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The Global Prevalence of Hepatitis A Virus Infection and Susceptibility: A Systematic Review

Immunization, Vaccines and Biologicals

World Health Organization

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Suggested reference: Jacobsen KH. The global prevalence of hepatitis A virus infection and susceptibility: a systematic review. Geneva, Switzerland: World Health Organization; 2009.

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BACKGROUND

HEPATITIS A VIRUS

Hepatitis A virus (HAV) is a member of the *Hepatovirus* genus of the family *Picornaviridae*, and is a nonenveloped single-stranded RNA virus [Cuthbert, 2001; Koff, 1998]. HAV replicates in hepatocytes (liver cells) and interferes with liver function, sparking an immune response that causes liver inflammation. Four of the seven genotypes of HAV affect humans (genotypes I and III are the most common), but only one serotype exists. Infection with any of the genotypes usually results in lifelong immunity against all strains of hepatitis A virus.

TRANSMISSION

HAV is transmitted via the fecal-oral route either by direct contact with an infectious person or by ingestion of contaminated food or water. (Persons with hepatitis A can shed the virus in their stool beginning several weeks before the onset of symptoms. The viral concentration in stool is highest in the prodromal phase. For those who develop symptoms, the viral concentration is usually very low by the time jaundice appears and undetectable before symptoms resolve.)

RISK FACTORS

Predictors of past or recent infection with hepatitis A virus include low household socioeconomic status (low income, wealth, and/or educational level), a larger household size and crowding, residence in a rural area, membership in certain ethnic groups, limited access to improved water sources, and limited access sanitation facilities [Jacobsen, 2004]. Several additional high-risk population groups have been identified, including those who travel or immigrate from a non-endemic region to an endemic region and those who work in certain high-risk occupations (such as some day-care employees) [Franco, 2003].

CLINICAL CHARACTERISTICS

Hepatitis A infection has four clinical phases, although these do not occur in all patients. The first stage is an incubation period of 15 to 50 days (mean 28 to 30 days). This stage is asymptomatic, but the infected person may be actively shedding the virus in the stool. The second stage is a pre-icteric period of several days to weeks that may precede the onset of jaundice. This prodromal period is characterized by nonspecific symptoms followed by gastrointestinal symptoms such as anorexia (loss of appetite), nausea, vomiting, abdominal pain, fatigue, malaise, and fever. Other symptoms at this stage may include myalgia (muscle pain), arthralgia (joint pain), cough, pharyngitis, constipation, diarrhea, pruritus (itchiness), and urticaria (hives). Dark urine caused by elevated bilirubin levels usually occurs prior the onset of jaundice. In the third stage, the characteristic yellowing of the skin and eyes of jaundice appear and most symptoms subside, although clinical signs such as hepatomegaly and hepatic tenderness are found in about half of patients. There is no treatment for HAV infection. Jaundice usually resolves within a few weeks. The final stage is a convalescent period during which the patient recovers.

AGE

The course of HAV infection varies by age. Young children with an acute hepatitis A viral infection are usually asymptomatic or non-specific and not diagnosed as hepatitis A because of the lack of jaundice. Adults with acute infections may have mild disease or may develop serious complications. (An estimated 80 to 95% of children less than 5 years old have asymptomatic infections, compared to 10 to 25% of adults [Hollinger, 1996].) The risk of disease increases with age.

COMPLICATIONS

The vast majority of hepatitis A patients make a full recovery, and the case fatality rate is low. The estimated mortality rate is 0.1% for children less than 15 years old, 0.3% for adults ages 15 to 39, and 2.1% for adults ages 40 and old [Hollinger, 1996]. Several complications may occur. About 15% of patients experience prolonged jaundice and/or relapses over several months. Some develop cholestatic hepatitis, in which the bile duct leading from the liver to the intestine becomes blocked. A few suffer from fulminant (acute) liver failure that may require a transplant or cause death. Although liver failure is more likely to occur in patients suffering from chronic liver disease prior to the onset of hepatitis A, it can occur in anyone with HAV infection. Hepatitis A does not cause chronic liver disease.

COST

The low mortality associated with hepatitis A does not mean that disease is not severe: infection may require several days or weeks of hospitalization and may cause absenteeism from work or school for several weeks or months. Thus, infection can be expensive in terms of both direct medical costs and lost productivity.

SEROLOGY

Current or recent infection can be determined by the presence of anti-HAV IgM antibodies in serum, which are detectable soon after infection and can remain detectable for about 6 months (or longer, in some cases). Past infection can be determined by the presence of anti-HAV IgG antibodies in serum, which appear shortly after the onset of symptoms and confer long-term (usually lifelong) immunity. In this report, the prevalence of anti-HAV antibodies in serologic (blood) samples taken from population-based samples will be the primary measure of population seroprevalence rates. (These assays measure total anti-HAV and assume that IgM anti-HAV, found only in those with recent infection, is rare and as a result IgG anti-HAV is the only contributor to the total anti-HAV.) The laboratory methods used to detect anti-HAV may vary in terms of technique, materials, and quality, and it is possible that some of the inconsistencies in rates reported from the same country or within the same region are a result of the application of different labaoratory standards.

SUSCEPTIBLE POPULATIONS

In many parts of the world, the anti-HAV seroprevalence rate is decreasing [Jacobsen, 2005]. Several factors are contributing to the declining infection rate, including increasing socioeconomic status, increasing access to clean water, and (in a few parts of the world) the availability of a hepatitis A vaccine that was developed in the 1990s [Jacobsen, 2004]. In some cases, this reduced force of infection has significantly increased the average age at infection. This delay in viral exposure has created a large population of susceptible adolescents and adults at risk of disease and led to outbreaks of hepatitis A. Because the severity of infection increases with age, it may be appropriate for populations with a high proportion of susceptible adults to consider implementing vaccination programs targeted to certain populations (often children) [Wasley, 2006].

SPECIFIC AIMS

The goal of this report is to present the results of a systematic evaluation of HAV seroprevalence and susceptibility rates in each of 21 geo-cultural world regions. The methods used in the systematic review are described in the following section, which is followed by 21 regional summaries.

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SYSTEMATIC REVIEW METHODS

GLOBAL BURDEN OF DISEASE (GBD) GOALS

The Operations Manual of the Global Burden of Diseases, Injuries, and Risk Factors Study states that the goal of GBD Phase 1 is to complete systematic epidemiological reviews of targeted diseases. The information should be presented separately for each of the 21 geographic regions that will be included in the GBD analysis and, when possible, separated by age group and sex.

WORLD REGIONS

The operations manual reports that the 21 world regions for the current iteration of the GBD study were defined based on four principles: (1) each region must be based on broad geographic regions or continents, (2) each region must contain a minimum of two coutntries, (3) the countries that make up a region must have similar child and adult mortality rates and similar leading causes of death, and (4) income level and population size were not used to define regions. This method of grouping has resulted in some uniquely defined regions that are not commonly used in other international reports. For example, the GBD operations manual considers Central Asia to consist of the traditionally-listed countries (such as Kazakhstan and Turkmenistan) along with the countries of the south Caucasus (Armenia, Azerbaijan, and Georgia). Other examples of non-standard world regions include the incorporation of Belize, French Guiana, and Guyana in the Caribbean region and the definition of Brazil and Paraguay as the only members of the tropical Latin American region. In this report, the countries included in each world region are listed at the start of each regional chapter and a full list of countries by region is provided in Table 2.

HEPATITIS A VIRUS CONSIDERATIONS

There are few, if any, hepatitis A registries, reporting of cases is known to be incomplete even in countries where notification is supposed to be compulsory, and many countries report only grouped data for all types of viral hepatitis [Gust, 1992]. Reports of outbreak investigations may be of limited use since outbreaks are rarely reported, many cases are asymptomatic, and it can be difficult to enumerate the population of at-risk individuals. Therefore, the most appropriate epidemiological research studies for estimating population exposure and risk are those that that measure the seroprevalence rate, which indicates both the proportion of the population that has had past exposure to hepatitis A virus and the remaining proportion that is at risk of infection. Thus, the primary focus of this review of the literature will be on seroprevalence studies

Children under 1 year of age will not be included in the age-seroprevalence data sets because of waning immunity conferred by maternal antibodies. In endemic areas, most children are born with circulating antibodies, but these generally disappear by about 6 months of age [Abdool Karim, 1993; Barin, 1980a; Barin, 1980b; Bile, 1986; Chadha, 1999; Derya, 2005; Kilpatrick, 1986; Prince, 1985; Ruiz-Gomez, 1985; Wu, 1982; Vitral, 1997; Zacarias, 1981].

SEARCH TERMS

As required by the GBD Operations Manual, all published articles that contained prevalence data for hepatitis A virus from 1980 through 2008 (and indexed by the end of 2008) were included in the systematic review. Relevant articles were identified by searching PubMed using the search string ["hepatitis A" AND (seroprevalence OR prevalence)] along with names of the current and former names of countries and territories. (For example, a search for the USSR was conducted as well as all of the now independent states.) The search was limited to articles published in 1980 or more recently. PubMed is a search engine from the U.S. National Institutes of Health that searches all MEDLINE citations along with several other databases and older publications.

This current review of the literature builds on a previous systematic review that was conducted in 2002 [Jacobsen, 2004]. That review began with a search of both MEDLINE and EMBASE, and the reference lists of all identified articles were also searched to identify any missing articles. At that time, a large number of articles were identified through the search of reference lists because the databases were relatively new and incomplete. In the subsequent years, the PubMed database has greatly increased the number of indexed articles and journals. In particular, the collection of abstracts from non-English language journals has significantly expanded. Thus, a search of PubMed in 2009 yielded nearly all of the articles identified by hand-searching in 2002, and also identified hundreds of new articles. This serves as a validation check for the search method.

ELIGIBILITY REQUIREMENTS

All abstracts and/or articles (if the abstract was not sufficient to indicate whether a study was eligible or ineligible) were screened to determine if they were eligible for inclusion. Eligible articles were required:

- to report a hepatitis A virus seroprevalence rate
- to be original research articles
- to represent the general population and not a special high-risk group or a group of patients with acute or chronic liver disease
- to have been published in or after 1980, even if the data reported was from prior to 1980

Review articles, outbreak investigations, and other reports that did not meet these criteria for inclusion in the systematic review are not included in the systematic review tables, but are provided, when necessary, to supplement information from primary sources identified through the search, screening, and extraction process.

ELIGIBILITY DECISION

A list of all articles identified in the database was compiled. First, all articles that could be removed based solely on the title – those that clearly were not from the country or region of interest, editorials, and some multi-country review articles – were eliminated from the list of potential articles. Then, the abstract and, when required, the full text of the remaining articles were screened and eligibility was determined by using the following list of questions:

1. Animal study: Is this a human study or animal study? If it is an animal study, then the article is ineligible.
2. Environmental study: Does the study involve testing of water or other environmental samples but not human sera? If so, then the article is ineligible.
3. Not HAV: Does this study focus on hepatitis A virus and not some other disease? If HAV is not the focus (for example, if HAV appears only in the discussion section), then the article is ineligible.
4. Special population: Is the population reasonably representative of the general population (even if the study was not truly a representative population-based sample, but was drawn from a school population, blood donors, hospital outpatients, or some other convenience sample)? Or is it a special population, such as persons with HIV infection or other chronic

diseases or participants in an immunoglobulin or vaccination trial? If the study focuses on a special high-risk population or involves an experimental trial, then the article is ineligible.

5. Acute hepatitis: Does the study population consist of acute or incident hepatitis infections only? If yes, then the article is ineligible.
6. Genetics/Lab: Does the study only provide information about the genetic structure of HAV samples collected in a particular place or only describe a laboratory procedure? If the study focuses solely on genetics or laboratory techniques and does not provide a seroprevalence rate, then the article is ineligible.
7. Review: Is the article a review article that does not provide original data or is it a report on a program or policy that does not provide prevalence rates? If so, then the article is ineligible for inclusion in the data tables.
8. Eligible: If none of these reasons for exclusion apply to the article, then it is eligible and will be included in the data tables.

ELIGIBILITY BY REGION

A list of the number of screened articles – the articles that had to have the abstract and/or article read in order to determine eligibility – is provided below (Table 1) for each region along with a tally of decisions about eligibility. This is not meant to be a comprehensive count of the total number of articles on hepatitis A, since it includes only the articles that required screening, but it does provide some helpful information about the relative differences in the amount of information available for different regions.

Table 1. Eligible Articles by World Region.

Region	Number of Articles Screened	Number Included	Number Ineligible	Ineligibility Reasons
1	137	29	108	Not HAV (34); Special population (vaccine trial participants, 1; others, 8); Acute hepatitis (40); Genetics/lab (6); Review (19)
2	31	8	23	Not HAV (10); Special population (IgG trial participants, 5); Acute hepatitis (14); Genetics/lab (1); Review (1)
3	166	38	128	Animal study (3); Environmental study (2); Not HAV (29); Special population (vaccine trial participants, 11; others, 6); Acute hepatitis (61); Genetics/lab (6); Review (10)
4	183	37	146	Animal study (1); Environmental study (4); Not HAV (46); Special population (vaccine trial participants, 5; others, 4) Acute hepatitis (71); Genetics/lab (3); Review (12)
5	103	36	67	Animal study (3); Environmental study (1); Not HAV (21); Special population (vaccine trial participants, 3; others, 4); Acute hepatitis (20); Genetics/lab (1); Review (14)
6	92	9	83	Not HAV (12); Special population (vaccine trial participants, 1; others, 18); Acute hepatitis (35); Genetics/lab (1); Review (16)
7	17	9	8	Not HAV (1); Acute hepatitis (6); Genetics/lab (1)
8	132	31	101	Environmental study (1); Not HAV (16); Special population (vaccine trial participants, 10; others, 6); Acute hepatitis (63); Genetics/lab (3); Review (2)
9	138	14	124	Environmental study (5); Not HAV (16); Special population (vaccine trial participants, 14); Acute hepatitis (79); Genetics/lab (4); Review (6)

10	970	207	763	Animal study (4); Environmental study (15); Not HAV (142); Special population (vaccine trial participants, 81; others, 93); Acute hepatitis (324); Genetics / lab (34); Review (69)
11	10	7	3	Not HAV (2); Acute hepatitis (1)
12	31	17	14	Environmental study (1); Not HAV (4); Special population (vaccine trial participants, 1; others, 1); Acute hepatitis (5); Review (2)
13	55	16	39	Not HAV (2); Special population (HIV+, 1; others, 8); Acute hepatitis (16); Genetics/lab (5); Review (7)
14	83	36	47	Environmental study (1); Not HAV (6); Special population (vaccine trial participants, 1; others, 9); Acute hepatitis (20); Genetics/lab (1); Review (9)
15	130	61	69	Environmental study (1); Not HAV (11); Special population (7); Acute hepatitis (44); Review (6)
16	575	41	534	Animal study (6); Environmental study (5); Not HAV (101); Special population (vaccine trial participants, 59; others, 54); Acute hepatitis (228); Genetics / lab (6); Review (75)
17	4	3	1	Acute hepatitis (1)
18	6	2	4	Animal study (2); Not HAV (1); Special population (HIV+, 1)
19	27	14	13	Not HAV (2); Acute hepatitis (9); Review (2)
20	21	11	10	Environmental study (1); Not HAV (2); Special population (hemophiliacs, 1); Acute hepatitis (5); Genetics/lab (1)
21	21	11	10	Not HAV (3); Acute/incident hepatitis (6); Genetics/lab (1)
All	2932	637	2295	

INCLUDED ARTICLES BY COUNTRY/AREA

Table 2 lists the number of articles included by country. Note that in the table, counts in parentheses within the "eligible articles" column indicate multi-country studies; each article is counted only once per region even if multiple countries within that region were studied. Also note that although some studies yielded multiple articles but the "included studies" column only counts each study once (so it will always be less than or equal to the eligible article column).

Table 2. Included Articles by World Region and Country.

Region	Country/Area	Eligible Articles	Included Studies
All Regions	**TOTAL**	**637**	**606**
High Income Asia Pacific (Region 1)	**Region Total**	**29**	**27**
	Brunei	0	0
	Japan	18	16
	Republic of Korea	6	6
	Singapore	5	5
Central Asia (Region 2)	**Region Total**	**8**	**8**
	Armenia	1	1
	Azerbaijan	0	0
	Georgia	0	0
	Kazakhstan	3	3
	Kyrgyzstan	0	0
	Mongolia	2	2

	Tajikistan	1	1
	Turkmenistan	0	0
	Uzbekistan	1	1
East Asia (Region 3)	**Region Total**	**38**	**36**
	China	11	11
	Democratic People's Republic of Korea	0	0
	Hong Kong	5	4
	Taiwan	22	21
South Asia (Region 4)	**Region Total**	**37**	**37**
	Afghanistan	0	0
	Bangladesh	1	1
	Bhutan	1	1
	India	28	28
	Nepal	3	3
	Pakistan	4	4
Southeast Asia (Region 5)	**Region Total**	**36**	**36**
	Cambodia	1	1
	Indonesia	3	3
	Lao People's Democratic Republic	0	0
	Malaysia	2	2
	Maldives	0	0
	Mauritius	1	1
	Mayotte	0	0
	Myanmar	0	0
	Philippines	1	1
	Seychelles	1	1
	Sri Lanka	1	1
	Thailand	22	22
	Timore Leste	0	0
	Viet Nam	3	3
	(Réunion)	1	1
Australasia (Region 6)	**Region Total**	**9**	**9**
	Australia	4	4
	New Zealand	5	5
Caribbean (Region 7)	**Region Total**	**9**	**8**
	Anguilla	0	0
	Antigua and Barbuda	0	0
	Aruba	0	0
	Bahamas	0	0
	Barbados	0	0
	Belize	1	1
	Bermuda	0	0
	British Virgin Islands	0	0
	Cayman Islands	0	0
	Cuba	1	1
	Dominica	0	0
	Dominican Republic	2	1
	French Guiana	1	1
	Grenada	0	0
	Guadaloupe	(1)	(1)

	Guyana	0	0
	Haiti	0	0
	Jamaica	1	1
	Martinique	2	2
	Montserrat	0	0
	Netherlands Antilles	0	0
	Saint Kitts and Nevis	0	0
	St. Lucia	0	0
	St. Vincent	0	0
	Suriname	0	0
	Trinidad and Tobago	1	1
	Turks and Caicos Islands	0	0
Central Europe (Region 8)	**Region Total**	**31**	**29**
	Albania	5	5
	Bosnia and Herzegovina	0	0
	Bulgaria	0	0
	Croatia	2	2
	Czech Republic	5	3
	Hungary	3	3
	Poland	6	6
	Romania	6	6
	Serbia and Montenegro	0	0
	Slovakia	0	0
	Slovenia	1	1
	Former Yugoslav Republic of Macedonia	1	1
	(Kosovo)	2	2
Eastern Europe (Region 9)	**Region Total**	**14**	**13**
	Belarus	2	2
	Estonia	1	1
	Latvia	0	0
	Lithuania	0	0
	Republic of Moldova	0	0
	Russian Federation	10	9
	Ukraine	1	1
Western Europe (Region 10)	**Region Total**	**207**	**197**
	Andorra	0	0
	Austria	1	1
	Belgium	8	7
	Channel Islands	0	0
	Cyprus	1	1
	Denmark	6	6
	Faeroe Islands	1	1
	Finland	2	2
	France	14	14
	Germany	14	14
	Gilbraltar	0	0
	Greece	9	8
	Greenland	1	1
	Holy See	0	0
	Iceland	3	3

	Ireland	2	2
	Isle of Man	0	0
	Israel	21	18
	Italy	44	42
	Liechtenstein	0	0
	Luxembourg	1	1
	Malta	1	1
	Monaco	0	0
	Netherlands	4	4
	Norway	4	4
	Portugal	6	6
	Saint Pierre et Miquelon	0	0
	San Marino	3	2
	Spain	42	41
	Sweden	3	2
	Switzerland	3	3
	United Kingdom	13	13
Andean Latin America (Region 11)	**Region Total**	**7**	**7**
	Bolivia	3	3
	Ecuador	0	0
	Peru	4	4
Central Latin America (Region 12)	**Region Total**	**17**	**15**
	Colombia	1	1
	Costa Rica	1	1
	El Salvador	0	0
	Guatemala	1	1
	Honduras	0	0
	Mexico	10	9
	Nicaragua	1	1
	Panama	0	0
	Venezuela	3 (+2)	3 (+1)
Southern Latin America (Region 13)	**Region Total**	**16**	**14**
	Argentina	6	5
	Chile	9 (+2)	8 (+2)
	Falkland Islands (Malvinas)	0	0
	Uruguay	1	1
Tropical Latin America (Region 14)	**Region Total**	**36**	**33**
	Brazil	36	33
	Paraguay	0	0
North Africa / Middle East (Region 15)	**Region Total**	**61**	**61**
	Algeria	2	2
	Bahrain	0	0
	Egypt	6	6
	Islamic Republic of Iran	4	4
	Iraq	1	1
	Jordan	1	1
	Kuwait	1	1
	Lebanon	3	3
	Libyan Arab Jamahiriya	0	0
	Morocco	1	1

	Occupied Palestinian Territory	1	1
	Oman	0	0
	Qatar	0	0
	Saudi Arabia	12	12
	Syrian Arab Republic	1	1
	Tunisia	2	2
	Turkey	24 (1)	24 (1)
	United Arab Emirates	1	1
	Western Sahara	0	0
	Yemen	1	1
High Income North America (Region 16)	**Region Total**	**41**	**37**
	Canada	14	13
	United States of America	27	24
Oceania (Region 17)	**Region Total**	**3**	**3**
	American Samoa	0	0
	Cook Islands	0	0
	Fiji	0	0
	French Polynesia	0	0
	Guam	0	0
	Kiribati	0	0
	Marshall Islands	1	1
	Federated States of Micronesia	(1)	(1)
	Nauru	0	0
	New Caledonia	1	1
	Niue	0	0
	Northern Mariana Islands	0	0
	Palau	0	0
	Papua New Guinea	1	1
	Pitcairn	0	0
	Samoa	0	0
	Solomon Islands	0	0
	Tokelau	0	0
	Tonga	0	0
	Tuvalu	0	0
	Vanuatu	0	0
	Wallis and Fortuna Islands	0	0
Central Sub-Saharan Africa (Region 18)	**Region Total**	**2**	**1**
	Angola	0	0
	Central African Republic	0	0
	Congo	0	0
	Democratic Republic of the Congo	2	1
	Equatorial Guinea	0	0
	Gabon	0	0
East Sub-Saharan Africa (Region 19)	**Region Total**	**14**	**13**
	Burundi	1	1
	Comoros	0	0
	Djibouti	1	1
	Eritrea	(1)	(1)
	Ethiopia	4	3
	Kenya	1	1

	Madagascar	2	2
	Malawi	0	0
	Mozambique	0	0
	Rwanda	0	0
	Somalia	3	3
	Sudan	0	0
	Uganda	1	1
	United Republic of Tanzania	1	1
	Zambia	0	0
Southern Sub-Saharan Africa (Region 20)	**Region Total**	**11**	**11**
	Botswana	0	0
	Lesotho	0	0
	Namibia	2	2
	South Africa	9	9
	Swaziland	0	0
	Zimbabwe	0	0
West Sub-Saharan Africa (Region 21)	**Region Total**	**11**	**11**
	Benin	0	0
	Burkina Faso	0	0
	Cameroon	4	4
	Cape Verde	1	1
	Chad	0	0
	Côte d'Ivoire	0	0
	Gambia	0	0
	Ghana	0	0
	Guinea	1	1
	Guinea-Bissau	0	0
	Liberia	1	1
	Mali	0	0
	Mauritania	0	0
	Niger	0	0
	Nigeria	1	1
	Saint Helena	0	0
	São Tomé and Príncipe	0	0
	Senegal	2	2
	Sierra Leone	1	1
	Togo	0	0

DATA EXTRACTION

The full text of all articles deemed to be eligible was read, and information about the study country, study year, study population, seroprevalence by age, and other study information was recorded.

LANGUAGES

Articles were not limited to any particular publication language. Of the 637 articles included in the tables, 502 (78.8%) were in English, 47 (7.4%) in Spanish, 18 (2.8%) in French, 18 (2.8%) in Italian, 13 (2.0%) in Russian, 11 (1.7%) in Chinese, 7 (1.1%) in German, and less than 1% each in Portuguese, Polish, Romanian, Korean, Czech, Japanese, Turkish, Croatian, Icelandic, and Swedish (Table 3).

Table 3. Elgible Articles by World Region and Publication Language.

Language	Region										
	1	2	3	4	5	6	7	8	9	10	11
English	26	4	27	37	36	9	8	22	6	147	4
Spanish										24	3
French							1			9	
Italian										17	
Russian		4							8		
Chinese			11								
German										6	
Portuguese										2	
Polish								3			
Romanian								3			
Korean	2										
Czech								2			
Japanese	1										
Turkish											
Croatian								1			
Icelandic										1	
Swedish										1	
Total	**29**	**8**	**38**	**37**	**36**	**9**	**9**	**31**	**14**	**207**	**7**

Language	Region										
	12	13	14	15	16	17	18	19	20	21	**Total**
English	9	4	32	56	41	2	1	12	11	8	502
Spanish	8	12									47
French				4		1		1		2	18
Italian								1			18
Russian										1	13
Chinese											11
German							1				7
Portuguese			4								6
Polish											3
Romanian											3
Korean											2
Czech											2
Japanese											1
Turkish				1							1
Croatian											1
Icelandic											1
Swedish											1
Total	**17**	**16**	**36**	**61**	**41**	**3**	**2**	**14**	**11**	**11**	**637**

Of the included articles, 21.2% were in languages other than English. The proportion of articles written in languages other than English varied by world region from 0% to 75%. In four of the 21 regions – Central Asia, Eastern Europe, Southern Latin America, and Central sub-Saharan Africa – at least half of the included articles were published in a language other than English. This highlights the value of including all languages in the systematic review. The proportion of the articles from each region published in English and in languages other than English is shown on Table 4.

Table 4. Elgible Articles by World Region and Publication in English and Other Languages.

Language	Region										
	1	2	3	4	5	6	7	8	9	10	11
# of articles in English	26	4	27	37	36	9	8	22	6	147	4
Total articles	29	8	38	37	36	9	9	30	14	207	7
% of articles in English	90	50	71	100	100	100	89	73	43	71	57
% of articles in other languages	**10**	**50**	**29**	**0**	**0**	**0**	**11**	**27**	**57**	**29**	**43**

Language	Region										
	12	13	14	15	16	17	18	19	20	21	Total
# of articles in English	9	4	32	56	41	2	1	12	11	8	502
Total articles	17	16	36	61	41	3	2	14	11	11	637
% of articles in English	53	25	89	92	100	67	50	86	100	73	79
% of articles in other languages	**47**	**75**	**11**	**8**	**0**	**33**	**50**	**14**	**0**	**27**	**21**

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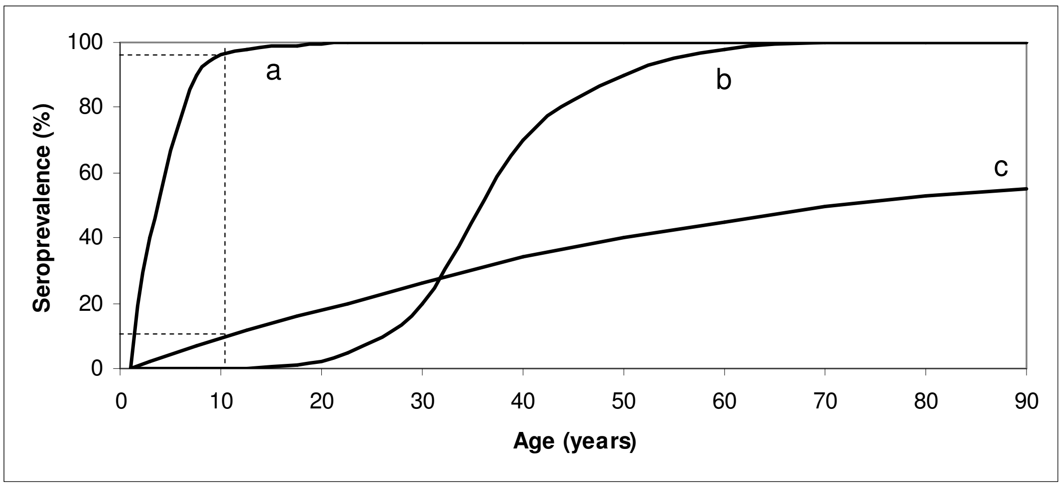
GRAPH INTERPRETATION

AGE-SPECIFIC SEROPREVALENCE CURVES

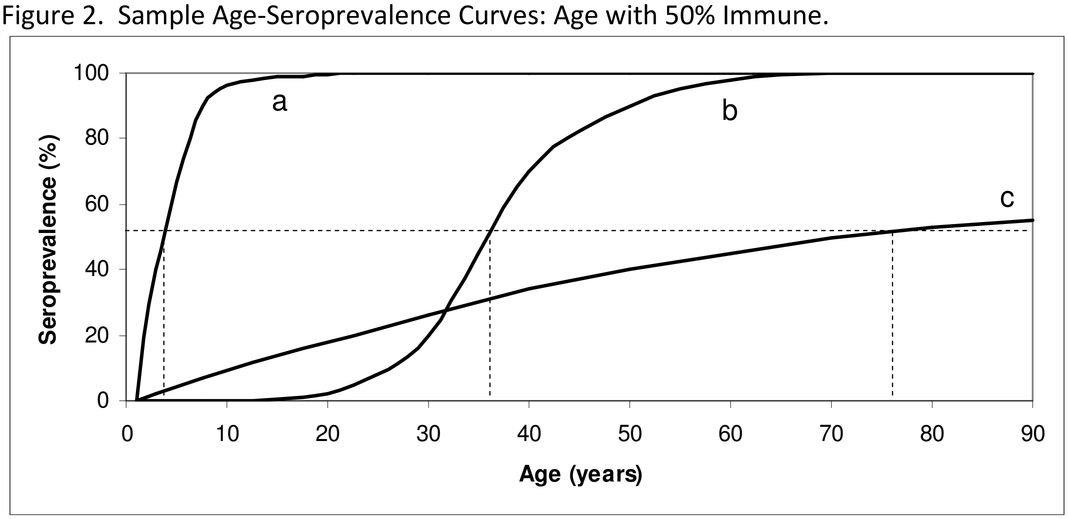
Age-seroprevalence curves are formed by plotting age on the x-axis and the prevalence rate on the y-axis. These can be "read" several ways. One way is to simply identify the proportion of each population at a particular age that is immune to hepatitis A virus. For example, in Figure 1 about 95% of 10-year-olds in population 'a,' 10% of 10-year-olds in population 'b,' and 0% of 10-year-olds in population 'c' are immune.

Figure 1. Sample Age-Seroprevalence Curves: Proportion Immune by Age.



Another way to "read" the graph is to look for the age at which half of the people in that age group have immunity. In Figure 2, about half of 4-year-olds in population 'a,' half of 36-year-olds in population 'b,' and half of 76-year-olds in population 'c' have immunity.

Figure 2. Sample Age-Seroprevalence Curves: Age with 50% Immune.



INCIDENCE AND AGE-SEROPREVALENCE CURVES

Age-seroprevalence curves provide information about both the past and current incidence rate in a population. The prevalence rate in the youngest age-groups, at least in highly endemic countries, usually reflects current incidence rates. For older age-groups, the prevalence rate primarily indicates the level of incidence many decades in the past when those adults where children.

For example, curve ‘a’ below shows a population which is highly endemic for HAV. The rate of transmission in population ‘a’ is high and sustained and most children are exposed and develop immunity at a young age. Curve ‘b’ shows a population that about thirty years ago transitioned from a high infection rate to a low infection rate. While most adults in population ‘b’ have immunity, a rapidly growing population of children and young adults are susceptible. Curve ‘c’ shows a population that has had a low incidence rate for a long period of time. Many adults in population ‘c’ remain susceptible and the population is at risk of epidemics.

Figure 3. Sample Age-Seroprevalence Curves: Trends Over Time.

The next several pages show examples of the age-prevalence curves created by various patterns of incidence rates over time. Figure 4 shows the smooth logarithmic curves that result when there is a consistent infection rate over time. A constant high incidence rate over time creates an age-seroprevalence curve similar to that in population ‘a’ above, and a constant low incidence rate creates an age-seroprevalence curve similar to that in population ‘c’ above.

Figure 4. Age-Seroprevalence Curves: Constant Infection Rate Over Time.

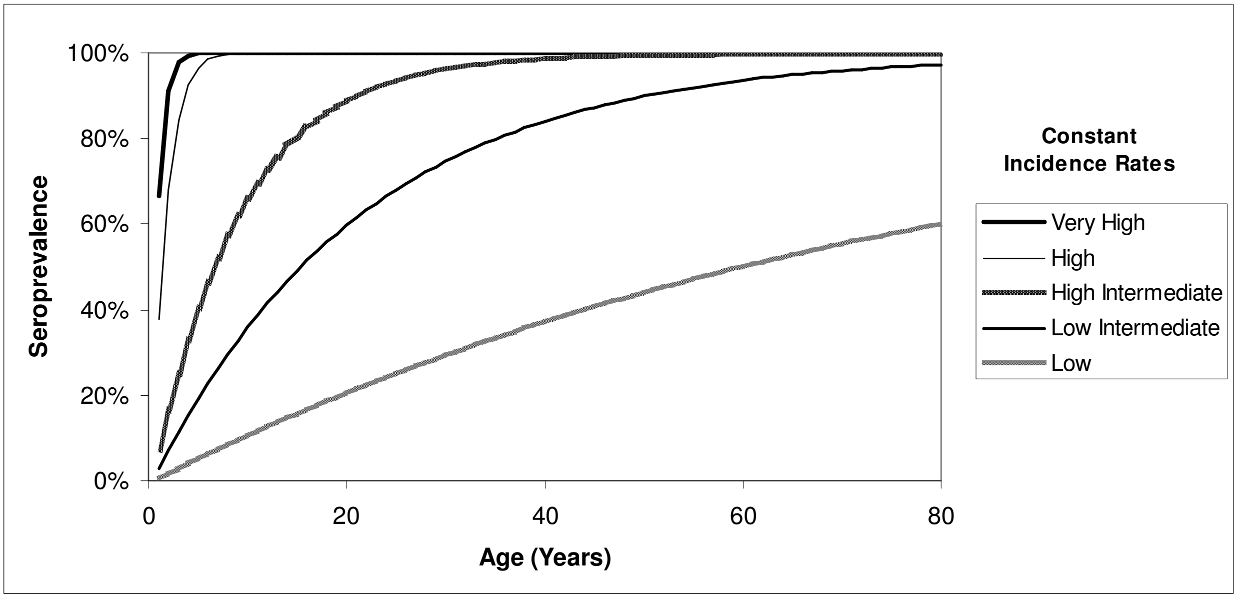


Figure 5 shows various types of decreases in the incidence rate that might have occurred over time. Note that the years on the x-axis of this graph go back in time from "0", which represents the year in which the age-prevalence graph for the population was plotted. For example, the line for "rapid decline" is a modeled representation of a steep decrease in the incidence rate occurring a little over 40 years in the past.

Figure 5. Decreasing Incidence Rate Over Time.

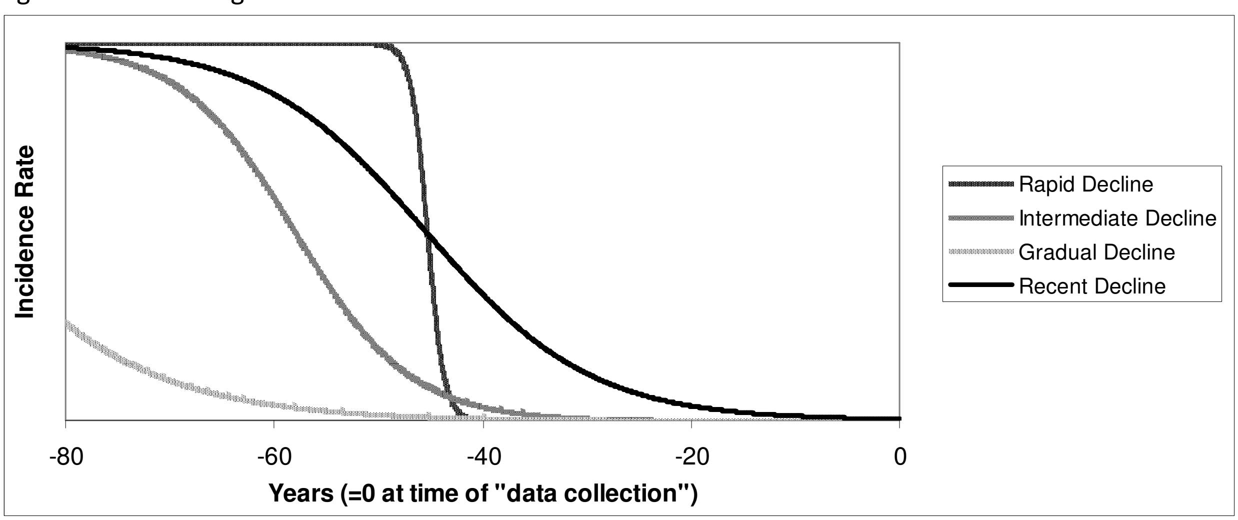


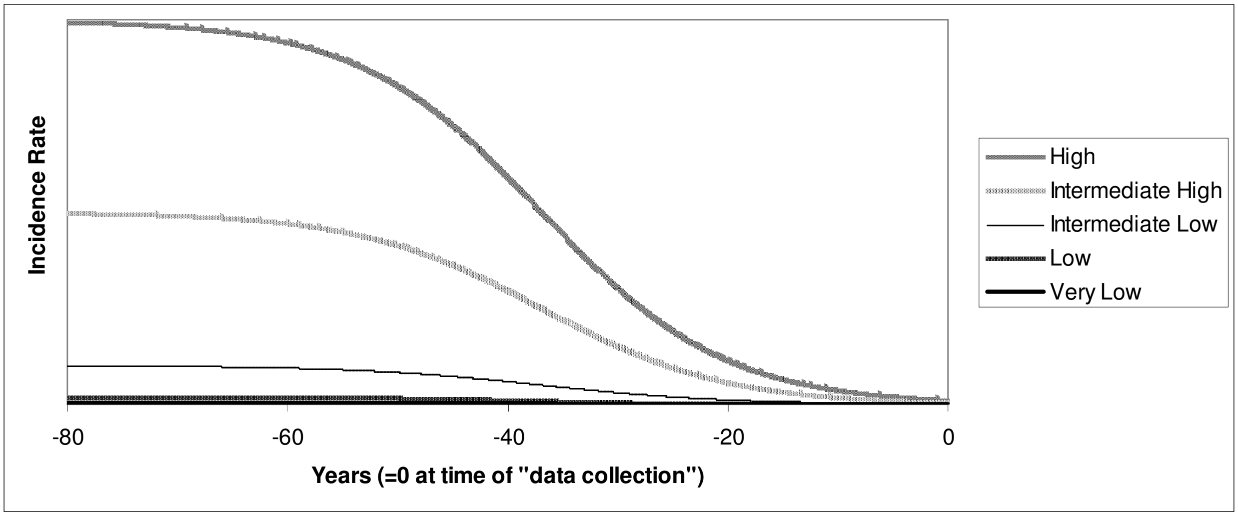
Figure 6 shows the corresponding age-seroprevalence curves that result from the incidence patterns above. A decreasing infection rate often creates a convex left tail on the resulting age-seroprevalence plot. (In other words, the curve at the left side of the graph – the one for younger age groups – faces up while the curves at the top right – the ones for older age groups – are concave and face down.)

Note that the incidence rates modeled in Figure 5 were relatively low for the past 20 years for all curves, and as a result the prevalence rates in Figure 6 are relatively low for people less than 20 years of age. In contrast, the incidence rates in Figure 5 were relatively high 40 to 80 years ago, and as a result the prevalence rates in Figure 6 are high for people 40 to 80 years of age. The curve produced by a model of a relatively rapid decline in the incidence rate about 40 years ago creates a curve similar to that in population 'b' in the earlier examples (Figure 3).

Figure 6. Age-Seroprevalence Curves: Decreasing Incidence Rate Over Time.

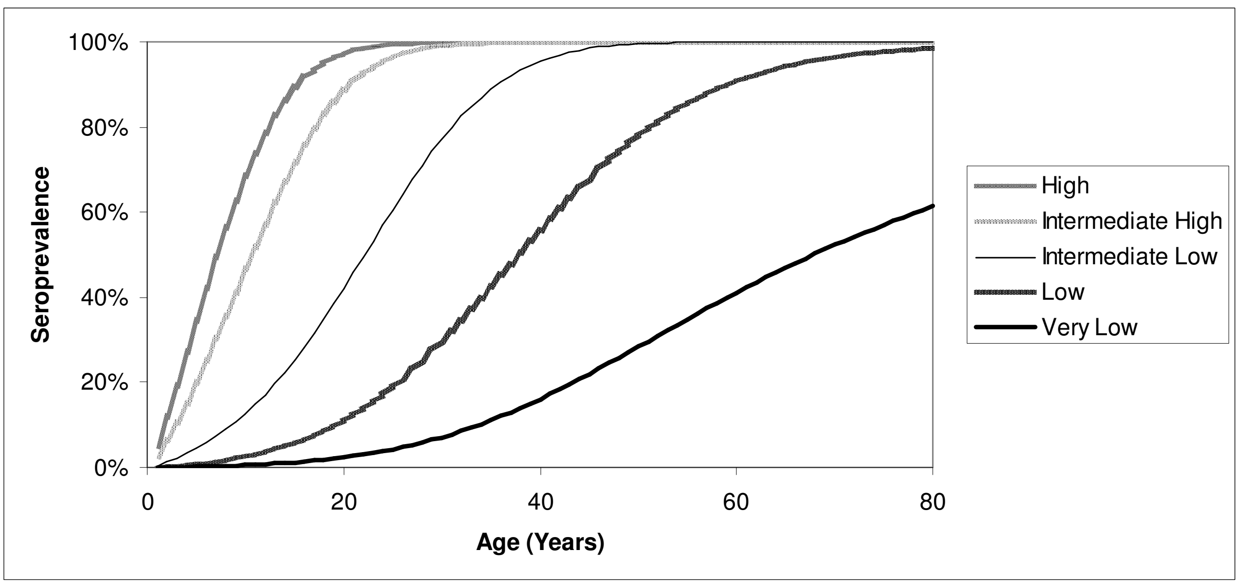
The shape of the age-seroprevalence curve depends on both the magnitude of the incidence rate and on the changes in the incidence rate over time. Below is another example of incidence curves over time. In this example, each population experienced a similar proportional decrease in the incidence rate, but the starting incidence rate – the rate 80 years ago – varied from high to very low.

Figure 7. Decreasing Incidence Rate Over Time With Varying Initial Magnitude.



The shapes of the resulting age-seroprevalence curves in Figure 8 vary based on the incidence rates in Figure 7.

Figure 8. Age-Seroprevalence Curves: Decreasing Incidence Rate Over Time.



Thus, age-seroprevalence curves provide insight into the changes in the incidence rate that have occurred over time. Mathematical models can be used to estimate past incidence rates based on the shape of the current age-seroprevalence curve or, better yet, the changes in the age-seroprevalence curve in a population over time. Although accurate incidence rates for hepatitis A virus are rarely available, age-seroprevalence curves allow for estimation of incidence trends.

SUMMARY AGE-PREVALENCE ESTIMATES

The summary age-prevalence estimates provided for each of the 21 world regions in the following chapters are based on a curve-fitting procedure. For each region, all data points from each eligible study that provided seroprevalence rates for two or more age groups were plotted. The x-axis value for each point was the median age of the age group or, if the median was not provided, the midpoint of the age range. This is not an ideal method since it does not adjust for differences in sample size and study quality, but it avoids the potential bias that could be introduced into the regional estimates when there is one or more large study from one country within a region and only a few smaller sample size studies from other countries in the region.

Two very simple unweighted curve fitting approaches were then used. First, a logarithmic curve was fit to all the data points. In other words, all of the age-seroprevalence coordinates used for the interpolated plots described below (in the paragraph on “Plot of Age-Seroprevalence Data from Included Studies”) were plotted using a scatterplot, and a logarithmic curve was fit to the points. (This creates curves similar to ‘a’ and ‘c’ in the figures above.) Second, because a logistic curve clearly did not capture the shape of the data for some countries and regions that had experienced a rapid decrease in the incidence rate, a polynomial curve was also fitted to all data sets. (This creates a curve similar to ‘b’ in the figures above.) The final curve used for the regional estimates was the curve that had the highest correlation to the data. In some cases, this required fitting a separate curve for different parts of the graph. The table of “Summary Age-Prevalence Estimates” provides the estimated prevalence for each age range for each region.

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

The estimated regional age-seroprevalence plot for each region is simply a graph of the summary age-prevalence estimates described in the previous paragraph.

PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

As a comparison to the estimated regional age-seroprevalence plot, a plot of the actual age-seroprevalence curves from included studies is also provided. Each line on the graph represents one included study, all of which are listed on the data table for the region. The points used for the lines are based on the mid-point (or median, if available) of each age group for which an age-group-specific prevalence rate was reported. The color and thickness of each line indicates the decade of data collection, as per the legend for each plot. Studies based on data from 2000 or more recently or, if the study year was not reported, study published in 2001 or more recently are represented by a red line. Similarly, studies from the 1990s are in orange, studies from the 1980s are in green, studies conducted in the 1970s are in blue, and studies conducted prior to that are in purple. To assist with visual interpretation of the graphs, the lines also vary in thickness. Thicker lines indicate more recent studies and thinner and dashed lines indicate older studies. These graphs of real data provides visual corroboration of the high level of congruity between the estimated regional curves and the corresponding raw data used to fit the estimated curves. Note that only graphs based on real data are in color; graphs of estimates are in grayscale only.

SUMMARY OF FINDINGS BY REGION, AGE, AND SEX

REGION

Table 5 summarizes the hepatitis A virus (HAV) population seroprevalence for adults and children in each of the 21 world regions. It also provides a summary of the amount of information about hepatitis A virus seroprevalence in each world region that is available in the published literature.

The child immunity rate is based on the estimated proportion of children ages 10 to 14 who are immune: high = greater than 90%, high-medium = 75% to 89%, medium = 60% to 74%, low-medium = 40% to 59%, and low = less than 20%. A high child immunity rate indicates a high current incidence rate; a low child immunity rate indicates a low current infection rate.

The adult susceptibility rate is based on the estimated proportion of adults age 35 to 44 who are at risk: high = greater than 40%, medium = 20% to 39%, low-medium = 10% to 19%, low = 1% to 9%, and very low = 0%. A high adult susceptibility rate indicates an elevated risk of outbreaks.

The colums for data sources indicate the relative number of articles on hepatitis A virus seroprevalence available for the region after adjusting for the total number of countries in the region. The ratings for total articles available correspond to roughly 5 or more articles per country within the region (▲▲▲), about 3 or 4 articles per country (▲▲), about 2 articles per country (▲), about one article per country (▽), and less than 1 article per country (▽▽). Seroprevalence estimates from regions with a low number of available articles have more uncertainty than those with a high number of available articles.

Recent articles available refer to articles published in or after 2000. The ratings for recent articles available correspond to roughly 5 or more recent articles per country within the region (▲▲▲), about 1 to 4 recent articles per country (▲), less than 1 article per country (▽▽), and no recent articles (▽▽▽). Seroprevalence estimates from regions with a low number of recent articles have less certainty than those with a high number of recent articles.

Table 5. Summary of Findings for Hepatitis A Virus by World Region.

Region		***Population Seroprevalence***		***Data Sources*** (adjusted for the total number of countries in region)	
		Child Immunity Rate	**Adult Susceptibility Rate**	**Total Articles Available**	**Recent Articles Available**
1	High income Asia Pacific	Low	High	▲▲▲	▲
2	Central Asia	Medium	Low-Medium	▽▽	▽▽
3	East Asia	Low-Medium	Low-Medium	▲▲▲	▲
4	South Asia	High-Medium	Very Low	▲▲▲	▲
5	Southeast Asia	Low-Medium	Low-Medium	▲	▽▽
6	Australasia	Low	High	▲▲	▲
7	Caribbean	Low-Medium	Medium	▽▽	▽▽
8	Central Europe	Low-Medium	Medium	▲	▲
9	Eastern Europe	Low-Medium	Medium	▲	▽▽
10	Western Europe	Low	High	▲▲▲	▲
11	Andean Latin America	High-Medium	Very Low	▲	▽▽
12	Central Latin America	High-Medium	Low	▽	▽▽
13	Southern Latin America	Medium	Low-Medium	▲▲	▲
14	Tropical Latin America	Medium	Low	▲▲▲	▲▲▲
15	North Africa / Middle East	Medium	Low	▲▲	▲
16	High income North America	Low	Medium	▲▲▲	▲▲▲
17	Oceania	Medium	Very Low	▽▽	▽▽▽
18	Central sub-Saharan Africa	High	Very Low	▽▽	▽▽▽
19	East sub-Saharan Africa	High	Very Low	▽▽	▽▽
20	South sub-Saharan Africa	High	Very Low	▽	▽▽
21	West sub-Saharan Africa	High-Medium	Low	▽▽	▽▽▽

Figure 9. Estimated child immunity rate. Darker shades indicate a higher exposure rate.

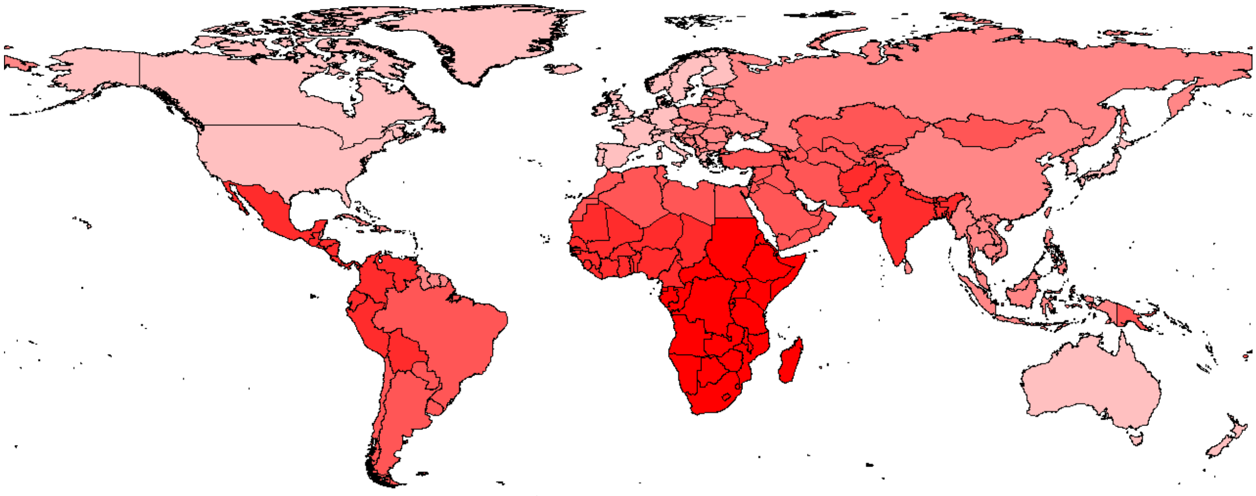
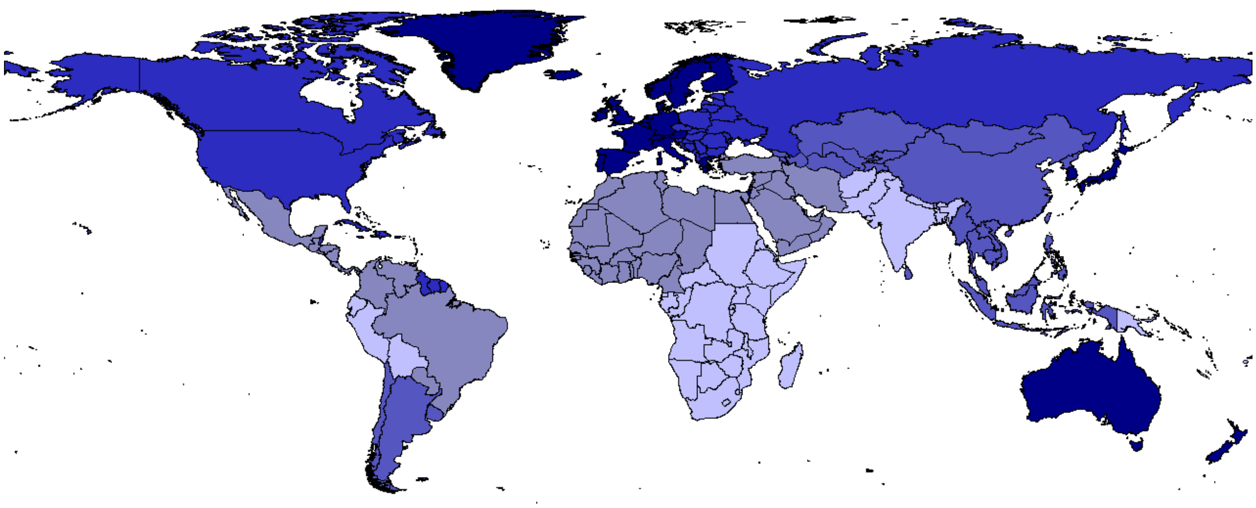


Figure 10. Estimated adult susceptibility rate. Darker shades indicate a greater proportion of at-risk adults.



AGE

The estimated proportion of the population that is immune by region and age (in years) is shown on Table 6. Additional details about the estimates for each region are provided in the regional chapters.

Table 6. Summary of Findings for Hepatitis A Virus by World Region and Age Group.

	Region	1-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65-74	75-84	85+
1	High income Asia Pacific	0	2	10	17	25	36	51	66	81	98	100	100
2	Central Asia	42	60	68	72	76	81	85	89	91	94	96	97
3	East Asia	24	44	56	63	69	75	82	87	91	94	97	100
4	South Asia	61	75	82	87	91	96	100	100	100	100	100	100
5	Southeast Asia	16	30	43	52	60	72	85	94	98	99	100	100
6	Australasia	3	7	11	15	18	22	30	39	49	60	72	86
7	Caribbean	14	31	42	50	57	65	76	86	95	100	100	100
8	Central Europe	21	35	41	46	51	58	67	75	82	87	92	96
9	Eastern Europe	20	33	40	47	54	64	76	86	95	100	100	100
10	Western Europe	1	6	18	28	35	45	56	66	75	82	88	94
11	Andean Latin America	54	69	78	85	91	97	100	100	100	100	100	100
12	Central Latin America	59	73	80	85	89	93	97	100	100	100	100	100
13	Southern Latin America	36	53	62	68	73	78	83	87	91	94	96	98
14	Tropical Latin America	28	51	64	72	79	86	93	99	100	100	100	100
15	North Africa / Middle East	37	58	70	77	83	89	96	100	100	100	100	100
16	High income North America	0	2	6	9	13	20	30	41	54	69	83	100
17	Oceania	17	45	61	71	78	87	96	100	100	100	100	100
18	Central sub-Saharan Africa	40	90	98	99	100	100	100	100	100	100	100	100
19	East sub-Saharan Africa	73	86	91	95	98	100	100	100	100	100	100	100
20	South sub-Saharan Africa	67	84	94	100	100	100	100	100	100	100	100	100
21	West sub-Saharan Africa	59	75	84	90	95	100	100	100	100	100	100	100

SEX

No significant differences by sex were consistenly noted in any world region or age group. Thus, the above estimates by age and region can be used for both males and females.

HIGH INCOME ASIA PACIFIC

(Brunei, Japan, Republic of Korea, Singapore)

REGIONAL SUMMARY

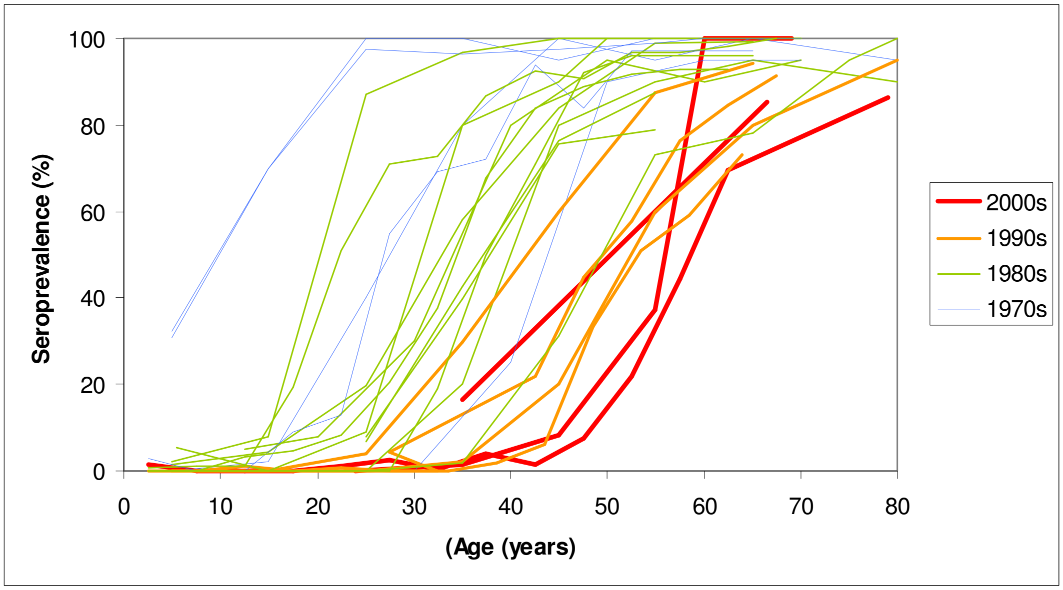
All of the countries in this region are moving toward a very low endemicity rate. Almost no children have been exposed to HAV, and many adults remain susceptible to infection. Separate paragraphs below describe the data from Japan, South Korea, and Singapore.

JAPAN

Age-seroprevalence curve based on studies conducted in Japan over the past several decades show an S-shaped curve shifting steadily to the right over time. This indicates that Japan had a high infection rate until about 50 or 60 years ago (as shown by the 100% prevalence rate at the top right of the 'S'), when there was a relatively rapid decrease in the infection rate to almost nil (shown by the 0% prevalence rate at the bottom left of the 'S'). Since this sharp decrease in incidence, almost no one has been infected. As a result, a large proportion of adults – nearly everyone less than 50 or 60 years of age – would be at risk of disease if an outbreak of hepatitis A occurred.

Serologic samples from the 1960s and 1970s show a low prevalence rate in children and a moderate rate in middle-aged adults, with about 50% of people in their early 20s demonstrating immunity [Fujisawa, 1999; Furusyo, 1998; Ichida, 1981; Ikematsu, 1987; Kashiwagi, 1983; Moritsugu, 1978; Noguchi, 1991; Taylor-Wiedeman, 1987]. In the 1980s, about half of people in their late 20s and early 30s had immunity and only a very small percent of those under the age of 20 had anti-HAV [Fujisawa, 1999; Fujiyama, 1994; Furusyo, 1998; Ikematsu, 1987; Kashiwagi, 1985; Kashiwagi, 1983; Kiyosawa, 1989; Malaty, 2003; Noguchi, 1991; Taylor-Wiedeman, 1987; Togashi, 1982]. By the 1990s, about half of people in their 40s and 50s had immunity and almost everyone in younger age groups was susceptible to infection [Akbar, 1992-1993; Fujisawa, 1999; Fujiyama, 1994; Furusyo, 1998; Kiyohara, 1997; Malaty, 2003; Noguchi, 1991]. In the 2000s, about half of people in their 50s and 60s had immunity and evidence of prior infection is negligible in those under 40 years of age [Furuta, 1997; Kiyohara, 2007; Mitsui, 2006; Nishise, 2003]. These prevalence data suggest that at present the incidence rate in Japan is extremely low.

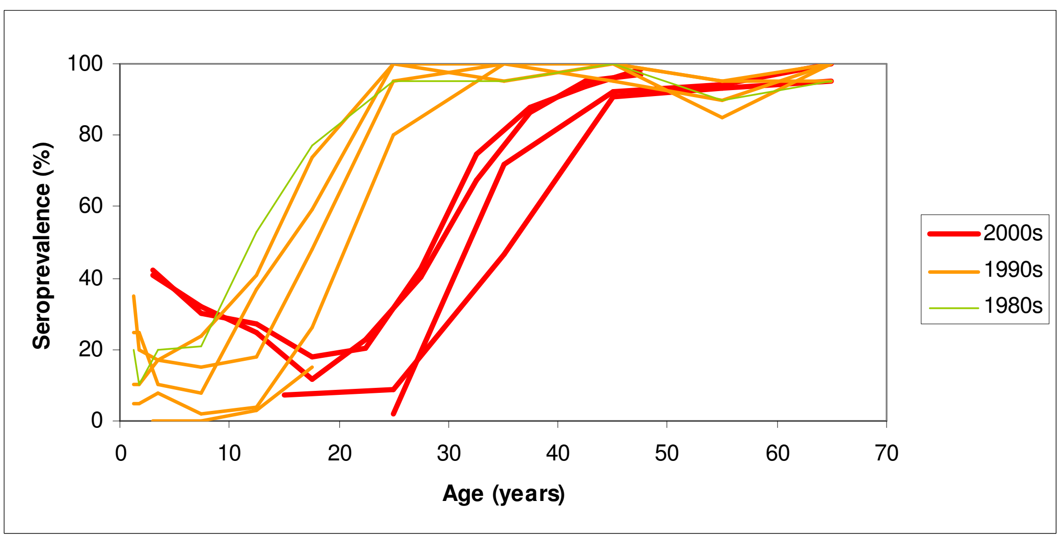
Figure 11. Plots of Age-Seroprevalence Data from Studies from Japan.



REPUBLIC OF KOREA

Seroprevalence studies conducted in South Korea in the 2000s show that there is a very low infection rate in children and young adults, only about 50% of those in early-middle adulthood are immune, that, and the immunity rate that does not reach 100% even in older adults [Lee, 2008; Kim, 2007; Kang, 2007; Song, 2007]. These data suggest a shift toward a lower infection rate in recent decades (Figure 12).

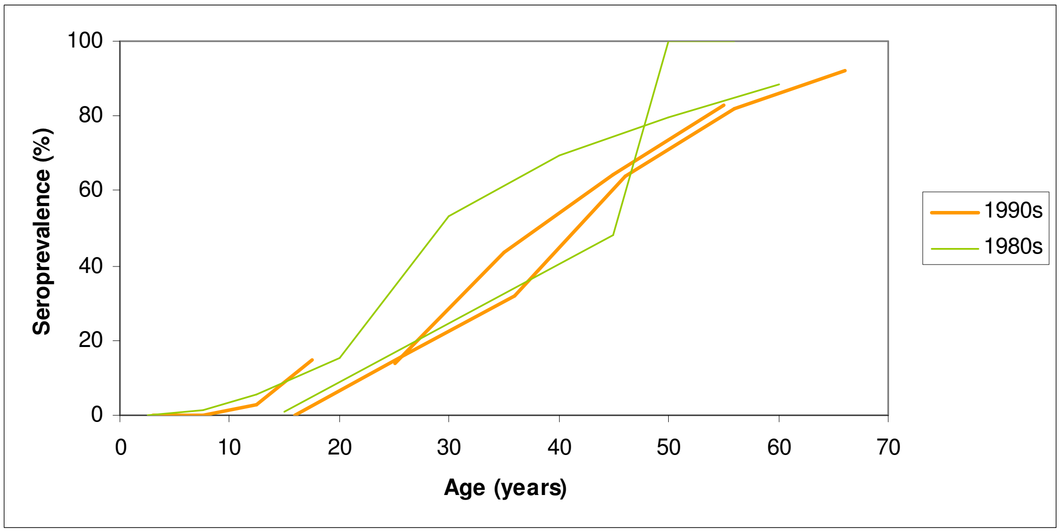
Figure 12. Plots of Age-Seroprevalence Data from Studies from the Republic of Korea.



SINGAPORE

Studies from the 1980s and early 1990s showed a very low seroprevalence rate in children and young adults and only about 50% of 40 years demonstrating immunity [Chow, 1996; Fock, 1995; Goh, 1987; Heng, 1993; Yap, 1993]. In other words, nearly half of all 40-year-olds remain susceptible to infection. These data suggest a low infection rate, and a high risk of disease if outbreaks occur.

Figure 13. Plots of Age-Seroprevalence Data from Studies from Singapore.



SUMMARY AGE-PREVALENCE ESTIMATES

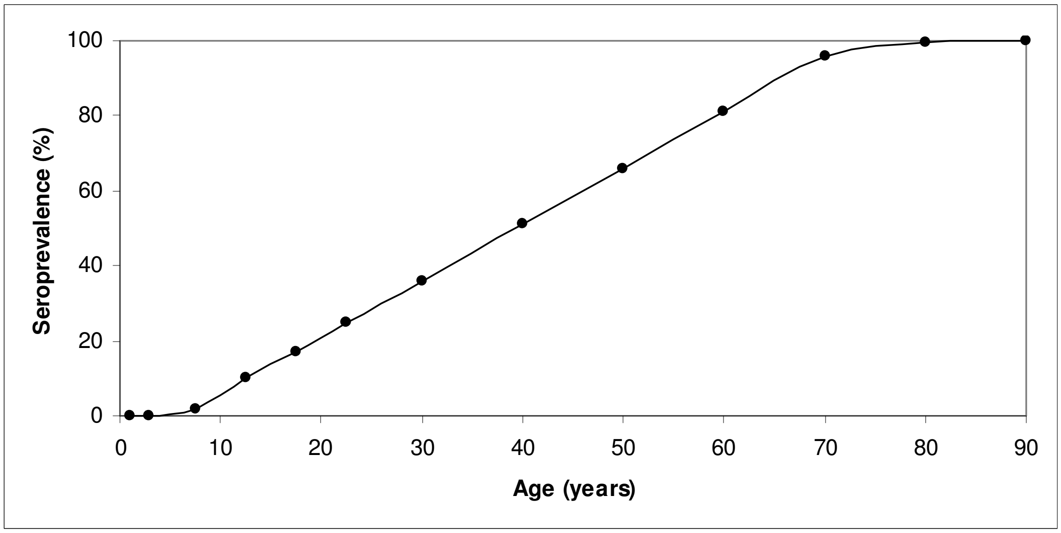
Table 7. Summary Prevalence Estimates by Age in High Income Asia Pacific.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	0	2	10	17	25
% at risk	--	--	100	98	90	83	75

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	36	51	66	81	96	100	100
% at risk	64	49	34	19	4	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 14. Plot of Estimated Seroprevalence by Age in High Income Asia Pacific.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Because such clear shifts in seroprevalence have occurred over the past several decades, only data from 1990 and more recently were used to fit the regional curve (Table 7, Figure 14).

Figure 15. Plots of Age-Seroprevalence Data from Studies from High Income Asia Pacific.

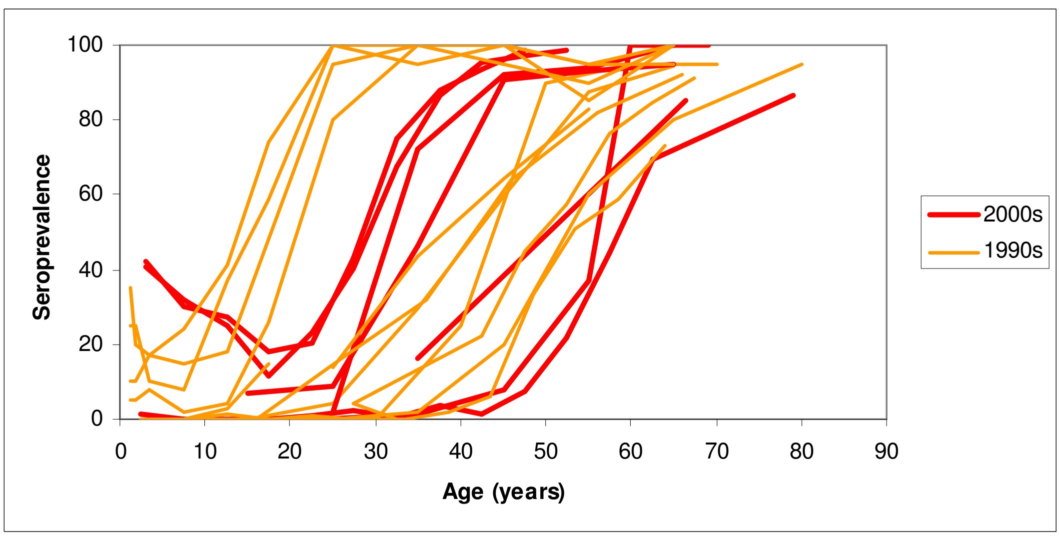


TABLE OF INCLUDED PREVALENCE STUDIES

Table 8. Information about Included Studies from High Income Asia Pacific.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Japan	Kiyohara, 2007	2003	1.3% (age 0-4), 0.0% (age 5-9), 0.0% (age 10-14), 0.0% (age 15-19), 1.0% (age 20-24), 2.5% (age 25-29), 0.5% (age 30-34), 3.8% (age 35-39), 1.6% (age 40-44), 7.5% (age 45-49), 21.8% (age 50-54), 44.5% (age 55-59), 69.4% (age 60-64), 86.5% (age 65-92); no differences by sex	2430	stored samples from the National Serum Reference Bank [Tōhoku region; Kantō region; Kansai region; Kyūshū-Yamaguchi (Chūgoku) regions]
Japan	Mitsui, 2006	2004	0.0% (age 18-29), 1.3% (age 30-39), 8.1% (age 40-49), 37.2% (age 50-59), 100% (age 60-69)	266	healthy medical staff members [Nagoya, Aichi Prefecture. Chūbi region]
Japan	Nishise, 2003	2000-2001	16.4% (age 20-49), 85.3% (age 50-82); no differences by sex	695	healthy outpatients [Yamagata Prefecture, Tōhuku region]
Japan	Malaty, 2003	1986; 1994	(estimated from graph) 1986: 5% (age 5-19), 8% (age 20), 30% (age 30), 80% (age 40), 95% (age 50), 90% (age 60), 95% (age 70); 1994: 0%, 0%, 0%, 25%, 90%, 95%, 95%; no differences by sex	649; 143	rural adults and children [South Kiso, Nagano Prefecture, Chūbu region]
Japan	Fujisawa, 1999	1974; 1984; 1994	(estimated from graph) 1974: 0% (age 0-9), 2% (age 10-19), 40% (age 20-29), 80% (age 30-39), 100% (age 40-49), 95% (age 50-59), 100% (age 60-69), 95% (age 70-89); 1984: 0%, 0%, 0%, 20%, 80%, 90%, 95%, 90%; 1994: 0%, 0%, 0%, 2%, 20%, 60%, 80%, 95%	341; 321; 341	stored samples from the National Serum Reference Bank [Nagano Prefecture, Chūbu region; Niigata Prefecture, Chūbu region; Gunma Prefecture, Kantō region; Toyama Prefecture, Chūbu region; Shizuoka Prefecture, Chūbu region; Mie Prefecture, Kansai

					region; Miyagi Prefecture, Tōhoku region]
Japan	Furusyo, 1998 / Noguchi, 1991	1970; 1980; 1988; 1996	1970: 32.1% (age 0-9), 70.0% (age 10-19), 100% (age 20-29), 100% (age 30-39), 95.0% (age 40-49), 100% (age 50-59), 100% (age 60+); 1980: 2.0%, 8.0%, 87.1%, 96.6%, 100.0%, 100.0%, 100.0%; 1988: 1.3%, 4.4%, 19.6%, 58.1%, 84.0%, 98.9%, 99.2%; 1996: 0.0%, 0.0%, 4.0%, 29.7%, 59.8%, 87.5%, 94.3%; no differences by sex	178; 241; 704; 523	rural residents [Iriomote Island, Yaeyama District, Okinawa Prefecture, Kyūshū region]
Japan	Furuta, 1997	--	0.0% (age 16-20), 0.0% (age 21-25), 0.0% (age 26-30), 0.0% (age 31-35), 1.8% (age 36-40), 6% (age 41-45), 33.5% (age 46-50), 51% (age 51-55), 59% (age 56-60), 73% (age 61+)	1043	healthy outpatients employed by Honda Motor Company [Hamamatsu, Shizuoka Prefecture, Chūbu region]
Japan	Kiyohara, 1997	1994	0.0% (age 0-4), 0.0% (age 5-9), 1.2% (age 10-14), 0.0% (age 15-19), 0.8% (age 20-24), 0.0% (age 25-29), 0.0% (age 30-34), 4.2% (age 35-39), 22.0% (age 40-44), 44.8% (age 45-49), 57.6% (age 50-54), 76.4% (age 55-59), 84.5% (age 60-64), 91.4% (age 65+); males: 23.5%, females: 16.3%	2708	stored samples from the Japanese Red Cross Blood Centeres and the National Serum Reference Bank [Hokkaidō Prefecture, Hokkaidō region; Akita and Miyagi Prefectures, Tōkohu region; Niigata Prefecture, Chūburegion; Gunma and Tokyo Prefectures, Kantō region; Osaka, Kagawa Prefecture, Kansai region; Yamaguchi Prefecture, Chūgoku region; Fukuoka and Ōita Prefectures, Kyūshū region]

Japan	Fujiyama, 1994	1982; 1991	1982: >90% (ages 30+), males 69.6%, females 63.3%; 1991: >90% (ages 50+), ~60% (age 40-49), ~20% (age 30-39), males 49.4%, females 49.8%; no differences by sex	467; 385	[Hondo City, Kumamoto Prefecture, Kyūshū region]
Japan	Akbar, 1992-1993	1989-1990	0.0% (age 0-9), 0.0% (age 10-19), 0.0% (age 20-29), 1.9% (age 30-39), 31.3% (age 40-49), 73.0% (age 50-59), 78.0% (age 60-69), 95.0% (age 70-79), 100% (age 80+); no differences by sex	1118	healthy students, teachers, and outpatients [Kuma town, Kamiukena District, Ehime Prefecture, Shikoku region]
Japan	Kiyosawa, 1989	1988	10.8% (age 16-52)	519	healthy male blood donors without a history of hepatitis [Matsumoto, Nagano Prefecture, Chūbu region]
Japan	Ikematsu, 1987 / Kashiwagi, 1983	1968-1973; 1980-1981	1968-1973: 30.7% (age 0-9), 69.9% (age 10-19), 97.5% (age 20-29), 96.4% (age 30-39), 97.5% (age 40-49), 98.9% (age 50-59), 100% (age 60+); 1980-1981: 0.6% (age 0-4), 1.2% (age 5-9), 1.2% (age 10-14), 19.3% (age 15-19), 50.8% (age 20-24), 71.0% (age 25-29), 72.8% (age 30-34), 86.6% (age 35-39), 92.4% (age 40-44), 90.8% (age 45-49), 96.7% (age 50-54), 96.8% (age 55-59), 98.1% (age 60-64), 100% (age 65-69), 92.1% (age 70+)	669; 1067	healthy outpatients [Naha City, Ishigaki City, Okinoerabu Island, Iriomote Island, Yonaguni Island, Hateruma Island, Kuroshima Island, all in Okinawa Prefecture, Kyūshū region]

Japan	Taylor-Wiedeman, 1987	1973; 1984	1973: 3% (age 0-4), 0% (age 5-9), 0% (age 10-14), 9% (age 15-19), 13% (age 20-24), 55% (age 25-29), 69% (age 30-34), 72% (age 35-39), 94% (age 40-44), 84% (age 45-49), 97% (age 50-54), 97% (age 55-59), 97% (age 60+); 1984: 0%, 0%, 0%, 0%, 0%, 0%, 19%, 50%, 71%, 92%, 96%, 96%, 96%	415; 416	randomly collected sera from healthy residents [Aomori, Iwate, Miyagi, and Yamagata Prefectures, Tōhoku region; Saitama Prefecture, Kantō region; Niigata, Nagano, and Shizuoka Prefectures, Chūbu region; Yamaguchi Prefecture, Chūgoku region; Ehime Prefecture, Shikoko region; Fukuoka Prefecture, Kyūshū region]
Japan	Kashiwagi, 1985	1980-1983	hospital staff: 8.0% (age <30), 39.7% (age 30-39), 75.5% (age 40-49), 78.9% (age 50-59); paper mill employees: 6.9%, 42.6%, 76.2%, 87.5%; no differences by sex	1883	hospital personnel and paper mill employees [Miyazaki Prefecture, Kyūshū region]
Japan	Togashi, 1982	1980	44.4% (newborn), 0.0% (age <1), 5.3% (age 1-9), 0.0% (age 10-19), 9.1% (age 20-29), 80.0% (age 30-39), 90.0% (age 40-49), 100% (age 50+)	109	random sampled residents [Hokkaidō Prefecture, Hokkaidō region]
Japan	Ichida, 1981	--	0.0% (age 0-4), 0.0% (age 5-9), 3.3% (age 10-14), 4.8% (age 15-19), 8.4% (age 20-24), 20.3% (age 25-29), 37.5% (age 30-34), 67.7% (age 35-39), 83.8% (age 40-44), 88.8% (age 45-49), 91.8% (age 50-54), 92.9% (age 55-59), 92.9% (age 60+)	1757	healthy subjects or ambulatory non-hepatic patients [Niigata Prefecture, Chūbu region; Matsumoto, Nagano Prefecture, Chūbu region; Gifu Prefecture, Chūbu region; Nagoya, Aichi Prefecture, Chūbu region; Wakayama Prefecture, Kansai region; Nagasaki Prefecture, Kyūshū

					region]
Korea	Lee, 2008	2003-2007	7.1% (age 10-19), 8.9% (age 20-29), 46.5% (age 30-39), 90.6% (age 40-49), 93.0% (age 50-59), 95.1% (age 60+)	307	hospitalized patients with abnormal liver enzymes but no HAV IgM
Korea	Kim, 2007	2002-2006	Seoul: 52.7% (age <1), 40.7% (age 1-4), 31.8% (age 5 to 9), 24.8% (age 10-14), 11.6% (age 15-19), 23.0% (age 20-24), 40.5% (age 25-29), 67.5% (age 30-34), 86.5% (age 35-39), 95.3% (age 40-44), 97.0% (age 45-49), 98.5% (age 50+); Guri: 57.1% (age <1), 42.2% (age 1-4), 30.3% (age 5 to 9), 27.1% (age 10-14), 18.2% (age 15-19), 20.3% (age 20-24), 42.9% (age 25-29), 75% (age 30-34), 88.1% (age 35-39), 93.6% (age 40-44), 98.7% (age 45-49), 98.6% (age 50+); male: 54.9% (age <1), 40.1% (age 1-4), 30.6% (age 5 to 9), 26.5% (age 10-14), 16.7% (age 15-19), 20.2% (age 20-24), 40.6% (age 25-29), 73.3% (age 30-34), 85.3% (age 35-39), 95.5% (age 40-44), 96.9% (age 45-49), 98.4% (age 50+); female: 54.0% (age <1), 42.9% (age 1-4), 32.1% (age 5 to 9), 24.2% (age 10-14), 6.1% (age 15-19), 26.2% (age 20-24), 42.6% (age 25-29), 67.7% (age 30-34), 90.6% (age 35-39), 92.7% (age 40-44), 98.8% (age 45-49), 98.8% (age 50+); no differences by sex	4299	hospital outpatients [Seoul; Guri, Gyeonggi province]
Korea	Kang, 2007	2005-2006	2.0% (age 19-24)	200	healthy male military personnel [Seoul]

Korea	Song, 2007	2006	2% (age 20-29), 72% (age 30-39), 92% (age 40-49), 94% (age 50-59), 100% (age 60-69); no differences by sex	250	healthy adults [Seoul]
Korea	Park, 2006	1988-1997	1988-1989: 80% (newborn), 60% (age 1-6 months), 30% (age 0.5-1), 20% (age 1-1.5), 10% (age 1.5-2), 20% (age 2-4), 21% (age 5-9), 53% (age 10-14), 77% (age 15-19), 95% (age 20-29), 95% (age 30-39), 100% (age 40-49), 90% (age 50-59), 95% (age 60-69); 1990-1991: 100%, 75%, 25%, 10%, 10%, 17%, 24%, 41%, 74%, 100%, 95%, 100%, 95%, 95%; 1992-1993: 100%, 68%, 20%, 25%, 25%, 10%, 8%, 37%, 59%, 100%, 100%, 100%, 95%, 100%; 1994-1995: 100%, 85%, 35%, 35%, 20%, 17%, 15%, 18%, 48%, 95%, 100%, 95%, 90%, 100%; 1996-1997: 95%, 85%, 25%, 5%, 5%, 8%, 2%, 4%, 26%, 80%, 100%, 100%, 85%, 100%; no differences by sex	2737	hospital in-patients without liver disease [Jinju, South Gyeongsang province]
Korea	Sohn, 2000	1997	27.3% (age <1), 0.0% (age 1-4), 0.0% (age 5-9), 2.9% (age 10-14), 15.0% (age 15-19)	334	rural residents [Paju, Kimpo, Yangpyeong, Hwaseong, Kuri, Suwon, Puchon (Pocheon), and Uijeongbu in Gyeonggi province]
Singapore	Chow, 1996	1993	74.2% (age 14-95)	124	inpatients with acute non-hepatic illnesses
Singapore	Fock, 1995	1991	0.0% (age 11-20), 16% (age 21-30), 32% (age 31-40), 64% (age 41-50), 82% (age 51-60), 92% (age 61+); no differences by sex	359	participants in a public liver cancer seminar

Singapore	Heng, 1994	1993	13.9% (age 20-29), 43.4% (age 30-39), 64.4% (age 40-49), 82.7% (age 50+)	453	outpatients without a history of HAV vaccination who were controls in a cohort study of sewage workers
Singapore	Yap, 1993	1987-1991	0.9% (age 10-19), 48.1% (age 40-49), 100% (age 50-56); males: 29%, females: 26%; no differences by sex	896	healthy volunteers
Singapore	Goh, 1987	1984-1985	0.0% (age 0-4), 1.6% (age 5-9), 5.7% (age 10-14), 15.5% (age 15-24), 53.3% (age 25-34), 69.3% (age 35-44), 79.5% (age 45-54), 88.2% (age 55+); males: 29.9%, females: 33.9%; no differences by sex	1630	healthy hospital outpatients, residents of welfare homes, and dental staff

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CENTRAL ASIA

(Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan)

REGIONAL SUMMARY

Studies conducted in the 2000s in urban areas in Armenia [Asratian, 2005] and Kazakhstan [Victor, 2006 (EI)] found a mean age at infection in the early 20s. The infection rate appears to have declined in recent decades. A 1982-1983 study in Aralsk, Kazakhstan, found that more than 90% of 10 to 19 year olds had anti-HAV [Savinkskaia, 1986], but school outbreaks have been reported in recent years as the proportion of susceptible children increases [Victor, 2006 (EI); Victor, 2006 (AJE)].

The reported seroprevalence rates are higher in some of the other countries in the region. Studies in Mongolia in the 2000s found that 100% of adults were immune and a 50% immunity rate in 5-year-olds [Tsatsralt-Od, 2007; Takahashi, 2004]. Studies from the 1970s generally also found high rates of immunity [Shakgil'dian, 1983]. Studies conducted in Kyrgyzstan [Balayan, 1994], Mongolia [Savinkskaia, 1986], Tajikistan [Rafiev, 1999], and Uzbekistan [Doroshenko, 1990] also indicated that in the 1980s and 1990s anti-HAV detected in the majority of preschool children.

No studies were identified from Azerbaijan, Georgia, Kyrgyzstan, or Turkmenistan. Although too few recent studies have been conducted in most countries in this region to be able to easily identify trends, the included studies show that – at least in urban areas – the incidence rate may be decreasing and causing an increase in the age at infection from very early childhood to late childhood, which would increase the risk of outbreaks in the region.

SUMMARY AGE-PREVALENCE ESTIMATES

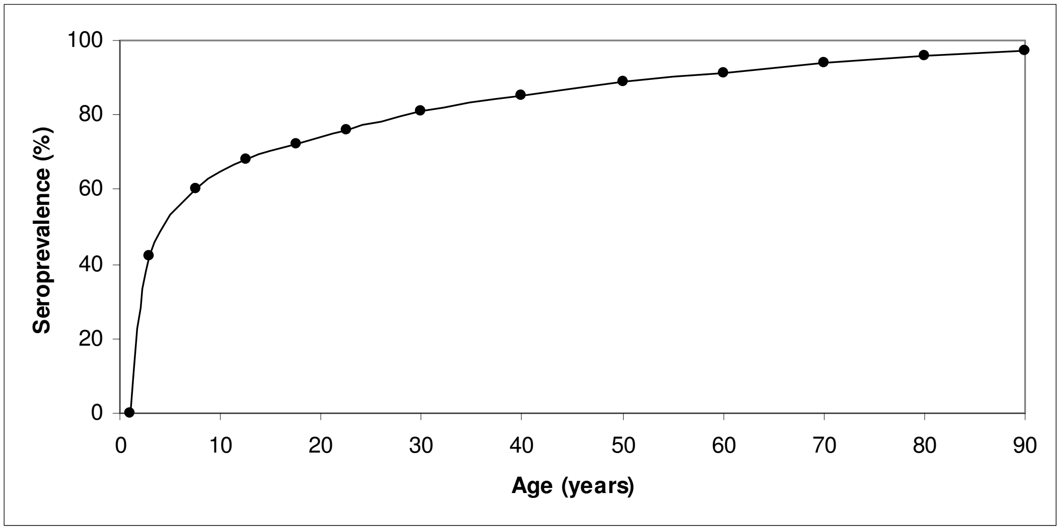
Table 9. Summary Prevalence Estimates by Age in Central Asia.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	42	60	68	72	76
% at risk	--	--	58	40	32	28	24

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	81	85	89	91	94	96	97
% at risk	19	15	11	9	6	4	3

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 16. Plot of Estimated Seroprevalence by Age in Central Asia.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 17. Plots of Age-Seroprevalence Data from Studies from Central Asia.

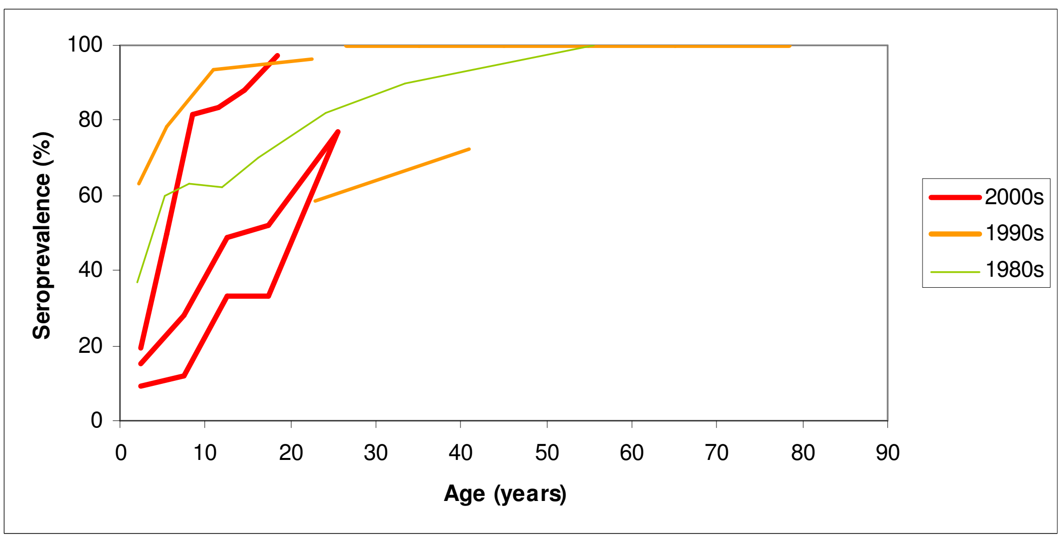


TABLE OF INCLUDED PREVALENCE STUDIES

Table 10. Information about Included Studies from Central Asia.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Armenia	Asratian, 2005	1997-2002	58.3% (age 15-30), 72.5% (age 31-50)	187	healthy adults [Yerevan, Yerevan province]
Kazakhstan	Victor, 2006 (EI)	2001	household contacts: 9% (age 0-4), 12% (age 5-9), 33% (age 10-14), 33% (age 15-19), 77% (age 20-30); community contacts: 15% (age 0-4), 28% (age 5-9), 49% (age 10-14), 52% (age 15-19), 77% (age 20-30)	1625	family and community contacts of hepatitis A cases [Almaty, Almaty province]
Kazakhstan	Nurgalieva, 2002	1999	Russian: 90% (age 10-60); Kazakh: 82% (age 10-60)	288	healthy urban residents born in Kazakhstan [Almaty, Almaty province]
Kazakhstan	Kompaniets, 1984	--	(estimated from graph) 46% (age 0-0.5), 23% (age 0.5-1), 37% (age 1-3), 60% (age 4-6), 63% (age 7-9), 62% (age 10-14), 70% (age 15-19), 82% (age 20-29), 90% (age 30-39), 100% (age 40+)	547	urban residents [Almaty (Alma Ata), Almaty province]
Mongolia	Tsatsralt-Od, 2007	2005-2006	75% (age 0-0.5), 0% (age 0.5-1), 19.5% (age 1-3), 50% (age 4-6), 81.4% (age 7-9), 83.4% (age 10-12), 88% (age 13-15), 97.2% (age 16-20); males: 73.7%, 0%, 15.0%, 55.1%, 78.5%, 86.0%, 88.4%, 100%; females: 76.9%, 0%, 23.4%, 44.9%, 84.4%, 81.2%, 87.7%, 95.0%; no differences by sex	717	healthy children [Ulaanbaatar]
Mongolia	Takahashi, 2004	2002	100% (age 23-29), 100% (age 30-39), 100% (age 40-49), 100% (age 50-59), 100% (age 60-69), 100% (age 70-86); no differences by sex	249	healthy urban adults and members of nomadic tribes [Ulaanbaatar]

Tajikistan	Rafiev, 1999	--	63.2% (age 0.5-3), 78.2% (age 4-6), 93.5% (age 7-14), 96.4% (age 15-29)	1816	southern Tajikistan
Uzbekistan	Doroshenko, 1990	1985-1987	82% (age 2-3)	200	preschool children

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EAST ASIA

(China, Democratic People's Republic of Korea, Hong Kong, Taiwan)

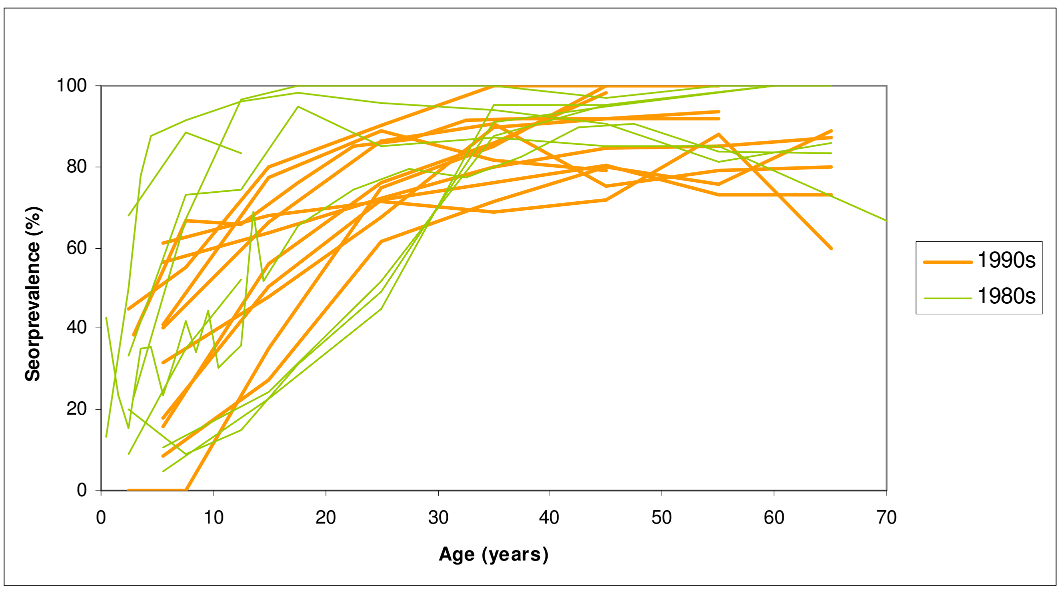
REGIONAL SUMMARY

There are a substantial number of articles from China and Taiwan, and a moderate number of articles from Hong Kong. These three areas will be discussed separately in the following paragraphs. No articles were available from the Democratic People's Republic of Korea (North Korea). The data from this region suggest an intermediate hepatitis A virus endemicity.

CHINA

Studies in urban China in the early 1990s found that although one-third to one-half of 10-year-olds had antibodies to hepatitis A, that proportion in most cities did not reach 100% even for those ages 60 and above [Li, 1998; Geng, 1998; Hazell, 1997; Song, 1991]. Rural areas had generally higher rates than urban areas [Li, 1998; Hazell, 1994]. Studies from rural and urban areas in the early 1980s usually – but not always – showed that about half of 5-year-olds had anti-HAV, and were more likely to find a 100% seroprevalence rate for older adult populations [Sun, 1985; Wang, 1985; Zou, 1984; Hu, 1984; Hu, 1983].

Figure 18. Plots of Age-Seroprevalence Data from Studies from China.

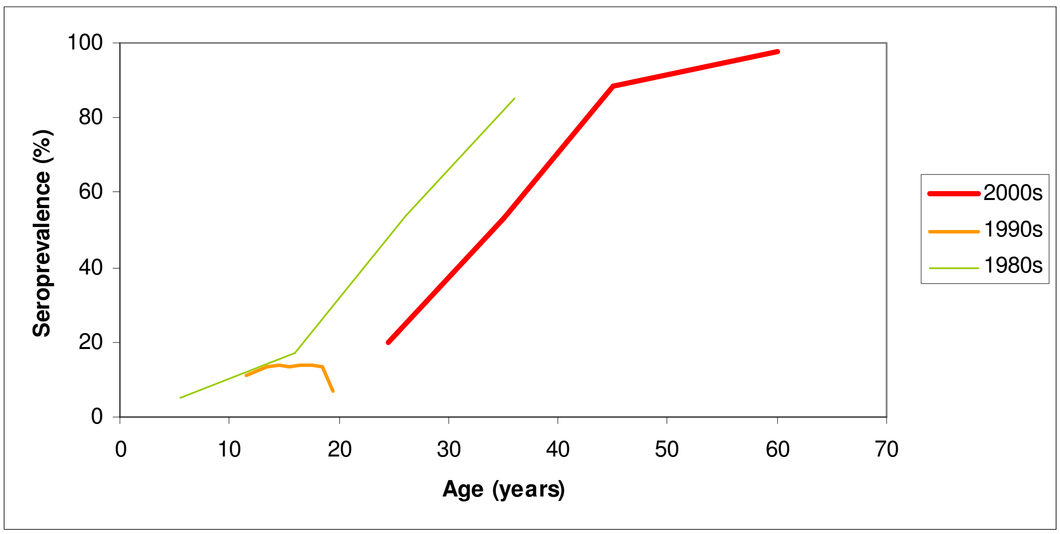


The most recent published studies on seroprevalence report on data from the early 1990s, so there is no evidence available to indicate whether a significant shift in seroprevalence has occurred in recent decades. The national annual incidence rate of hepatitis A was reported to have dropped from more than 50 per 100,000 in 1990 to 1992 to only about 5 per 100,000 in 2005 to 2006 as the use of hepatitis A vaccine expanded to more than 135 million doses in 2006 [Xu, 2008]. Studies in individual cities show drops in annual incidence from about 120 per 100,000 before the initiation of vaccination programs to 15 to 35 per 100,000 several years after vaccinations programs were implemented [Xu, 2008], and a study in Guangdong Province found a decrease in incidence from 79 per 100,000 in 1991 to 45 per 100,000 in 2001 [Huang, 2002]. Outbreaks have been reported in Chinese cities, including a major outbreak in Shanghai in 1988 [Cooksley, 2000]. These reports suggest that some populations within China have experienced decreasing infection rates along with socioeconomic development (and, to a lesser extent, along with immunization programs).

HONG KONG

Studies in Hong Kong in the mid-1990s and early 2000s found that fewer than 20% of children and young adults had anti-HAV [Wong, 2004; Lee, 1999]. Studies in the late 1980s found that about 50% of young adults had immunity and 50% remained susceptible to infection [Li, 1991; Chin, 1991].

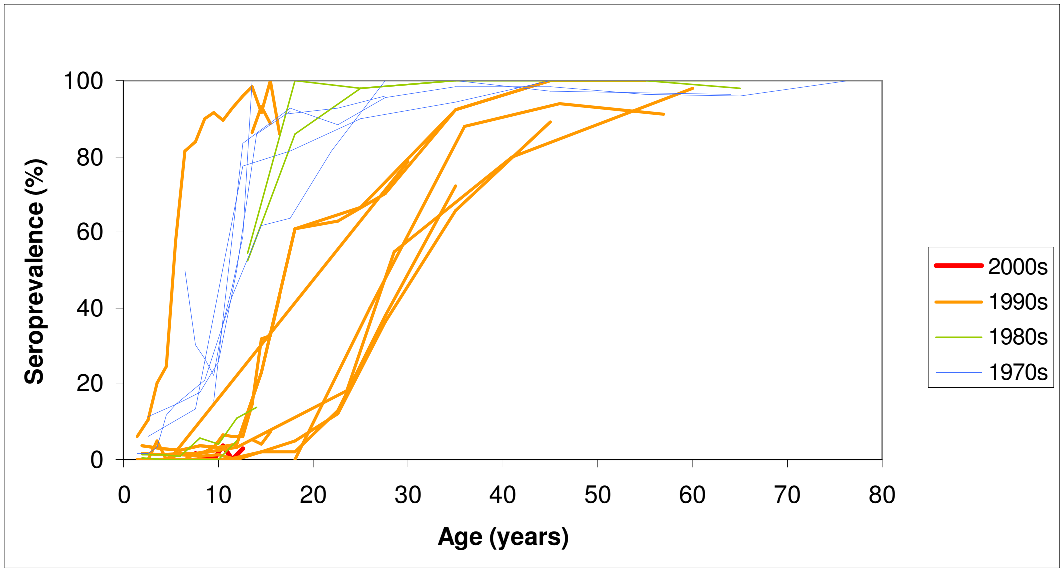
Figure 19. Plots of Age-Seroprevalence Data from Studies from Hong Kong.



TAIWAN

Studies in the Taiwan in the 1990s generally showed a low seroprevalence rate in children [Lin, 2006; Lin, 2005; Yang, 2003; Chen, 2003; Tseng, 2001; Lin, 2000 (AJTMH); Lin, 2000 (SAJTMPH); Wang, 2001; Yu, 2000; Wu, 1993; Wang, 1993], with about 50% of 30-year-olds demonstrating immunity [Yang, 2003; Tseng, 2001; Wang, 2001]. Some aboriginal and rural populations showed higher rates [Chen, 2003; Lin, 2000 (Infection); Wu, 1993; Yu, 1997]. Studies from the 1980s showed a very low immunity rate in children [Tzen, 1991; Hsu, 1985; Chiou, 1984] and about 50% of young adults showing immunity [Chiou, 1984]. Studies in the 1970s showed that about 50% of 10-year-olds had acquired immunity [Hwang, 1983; Wu, 1982; Sung, 1980; Wu JS, 1980; Wu KW, 1980; Lu, 1980]. These data, shown in Figure 20, suggest that a decline in the incidence rate has occurred in recent decades.

Figure 20. Plots of Age-Seroprevalence Data from Studies from Taiwan.



SUMMARY AGE-PREVALENCE ESTIMATES

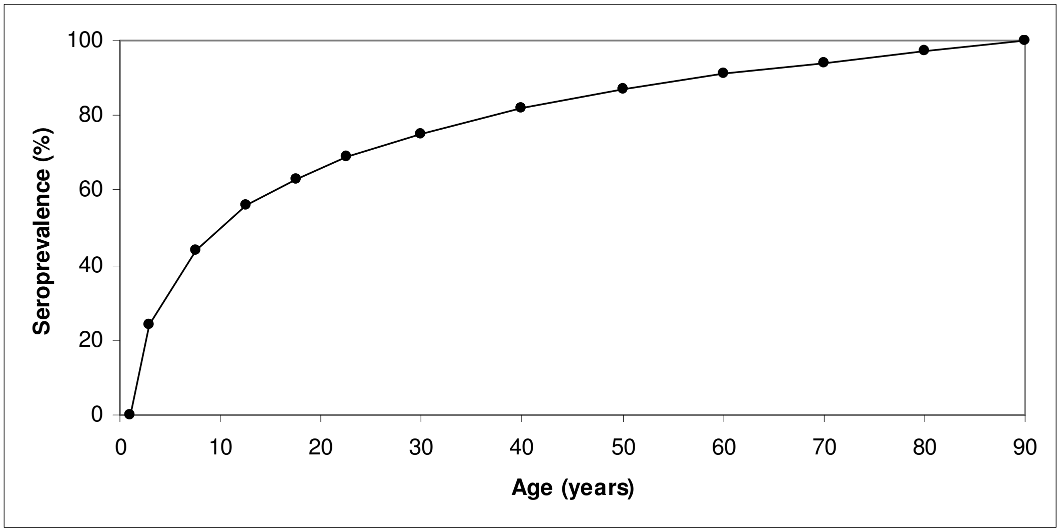
Table 11. Summary Prevalence Estimates by Age in East Asia.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	24	44	56	63	69
% at risk	--	--	76	56	44	27	31

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	75	82	87	91	94	97	100
% at risk	25	18	13	9	6	3	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

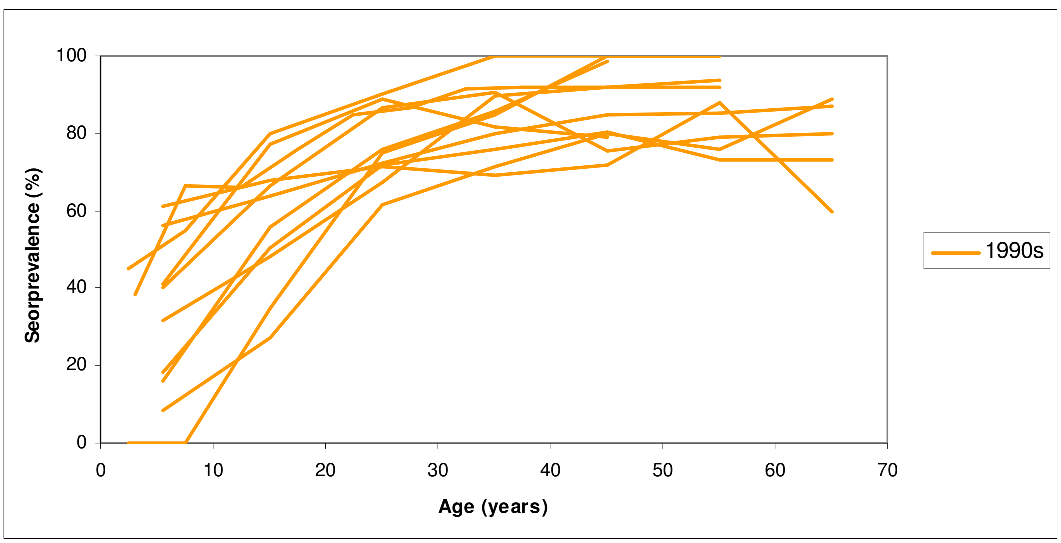
Figure 21. Plot of Estimated Seroprevalence by Age in East Asia.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Because there are notable differences between the three areas but nearly 98% of the region's population lives in China rather than Hong Kong or Taiwan, only data from China since 1990 were used to estimate the age-prevalence data above (Table 11).

Figure 22. Plots of Age-Seroprevalence Data from Studies from China Since 1990.



A best fit plot for each of the three entities in the region show some moderate differences between the three.

Figure 23. Plot of Estimated Seroprevalence by Age in China, Hong Kong, and Taiwan.

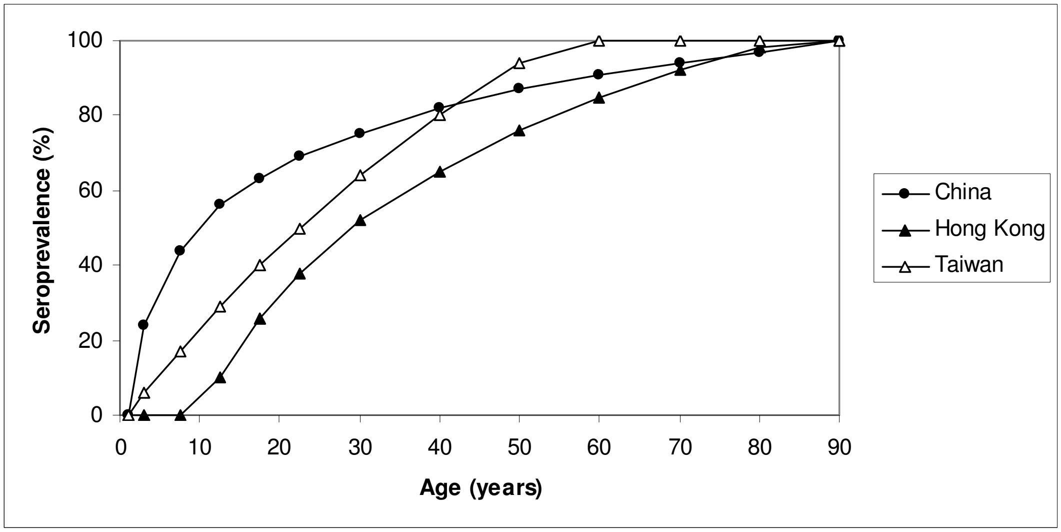


TABLE OF INCLUDED PREVALENCE STUDIES

Table 12. Information about Included Studies from East Asia.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
China	Li, 1998	1992	38.3% (age 1-4), 66.5% (age 5-9), 66.0% (age 10-14), 75.9% (age 15-19), 85.0% (age 20-24), 86.6% (age 25-29), 91.6% (age 30-34), 91.9% (age 35-39), 92.0% (age 40-49), 93.8% (age 50-59); males: 75.8%, females: 77.2%	3809	urban and rural adults and children [Fujian province]
China	Geng, 1998	1990	Xi'an: 40% (age 1-9), 66.3% (age 10-19), 86.5% (age 20-29), 90.5% (age 30-39), 75.4% (age 40-49), 79% (age 50-59), 80% (age 60+); Huhehaote: 41.2%, 77.3%, 88.9%, 81.8%, 79.2%, n/a, n/a; Chongqing: 8.6%, 27.4%, 61.6%, 71.3%, 79.8%, 75.8%, 88.9%; Nanjing: 31.8%, 48%, 67.6%,	10255	urban residents [Xi'an, Shaanxi province; Huhehaote (Hohhot), Inner Mongolia autonomous region; Chongqing; Nanjing, Jiangsu province; Jinan, Shandong province;

			89.9%, 91.8%, 91.9%, n/a; Jinan: 18.1%, 50.6%, 71.7%, 75.9%, 80.4%, 73.1%, 73.0%; Ha'erbin: 15.9%, 56.0%, 76.1%, 85.7%, 98.5%, n/a, n/a; Fuzhou: 56.2%, 63.8%, 72.3%, 80.1%, 84.8%, 85.1%, 87%; Nanchang: 61.3%, 67.8%, 71.4%, 69%, 71.9%, 88%, 60%		Ha'erbin (Harbin), Heilongjiang province; Fuzhou, Fujian province; Nanchang, Jiangxi province]
China	Hazell, 1994	--	(approximated from raph) rural: 45% (age 0-4), 55% (age 5-9), 80% (age 10-19), 90% (age 20-29), 100% (age 30-39), 95% (age 40-49), 90% (age 50+); urban: 0% (age 0-4), 0% (age 5-9), 35% (age 10-19), 75% (age 20-20), 85% (age 30-39), 100% (age 40-49), 100% (age 50+)	1501	urban and rural residents [Guangzhou, Panyu, Xinhui, and Nanhai in Guangdong province]
China	Song, 1991	1988	42.9% (age <1), 23.5% (age 1), 15.4% (age 2), 34.9% (age 3), 35.4% (age 4), 23.3% (age 5), 31.6% (age 6), 41.9% (age 7), 34.4% (age 8), 44.4% (age 9), 30.3% (age 10), 33.3% (age 11), 35.9% (age 12), 53.6% (age 13), 51.6% (age 14), 65.3% (age 15-19), 74.3% (age 20-24), 79.7% (age 25-29), 77.4% (age 30-34), 82.6% (age 35-39), 89.9% (age 40-44), 90.8% (age 45-49), 83.6% (age 50-59), 83.3% (age 60+); males: 57.1%, 40.0%, 13.0%, 52.0%, 33.3%, 14.3%, 45.0%, 57.1%, 27.8%, 45.0%, 27.8%, 33.3%, 33.3%, 46.7%, 47.4%, 64.3%, 70.5%, 83.6%, 80.4%, 82.3%, 83.3%, 92.1%, 85.0%, 82.4%; females: 14.3%, 10.5%, 18.8%, 11.1%, 37.0%, 31.8%, 16.7%, 29.4%,	1663	urban and rural residents [Guangzhou, Guangdong province]

			42.9%, 43.8%, 33.3%, 33.3%, 38.9%, 61.5%, 58.3%, 66.3%, 77.5%, 75.8%, 74.6%, 82.9%, 95.4%, 89.8%, 82.0%, 84.6%		
China	Li, 1989	1986	early epidemic: 8.9% (age 0-4), 35.1% (age 5-9), 52.2% (age 10-14); post-epidemic: 67.9% (age 0-4), 88.3% (age 5-9), 83.3% (age 10-14)	257	suburban children [Jinan, Shandong province]
China	Sun, 1985	1980	13.3% (age <1), 33.3% (age 1), 50.0% (age 2), 77.8% (age 3), 87.5% (age 4), 91.4% (age 5-9), 96.2% (age 10-14), 98.2% (age 15-19), 95.7% (age 20-29), 94.1% (age 30-39), 90.5% (age 40-49), 81.0% (age 50-59), 85.7% (age 60+)	1032	healthy volunteers [Quin Yuan County, Hebei province]
China	Xu, 1985	1981-1982	16.9% (age 2-6.5)	314	preschool children
China	Wang, 1985	1982-1983	23.1% (age 1-4), 67.3% (age 5-9), 96.4% (age 10-14), 100% (age 15-19), 100% (age 20-29), 100% (age 30-39), 97.2% (age 40-49), 100% (age 50-59), 100% (age 60+); males: 25.0%, 68.2%, 95.7%, 100%, 100%, 100%, 100%, 100%, 100%; females: 21.4%, 66.7%, 97.3%, 100%, 100%, 100%, 96.7%, 100%, 100%; no differences by sex	491	suburban residents [Beijing, Beijing province]
China	Zou, 1984	--	33.3% (age 0-4), 73.2% (age 5-9), 74.5% (age 10-14), 94.7% (age 15-19), 85.0% (age 20-29), 87.0% (age 30-39), 85.0% (age 40-49), 85.0% (age 50-59), 66.7% (age 60-79); males: 35.3%, 58.8%, 63.6%, 88.9%, 80.0%, 83.3%, 70.0%, 90.0%, 60.0%; females: 31.3%, 83.3%, 84.0%, 100%, 90.0%, 90.9%, 100%, 80.0%, 72.7%; no differences by sex	543	urban and rural residents [Guiyang, Guizhou province]

China	Hu, 1984	1980	urban: 10.5% (age 1-9), 24.4% (age 10-19), 51.9% (age 20-29), 87.5% (age 30-39), 95.5% (age 40-49), 100% (age 50+); rural: 4.7% (age 1-9), 22.7% (age 10-19), 44.8% (age 20-29), 95.2% (age 30-39), 95.2% (age 40-49), 100% (age 50+); no differences by sex	339	healthy schoolchildren and adults in urban and rural areas [Shanghai]
China	Hu, 1983	1980	20% (age 0-4), 9% (age 5-9), 15% (age 10-14), 31% (age 15-19), 49% (age 20-29), 91% (age 30-39), 95% (age 40-49), 100% (age 50+)	365	urban area [Shanghai]
Hong Kong	Wong, 2004	2001	19.7% (age 18-30), 53.2% (age 31-40), 88.3% (age 41-50), 97.7% (age 51+); no differences by sex	936	urban adults [Hong Kong]
Hong Kong	Lee, 1999 (Vaccine); Lee, 1999 (Public Health)	1996-1997	11.1% (age 11-12), 13.3% (age 13), 13.9% (age 14), 13.5% (age 15), 13.8% (age 16), 14.0% (age 17), 13.2% (age 18), 7.0% (age 19-20); males: 10.3%, 11.6%, 13.0%, 13.5%, 15.1%, 15.5%, 13.5%, 7.4%; females: 12.1%, 15.5%, 15.2%, 13.4%, 12.1%, 12.0%, 12.8%, 7.0%; no differences by sex	1580	urban secondary schoolchildren [Hong Kong]
Hong Kong	Li, 1991	1988	50% (adults)	50	blood donors [Hong Kong]
Hong Kong	Chin, 1991	1987-1989	5.3% (age 0-10), 17.1% (age 11-20), 53.8% (age 21-30), 85.1% (age 31-40), 94.7% (age 40+); no differences by sex	702	urban adults and children [Hong Kong]
Taiwan	Lin, 2006	--	<1% (ages 3-6); no differences by sex	2548	urban and rural preschool children in central Taiwan [Taichung County/city; Miaoli County; Changhua County; Nantou County]

Taiwan	Lin, 2005	2003	1.8% (age 7), 0.0% (age 8), 0.0% (age 9), 3.7% (age 10), 0.0% (age 11), 3.0% (age 12); no differences by sex	289	primary school children [Danshuei Township, Taipei County]
Taiwan	Yang, 2003	1998	17.1% (age <1), 0.0% (age 1-4), 0.0% (age 5-8), 0.0% (age 9-12), 2.0% (age 13-15), 1.9% (age 16-19), 12.8% (age 20-24), 38.1% (age 25-29), 72.3% (age 30-39)	500	healthy schoolchildren and well-visit outpatients [Tainan City and County]
Taiwan	Chen, 2003	1996	Green Island: 5.3% (age 13), 4.0% (age 14), 7.1% (age 15); Lanyu Island: 86.4% (age 13), 93.0% (age 14), 88.9% (age 15)	229	healthy schoolchildren [Green Island; Lanyu Island]
Taiwan	Tseng, 2001	1999	23.3% (age <1), 1.5% (age 1-2), 1.1% (age 3-4), 1.6% (age 5-6), 1.8% (age 7-8), 3.2% (age 11-12), 18.2% (age 21-25), 54.7% (age 26-30), 80.0% (age 31-50), 97.8% (age 51+); no differences by sex	1017	healthy residents not vaccinated against HAV [Taipei]
Taiwan	Lin, 2000 (Am J Trop Med Hyg); Lin, 2000 (Southeast Asian J Trop Med Public Health)	--	0.4% (age ≤6), 78.8% (age 18+); no differences by sex	2151	children and teachers in urban and rural Tawain not vaccinated against HAV [Taichung County; Taichung City; Miaoli County; Changhua County; Nantou County]
Taiwan	Wang, 2001	1992; 1998	1992: 64.6% (age <1), 3.6% (age 1-2), 2.9% (age 3-4), 2.3% (age 5-6), 3.7% (age 7-8), 3.3% (age 9-10), 4.1% (age 11-12), 22.9% (age 13-15), 60.7% (age 16-19), 62.9% (age 20-24), 70.2% (age 25-29), 92.3% (age 30-39), 100% (age 40-49), 100% (age 50+); 1998: 20.7% (age <1), 0% (age 1-2), 0% (age 3-4), 1.1% (age 5-6), 0.8% (age 7-8), 1.4% (age 9-10), 0% (age 11-12), 2% (age 13-15),	738; 948	healthy schoolchildren and outpatients [Tainan City, Tainan County, and surrounding areas]

			4.9% (age 16-19), 12.1% (age 20-24), 36.4% (age 25-29), 65.9% (age 30-39), 89.1% (age 40-49), 94.1% (age 50+); higher rate in females than males		
Taiwan	Yu, 2000	1997	0% (age 15-20), 40% (age 21-30), 88% (age 31-40), 94% (age 41-50), 91% (age 51-62)	244	employees of hospital-based restaurants [Taipei]
Taiwan	Lin, 2000 (Infection)	1996-1998	Futien: 97.5%; Fonbin: 97.1%; Fushiu: 98.7%; Sholin: 99%; no differences by sex	1748	adults living in Ami and Atayal aboriginal villages [Fushiu, Sholin, Futien, and Fonbin]
Taiwan	Liu, 1994	1992	64.6% (age <1), 3.6% (age 1-2), 2.9% (age 3-4), 2.3% (age 5-6), 3.7% (age 7-8), 3.3% (age 9-10), 4.1% (age 11-12), 22.9% (age 13-15), 60.7% (age 16-19), 66.7% (age 20-29), 92.3% (age 30-39), 100% (age 40-49), 100% (age 50+)	738	healthy schoolchildren and outpatients [Tainan District, Taipei]
Taiwan	Wu, 1993	1993	Western Plain Region: 75.0% (age 0-5 months), 11.8% (age 0.5-1), 0.0% (age 1), 0.0% (age 2), 5.0% (age 3), 0.0% (age 4), 0.0% (age 5), 0.0% (age 6), 1.5% (age 7), 2.2% (age 8), 3.4% (age 9), 6.3% (age 10), 6.1% (age 11), 6.0% (age 12), 14.7% (age 13), 31.8% (age 14), 32.8% (age 15), 43.2% (age 16); Eastern / Central Mountain Region: 100% (age 0-5 months), 37.5% (age 0.5-1), 5.9% (age 1), 10.3% (age 2), 20.0% (age 3), 24.6% (age 4), 57.6% (age 5), 81.5% (age 6), 83.7% (age 7), 89.9% (age 8), 91.4% (age 9), 89.6% (age 10), 92.6% (age 11), 95.8% (age 12), 98.5% (age 13), 91.4% (age 14), 100% (age 15), 85.7% (age 16)	3309	rural and urban children, including those from aboriginal communities that had not had recent hepatitis outbreaks [Lung-Chi village; Tainan City; Kao-Hisung, I-Lan, Hua-Lien, and Tai-Tuong counties]

Taiwan	Wang, 1993	1991	31.5% (ages 13-16)	875	junior high school students from 20 different townships [north, central, and south Taiwan]
Taiwan	Tzen, 1991	1989	27.5% (age <1), 0.5% (age 1 to 2), 0% (age 3 to 4), 0% (age 5 to 6), 0% (age 7 to 8), 0% (age 9 to 10), 5.0% (age 11 to 12)	1105	healthy school children and outpatients [Taipei City]
Taiwan	Hsu, 1985	1984	27.0% (age <1), 1.2% (age 1-2), 1.1% (age 3-4), 0.9% (age 5-6), 5.8% (age 7-8), 4.1% (age 9-10), 10.7% (age 11-12), 13.6% (age 13-14); no differences by sex	1200	healthy school children and outpatients [Taipei City]
Taiwan	Chiou, 1984	1981-1982	city: 52.4% (age 10-15), 85.7% (age 16-19), 98.0% (age 20-29), 100% (age 30-39), 100% (age 40-49), 100% (age 50-59), 100% (age 60+); villages: 54.4% (age 10-15), 100% (age 16-19), 97.9% (age 20-29), 100% (age 30-39), 100% (age 40-49), 100% (age 50-59), 97.8% (age 60+)	2985	rural and urban residents [southern Taiwan]
Taiwan	Hwang, 1983	1975-1976	35.9% (age <1), 1.6% (age 1), 1.7% (age 2), 3.1% (age 3), 11.8% (age 4), 14.7% (age 5), 15.6% (age 6), 17.9% (age 7-8), 25.9% (age 9-10), 50.0% (age 11-12), 86.0% (age 13-14), 92.0% (age 15-19); no differences by sex	823	healthy outpatients and school children [Taipei]
Taiwan	Wu, 1982	--	100% (age <1 month), 40% (age 1-4 months), 31.3% (age 5-8 months), 4.5% (age 9-12 months), 11.3% (age 1-3), 14.6% (age 4-6), 21.0% (age 7-9), 43.2% (age 10-12), 61.8% (age 13-15), 63.8% (age 16-18), 81.3% (age 19-24), 100% (age 25-29), 100% (age 30-39), 97.0% (age 40-49), 96.4%	1210	healthy residents

			(age 50-78); males: 14.3% (age 1-3), 14.6% (age 4-6), 22.3% (age 7-9), 41.8% (age 10-12), 63.9% (age 13-15), 58.5% (age 16-18), 81.4% (age 19-24), 100% (age 25-29), 100% (age 30-39), 100% (age 40-49), 97.7% (age 50-78); females: 7.7%, 14.5%, 19.1%, 45.2%, 60.0%, 78.9%, 81.1%, 100%, 100%, 94.4%, 94.0%; no differences by sex		
Taiwan	Sung, 1980	1976-1978	5.9% (age 0-4), 13.3% (age 5-9), 77.3% (age 10-14), 81.3% (age 15-19), 90.0% (age 20-29), 94.4% (age 30-39), 100% (age 40-49), 100% (age 50+)	134	stored sera from healthy participants of previous seroepidemiological studies
Taiwan	Wu JS, 1980	--	15.4% (age 9), 83.3% (age 10-14), 92.7% (age 15-19), 88.5% (age 20-24), 95.4% (age 25-29), 98.5% (age 30-39), 98.5% (age 40-49), 96.3% (age 50-59), 95.9% (age 60-69), 100% (age 70-82); no differences by sex	503	outpatients and inpatients without liver disease from a hospital [Taipei]
Taiwan	Wu KW, 1980	--	50.0% (age 6), 30.4% (age 7), 26.7% (age 8), 22.2% (age 9), 35.7% (age 10), 45.7% (age 11), 58.8% (age 12), 100% (age 13); no differences by sex	195	primary school children [Taipei City]
Taiwan	Lu, 1980	1978-1979	91.2% (age 14-19), 92.6% (age 20-24), 96.1% (25-29), 98.4% (age 30+); no differences by sex	946	restaurant workers [Chung Shan District, Taipei]

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SOUTH ASIA

(Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan)

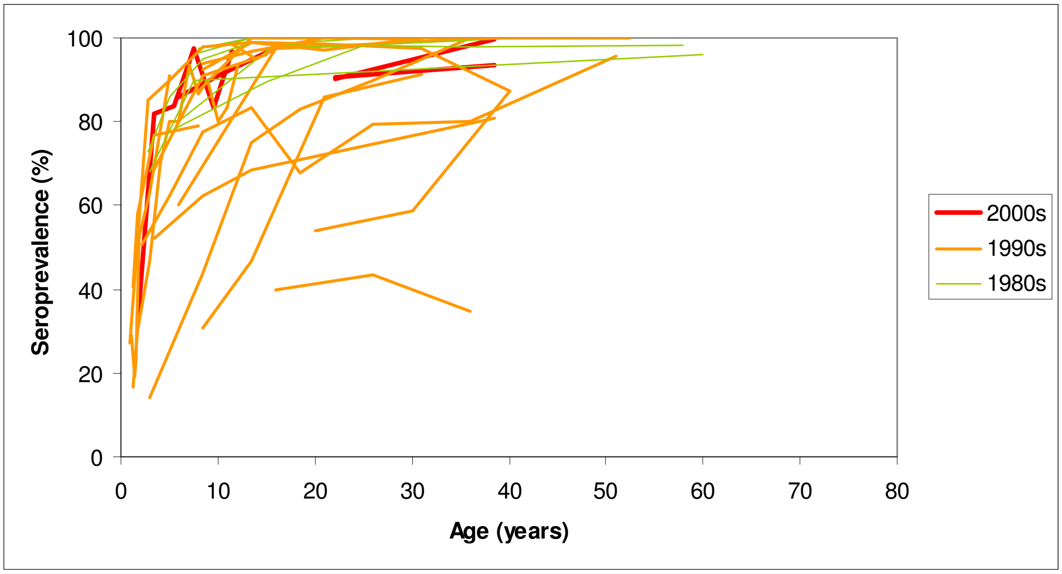
REGIONAL SUMMARY

Most studies from India and nearly all studies from the other countries in this region show a high rate of hepatitis A virus endemicity. India is discussed in a separate paragraph below. Studies from Pakistan in the 1980s, 1990s, and 2000s indicate that more than half of children acquire immunity by their preschool years and nearly all adolescents and adults are immune [Agboatwalla, 1994; Aziz, 2007; Malik, 1988; Qureshi, 2000]. Studies from Nepal in the 1980s and 1990s showed a nearly universal immunity by age 15 [Kitson, 1999; Nakashima, 19 95; Sawayama, 1999]. Studies from Bangladesh [Ahmed, 2009] and Bhutan [Da Villa, 1997] show that more than half of 5-year-old children and nearly all adolescents and adults in these countries are immune. No studies were available from Afghanistan, but the country is expected to have a high seroprevalence rate. The available reports suggest that hepatitis A is highly endemic in this region.

INDIA

Studies conducted in the 2000s across India consistently found that more than 90% of adolescents and adults [Anand, 2004; Arankalle, 2001; Batra, 2002; Gadgil, 2008; Mall, 2001; Murhekar, 2002; Ramachandran, 2004; Xavier, 2003] and the majority of children acquire immunity during their preschool years [Acharya, 2003; Mall; 2001; Mohanavalli, 2003]. Studies from the 1980s and 1990s also generally showed a very high seroprevalence rate in adolescents and adults [Aggarwal, 1999; Arankalle, 1995; Chitambar, 1999; Das, 1996; Dhawan, 1998; Gandi, 1981; Joshi, 2000; Tandon, 1984; Werner, 1990; Werner, 1989] and an early average age at infection [Aggarwal, 1999; Arankalle, 1995; Chadha, 1999; Chitambar, 1999; Dhawan, 1998; Dutta, 2000; Gandi, 1981; Graham, 1991; Joshi, 2000; Mittal, 1998; Tandon, 1984; Thapa, 1995; Werner, 1990; Werner, 1989]. Although a few pockets of lower seroprevalence in high-income urban areas are emerging with socioeconomic development [Arankalle, 2001; Das, 2000; Das, 1998; Jindal, 2002], these higher-risk young adults make up only a small portion of the total population of India.

Figure 24. Plots of Age-Seroprevalence Data from Studies from India.



SUMMARY AGE-PREVALENCE ESTIMATES

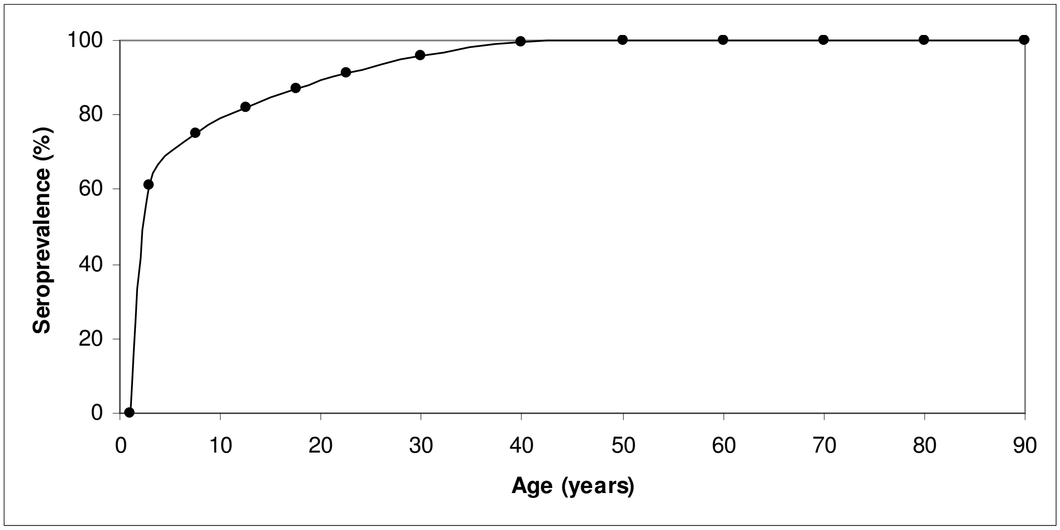
Table 13. Summary Prevalence Estimates by Age in South Asia.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	61	75	82	87	91
% at risk	--	--	39	25	18	13	9

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	96	100	100	100	100	100	100
% at risk	4	0	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 25. Plot of Estimated Seroprevalence by Age in South Asia.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 26. Plots of Age-Seroprevalence Data from Studies from South Asia.

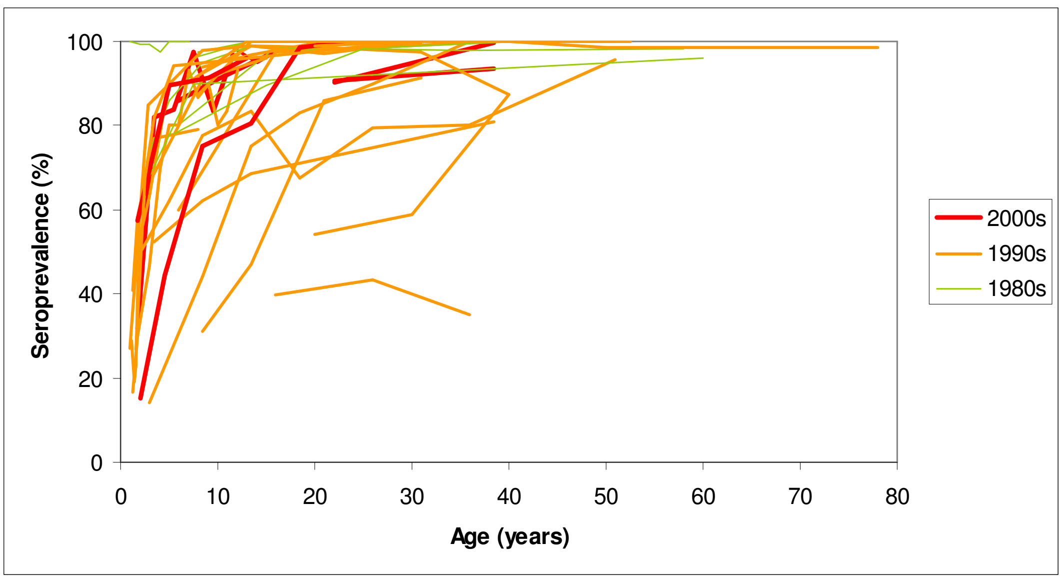


TABLE OF INCLUDED PREVALENCE STUDIES

Table 14. Information about Included Studies from South Asia.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Bangladesh	Ahmed, 2009	2005	15% (age 1-2), 44.4% (age 3-5), 75.2% (age 6-10), 80.4% (age 11-15), 98.5% (age 16-20), 100% (age 21-25)	465	outpatients and volunteers from rural and urban areas with no history of hepatitis or HAV vaccination [Dhaka]
Bhutan	Da Villa, 1997	1995-1996	89.5% (age 0-12), 100% (age 13+); no differences by sex	257	healthy volunteers and outpatients [Thimpu]
India	Gadgil, 2008	2002-2005	2002: 90.3% (age 18-25), 99.5% (age 26-50); 2004-2005: 90.6% (age 18-25), 93.6% (age 26-50)	1145	volunteer blood donors from the city and suburbs [Pune, Maharashtra state]
India	Anand, 2004	2002	94.6% (adults)	89	healthy controls in a study of patients with chronic liver disease [New Delhi, National Capital Territory of Delhi]
India	Ramachandran, 2004	2001-2002	100% (age 18-65)	79	healthy controls in a study of patients with chronic liver disease [Vellore, Tamil Nadu state]
India	Acharya, 2003	--	86% (age 4-7), 91% (age 8-11), 97% (age 12-18); males: 90%, 92%, 96%; females: 81%, 92%, 97%; no differences by sex	1424	children attending government schools [South Delhi, National Capital Territory of Delhi]
India	Mohanavalli, 2003	--	31.6% (age 0.5-2), 81.8% (age 2-4), 83.6% (age 4-6), 97.4% (age 6-8), 83.3% (age 8-10), 96.9% (age 10-12)	185	healthy children from an orphanage and a government school [Chennai, Tamil Nadu state]
India	Xavier, 2003		100% (adults)	50	outpatients with dyspepsia serving as controls in a study of cirrhosis patients [Malappuram district, Kerala state]

India	Jindal, 2002	1999	62.6% (young adults); no differences by sex	91	medical students [New Delhi, National Capital Territory of Delhi]
India	Batra, 2002	--	98.6% (age 10-12), 94.8% (age 13-14), 98.3% (age 15-17); males: 97.3%, 94.6%, 97.1%; females: 100%, 95.0%, 100%; no differences by sex	500	children attending government schools [Delhi]
India	Murhekar, 2002	1999; 1989	Nicobarese - 1999: 60.0% (age ≤10), 97.6% (age 11-20), 98.6% (age 21-30), 99.7% (age 31+); Nicobarese - 1989: 80.0% (age ≤10), 98.7% (age 11-20), 100% (age 21-30), 100% (age 31+); Great Andamanese: 87.5% (age ≤15), 89.5% (age 16+); Onges: 50% (age ≤15), 84.4% (age 16+); Shompens: 100% (age ≤15), 100% (age 16+)	951; 240	random sample of apparently healthy tribal members (Nicobarese, Great Andamanese, Onges, and Shompens) [Car Nicobar Island, Union Territory of Andaman and Nicobar Islands]; stored sera
India	Mall, 2001	1998	52.2% (age 1-5), 62.2% (age 6-10), 68.5% (age 11-15), 80.8% (age 16-60); males: 55.9%, 56.8%, 62.1%, 86.8%; females: 49.4%, 66.0%, 72.0%, 76.3%; Calcutta: 40.2%, 69.1%, 81.2%, 97.0%; Cochin: 10.3%, 8.2%, 24.5%, 61.6%; Jaipur: 63.2%, 79.2%, 65.4%, 75.0%; Patna: 71.4%, 77.9%, 89.6%, 96.6%; Indore: 91.6%, 91.4%, 92.3%, 65.4%; no differences by sex	1612	healthy children and adults from 5 cities [Calcutta, West Bengal state; Cochin, Kerala state; Jaipur, Rajasthan state; Patna, Bihar state; Indore, Madhya Pradesh state]
India	Arankalle, 2001	1998	urban high socio-economic status: 30.9% (age 6-10), 46.9% (age 11-15), 85.9% (age 16-25), 91.3% (age 26+); urban lower middle socio-economic status: 94.0%, 96.9%, 100%,	4091	urban and rural residents [Pune, Maharashtra state]

			99.5%; rural lower middle socio-economic status: 92.5%, 99.0%, 98.6%, 97.5%		
India	Das, 2000	1998	54.1% (age 15-24), 58.7% (age 25-34), 87.4% (age 35-44), 97.5% (age 45+); males: 55.9%, 57.4%, 89.9%, 98.1%; females: 51.2%, 60.8%, 83.3%, 97.4%; no differences by sex	500	healthy outpatients [New Delhi, National Capital Territory of Delhi]
India	Joshi, 2000	--	14.2% (age 0-5), 44% (age 6-10), 75% (age 11-15), 83% (age 16-20), 90% (age 21-30), 100% (age 31-40), 100% (age 40-64)	90	healthy outpatients [Hyderabad, Andhra Pradesh state]
India	Dutta, 2000	--	60.0% (age 0-0.5), 16.7% (age 0.5-1), 16.7% (age 1-1.5), 30.0% (age 1.5-2), 46.7% (age 2-3), 70.0% (age 3-4), 80.0% (age 4-5), 80.0% (age 5-6), 93.3% (age 6-7), 86.7% (age 7-8), 90% (age 8-9), 80% (age 9-10), 83.3% (age 10-11), 93.3% (age 11-12); no differences by sex	420	healthy children in an outpatient clinic [Delhi]
India	Chitambar, 1999	1983-1995	1983: 97.6% (age 5-10), 100% (age 11-15), 100% (age 16-74); 1987: 96.5% (age 5-10), 100% (age 11-15), 100% (age 16-50); 1995: 87.4% (age 5-10), 100% (age 11-15), 100% (age 16-57)	981	healthy children and adults [Bhor Taluk, Maharashtra state]
India	Aggarwal, 1999	--	68% (age 0.5-5), 91% (age 6-10), 96% (age 11-18)	73	healthy children [Lucknow, Uttar Pradesh state]
India	Chadha, 1999	1991-1995	94.7% (age 3 days-3 months), 66.7% (age 4-6 months), 13.6% (age 7-9 months), 9.3% (age 10-12 months), 28.9% (age 13-15 months), 19.3% (age 16-18 months), 23.1% (age 19-21 months), 52.5% (age 22-24	499	urban child outpatients [Pune, Maharashtra state]

			months), 63.0% (age 25-48 months), 90.9% (age 49-72 months)		
India	Mittal, 1998	--	58.3% (newborn), 60.0% (age 3-6 months), 51.2% (age 6-9 months), 50.0% (age 10-12 months), 40.7% (age 13-18 months), 58.1% (19-24 months), 76.9% (age 2-5), 79.1% (age 5-10)	365	healthy child outpatients [Delhi]
India	Das, 1998	1995-1996	39.8% (age 11-20), 43.3% (age 21-30), 34.9% (age 31-40), 23.1% (age 41+); males: 25.0%, 38.8%, 34.3%, 20.8%; females: 55.6%, 50.0%, 36.3%, 26.7%; higher rate in females than males	395	outpatients without evidence of liver disease [New Delhi, National Capital Territory of Delhi]
India	Dhawan, 1998	1995-1996	50.7% (age 0.5-3), 62.2% (age 4-5), 77.5% (age 6-10), 83.3% (age 11-15), 67.6% (age 16-20), 79.3% (age 21-30), 80.0% (age 31-40), 95.8% (age 41-60); no differences by sex	670	healthy outpatients [Mumbai, Maharashtra state]
India	Das, 1996	--	91.6% (adults); no differences by sex	95	inpatients with irritable bowel syndrome by no evidence of hepato-biliary disease [New Delhi, National Capital Territory of Delhi]
India	Thapa, 1995	--	Low socio-economic status: 96% (age 3-15); high socio-economic status: 85% (age 3-15)	334	healthy schoolchildren [Chandigarh]
India	Arankalle, 1995	1981-1982, 1992	1982: 18% (age 7 months-1.5 years), 73% (age 1.6-3), 86% (age 4-5), 95% (age 6-10), 99% (age 11-15), 98% (age 16-25), 99% (age 26-35), 100% (age 36-45), 100% (age 46+); 1992: 67% (age 0-6 months), 27% (age 7 months-1.5 years), 85% (age 1.6-3), 90% (age	485; 661	healthy students, outpatients, and volunteer blood donors [Pune, Maharashtra state]

			4-5), 98% (age 6-10), 99% (age 11-15), 97% (age 16-25), 100% (age 26-35), 100% (age 36-45), 100% (age 46+)		
India	Graham, 1991	1988-1989	98.2% (age 3-21)	238	outpatients [Hyderabad, Andhra Pradesh state]
India	Werner, 1990 /Werner, 1989	1985-1986	78.1% (age 1-9), 89.4% (age 10-19), 98.1% (age 20-20), 97.9% (age 30-39), 98.1% (age 40-76)	385	apparently healthy adults and children [Punjab]
India	Tandon, 1984; Gandi, 1981	--	100% (newborn), 68% (age 1-5), 90% (age 5-10), 96% (age 60+)	310	healthy volunteers [New Delhi, National Capital Territory of Delhi]
Nepal	Sawayama, 1999	1996	98.9% (age 15-24), 100% (age 25-34), 100% (age 35-44), 98.6% (45-54); 98.5% (55-64), 98.4% (age 65-90); males: 97.7%, 100%, 100%, 100%, 100%, 100%; females: 100%, 100%, 100%, 97.7%, 97.4%, 96.0%; no differences by sex	458	healthy rural and suburban residents [Bhadrakali, Janakpur Zone; Kotyang, Sagarmatha Zone]
Nepal	Kitson, 1999	1997	99.4% (age 18-22)	160	Nepalese (Gurkha) military recruits undergoing basic training in the UK
Nepal	Nakashima, 1995	1987	100% (age 15-24), 99.4% (age 25-34), 99.2% (age 35-44), 97.5% (age 45-54), 100% (age 55-64), 100% (age 65-84); males: 100%, 100%, 100%, 98.2%, 100%, 100%; females: 100%, 98.9%, 98.4%, 96.8%, 100%, 100%; no differences by sex	676	healthy rural residents [Bhadrakali, Janakpur Zone; Kotyang, Sagarmatha Zone]
Pakistan	Aziz, 2007	2002-2004	57.5% (age 0.5-2), 89.6% (age 3-6), 91.4% (age 7-10), 96% (age 11-15)	380	healthy children from squatter settlements [Karachi, Sindh province]
Pakistan	Qureshi, 2000	--	81.6% (age 7 months-10 years)	98	healthy outpatients and schoolchildren [Karachi]

Pakistan	Agboatwalla, 1994	1990-1991	61.9% (age 0-0.5), 8.7% (age 0.5-1), 26.8% (age 1), 67.5% (age 2), 81.8% (age 3), 88.5% (age 4), 94.1% (age 5), 100% (age 30-50)	258	healthy children and adults [Karachi]
Pakistan	Malik, 1988	1984-1986	Medical students: 96.6% (age 18-20); military recruits: 100% (age 16-18)	435	students, military recruits, and healthy outpatients [Rawalpindi, Punjab province; Islamabad]

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SOUTHEAST ASIA

(Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Maldives, Mauritius, Mayotte, Myanmar, Philippines, Seychelles, Sri Lanka, Thailand, Timore Leste, Viet Nam)

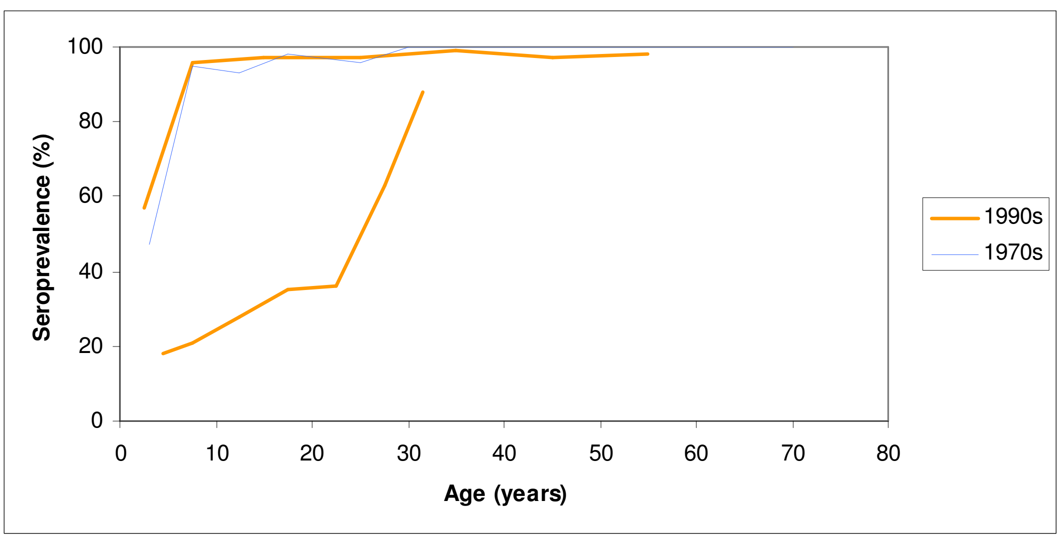
REGIONAL SUMMARY

There is considerable variety in the seroprevalence rates in countries in this region, with some continuing to have high rates and others making a transition to moderate or low rates. A 1979 survey of Seychelles found that more than 90% of adolescents and adults had immunity to hepatitis A virus [Nuti, 1982]. Serosurveys from Malaysia and the Philippines in the 1980s found that about half of adolescents and more than 90% of 40-year-olds had anti-HAV [Lim, 1986; Tan, 1986; Ton, 1983]. A study conducted in Cambodia in 1990 found that more than 90% of children and 100% of adults had immunity [Thüring, 1993]. A review of potential changes in seroprevalence in Southeast Asia published in 1998 found evidence for a decreasing rate among children and adolescents in Malaysia and Thailand and some parts of Indonesia, but found little evidence for decreasing rates in most of Indonesia, Vietnam, and the Philippines [Kunasol, 1998]. The situations in Indonesia, Mauritius, Sri Lanka, Thailand, and Vietnam are detailed in the following paragraphs. No studies were available from Lao, Maldives, Mayotte, Myanmar, or Timor Leste.

INDONESIA

A study from 1978 to 1981 found a very high seroprevalence rate, with more than 90% of 10-year-olds immune [Brown, 1985]. Studies in the mid-1990s found a significant difference between rural and urban areas. While rural areas continue to experience a high seroprevalence rate, some urban communities have a moderate rate [Corwin, 1997; Juffrie, 2000].

Figure 27. Plots of Age-Seroprevalence Data from Studies from Indonesia.



MAURITIUS

Mauritius experienced a large nationwide outbreak of hepatitis A in 1984 and 1985 that primarily affected young children; almost no cases were found in persons over 14 years of age [Shaw, 1989]. This supports the high seroprevalence rate found in a 1987 survey, but may suggest that the incidence rate was beginning to decline [Schwarz, 1991]. No studies are available from the past twenty years.

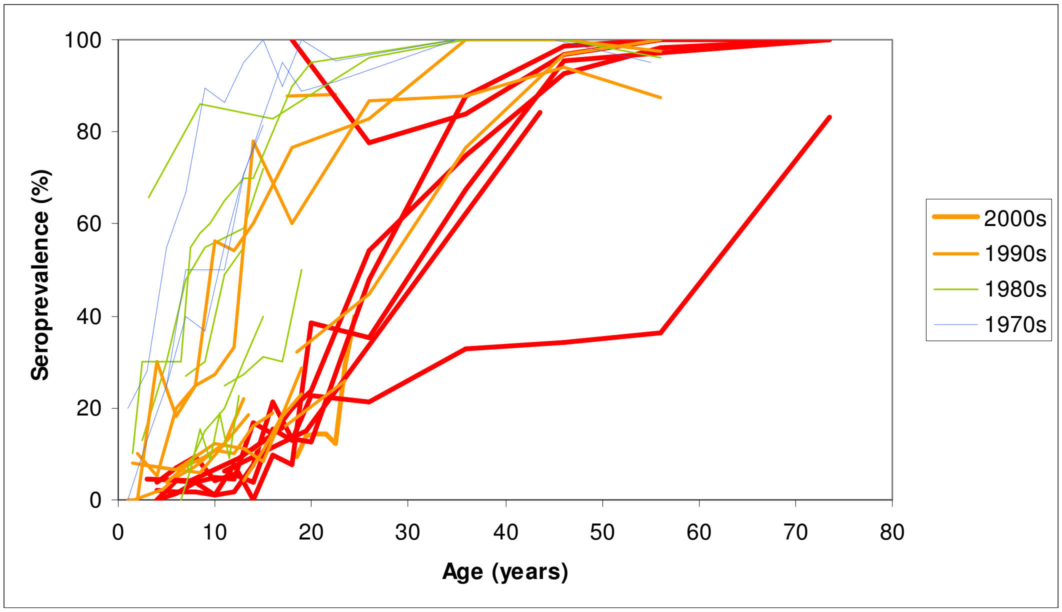
SRI LANKA

A 1976 survey of children from across Sri Lanka found a 26.6% prevalence in children ages 1 to 5 and a 55.9% prevalence in children ages 5 to 10 [da Silva, 2005], and studies in Colombo and other urban areas found that more than half of children less than 10 years of age had anti-HAV antibody [Moritsugu, 1979; Vitarana, 1978]. A 2001-2002 study in Colombo found a much lower rate of 8.5% in 1 to 5 years olds and 18.8% in 5 to 10 years olds [da Silva, 2005], which suggests a shift toward a lower seroprevalence rate.

THAILAND

Studies conducted in Thailand in the 1970s generally found that at least half of 5- to 10-year-olds and 100% of 30-year-olds had anti-HAV [Burke, 1981; Viranuvatti, 1982]. Most studies from the 1980s found that more than half of 10-year-olds and 100% of 30-year-olds had anti-HAV [Eccheverria, 1983; Innis, 1991; Poovorawan, 1997; Poovorawan, 1993; Poovorawan, 1991]. Studies from the 1990s showed slightly lower rates, with most studies finding that only about 10% of 10-year-olds and one-third of young adults had immunity to hepatitis A virus [Chatchatee, 2002; Chub-uppakarn, 1998; Issaragrisil, 1997; Jutavijittum, 2002; Kalayanarooj, 1995; Kosuwan, 1996; Pancharoen, 2001; Poovorawan, 2000; Poovorawan, 1997; Poovorawan 1993; Pramoolsinsap, 1999]. Studies from the 2000s have found a very low seroprevalence rate in children, with less than 5% of 10-year-olds and only about one-quarter of young adults immune [Chatchatee, 2002; Chatproedprai, 2007; Ratanasuwan, 2004; Samakoses, 2007]. Higher rates have been noted in some populations like the hill tribes and other ethnic minority groups [Louisirirotchanakul, 2002; Luksamijarulkul, 2003]. Comparisons of data from both rural and urban populations suggested that a significant decline in anti-HAV seroprevalence occurred in Thailand from the 1970s and 1980s to the 1990s [Poovorawan, 1993], and this trend toward lower prevalence appears to be continuing.

Figure 28. Plots of Age-Seroprevalence Data from Studies from Thailand.



VIET NAM

Studies conducted in Vietnam in the 1990s found that more than 95% of 5-year-olds had anti-HAV [Katelaris, 1995; Hau, 1999], which indicates a high infection rate.

SUMMARY AGE-PREVALENCE ESTIMATES

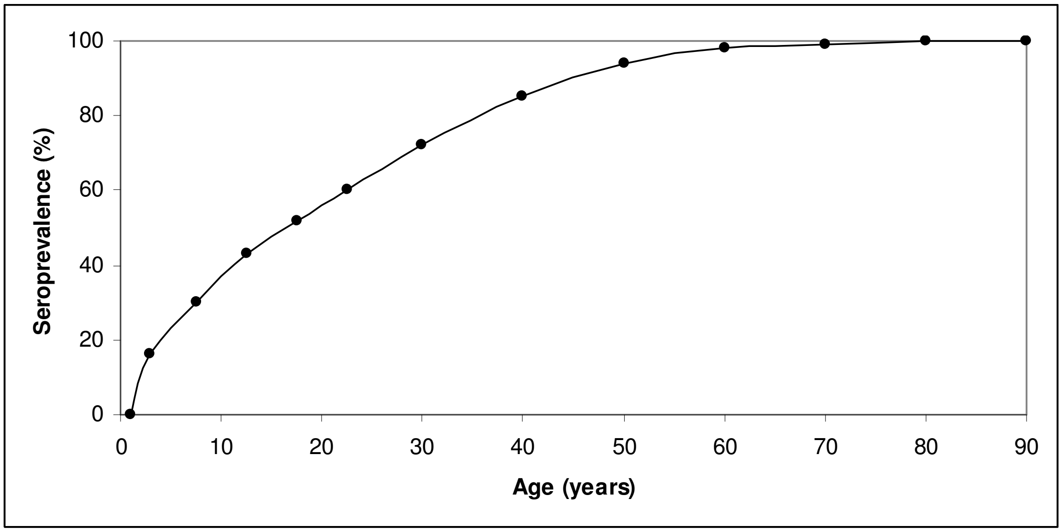
Table 15. Summary Prevalence Estimates by Age in Southeast Asia.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	16	30	43	52	60
% at risk	--	--	84	70	57	48	40

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	72	85	94	98	99	100	100
% at risk	28	15	6	2	1	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 29. Plot of Estimated Seroprevalence by Age in Southeast Asia.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 30. Plots of Age-Seroprevalence Data from Studies from Southeast Asia.

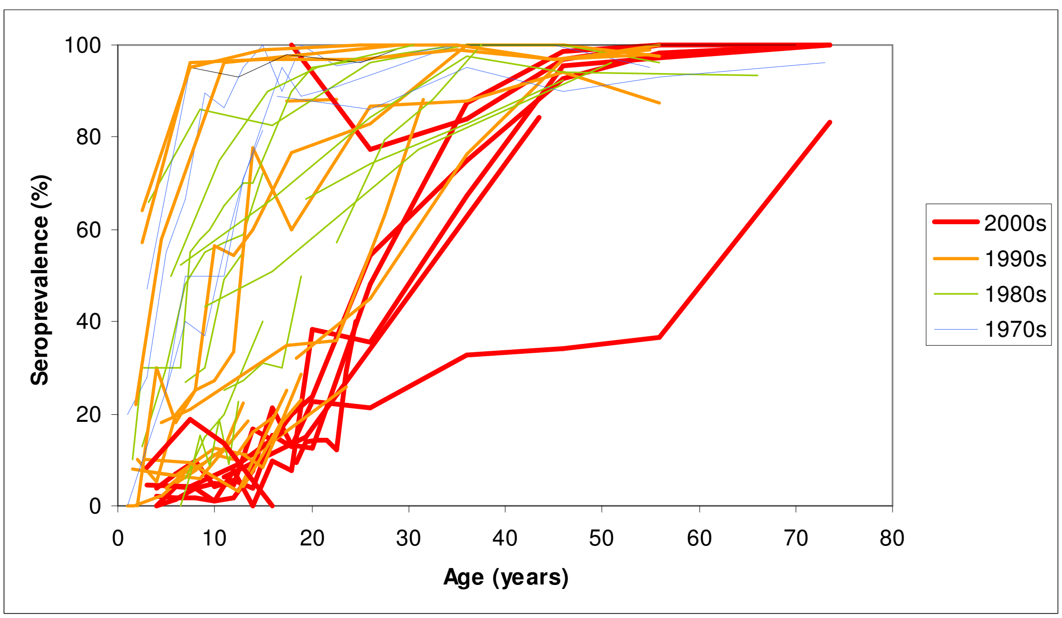


TABLE OF INCLUDED PREVALENCE STUDIES

Table 16. Information about Included Studies from Southeast Asia.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Cambodia	Thüring, 1993	1990-1991	22% (age 0.5-2), 58% (age 3-5), 96% (age 6-15), 100% (age 16-60); no differences by sex	505	healthy pregnant women and outpatients [Takéo, Takéo province]
Indonesia	Juffrie, 2000	1995-1996	18% (age 4), 21% (age 5-9), 28% (age 10-14), 35% (age 15-19), 36% (age 20-24), 63% (age 25-29), 88% (age 30-32); no differences by sex	1103	healthy urban children and adults [Gondokusuman, Yogyakarta, Yogyakarta Province (central Java Island)]
Indonesia	Corwin, 1997	1994	57% (age 0-4), 96% (age 5-9), 97% (age 10-19), 97% (age 20-29), 99% (age 30-39), 97% (age 40-49), 98% (age 50+)	885	rural communities along the Kapuas River, including some that had experienced a hepatitis E virus outbreak in 1987 [Sintang District, West Kalimantan, Borneo]
Indonesia	Brown, 1985	1978-1981	47% (age 1-4), 95% (age 5-9), 93% (age 10-14), 98% (age 15-19), 96% (age 20-29), 100% (age 30-39), 100% (age 40-49), 100% (age 50-59), 100% (age 60-69), 100% (age 70+)	287	inpatients with non-hepatitic illnesses, high school and medical students, and village residents without clinical evidence of hepatitis at time of testing [Grokgak, Seririt, Negara, Dauh Waru, P enebel, Tabanan, Ayunan, Tenganan, Denpasar, and Renon, all on the island of Bali]
Malaysia	Tan, 1986	--	43.1% (age 7-10), 50.8% (age 11-20), 77.4% (age 21-40), 96% (age 41+); no differences by sex	494	urban and rural inpatients with non-hepatitic illnesses [nationwide]

Malaysia	Ton, 1983	--	66.7% (age 18-20), 74.2% (age 21-30), 82.8% (age 31-40), 92.3% (age 41+)	100	male voluntary blood donors [Kuala Lumpur]
Mauritius	Schwarz, 1991	1987	52.4% (age 2-10), 66.7% (age 11-20), 84.4% (age 21-30), 97.4% (age 31-40), 94.2% (age 41-50), 93.3% (age 51-80); no differences by sex	583	hospital patients and staff, hotel staff, flight personnel, seamen, prisoners, and blood donors [Mauritius Island and Rodrigues Island]
Philippines	Lim, 1986	--	57.1% (age 20-24), 79.3% (age 25-29), 88.0% (age 30-34), 100% (age 35-39)	234	dentists
Réunion (French department)	Michault, 2000	1998	10.0% (age 0.5-4), 9.4% (age 5-9), 3.0% (age 10-14), 25.0% (age 15-19); males: 14.1%, 6.0%, 1.7%, 18.9%; females: 2.8%, 13.6%, 4.9%, 29.0%; no differences by sex	400	hospital inpatients [South Reunion Island]
Seychelles	Nuti, 1982	1979	89% (age 12-20), 86% (age 21-30), 95% (age 31-40), 90% (age 41-50), 93% (age 51-60), 96% (age 60-85); no differences by sex	417	hospital outpatients [Mahé]
Sri Lanka	de Silva, 2005	2001	0% (age <1), 8.5% (age 1-5), 18.8% (age 5-10), 13.6% (age 10-12), 0% (age 13-18)	288	pediatric inpatients with mild illnesses [Colombo, Western Province]
Thailand	Samakoses, 2007	2001	9.4% (age 18), 13.9% (age 19), 14.2% (age 20), 14.3% (age 21), 12.1% (age 22), 29.2% (age 23), 40.0% (age 24); no differences by sex	432	army medical cadet and nursing students [Bangkok and nationwide]
Thailand	Chatproedprai, 2007	2004	13.9% (0.5-2), 1.8% (age 3-4), 3.6% (age 5-6), 4.7% (age 7-8), 2.8% (age 9-10), 4.8% (age 11-12), 6.9% (age 13-14), 15.3% (age 15-16),	3997	hospital inpatients and outpatients without chronic illness [Chaing Rai province, North region; Udon Thani

			13.1% (age 17-18), 24.1% (age 19-20), 35.8% (age 21-30), 59.4% (age 31-40), 70.6% (age 41-50), 74.8% (age 51-60), 91.4% (age 60-85); Chonburi: 9.7%, 0.0%, 1.4%, 4.0%, 1.2%, 7.7%, 0.0%, 9.7%, 7.7%, 38.5%, 35.4%, 67.4%, 95.5%, 97.1%, 100%; Nakhonsrithammarat: 14.0%, 0.0%, 4.1%, 3.9%, 4.8%, 4.7%, 16.7%, 14.3%, 20.0%, 23.8%, 54.2%, 75.0%, 92.8%, 98.2%, 100%; Udonthani: 14.9%, 2.0%, 1.9%, 1.7%, 1.1%, 1.9%, 7 .7%, 21.2%, 13.3%, 12.5%, 48.0%, 87.6%, 98.7%, 100%, 100%; Chaingrai: 16.0%, 3.9%, 6.9%, 9.6%, 4.2%, 5.5%, 3.7%, 15.4%, 13.0%, 22.7%, 21.4%, 32.8%, 34.2%, 36.5%, 83.3%		province, Northeast region; Chon Buri province, East region; Nakhonsrithammarat (Nakhon Si Thammarat) province, South region]
Thailand	Ratanasuwan, 2004	2000-2002	6.4% (age <13), 14.9% (age 13-25), 84.2% (age 26-60), 94.7% (age 61+)	1514	[Bangkok; Nakhon Pathom, Kanchanaburi, Petchaburi, Ratchaburi, Prachuab Khiri Khan, and Suphanburi provinces, Central region]
Thailand	Luksamijarulkul, 2003	1999-2000	87.7% (age 15-19), 88.1% (age 20-24); males: 89.7%, females: 84.9%; no differences by sex	190	Akha hill-tribe youth [Amphoe Mae Suai, Chiang Rai province, North region]
Thailand	Louisirirotchanakul, 2002	2000	100% (age 15-20), 77.5% (age 21-30), 83.8% (age 31-40), 96.9% (age 41-50), 100% (age 51-60);	140	rural and ethnic members of Hmong communities [Khun Chang Khian and Mae Sa Mai, Chiang Main

			males: 93.9%, females: 79.3%; higher rate in males than in females		province, North region]
Thailand	Jutavijittum, 2002	1998-2000	2% (age 4), 5% (age 5-6), 7.5% (age 7-8), 11% (age 9-10), 10% (age 11-12), 16% (age 13-14), 19% (age 15-16); higher rate in females than males	1145	rural and urban school children [Chiang Mai Province, North region]
Thailand	Chatchatee, 2002	1996-2001	1996: 16.7% (age 20-22); 2001: 6.7% (age 20-22)	135	medical students [Bangkok, Central region]
Thailand	Pancharoen, 2001	1998-1999	7.7% (age 1-3), 6.6% (age 4-7), 12.4% (age 8-11), 10.7% (age 12-15), 25.9% (age 16-30); no differences by sex	825	healthy school children and outpatients who had not received hepatitis A vaccine [Don mueang, Bangkok, Central region]
Thailand	Poovorawan, 2000	--	4.5% (age 1-4), 4.2% (age 5-9), 9.2% (age 10-14), 15.9% (age 15-18); Chonburi: 13.0%, 3.7%, 7.0%, 5.6%; Lopburi: 4.4%, 3.6%, 5.6%, 13.6%; Udon Thaini: 0.0%, 8.8%, 1.8%, 22.7%; Nakhorn Si Thammarat (had outbreak in 1992): 4.1%, 4.4%, 32.1%, 57.1%; Lampang: 0.0%, 0.0%, 0.0%, 11.4%	961	participants in a study of hepatitis B virus [Chonburi Province, East region; Lopburi Province, Central region; Udonthani Province, Northeast region; Nakhon Si Thammarat Province, South region; Lopburi Province, Central region]
Thailand	Pramoolsinsap, 1999	--	32% (age 16-20), 44.9% (age 21-30), 76.4% (age 31-40), 97% (age 41-50), 100% (age 51-60)	195	healthy blood donors [Bangkok, Central region]
Thailand	Chub-uppakarn, 1998	--	8.1% (age 0-2), 6.9% (age 3-5), 6.0% (age 6-10), 18.6% (age 11-15)	190	outpatients with acute diseases not affecting the liver [Songkhla Province, South region]

Thailand	Issaragrisil, 1997	1989-1994	81% (overall); 68% (age 15-24)	183	urban and rural inpatients with minor illnesses serving as controls for a case-control study of aplastic anemia [Bangkok, Central region; Khonkaen. Khon Kaen province, Northeast region; Songkla, Songkhla province, South region]
Thailand	Poovorawan, 1997 (Southeast Asian J Trop Med Public Health) / Poovorawan, 1993	1987; 1993; 1996	1987: 25.0% (age 10-11), 27.3% (age 12-13), 31.0% (age 14-15), 30.0% (age 16-17), 50.0% (age 18-19); 1993: 11.1% (age 12-13), 8.3% (age 14-15), 18.1% (age 16-17), 23.1% (age 18-19); 1996: 4.2% (age 12-13), 11.0% (age 14-15), 18.5% (age 16-17), 28.6% (age 18-19)	172; 253; 254	secondary school children who had not been vaccinated against HAV [Bangkok, Central region]
Thailand	Poovorawan, 1997 (Ann Trop Med Parasitol) / Poovorawan, 1993	1988; 1996	1988: 6.7% (age 4-5), 25.9% (age 6-7), 28.1% (age 8-9), 51.2% (age 10-11); 1996: 3.7% (age 4-5), 7.3% (age 6-7), 9.4% (age 8-9), 12.4% (age 10-11), 22.2% (age 12-13)	180; 260	primary school children who had not been vaccinated against HAV [Bangkok, Central region]
Thailand	Kosuwan, 1996	--	0.0% (age 6), 6.5% (age 7), 15.3% (age 8), 8.6% (age 9), 18.9% (age 10), 9.2% (age 11), 22.6% (age 12); higher rate in males than females	441	urban and rural schoolchildren [Khon Kaen province, Northeast region]
Thailand	Kalayanarooj, 1995	1994	0.0% (age 10.7-15.4 months), 0.0% (age 18.6-37.9 months), 2.0% (age 44-72.3 months)	183	healthy outpatients [Bangkok, Central region]

Thailand	Poovorawan, 1993	1989-1992	30.2% (age 20-21)	165	pediatric inpatients and outpatients and medical students [Bangkok, Central region]
Thailand	Innis, 1991	1985-1989	(estimated from graph) Bangkok: 6% (age 6-7), 15% (age 8-9), 20% (age 10-11), 30% (age 12-13), 40% (age 14-15); Kamphaeng Phet vaccine trial: 13% (age 1-3), 30% (age 4-5), 48% (age 6-7), 55% (age 8-9), 57% (age 10-11), 59% (age 12-13), 72% (age 14-15); Kamphaeng Phet prospective study: 27% (age 6-7), 30% (age 8-9), 49% (age 10-11), 55% (age 12-13)	75,016	urban and rural children, including participants in a field trial for a Japanese encephalitis vaccine and those randomly selected for a prospective study of viral hepatitis [Bangkok, Central region; Kamphaeng Phet province, Central region]
Thailand	Poovorawan, 1991 / Poovorawan, 1993	--	Pong Nam Ron: 10.0% (age 1-2), 5.3% (age 3-4), 20.0% (age 5-6), 25% (age 7-8), 56.3% (age 9-10), 54.2% (age 11-12), 60.0% (age 13-14), 76.7% (age 15-20), 83% (age 21-30), 100% (age 31-40), 100% (age 41-50), 97.4% (age 51+); Bo Thong: 0.0% (age 1-2), 30.0% (age 3-4), 18.2% (age 5-6), 25.0% (age 7-8), 27.3% (age 9-10), 33.3% (age 11-12), 77.8% (age 13-14), 60.0% (age 15-20), 86.8% (age 21-30), 87.8% (age 31-40), 94.1% (age 41-50), 87.5% (age 51+)	600	rural residents [Pong Nam Ron, Chanthaburi province, East region; Bo Thong, Chon Buri province, East region]

Thailand	Echeverria, 1983	1980	(estimated from graph) 0.0% (newborn), 10% (age 1), 30% (age 2), 30% (age 3), 30% (age 4), 30% (age 5), 30% (age 6), 55% (age 7), 58% (age 8), 60% (age 9), 65% (age 10-11), 70% (age 12-13), 70% (age 14), 90% (age 18), 95% (age 20), 100% (age 30-39), 100% (age 40-49)	several hundred	rural children and adults from schools and health clinics [Amphur Soongnern, Nakornrajsima (Nakhon Ratchasima), Northeast region]
Thailand	Viranuvatti, 1982	--	93.7% (newborn), 65.7% (age 2 months-5 years), 86% (age 6-10), 82.7% (age 11-20), 96.0% (age 21-30), 100% (age 31-40), 100% (age 41-50), 96.3% (age 51+)	1085	medical students, blood donors, pregnant women, and outpatients [Bangkok, Central region]
Thailand	Burke, 1981	1971-1973; 1976; 1977	Huay Khwang: 20.0% (age <2), 27.8% (age 2-3), 55.0% (age 4-5), 66.7% (age 6-7), 89.5% (age 8-9), 86.4% (age 10-11), 95.2% (age 12-13), 100% (age 14-15), 90.0% (age 16-17), 100% (age 18-19), 95.5% (age 20-24), 100% (age 30-39), 100% (age 40-49), 95.0% (age 50+); Ban Tablan: 0.0% (age <2), 13.0% (age 2-3), 25.0% (age 4-5), 50.0% (age 6-7), 50.0% (age 8-9), 50.0% (age 10-11), 70.6% (age 12-13), 83.3% (age 14-15), 95.0% (age 16-17), 88.9% (age 18-19), 90.9% (age 20-24), 100% (age 30-39); Phibunprachasan School: 25.0% (age 4-	308; 206; 232	randomly selected urban households [Huay Khwang district, Bangkok, Central region]; all households in a rural village [Ban Tablan, Prachin Buri province, East region]; school children [Din Daeng district, Bangkok, Central region]

			5), 40.0% (age 6-7), 36.8% (age 8-9), 55.3% (age 10-11), 71.1% (age 12-13), 81.6% (age 14-15)		
Viet Nam	Hau, 1999	1994	64% (age 0-4), 95% (age 5-9), 99% (age 10-19), 100% (age 20-29), 100% (age 30-39), 97% (age 40-49), 99% (age 50-87); slightly higher prevalence in females (98%) than males (95%)	646	population-based sample of rural households [Tan Chau District, An Giang province, Tây Nam Bo (Mekong River Delta) region]
Viet Nam	Katelaris, 1995	--	93% (age 2-12); no differences by sex	87	population-based sample of rural children [Phu Ngoc commune, Dong Nai (Đồng Nai)) province, Tây Nam Bo region]
Viet Nam	Skinhøj, 1981	--	50% (age 5), 75% (age 10), 90% (age 15), 95% (age 20), 100% (age 30)	564	Vietnamese refugees resettled to the United States

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AUSTRALASIA
(Australia, New Zealand)

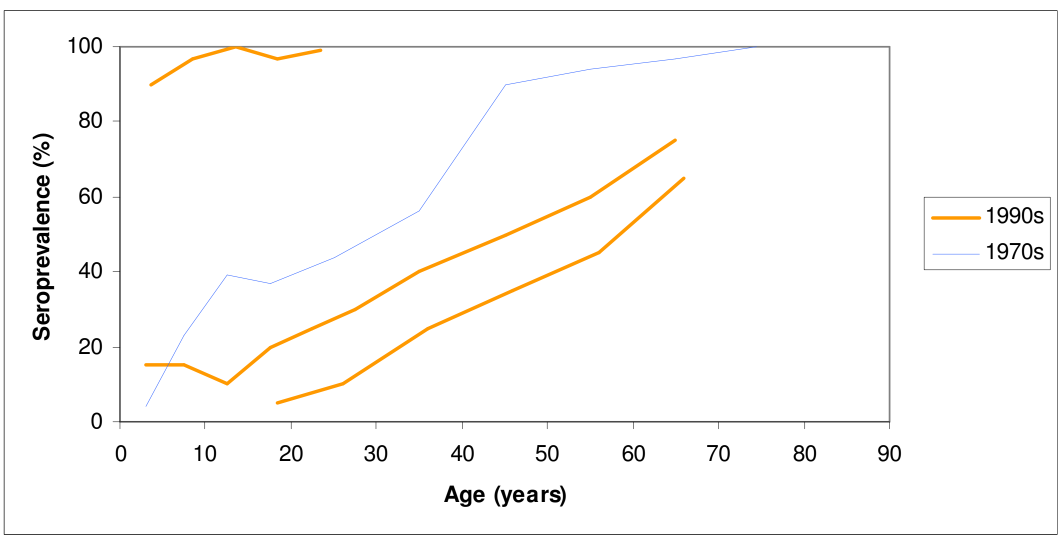
REGIONAL SUMMARY

The data in this region indicate a low seroprevalence rate. Details for each country are provided below.

AUSTRALIA

An evaluation of sera collected in 1954 and 1955 in Melbourne found that about 15% of pre-school children, 50% of adolescents and young adults, and 90% to 100% of middle-aged and older adults had anti-HAV [Gust, 1978]. Studies from Sydney and Victoria in the 1970s found that about 10% of pre-school children, one-third of adolescents, two-thirds of middle-aged adults, and 90% of older adults had anti-HAV [Boughton, 1980; Lehman, 1977]. In the 1990s, about 10% of adolescents, one-third of middle-aged adults, and two-thirds of older adults had immunity [Amin, 2001; Crofts, 1997]. A series of outbreaks in the 1990s resulted from a low population immunity and primarily affected homosexual males and injecting drug users [Ferson, 1998]. The national incidence rate in the early 2000s was about 10 per 100,000 in children and adolescents [MacIntyre, 2003]. The reported incidence rate is higher in the north of the country than in the south [MacIntyre, 2003] and is much higher among Aboriginal populations, as noted by the one very high prevalence curve for children in Figure 31, which is from an Aboriginal population [Bowden, 1994].

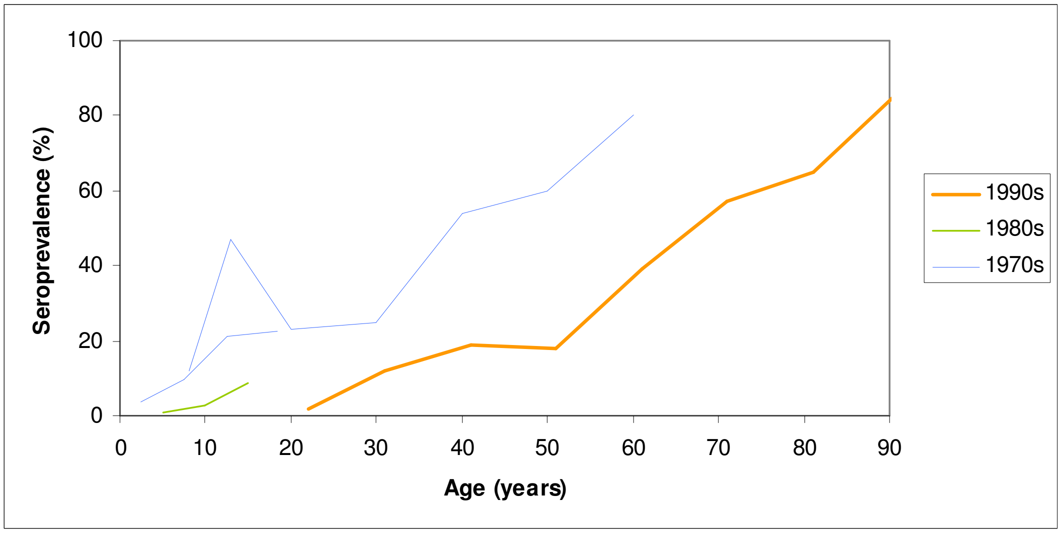
Figure 31. Plots of Age-Seroprevalence Data from Studies from Australia.



NEW ZEALAND

Surveys from the 1970s found that about one-quarter of adolescents and half of 40-year-olds had immunity to hepatitis A virus [Austin, 1982; Tobias, 1986]. In the 1970s, about 10% of 10-year-olds had anti-HAV [Lucas, 1994; Tobias, 1988]. By the 1990s, the rate in children was much lower, with less than 2% of adolescents testing positive for anti-HAV [Chapman, 2000; Lucas, 1994]. The reported incidence rate in the 1990s was about 10 per 100,000, with a higher rate reported in Pacific Islands and Maori residents and a lower rate in those of European ancestry [NZPHR, 1998].

Figure 32. Plots of Age-Seroprevalence Data from Studies from New Zealand.



SUMMARY AGE-PREVALENCE ESTIMATES

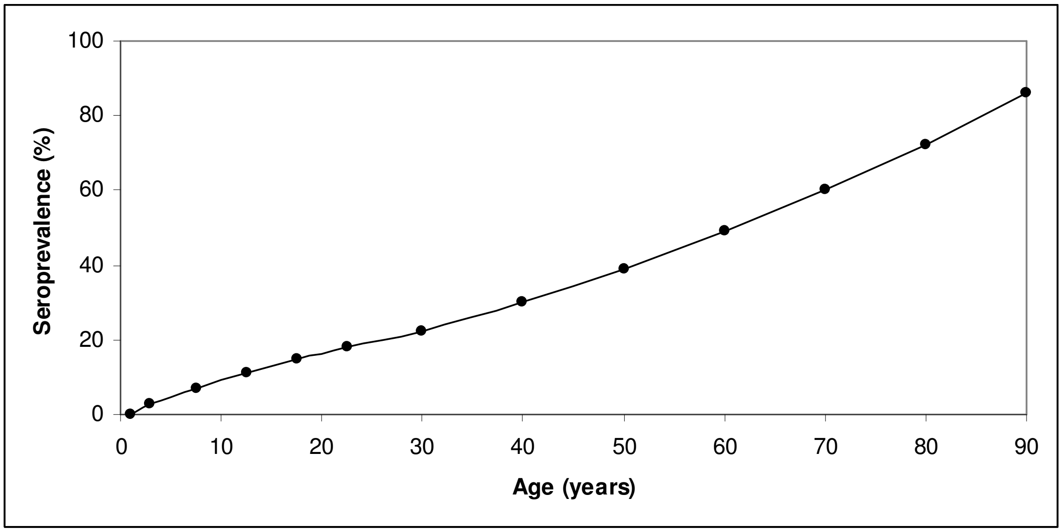
Table 17. Summary Prevalence Estimates by Age in Australasia.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	3	7	11	15	18
% at risk	--	--	97	93	89	85	82

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	22	30	39	49	60	72	86
% at risk	78	70	61	51	40	28	14

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 33. Plot of Estimated Seroprevalence by Age in Australasia.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Based only on data from studies with nationally-representative samples that were published after 1990.

Figure 34. Plots of Age-Seroprevalence Data from Studies from Australasia.

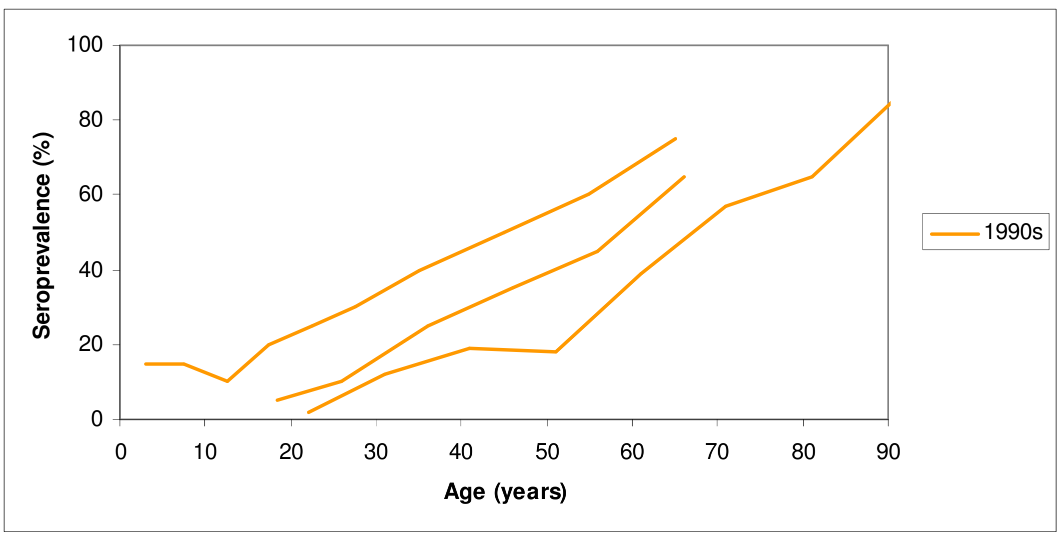


TABLE OF INCLUDED PREVALENCE STUDIES

Table 18. Information about Included Studies from Australasia.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Australia	Amin, 2001	1998	(estimated from graph) 15% (age 1-4), 15% (age 5-9), 10% (age 10-14), 20% (age 15-19), 25% (age 20-24), 30% (age 25-29), 40% (age 30-39), 50% (age 40-49), 60% (age 50-59), 75% (age 60-69); no differences by sex	3043	serum examined by medical laboratories [nationwide]
Australia	Crofts, 1997	1995	5% (age 16-20), 10% (age 21-30), 25% (age 31-40), 35% (age 41-50), 45% (age 51-60), 65% (age 61-70); higher rate in males than females	2983	volunteer blood donors [Victoria]
Australia	Bowden, 1994	--	90% (age 1-5), 96.6% (age 6-10), 100% (age 11-15), 97.0% (age 16-20), 99% (age 21+)	344	rural Aboriginal populations [Northern Territory]
Australia	Boughton, 1980	1971-1974	29% (age 0.25-1), 4% (age 1-4), 23% (age 5-9), 39% (age 10-14), 37% (age 15-19), 44% (age 20-29), 56% (age 30-39), 90% (age 40-49), 94% (age 50-59), 97% (age 60-69), 100% (age 70-78)	683	inpatients without liver disease [Sydney]
New Zealand	Chapman, 2000	1996	2% (age 18-25), 12% (age 26-35), 19% (age 36-45), 18% (age 46-55), 39% (age 56-65), 57% (age 66-75), 65% (age 76-85), 86% (age 86+); no differences by sex	1064	population-based sample [Christchurch, Canterbury Region]
New Zealand	Lucas, 1994	1993; 1984	1993: 0.4% (age 11-13); 1984: 29.6% (age 11-13)	242; 270	unvaccinated middle school students [Kawerau, Bay of Plenty Region]
New Zealand	Tobias, 1988	1985	0.8% (age 5), 2.7% (age 10), 8.6% (age 15)	2631	randomly selected healthy school children [nationwide]

New Zealand	Tobias, 1986	1978-1979	3.9% (age 0-4), 9.6% (age 5-9), 21.2% (age 10-14), 22.6% (age 15-21); no differences by sex	2000	healthy children and young adults [nationwide]
New Zealand	Austin, 1982	1973-1975	12% (age 5-10), 47% (age 11-14), 23% (age 15-24), 25% (age 25-34), 54% (age 35-44), 60% (age 45-54), 80% (age 55+); no differences by sex	97	longitudinal cohort study participants [Port Chalmers]

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CARIBBEAN

(Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cuba, Dominica, Dominican Republic, French Guiana, Grenada, Guadaloupe, Guyana, Haiti, Jamaica, Martinique, Montserrat, Netherlands Antilles, Saint Kitts and Nevis, St. Lucia, St. Vincent, Suriname, Trinidad and Tobago, Turks and Caicos Islands)

REGIONAL SUMMARY

More than 90% of teenagers were seropositive in studies conducted in Belize [Craig, 1993] and the Dominican Republic [Tapia-Conyer, 1999], which indicates that in these countries about 50% of young children are immune. This finding is supported by a study of acute hepatitis infections in Belize that estimated an annual incidence rate of 0.26 per 1000 and found acute hepatitis A only in children [Bryan, 2001]. In comparison, studies from Cuba [Quintana, 2005], French Guiana [Talarmin, 1997], and Jamaica [Brown, 2000] found a median age at infection of about 20 years. (This may represent an increasing age at infection, since a study conducted in 1982-1983 in Mariel and San Jose, Cuba, found that nearly 80% of all 10 to 14 year olds and more than 90% of 15 to 19 year olds had anti-HAV [Savinkskaia, 1986].) Studies from Martinique and Guadeloupe in the mid-1990s found that about 50% of residents in early or middle adulthood were immune [Dulat, 1996]. This may represent a slight decrease in the infection rate, since a study conducted in Martinique in the mid-1980s found that two-thirds of 20-year-olds and 100% of adults ages 45 and older were seropositive [Monsplaisir, 1988].

The diversity in population seroprevalence rates in the region has been present for decades: a study from the early 1980s in Trinidad and Tobago found seroprevalence rates of 68.7% for Trinidad and 95.4% for Tobago [Blattner, 1990], and a multi-country study conducted in 1977 found a population seroprevalence of 64.2% in Barbados, 99.8% in the Dominican Republic, and 81.5% in Suriname [Nath, 1980]. No eligible studies were identified from Anguilla, Antigua and Barbuda, Aruba, the Bahamas, Barbados, Bermuda, the British Virgin Islands, the Cayman Islands, Dominica, Grenada, Guyana, Haiti, Montserrat, Netherlands Antilles, Saint Kitts and Nevis, St. Lucia, St. Vincent, Suriname, and Turks and Caicos.

SUMMARY AGE-PREVALENCE ESTIMATES

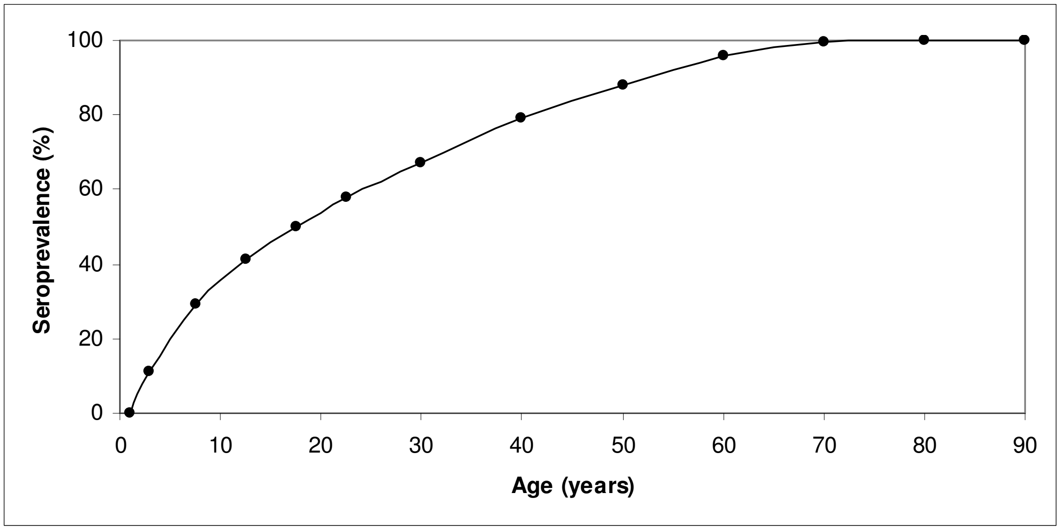
Table 19. Summary Prevalence Estimates by Age in the Caribbean.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	14	31	42	50	57
% at risk	--	--	86	69	58	50	43

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	65	76	86	95	100	100	100
% at risk	35	24	14	5	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 35. Plot of Estimated Seroprevalence by Age in the Caribbean.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 36. Plots of Age-Seroprevalence Data from Studies from the Caribbean.

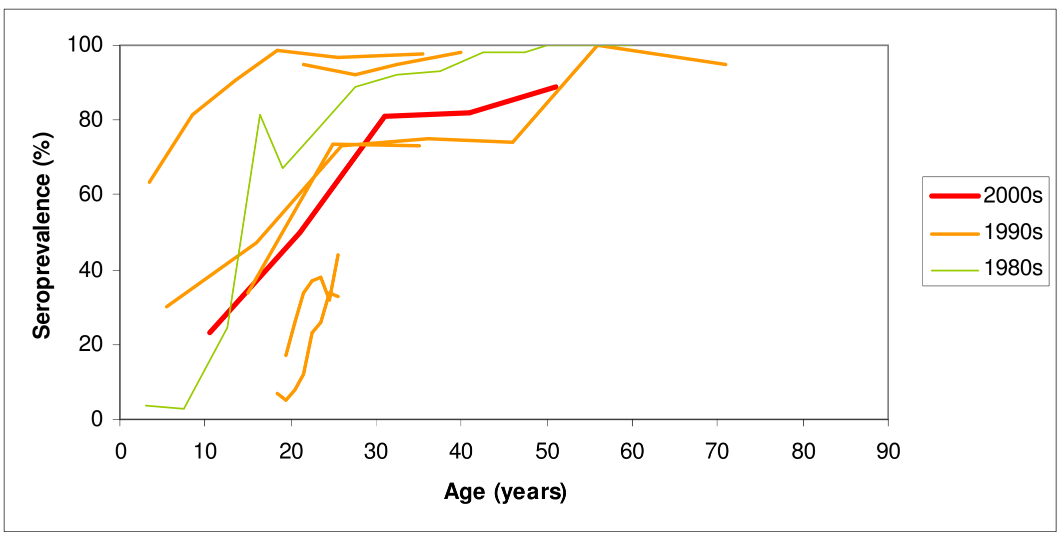


TABLE OF INCLUDED PREVALENCE STUDIES

Table 20. Information about Included Studies from the Caribbean.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Belize	Craig, 1993	1992	95% (age 18-24), 92% (age 25-29), 95% (age 30-34), 98% (age 35-44); males: 100%, females: 100%; no differences by sex	492	members of the military [nationwide]
Cuba	Quintana, 2005	--	23% (age 5-15), 50% (age 16-25), 81% (age 26-35), 82% (age 36-45), 89% (age 46-55)	209	random sample of urban residents [Havana city]
Dominican Republic	Tapia-Conyer, 1999; Tanaka, 2000	1996-1997	63.4% (age 1-5), 81.6% (age 6-10), 90.9% (age 11-15), 98.5% (age 16-20), 96.6% (age 21-30), 97.7% (age 31-40); males: 59.4%, 84.2%, 100%, 100%, 100%, 100%; females: 66.7%, 78.9%, 86.1%, 98.3%, 96.5%, 97.4%	473	outpatients attending health clinics for low-income populations
French Guiana	Talarmin, 1997	1992-1996	31.1% (age <10), 33.7% (age 10-19), 73.6% (age 20-29), 73.1% (age 30-39), 86.7% (age 40+)	941	randomly selected stored sera [nationwide]
Guadeloupe	Dulat, 1996	1994-1995	17% (age 19), 26% (age 20), 34% (age 21), 37% (age 22), 38% (age 23), 32% (age 24), 44% (age 25)	748	military recruits [nationwide]
Jamaica	Brown, 2000	1995-1998	30% (age 0-10), 47% (age 11-20), 73% (age 21-30), 75% (age 31-40), 74% (age 41-50), 100% (age 51-60), 95% (age 61-90); males: 56.3%, females: 62.6%; no differences by sex	339	urban squatter community, outpatient clinic and schools; rural school and clinics; patients did not have liver disease [Kingston, Surrey County; Portland, Clarendon Parish, Middlesex County; St. Andrew Parish, Surrey County]

Martinique	Dulat, 1996	1994-1995	7% (age 18), 5% (age 19), 8% (age 20), 12% (age 21), 23% (age 22), 26% (age 23), 34% (age 24), 33% (age 25)	937	military recruits [nationwide]
Martinique	Monplaisir, 1988	--	3.6% (age 1-4), 2.6% (age 5-9), 24.6% (age 10-14), 81.5% (age 15-17), 67% (age 18-19), 76% (age 20-24), 89% (age 25-29), 92% (age 30-34), 93% (age 35-39), 98% (age 40-44), 98% (age 45-49), 100% (age 50-54), 100% (age 55-60)	647	asymptomatic blood donors [nationwide]
Trinidad and Tobago	Blattner, 1990	1982-1984	Trinidad: 68.7%, males: 69.0%, females: 68.6%; Tobago: 95.4%, males: 92.6%, females: 96.8%	1190	population-based sample of employees in Trinidad; cohort study participants in Tobago; all participants of African descent

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CENTRAL EUROPE

(Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Serbia and Montenegro, Slovakia, Slovenia, The Former Yugoslav Republic of Macedonia)

REGIONAL SUMMARY

This region has a fairly diverse range of hepatitis A profiles. This is reflected in both the prevalence data reported below and in the reported hospitalization rates for acute hepatitis. A hospitalization rate of 72.0 to 88.8 per 100,000 inhabitants was reported for Bulgaria and 52.1 to 97.8 per 100,000 for Romania in the years from 1997 to 2001; In contrast, hospitalization rates of 3.2 to 11.6 per 100,000 for the Czech Republic, 3.0 to 11.4 for Hungary, 0.7 to 10.0 for Poland, 12.5 to 22.4 for Slovakia, and 0.9 to 3.2 for Slovenia were reported during these years [Bonnani, 2007]. Three deaths or fewer were reported in each year in Bugaria, Hungary, Poland, and Slovakia each year; no deaths were reported from Romania, the Czech Republic, or Slovenia [Bonanni, 2007]. A comparison of the age-seroprevalence plots from the Czech Republic, Poland, and Romania on the following pages further demonstrates diversity of hepatitis A patterns in the region: the Czech Republic has a low rate, Poland has an intermediate rate, and Romania has a relatively high rate. Studies were also identified from Croatia, Hungary, Kosovo, Slovenia, and the Former Yugoslav Republic of Macedonia. Studies conducted in Croatia show a relatively low prevalence rate in children [Burek, 1985; Kaic, 2001; Puntarić, 1995]. Studies from the 1980s in Hungary showed an intermediate rate [Dávid, 1983; Kassas, 1995], and more recent studies suggest a significant decline in the prevalence rate from the 1980s through the 1990s [Pohl, 2003]. The rate in Kosovo was higher, with about 50% of 10-year-olds demonstrating immunity to HAV [Quaglio, 2008]. In contrast, 50% of middle-aged adult travelers in Slovenia remained susceptible to hepatitis A [Sočan, 2001]. No studies were identified from Bosnia and Herzegovina, Bulgaria, Montenegro, or Slovakia.

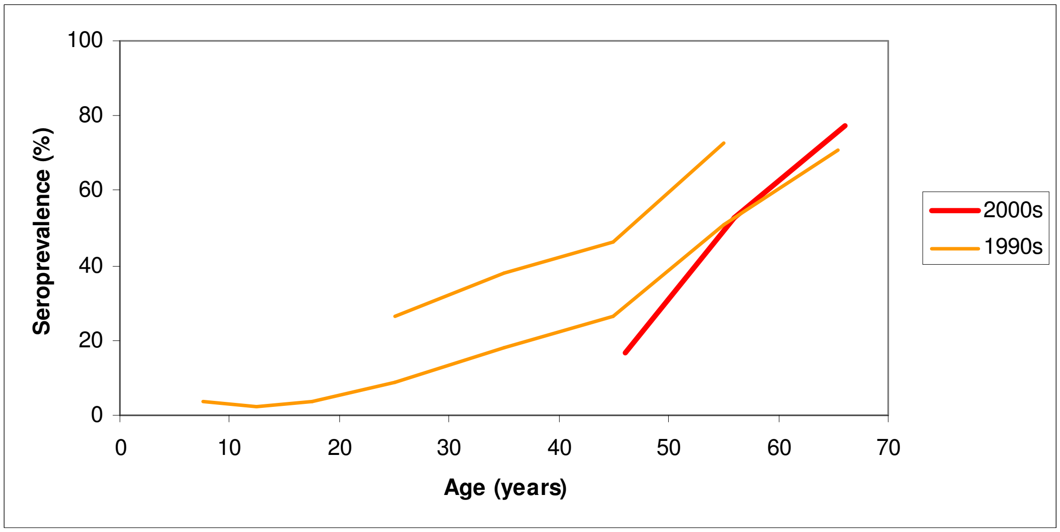
ALBANIA

No studies were identified that had been conducted in Albania, although five studies were conducted among Albanian migrants to Italy or Greece [Chironna, 2006; Chironna, 2001; Malamitsi-Puchner, 1996; Santantonio, 1991; Ventura, 2004]. These studies found a nearly 100% seroprevalence rate in adults and showed that more than 50% of 10-year-olds had immunity.

CZECH REPUBLIC

Studies from the Czech Republic conducted in the 1990s and 2000s show a low seroprevalence rate, with only about half of middle-aged adults having anti-HAV [Beran, 1999; Beran, 1996 (CEJPH); Beran, 1996 (Acta Medica); Beran, 1995; Chlibek, 2006].

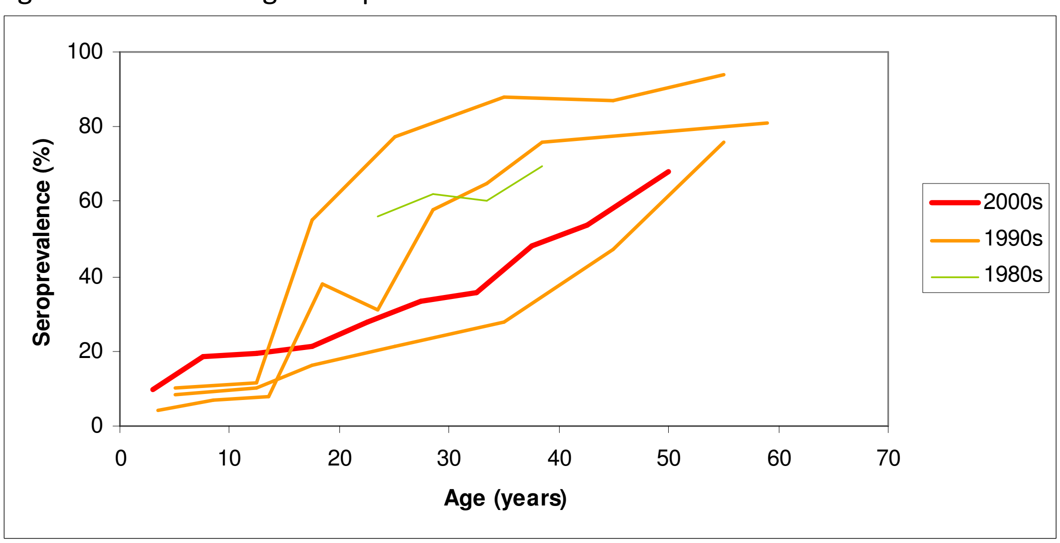
Figure 37. Plots of Age-Seroprevalence Data from Studies from the Czech Republic.



POLAND

Studies from Poland in the late 1990s and 2000s generally show low rates in children, with about 50% of middle-aged adults remaining susceptible to infection, and seroprevalence rates less than 90% even in adults over 40 years of age [Cianciara, 2000; Grezeszczuk, 2003; Janaszek-Seydlitz, 2007; Polz-Dacewicz, 2000; Ryszkowska, 2000]. (These studies are shown on the graph below.) Studies from the 1980s and early 1990s found a low childhood prevalence and about 50% of teenagers lacking antibodies to HAV [Polz-Dacewicz, 2000; Zalewska, 1989]. A 1979 study in Warsaw found that fewer than 10% of children under age 10 had anti-HAV, but 50% of 15-year-olds did, and the rate was greater than 90% in those age 20 and older [Cianciara, 2000]. These data suggest that the incidence rate may be decreasing over time, leaving a larger proportion of adults susceptible to infection.

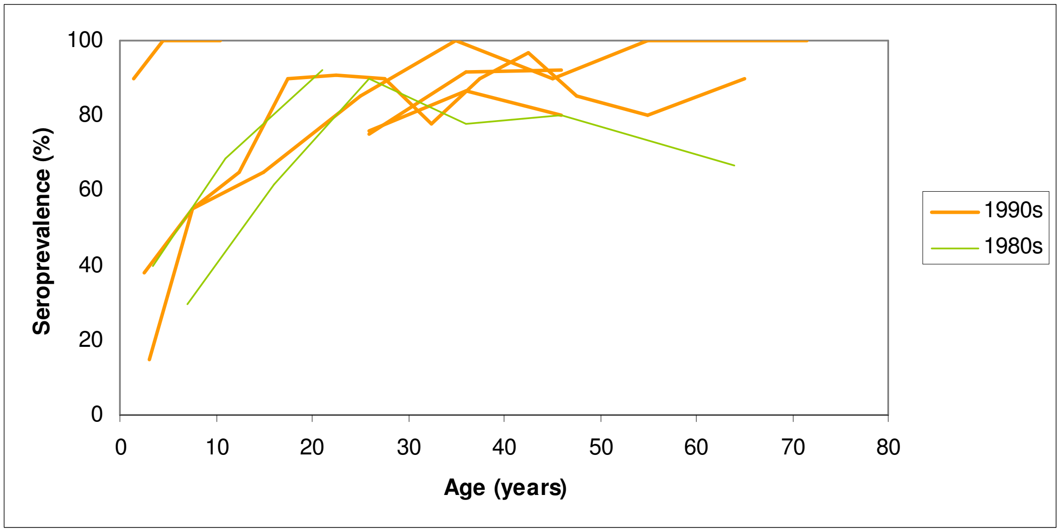
Figure 38. Plots of Age-Seroprevalence Data from Studies from Poland.



ROMANIA

Studies conducted in Romania in the 1980s and 1990s all show intermediate prevalence rates, with more than half of children under the age of 10 demonstrating immunity but some adults remaining susceptible [Beldescu, 1995; Iacob, 1999; Onesciuc, 1981; Paquet, 1993; Rudin, 1990; Sabău, 1983].

Figure 39. Plots of Age-Seroprevalence Data from Studies from Romania.



SUMMARY AGE-PREVALENCE ESTIMATES

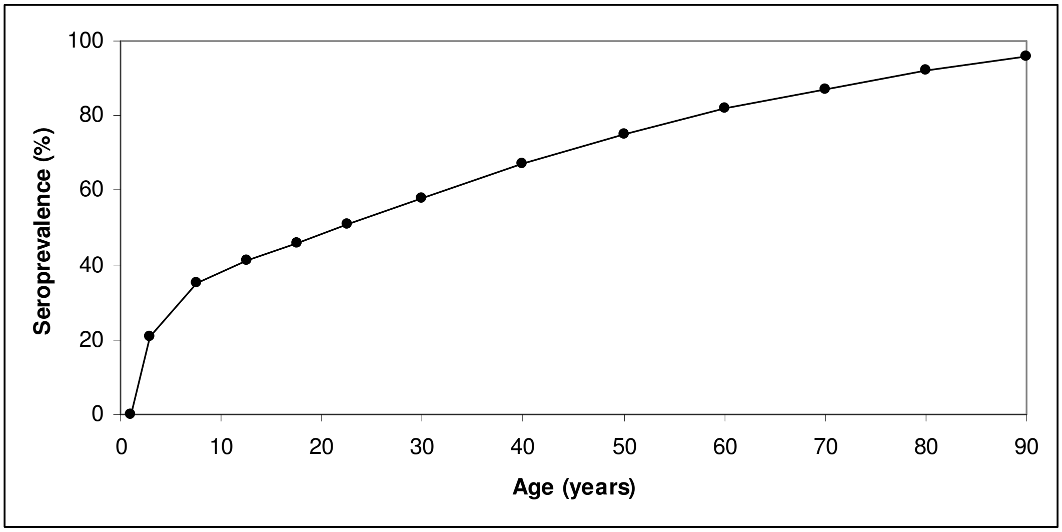
Table 21. Summary Prevalence Estimates by Age in Central Europe.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	21	35	41	46	51
% at risk	--	--	79	65	59	54	49

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	58	67	75	82	87	92	96
% at risk	42	33	25	18	13	8	4

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 40. Plot of Estimated Seroprevalence by Age in Central Europe.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 41. Plots of Age-Seroprevalence Data from Studies from Central Europe.

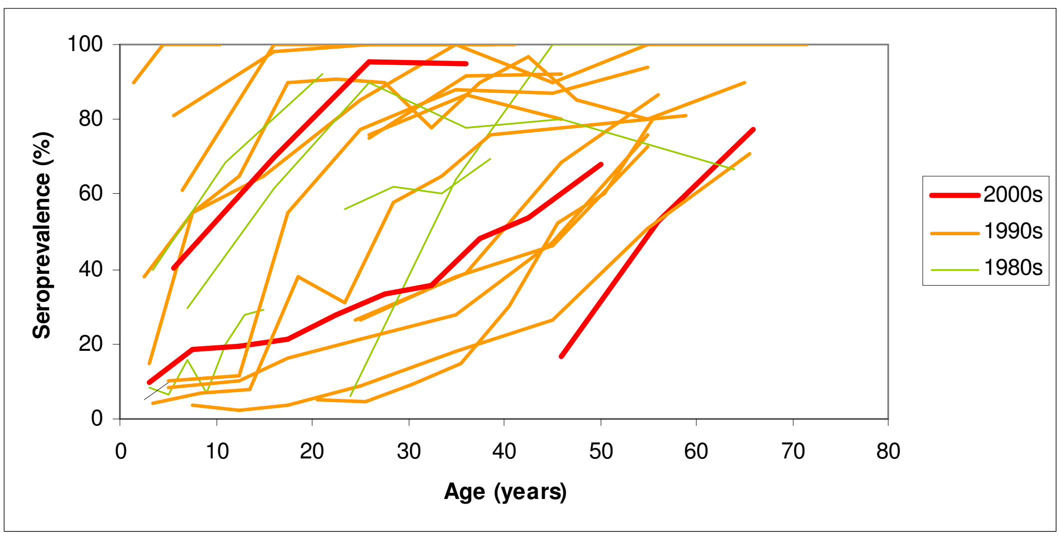


TABLE OF INCLUDED PREVALENCE STUDIES

Table 22. Information about Included Studies from Central Europe.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Albania	Chironna, 2006	1997	91.1% (age 1-60); males: 92.3%, females: 88.6%	236	Albanian migrants to southern Italy [Puglia region]
Albania	Ventura, 2004	2001	100% (age 20-44)	61	Albanian migrants to southern Italy [Toritto and Monopoli, Apulia region]
Albania	Chironna, 2001	1999	61% (age 2-10), 100% (age 11-20), 100% (age 21-30), 100% (age 31+); no differences by sex	526	Albanian refugees from Albania and Kosovo to southern Italy [Puglia region]
Albania	Malamitsi-Puchner, 1996	--	96.2% (age 14-42)	500	pregnant Albanian migrants to Greece [Athens]
Albania	Santantonio, 1993	1991	81% (age 0-10), 98% (age 11-20), 100% (age 21-30), 100% (age 31-46)	393	apparently healthy Albanian refugees to Italy [Apulia region]
Croatia	Kaic, 2001	2000	68.5% (age 1-15)	108	Croatians displaced from Kosovo tested before vaccination following a few cases of acute hepatitis [Dumace settlement near Petrinja, Sisak-Moslavina County]
Croatia	Puntarić, 1995	1989	47.4% (age 0-1), 8.3% (age 2-3), 6.4% (age 4-5), 15.9% (age 6-7), 6.8% (age 8-9), 20.0% (age 10-11), 27.8% (age 12-13), 29.0% (age 14-15); no differences by sex	305	children [Ivanić-Grad, Zagreb County]
Croatia	Burek, 1985	1979	51.0% (age 0-1), 5.0% (age 1-3), 9.5% (age 3-7)	887	urban children attending day care centers [Zagreb]
Czech Republic	Chlíbek, 2006	2003-2004	16.8% (age 41-50), 52.9% (age 51-60), 77.5% (age 61+)	972	adults with no history of viral hepatitis or hepatitis vaccination [Hradec Krávlové, Hradec Krávlové Region]

Czech Republic	Beran, 1999	1996	6.1% (age 0-4), 3.6% (age 5-9), 2.4% (age 10-14), 3.6% (age 15-19), 8.8% (age 20-24), 18.2% (age 25-29), 26.4% (age 30-39), 51.1% (age 40-49), 70.8% (age 50-59), 85.8% (age 60-70); no differences by sex	1796	randomly selected residents participating in a national serological survey [nationwide]
Czech Republic	Beran, 1996 (Cent Eur J Public Health) / Beran, 1996 (Acta Medica) / Beran, 1995	1991-1995	26.2% (age 20-29), 37.9% (age 30-39), 46.4% (age 40-49), 72.7% (age 50-59)	865	Czech troops serving with the United Nations who had not been vaccinated against hepatitis [nationwide]
Hungary	Pohl, 2003	1982; 1987; 1994, 1999	1982: 29.2% (age 2-39); 1987: 20.2% (age 2-39); 1994: 10.4% (age 2-39); 1999: 5.9% (age 2-39)	10000; 4000; 4000; 7000	blood samples from patients without symptoms of any infectious disease [nationwide]
Hungary	Kassas, 1995	1986-1993	26.2% (age 18-30), 38.9% (age 31-40), 68.3% (age 41-50), 86.5% (age 51+); males: 52.5%, females: 49.9%; no differences by sex	410	healthy hospital workers [Budapest]
Hungary	Dávid, 1983	--	6% (age <30), 64% (age 30-39), 100% (age 40-49), 100% (age 50-59), 100% (age 60-80)	185	controls (athletes and inpatients without liver disease) in a study of chronic liver disease [Budapest]
Poland	Janaszek-Seydlitz, 2007	2004-2005	9.7% (age 1-4), 18.4% (age 5-9), 19.6% (age 10-14), 21.5% (age 15-19), 27.8% (age 20-24), 33.3% (age 25-29), 35.7% (age 30-34), 48.0% (age 35-39), 53.8% (age 40-44), 68.2% (age 45-54)	895	urban residents [Warsaw, Masovian Voivodeship]
Poland	Grezeszczuk, 2003	1999-2000	healthcare workers: 59.2% (age <41), 88.6% (age 41+); Controls: 43.4% (age <41), 88.8% (age 41+); no differences by sex	502	healthcare workers and healthy controls [Bialystok, Podlaski Voivodeship]

Poland	Ryszkowska, 2000	--	6.6% (age 3-18)	377	rural and urban children [Otmuchów, Opole Voivodeship; Warsaw, Masovian Voivodeship]
Poland	Polz-Dacewicz, 2000	1990; 1998-1999	1990: 10.4% (age 0-9), 11.6% (age 10-14), 55.0% (age 15-19), 77.1% (age 20-29), 87.9% (age 30-39), 87.0%(age 40-49), 93.8% (age 50+); 1998-1999: 8.2% (age 0-9), 10.1% (age 10-14), 16.2% (age 15-19), 21.4% (age 20-29), 27.8% (age 30-39), 47.2% (age 40-49), 75.8% (age 50+); no differences by sex	1000; 1450	inpatients without infectious diseases [Lublin Voivodeship]
Poland	Cianciara, 2000	1997	4% (age 2-5), 7% (age 6-10), 8% (age 11-15), 38% (age 16-20), 31% (age 21-25), 58% (age 26-30), 65% (age 31-35), 76% (age 36-40), 81% (age 41-78)	1300	urban residents [Warsaw, Masovian Voivodeship]
Poland	Zalewska, 1989	--	56.2% (age 21-25), 61.9% (age 26-30), 60.0% (age 31-35), 69.6% (age 36+)	70	hospital workers [Wroclaw, Lower Silesian Voivodeship]
Romania	Iacob, 1999	1993-1997	healthcare workers: 52.0%, males: 66.3%, females: 53.2%; construction workers: 75.0% (age 21-30), 91.6% (age 31-40), 92.3% (age 41-50); restaurant workers: 76.1% (age 20-30), 86.6% (age 31-40), 80.0% (age 41-50), males: 85.0%, females: 84.7%	295	healthy workers [Iaşi, Iaşi County]
Romania	Beldescu, 1995	--	(estimated from graph) 8.5% (age <1), 15% (age 1-4), 55% (age 5-9), 65% (age 10-14), 90% (age 15-19), 90.6% (age 20-24), 90% (age 25-29), 77.8% (age 30-34), 90% (age 35-39), 96.9% (age 40-44), 85% (age 45-49), 80% (age	860	apparently healthy persons [Călăraşi County, Sud region; Mehedinți County, Sud-Vest region; Bucharest; Brăila County, Sud-Est region; Vâlcea County, Sud-Vest

			50-59), 90% (age 60+)		region; Teleorman County; Giurgiu County, Sud region; Tulcea County, Sud-Est region; Dolj County, Sud-Vest region; Buzău County, Sud-Est region; Braşov County, Centru region; Constanța County, Sud Est region]
Romania	Paquet, 1993	1990	(estimated from graph) 38% (age 0-4), 55% (age 5-9), 65% (age 10-19), 85% (age 20-29), 100% (age 30-39), 90% (age 40-49), 100% (age 50-59), 100% (age 60-82)	1155	pediatric inpatients without infectious diseases, healthy adult outpatients, children living in orphanages, and volunteer medical personnel [Bucharest]
Romania	Rudin, 1990	1990	89.8% (age 0-3), 100% (age 3-6), 100% (age 9-11)	149	orphans [Pascani, Iaşi County]
Romania	Sabău, 1983	--	40% (age 1-5), 68.4% (age 6-15), 91.9% (age 16-25); no differences by sex	200	healthy outpatients, pregnant women and blood donors [Mureş County, Centru region]
Romania	Onesciuc, 1981	--	29.6% (age 3-10), 61.5% (age 11-20), 90.0% (age 21-30), 77.7% (age 31-40), 80.0% (age 41-50), 66.6% (age 51-76); males: 72%, females: 62%; no differences by sex	194	healthy urban adults [Cluj-Napoca, Cluj County]
Kosovo / Serbia	Quaglio, 2008	2005	40.5% (age 0-10), 70.1% (age 11-20), 95.2% (age 21-30), 94.8% (age 31+); males: 88.1%, females: 88.9%; no differences by sex	1285	blood donors, healthy outpatients, and health care workers [Peja-Pec, Istog, Klina, and Decan in the Peja-Pec region]

Slovenia	Sočan, 2001	1999	5.0% (age 18-22), 4.4% (age 23-27), 9.3% (age 28-32), 15.0% (age 33-37), 30.0% (age 38-42), 52.5% (age 43-47), 60.0% (age 48-52), 80.0% (age 53-57)	328	adult travelers to low-income countries with no history of hepatitis or hepatitis A vaccination [Ljubljana]

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EASTERN EUROPE

(Belarus, Estonia, Latvia, Lithuania, Republic of Moldova, Russian Federation, Ukraine)

REGIONAL SUMMARY

The majority of articles published from this region are from Russia, and the results of these studies and studies from the Baltic States are discussed in separate paragraphs below. Studies were also conducted in Belarus and Ukraine, where about 50% of middle-aged adults and many older adults remain susceptible [Fisenka, 2008; Moisseeva, 2008]. Older studies showed a higher prevalence rate, with 50% of children and nearly all adults immune [Gudkov, 1992]. These studies and studies from the Baltics and Russia suggest that Eastern Europe has a low-intermediate endemicity rate.

ESTONIA, LATVIA, LITHUANIA

A study conducted in Estonia in the early 1980s found that about half of people in their 20s had immunity to HAV [Kompaniets, 1984] and a 1982-1983 study in Vilnius, Lithuania, found a slightly higher rate, with about half of 10 to 19 year olds and 80% of adults having anti-HAV [Savinkskaia, 1986]. No recent studies were available from the Baltic States, but the rate of acute hepatitis has been decreasing. The hospitalization rate for hepatitis A was reported to drop significantly from 8.2 and 43.9 per 100,000 in 1997 and 1998 to 3.6 and 3.7 per 100,000 in 2000 and 2001 in Estonia [Bonanni, 2007]. A similar drop was observed in Lithuania, where the hospitalization rate fell significantly from 73.7 and 40.4 per 100,000 in 1997 and 1998 to 2.1 and 1.9 per 100,000 in 2000 and 2001, and only one death from hepatitis A was reported in Lithuania between 1997 and 2001 [Bonanni, 2007].

RUSSIA

Studies in Moscow between 1977 and 1983 found a very low child seroprevalence rate (about 10% for children ages 5 to 9 and about 30% for children ages 10 to 14 years) that gradually rose during adulthood [Savinskaia, 1986; Savinskaia, 1986]. Other studies from this time period showed slightly higher prevalence rates in children, with 50% of 10- to 15-year-olds immune [Karetnyĭ, 1990; Kornachev, 1990; Prikazchikov, 1988; Prikazchikov, 1987; Shliakhtenko, 2008; Shliakhtenko, 1994]. Studies from the 1990s showed that about 50% of teenagers and residents in their early 20s immune [Balayan, 1994; Mukomolov, 2001; Shliakhtenko, 2008; von Hertzen, 2006]. Studies in the 2000s suggest that about 50% of middle-aged adults do not have anti-HAV [Shliakhtenko, 2008], which means that a large proportion of children and a growing number of adolescents and adults remain susceptible to hepatitis A virus.

SUMMARY AGE-PREVALENCE ESTIMATES

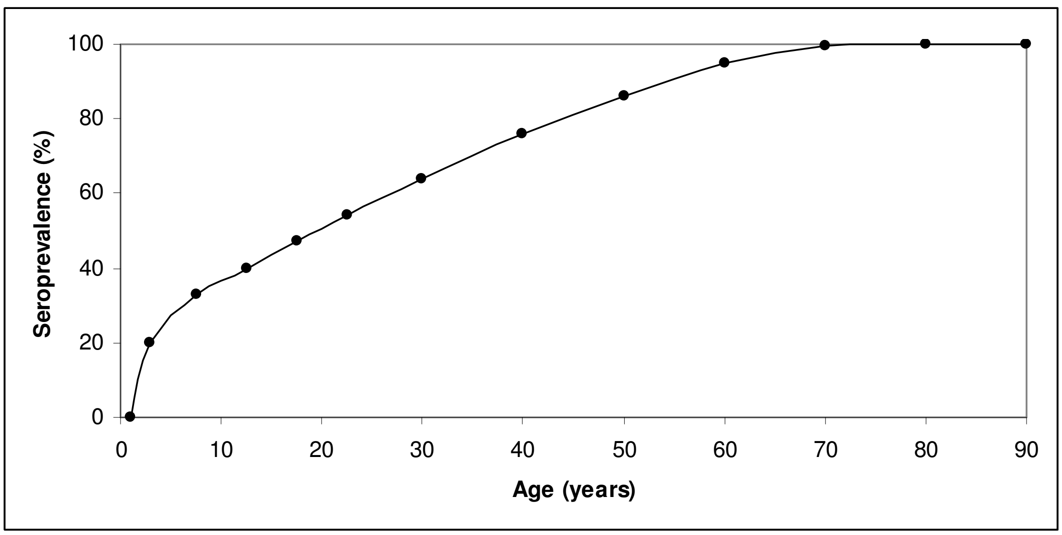
Table 23. Summary Prevalence Estimates by Age in Eastern Europe.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	20	33	40	47	54
% at risk	--	--	80	67	60	53	46

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	64	76	86	95	100	100	100
% at risk	36	24	14	5	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 42. Plot of Estimated Seroprevalence by Age in Eastern Europe.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 43. Plots of Age-Seroprevalence Data from Studies from Eastern Europe.

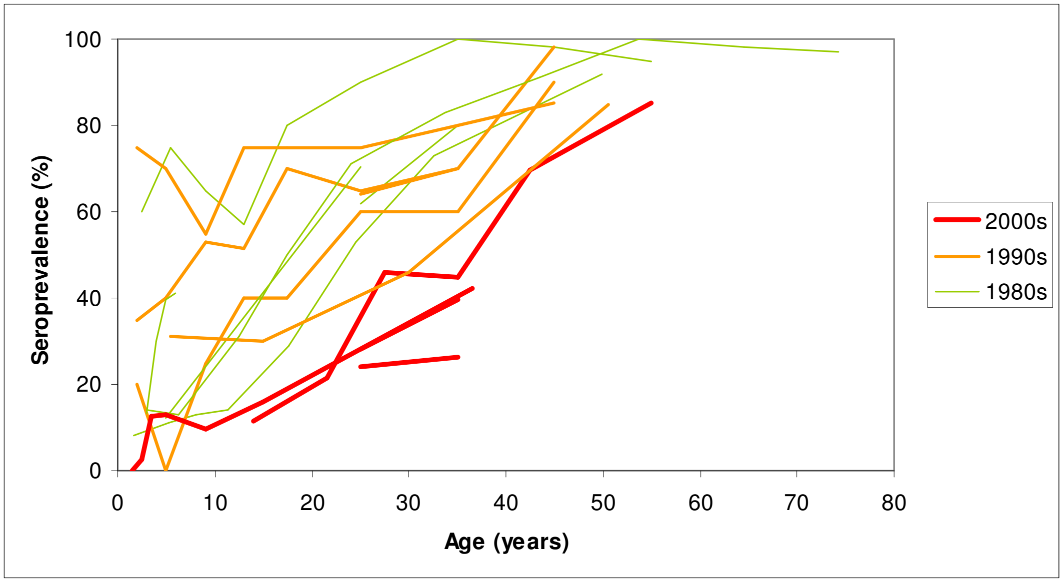


TABLE OF INCLUDED PREVALENCE STUDIES

Table 24. Information about Included Studies from Eastern Europe.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Belarus	Fisenka, 2008	2007	3.2% (age 1-5), 95.5% (age 6-9: vaccinated population), 11.3% (age 10-17), 21.6% (age 18-24), 45.9% (age 25-29), 44.9% (age 30-39), 69.6% (age 40-44), 85.0% (age 45+)	568	urban residents after the introduction of universal hepatitis A vaccination of 6-year-olds in 2003-2006 [Minsk]
Belarus	Gudkov, 1992	1986-1990	85.3% (age <1), 60% (age 1-3), 75% (age 4-6), 65% (age 7-10), 57.2% (age 11-14), 80% (age 15-19), 90% (age 20-29), 100% (age 30-39), 98% (age 40-49), 95% (age 50+)	2128	urban residents
Estonia	Kompaniets, 1984	--	(estimated from graph) 8% (age 1-3), 11% (age 4-6), 13% (age 7-9), 14% (age 10-14), 29% (age 15-19), 53% (age 20-29), 73% (age 30-39), 92% (age 40+)	543	urban residents [Tallinn]

Russian Federation	Shliakhtenko, 2008	1986; 1999; 2003; 2006	1986: 61.7% (age 20-29), 80.0% (age 30-39), 88.1% (age 40+); 1999: 64.0%, 70.0%, 98.0%; 2003: 24.0%, 26.3%, 71.3%; 2006: 28.3%, 39.6%, 71.9%	578; 296; 152; 529	blood donors, pregnant women, and patients with noninfectious diseases [Saint Petersburg (Leningrad), Northwestern district]
Russian Federation	von Hertzen, 2006	1997	81.6% (age 25-54)	387	population-based sample [Republic of Karelia, Northwestern district]
Russian Federation	Mukomolov, 2001	1999	(estimated from graph) Rostov-on-Don: 35% (newborn), 20% (age 1-2), 0% (age 3-6), 25% (age 7-10), 40% (age 11-14), 40% (age 15-19), 60% (age 20-29), 60% (age 30-39), 90% (age 40+); St. Petersburg: 60%, 35%, 40%, 53.1%, 51.5%, 70%, 65%, 70%, 98.0%; Yakutsk: 60%, 75%, 70%, 55%, 75%, 75%, 75%, 80%, 85%	2958	healthy residents [Saint Petersburg, Northwestern district; Rostov-on-Don, Rostov Oblast; Yakutsk, Sakha Republic]
Russian Federation	Shliakhtenko, 1994	1986-1989	70.2% (age <1), 12.2% (age 3-6), 70.5% (age 20-39), 87.7% (age 40+)	1351	[St. Petersburg, Northwestern district]
Russian Federation	Balayan, 1994	--	31.0% (age 1-9), 30.0% (age 10-19), 46.1% (age 20-39), 84.8% (age 40-60)	183	volunteer adult blood donors and pediatric outpatients with mild diseases and no liver disorders [Moscow, Central district]
Russian Federation	Karetnyĭ, 1990	1987	Kemerovskaia Oblast: 52.3% (age 15-17); Krasnodaroskoye Krai: 64.1% (age 15-17); Moscow: 22.7% (age 15-17)	2375	adolescents attending schools [Kemerovsky District, Kemerovo Oblast; Krasnodarskoye, Altai Krai; Moscow]
Russian Federation	Kornachev, 1990	1981-1984	45.6% (age 3-14)	305	healthy children

Russian Federation	Prikazchikov, 1988 / Prikazchikov, 1987	1985-1986	13.4% (age 2.5-3.5), 30.1% (age 3.5-4.5), 39.7% (age 4.5-5.5), 41.1% (age 5.5-6.5)	567	children attending day-care centers with no history of hepatitis [Kemerovo, Kemerovo Oblast]
Russian Federation	Savinskaia, 1982	1977-1981	79% (age <1), 14% (age 1-4), 13% (age 5-9), 31% (age 10-14), 50% (age 15-19), 71% (age 20-29), 83% (age 30-39), 91% (age 40-49), 100% (age 50-59), 98% (age 60-69), 97% (age 70+); males: 24.3% (age 0-9), 40.2% (age 10-19), 75.5% (age 20-29), 91.6% (age 30+); females: 17.7%, 40.4%, 73.0%, 92.0%	1002	healthy urban residents [Moscow, Central district]
Ukraine	Moisseeva, 2008	2007	0.0% (age 1-2), 2.6% (age 2-3), 12.5% (age 3-4),13.0% (age 4-5), 9.7% (age 6-11), 16.1% (age 12-17), 42.1% (age 18-50), 81.7% (age 50+)	1001	outpatients without history of hepatitis or HAV vaccination [Darnytskyi, Dniprovskyi, Pecherskyi, and Solomianskyi districts within Kiev]

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WESTERN EUROPE

(Andorra, Austria, Belgium, Channel Islands, Cyprus, Denmark, Faeroe Islands, Finland, France, Germany, Gibraltar, Greece, Greenland, Holy See, Iceland, Ireland, Isle of Man, Israel, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, Saint Pierre et Miquelon, San Marino, Spain, Sweden, Switzerland, United Kingdom)

REGIONAL SUMMARY

This region has a low seroprevalence rate. Details are provided in the country-specific paragraphs below.

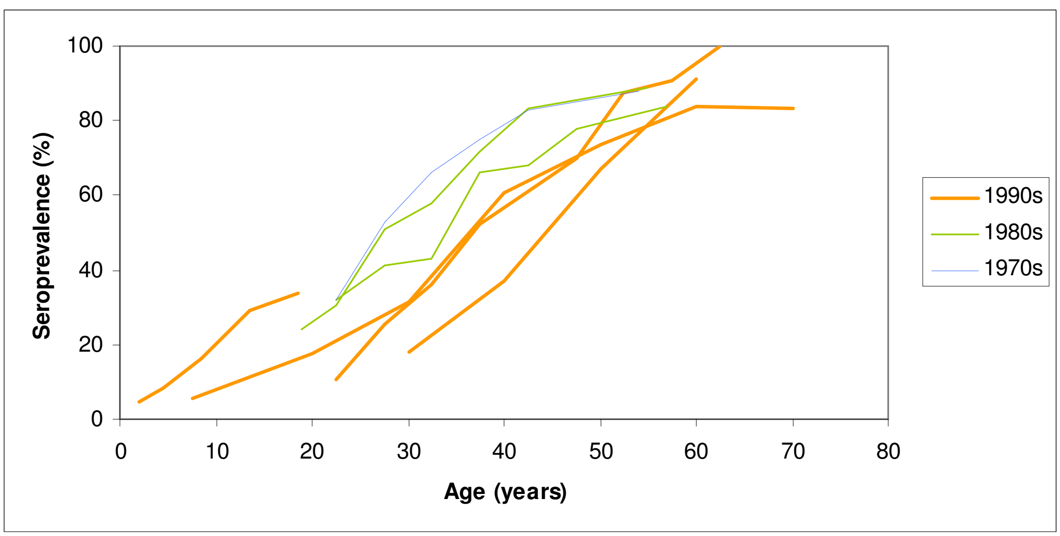
AUSTRIA

A 1991 study found that two-thirds of adults age 41 to 50 had immunity, but only 20% of 31- to 40-year-olds and 7% of 21- to 30-year-olds [Prodinger, 1994]. A hospitalization rate of 1.5 to 4.8 per 100,000 per year was reported in Austria during 1997 to 2001, and no hepatitis A deaths were reported [Bonanni, 2007]. This confirms a continuing low incidence rate.

BELGIUM

Rates of studies conducted around 1980 found that more than half of all 30-year-olds had immunity to hepatitis A [Vranckx, 1990; Vranckx, 1984]. In the 1990s, about half of all 30-year-olds and more than 90% of 60-year-olds had anti-HAV [Beutels, 1998; Beutels, 1997; Jacques, 1994; Vranckx, 1999; Vranckx, 1993; Vranckx, 1990] while the rate in adolescents and children was generally less than 10% [Beutels, 1998; Beutels, 1997; Jacques, 1994; Vranckx, 1993]. A hospitalization rate of 3.6 to 4.2 per 100,000 per year was reported in Belgium during 1997 to 2001 [Bonanni, 2007].

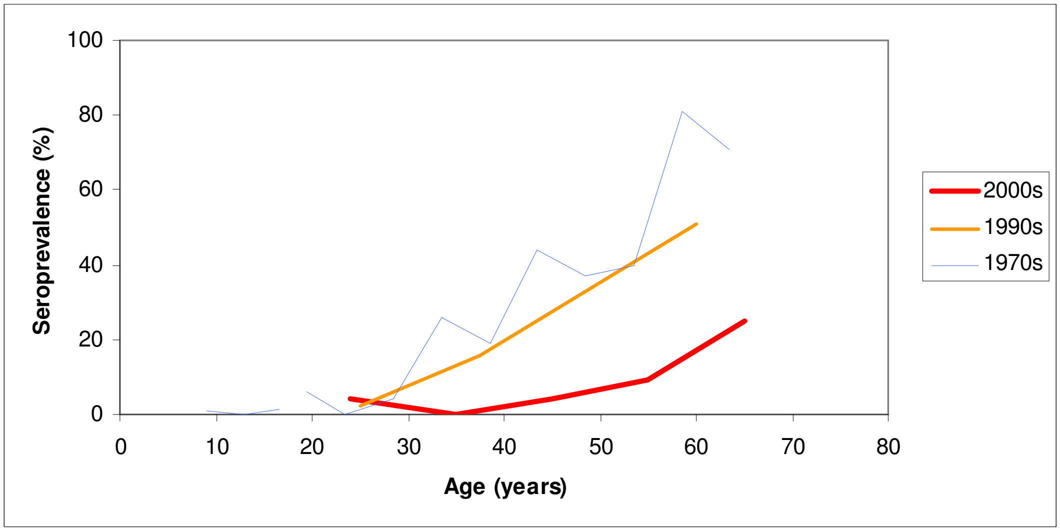
Figure 44. Plots of Age-Seroprevalence Data from Studies from Belgium.



DENMARK

Studies from Denmark in the 1970s and 1980s found that less than 5% of adolescents and less than 50% of 50-year-olds had anti-HAV [Mathiesen, 1980; Scheutz, 1985; Skinhøj, 1984; Skinhøj, 1982]. Studies from the 1990s and 2000s show a continuing very low infection rate, with less than 10% of middle-aged adults immune [Christensen, 2005; Linneberg, 2003]. The incidence rate is very low.

Figure 45. Plots of Age-Seroprevalence Data from Studies from Denmark.



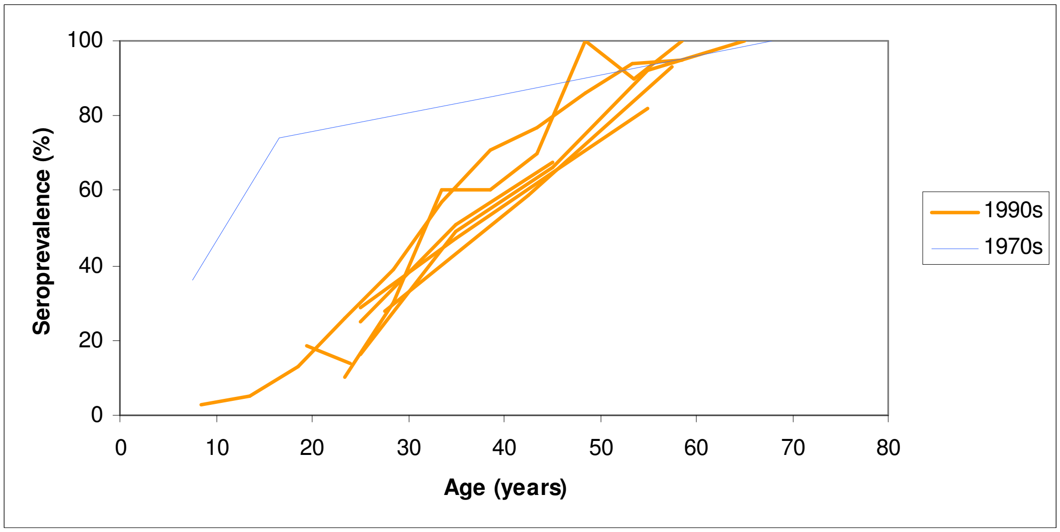
FINLAND

Studies from Finland in the 1970s showed that about half of 40- to 49-year-olds and about one-quarter of younger adults had anti-HAV [Pohjanpelto, 1984; Ukkonen, 1979]. Rates in young adults in the 1980s were lower [Pohjanpelto, 1984] and only about 10% of 25- to 54-year-olds were immune in a 1997 study [von Hertzen, 2006]. Finland has experienced several foodborne outbreaks of hepatitis A [Pebody, 1998], which suggests that the seroprevalence rate continues to be low and the incidence rate is low outside of outbreaks.

FRANCE

A survey conducted in Paris in 1977 found a moderate population seroprevalence rate of 75% [Frösner, 1979]. Studies in the 1980s found that about one-third of adolescents had anti-HAV, with some regions showing higher rates [Joussemet, 1992; Joussemet, 1987; Lemaire, 1980]. Studies from the 1990s were remarkably consistent in their observations of seroprevalence by age, as noted by the graph below. Less than 20% of children and adolescents, about 50% of 40-year-olds, and nearly all older adults have immunity [Cadilhac, 1996; Denis, 2003; Djeriri, 1996; Domart, 1999; Dubois, 1992; Germanaud, 1992; Joussemet, 1999; Lagarde, 1995; Lucht, 1996; Nalpas, 2000; Nguyen-Khac, 1996]. These data indicate a low incidence rate.

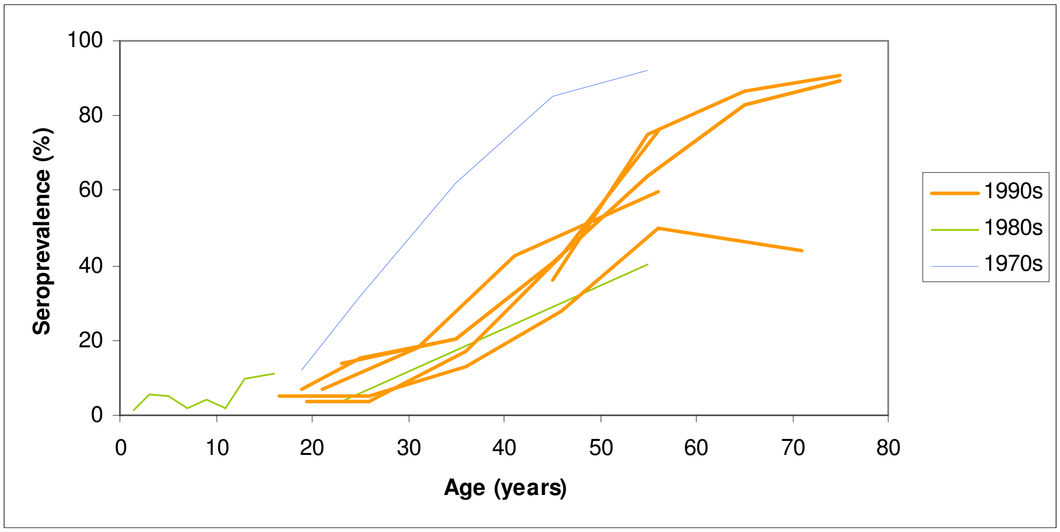
Figure 46. Plots of Age-Seroprevalence Data from Studies from France.



GERMANY

An evaluation of sera collected in Hanover in 1965 and in 1975 showed that few infections had occurred in the intervening years [Frösner, 1978]. There was a very low prevalence rate in children and young adults, and a high rate in older adults [Frösner, 1978]. Surveys conducted in the late 1970s found a moderate population seroprevalence rate of 55% [Frösner, 1980; Frösner, 1979; Frösner, 1977]. Studies in the 1980s found even more moderate rates [Bölke, 1995; Ebell, 1983; Koster, 1990; Lasius, 1983]. Studies in the 1990s showed that only about 5% of children and adolescents [Abb, 1994; Bienzle, 1993] and less than 50% of 40-year-olds had immunity to HAV [Abb, 1994; Bienzle, 1993; Hafner, 2008; Hoffman, 1992; Nübling, 2002; Ongey, 2004; Rudi, 1997; Thierfelder, 2001; Thierfelder, 1999]. A nationwide serosurvey in 1998 found a population seroprevalence rate of 46.5%, with only small differences between east Germany (51.8%) and west Germany (45.1%) [Thierfelder, 2001; Thierfelder, 1999]. A hospitalization rate of 1.6 per 100,000 in 2000 and 2.0 per 100,000 in 2001 were reported by Germany [Bonanni, 2007]. Nine to 17 deaths per years were reported between 1997 and 2001, for an annual mortality rate of about 0.01 to 0.02 per 100,000 [Bonanni, 2007].

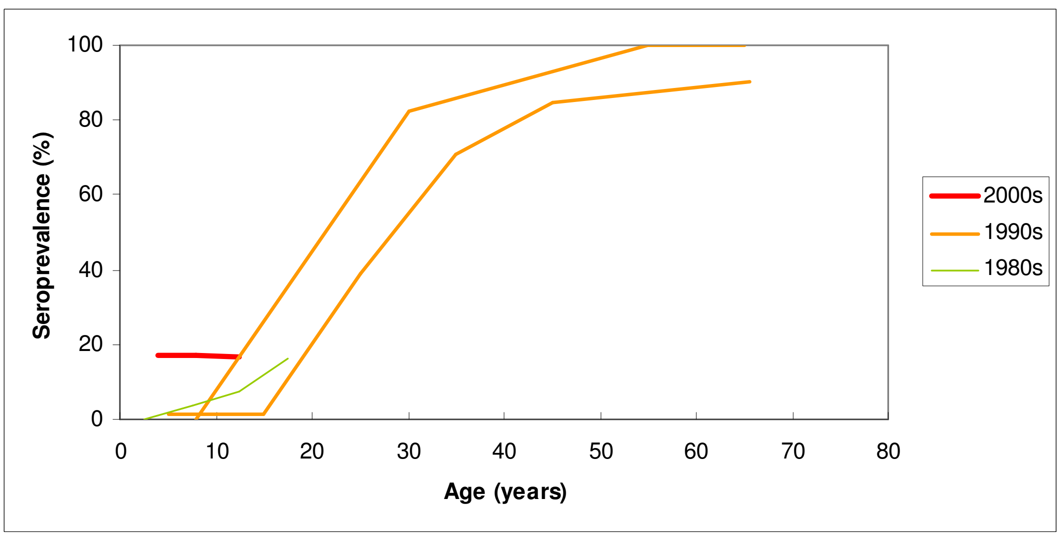
Figure 47. Plots of Age-Seroprevalence Data from Studies from Germany.



GREECE

Surveys conducted in Greece in the mid-1970s found that more than 80% of people in their 20s had anti-HAV [Frösner, 1979; Papaevangelou, 1980]. In the 1980s, less than 10% of children demonstrated immunity to HAV [Kremastinou, 1984]. In the 1990s and 2000s, the immunity rate in children and young adults remained low [Dalekos, 1995; Kyrka, 2009; Lionis, 1997 (EJE); Lionis, 1997 (JVH); Mazokopakis, 2003; Mazokopakis, 2000; Michos, 2008], while the vast majority of middle-aged and older adults continued to demonstrate immunity as a result of exposures they had experienced in childhood [Dalekos, 1995; Lionis, 1997 (JVH)].

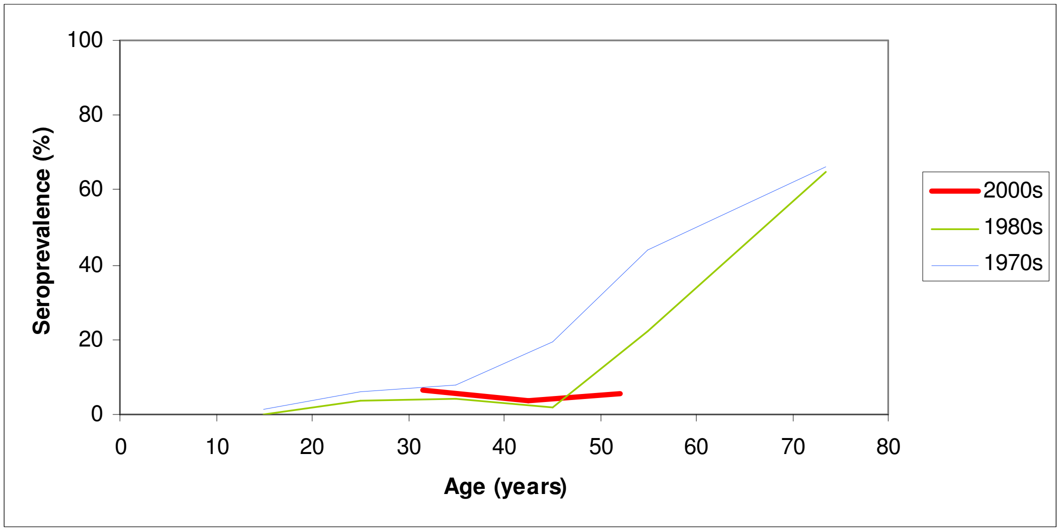
Figure 48. Plots of Age-Seroprevalence Data from Studies from Greece.



ICELAND

Only about 2 cases per 100,000 of acute hepatitis were reported annually in the 1970s and 1980s [Briem, 1991], and less than 10% of people younger than 50 years old had immunity to HAV [Briem, 1991; Briem, 1982]. Less than 5% of working-age adults showing anti-HAV in a study conducted in 2000 [Asbjoernsdottir, 2006], which indicates that the incidence rate continues to be very low.

Figure 49. Plots of Age-Seroprevalence Data from Studies from Iceland.



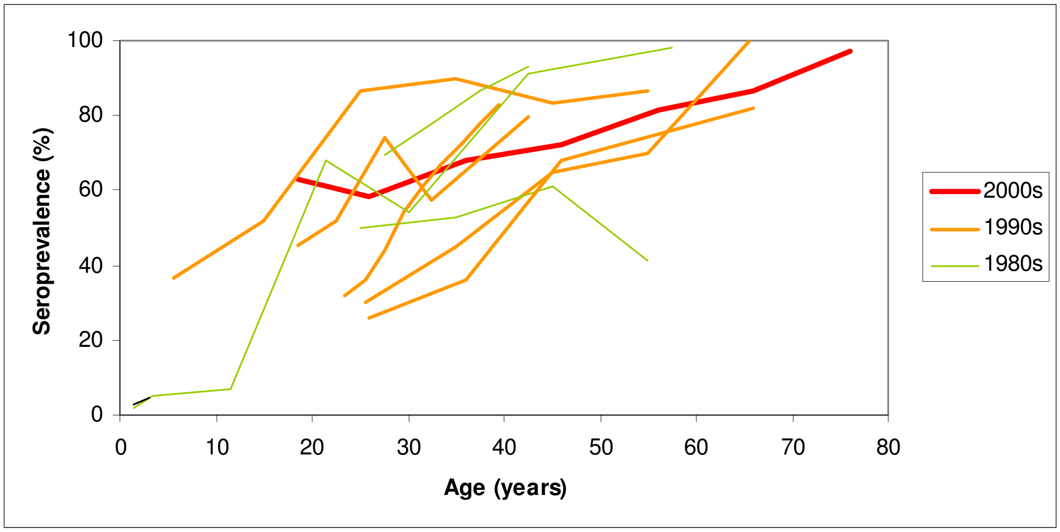
IRELAND

A study of international travelers in the late 1980s found that more than half of 50-year-olds had immunity to HAV [Fry, 199]. A 1991 study conducted after the water supply in a community was contaminated with sewage found that 56% of the residents had immunity to HAV from prior infection, with only 2% of those under 10 years of age and less than 20% of those ages 10 to 19 immune, but more than 90% of those over 60 years old [Thornton, 1995]. A study conducted in the mid-1990s found that the majority of adults had anti-HAV [Rajam, 1998]. No recent nationwide seroprevalence surveys have been published in the peer-reviewed literature, but the infection rate is expected to have remained low.

ISRAEL

A steady decline in the seroprevalence rate has been observed in studies of military recruits reporting for compulsive national service. The prevalence of 18- and 19-year-old inductees dropped from 64% in 1977 [Kark, 1985; Kark, 1980] to 54% in 1984 [Kark, 1992-1993] to 46% in 1987 [Green, 1990] to about 40% in 1996 [Gdalevich, 1998; Katz, 2000]. Rates in members of the permanent military also appear to have decreased from the 1980s [Green, 1992; Green, 1989] through the 1990s [Almog, 1999; Gillis, 2002]. Similar rates have been observed among healthcare workers [Ashkenazi, 2001; Chodick, 2003; Livni, 2002], agriculture workers [Fattal, 1987; Margalith, 1986; Morag, 1984], and outpatients [Samuels, 2005; Schwartz, 1998]. A national childhood vaccination program was implemented in 1999 and has contributed, along with socioeconomic improvements, to a significant decline in incidence [Chodick, 2008; Chodick, 2007]. A low hospitalization rate of 2.0 to 6.9 per 100,000 per year was reported in Israel during 1997 to 2001 [Bonanni, 2007]. Although significant differences in risk have been noted by country of origin for immigrants to Israel [Karetnyi, 1995], by occupational group [Lerman, 1999], and by socioeconomic status [Hasin, 2007], Israel now appears to have a moderate seroprevalence rate and a low incidence rate.

Figure 50. Plots of Age-Seroprevalence Data from Studies from Israel.

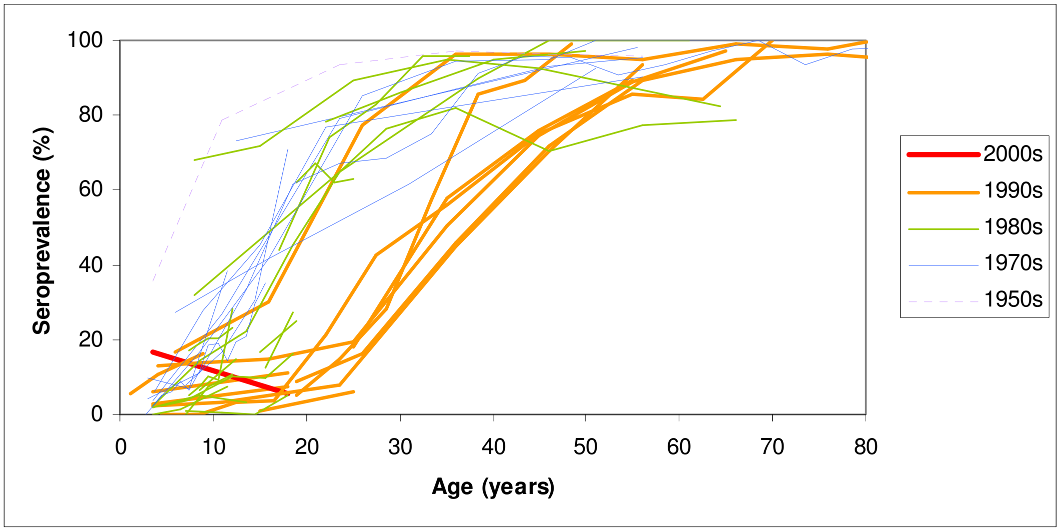


ITALY

Studies from Italy in the 1970s found a very high childhood seroprevalence in some parts of the country (like Sicily [La Rosa, 1978]) and moderate rates in others (like Milan [Zanetti, 1978]). Despite continuing regional differences, the age-seroprevalence plot below shows a fairly consistent curve for studies conducted with the same decade. Studies conducted around 1980 consistently showed that more than half of 20-year-olds had anti-HAV [Biglino, 1980; Chiaramonte, 1991; Chiaramonte, 1983; D'Argenio, 1989; Federico, 1980; Leonardi, 1985; Meloni, 1982; Merletti, 1980; Pasquini, 1984; Pasquini, 1982 (IJE); Pasquini, 1982 (AS); Patti, 1987; Romano, 1981; Utili, 1983; Vendramini, 1980]. Most studies conducted between the late 1980s and mid-1990s found a considerably lower rate, with about one-quarter of 20-year-olds immune [Castelli, 1996; Contu, 1989; Matricardi, 2000; Matricardi, 1997; Romano, 1996; Russo, 1997; Stroffolini, 1998; Stroffolini, 1993; Stroffolini, 1991 (Infection); Stroffolini, 1991 (Microbiologica); Trevisan, 1999], although a few found higher [Luzza, 1997; Masia, 1989] or lower [Chiaramonte, 1991; Gentile, 2009] rates. Studies conducted around 1990 also usually found that less than 10% of 10-year-olds had anti-HAV [Chiaramonte, 1991; D'Argenio, 1989; Franco, 1988; Moschen, 1994; Patti, 1987; Ripabelli, 1997; Russo, 1997; Stroffolini, 1991 (Infection); Stroffolini, 1990; Stroffolini, 1989; Zanetti, 1994]. By the late 1990s, only about 10% of 20-year-olds had anti-HAV [Ansaldi, 2008; Calabri, 1999; De Silvestri, 2002; Gentile, 2009; Patti, 1999], which indicates that few infections had occurred in the population in the previous 10 years. Studies in adolescents and young adults in the 2000s found that this low prevalence has continued [Beggio, 2007; D'Amelio, 2005; Gentile, 2009]. Higher prevalence rates continue to be observed among refugees and other immigrants [Chironna, 2006; Chironna, 2001; Majori, 2008; Santantonio, 1993; Ventura, 2004].

Figure 51 also highlights this significant shift in seroprevalence over time. Several studies conducted at the same sites one or more decades apart have also found significant decreases in prevalence over time [Chiaramonte, 1991; D'Argenio, 1989; Stroffolini, 1990; Zanetti, 1994]. In 1985, the annual incidence rate was 10 per 100,000 [Mele, 1997]. Between 1991 and 2006, the annual incidence of acute hepatitis A generally ranged between 1 and 4 per 100,000 [Tosti, 2008]. A hospitalization rate of 2.0 to 15.6 per 100,000 per year was reported in Italy during 1997 to 2001; only one hepatitis A death was reported during that time period [Bonanni, 2007]. A childhood vaccination program was implemented in 1997 in the Puglia Region after a series of outbreaks [Germinario, 2000], and has contributed to reduced incidence there. These data suggest that Italy now has a low incidence rate.

Figure 51. Plots of Age-Seroprevalence Data from Studies from Italy.



LUXEMBOURG

Luxembourg has a low seroprevalence rate [Mossong, 2006].

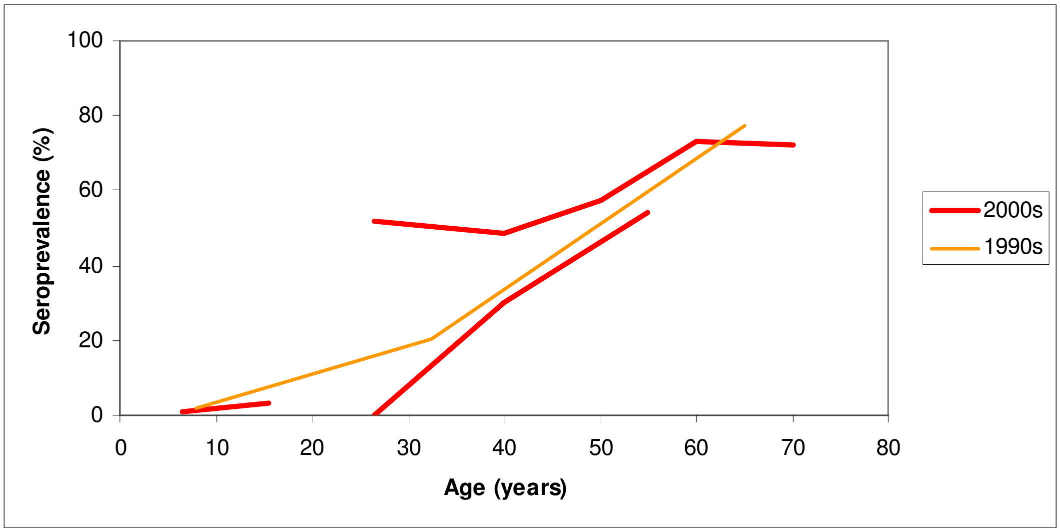
MALTA

A study conducted in the 1990s found a low adult seroprevalence rate. A hospitalization rate of 0.3 to 1.8 per 100,000 per year was reported in Malta during 1997 to 2001, and only one hepatitis A death was reported during this time period [Bonanni, 2007]. Malta has a low incidence rate.

NETHERLANDS

A survey conducted in Amsterdam in 1977 found a moderate population seroprevalence rate of 52% [Frösner, 1979]. The age-adjusted rate in 1995-1996 was estimated to be 34% [Termorshuizen, 2000]. Studies from the 1990s and 2000s generally found that less than 5% of children and about 50% of 50-year-olds have anti-HAV, with higher rates in immigrant populations [Baaten, 2007; Richardus, 2004; Termorshuizen, 2000; Veldhuijzen, 2009]. A hospitalization rate of 0.0 to 0.2 per 100,000 per year was reported in the Netherlands during 1997 to 2001, and only four hepatitis A deaths were reported during this time period, for an annual mortality rate of less than 0.01 per 100,000 [Bonanni, 2007].

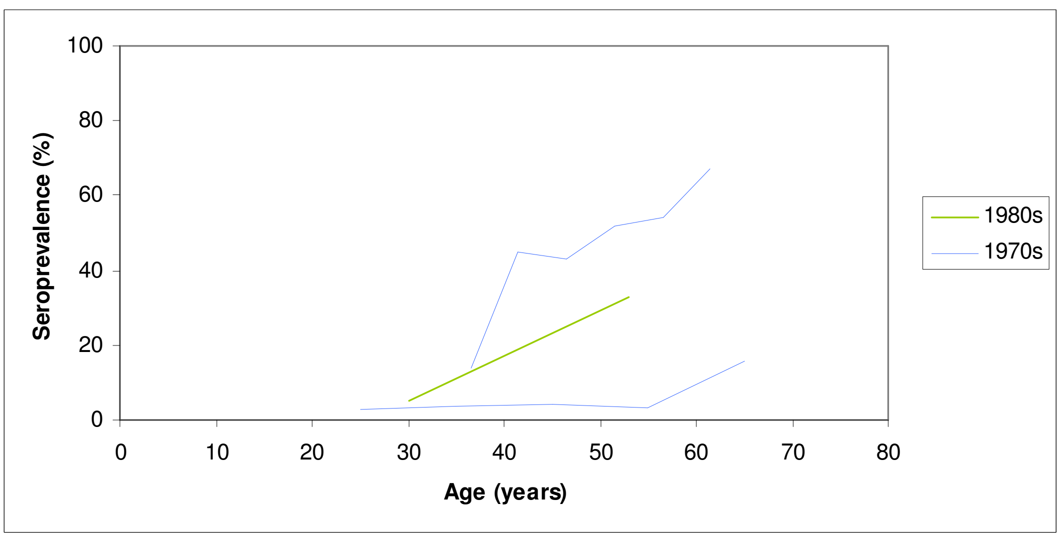
Figure 52. Plots of Age-Seroprevalence Data from Studies from the Netherlands.



NORWAY

A survey conducted in Lillehammer in 1976 found a very low population seroprevalence rate of 17% [Frösner, 1979; Frösner, 1977], and other surveys from the 1970s and 1980s confirmed a low prevalence rate among young adults [Hurlen, 1980; Siebke, 1989; Siebke, 1982]. A survey from the 1990s found that less than 5% of working adults had anti-HAV [Andenaes, 2002]. Norway likely continues to have a very low incidence rate.

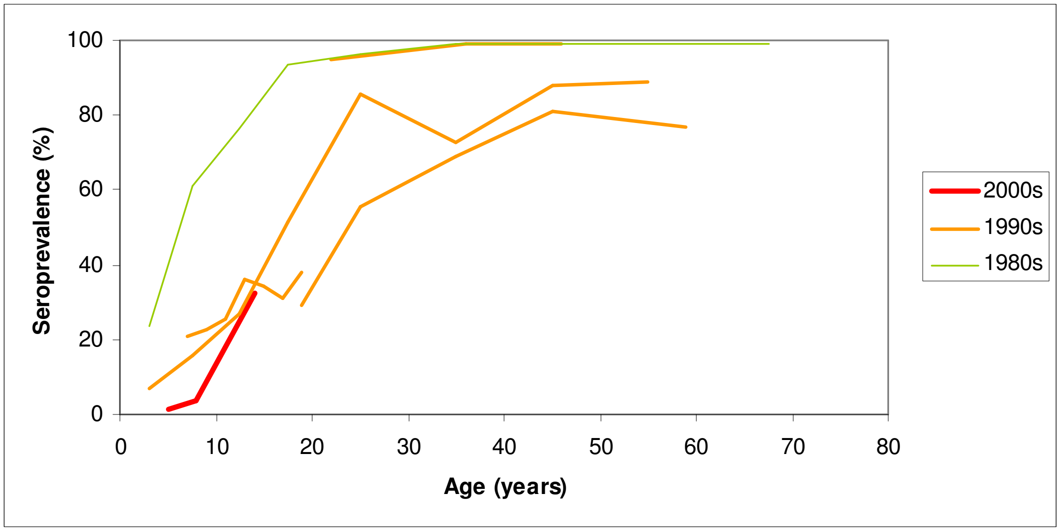
Figure 53. Plots of Age-Seroprevalence Data from Studies from Norway.



PORTUGAL

A nationwide serosurvey from the early 1980s found an age-standardized prevalence of 84.9%, with nearly all adults immune [Lecour, 1984]. Surveys from the 1990s and 2000s found that at least one-third of 20-year-olds had anti-HAV, with considerably higher rates in some areas [Antunes, 2004; Barros, 1999; Cunha, 2001; Macedo, 1998; Marinho, 1997].

Figure 54. Plots of Age-Seroprevalence Data from Studies from Portugal.

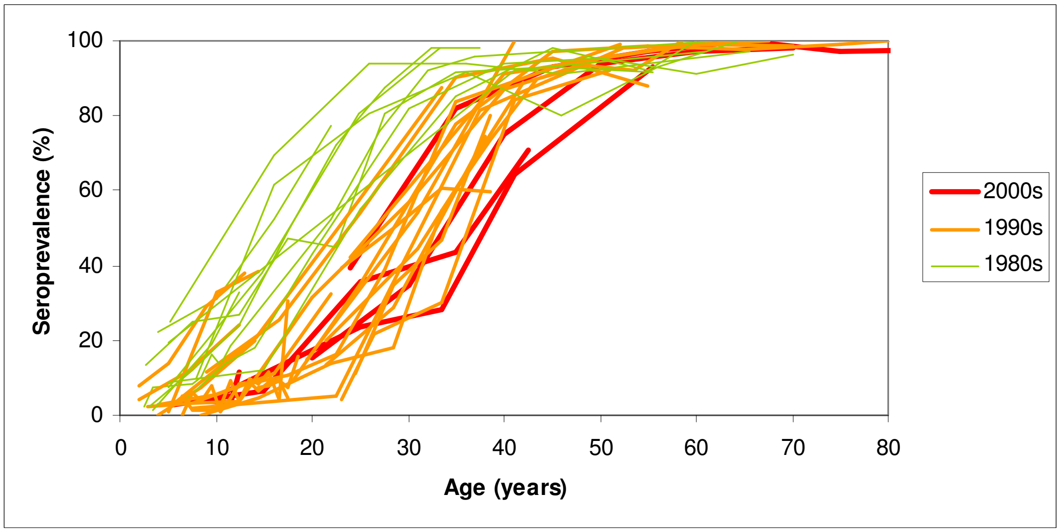


SPAIN

Seroprevalence studies conducted in the 1980s showed that at least 20% of 10-year-olds and at least half of 20-year-olds had immunity to hepatitis A virus [Amela, 1995; Bolumar, 1995; Carreño García, 1983; Dal-Ré, 1991; García de Pesquera, 1998; Grau, 1982; Perez Trallero, 1994; Perez Trallero, 1988; Ruiz Moreno, 1988; Salleras, 1992]. In the 1990s and 2000s, less than 10% of 10-year-olds and less than one-third of 20-year-olds had anti-HAV [Bayas, 1996; Benito Ruesca, 1997; Bruguera, 1999; Buti, 1996; Cilla, 2007; Cilla, 1995; Dal-Ré, 2000; de Juanes, 2001; de Juanes, 1999; Domínguez, 2007; Domínguez, 2004; García de Pesquera, 1998; Garcia Erce, 1996; García-Fulgueiras, 1997; Gil, 1998; Gil, 1997; Gil, 1991; Gil Miguel, 1999; Gil Miguel, 1996; González, 1994; González-Praetorius, 2001; Gonzalez-Quintela, 2005; Junquera, 2004; Menéndez, 1996; Morales, 1992; Montes Martínez, 1996; Perez-Trallero, 1994; Rodriguez-Iglesias, 1995; Santana, 2000; Soriano, 2004; Suárez, 1997; Suárez, 1996].

Several studies have found a decreasing prevalence over time. In Catalonia, the prevalence rate in children and young adults appeared to drop fairly steadily from 1989 to 1996 to 2002 [Salleras, 1992; Bruguera, 1999; Domínguez, 2007; Domínguez, 2004]. Universal adolescent vaccination against hepatitis A was introduced in Catalonia in 2001 [Domínguez, 2008; Salleras, 2000]. In Basque Country, the prevalence rate dropped substantially between 1986 and 2004 [Cilla, 2007; Perez-Trallero, 1994]. A study conducted in Barcelona found a drop from a 49% and 73% prevalence in 11- to 20-year-olds and 21- to 30-year-olds, respectively, in 1977 to 30% and 59% in 1985 [Vargas, 1987; Vargas, 1979]. This decrease in prevalence has followed a declining incidence rate. The incidence rate in Basque Country declined from 38 per 100,000 in 1986-1988 to 9 per 100,000 in 1992 and 3 per 100,000 in 2002-2004; the average age of acute hepatitis A patients increased during this time from 16 to 20 to 25 years [Cilla, 2007; Perez-Trallero, 1994].

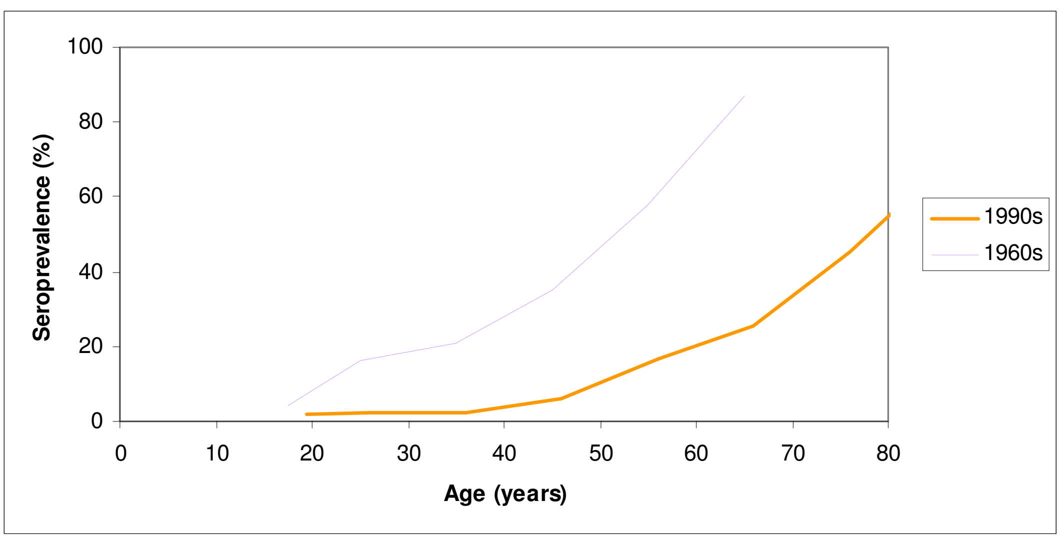
Figure 55. Plots of Age-Seroprevalence Data from Studies from Spain.



SWEDEN

A study conducted in 1968 found that few children and adolscents and only about one-quarter of young- and middle-aged adults had immunity to heaptits A virus [Weiland, 1980]. A survey conducted in Göteborg in 1977 found a very low population seroprevalence rate of 13% [Frösner, 1979; Iwarson, 1978]. The incidence rate in children between 1979 and 1983 was a very low 2 per 100,000 [Christenson, 1986]. A study from 1990-1991 found that only about 2% of 40-year-olds demonstrating anti-HAV [Böttiger, 1998; Böttiger, 1997]. The incidence rate has been, and likely continues to be, very low.

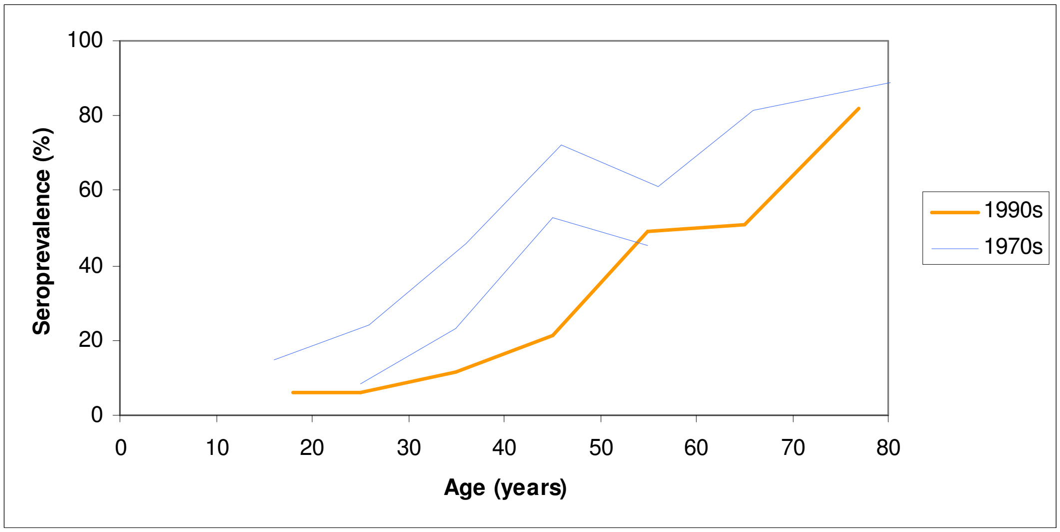
Figure 56. Plots of Age-Seroprevalence Data from Studies from Sweden.



SWITZERLAND

A survey of volunteer blood donors in 1977 found a low population seroprevalence rate of 39% [Frösner, 1979]. Other studies from the late 1970s found that about 25% of 30-year-olds had immunity [Holdener, 1982; Stadelmann, 1980]. A 1990 study found that only about 5% of young adults and less than 10% of 30-year-old had anti-HAV [Studer, 1993]. The current incidence rate appears to be low.

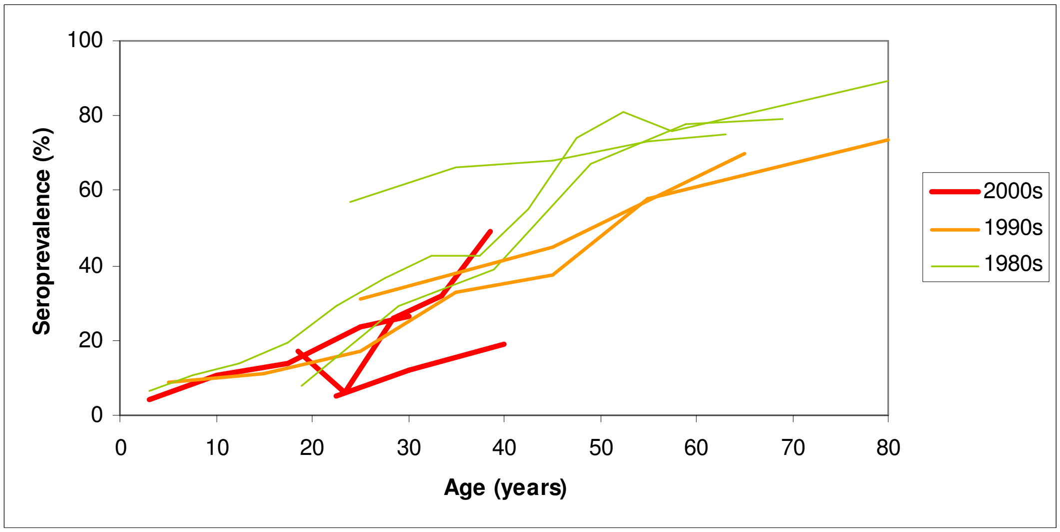
Figure 57. Plots of Age-Seroprevalence Data from Studies from Switzerland.



UNITED KINGDOM

A 1977-1978 study conducted in London found a prevalence of 7% in children less than 10 years old with more than half of 40-year-olds immune [Damjanovic, 1979]. Studies from the 1980s showed similar anti-HAV rates that were low in children and moderate for adults [Bernal, 1996; Cumberland, 1994; Gay, 1994; Higgins, 1990; Masterton, 1991; Scott, 1989]. Studies from the 1990s found fewer immune adults [Morris, 2002; Nandwani, 1993; Zuckerman, 1994], and a study comparing data from the same medical laboratories in 1986 and 1996 that found no difference in seroprevalence for the participating birth cohorts suggested a very low incidence rate [Morris, 2002]. A hospitalization rate of 0.7 per 100,000 per year was reported in England and Wales each year during 1998 to 2001, and only 13 hepatitis A deaths were reported during this time period, which translates to a mortality rate of less than 0.01 per 100,000 [Bonanni, 2007]. In the 2000s, only about one-quarter of 30-year-olds had immunity to HAV [Dalton, 2008; Jarvis, 2004; Morris-Cunnington, 2004 (AJE); Ross, 2002].

Figure 58. Plots of Age-Seroprevalence Data from Studies from the United Kingdom.



SUMMARY AGE-PREVALENCE ESTIMATES

Table 25. Summary Prevalence Estimates by Age in Western Europe.

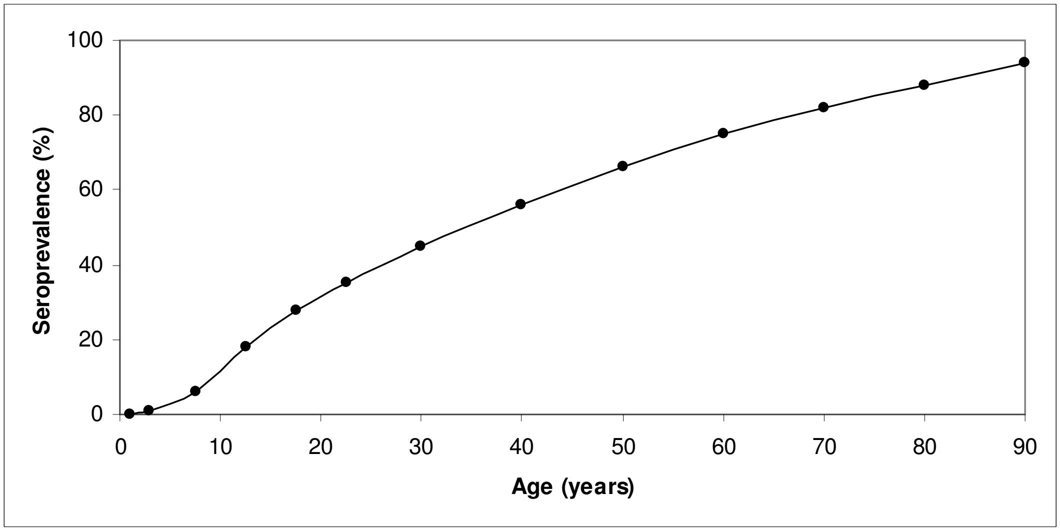
	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	1	6	18	28	35
% at risk	--	--	99	94	82	72	65

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	45	56	66	75	82	88	94
% at risk	55	44	34	25	18	12	6

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Based only on data from studies published in or after 1990.

Figure 59. Plot of Estimated Seroprevalence by Age in Western Europe.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

See individual countries for plots of included studies.

TABLE OF INCLUDED PREVALENCE STUDIES

Table 26. Information about Included Studies from Western Europe.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Austria	Prodinger, 1994	1991	7.0% (age 21-30), 20.0% (age 31-40), 66.7% (age 41-50), 86.7% (age 51+)	406	volunteer blood donors and medical students [Tyrol state]
Belgium	Vranckx, 1999	1996-1997	18% (age 25-34), 37% (age 35-44), 67% (age 45-54), 91% (age 55-64)	5068	healthcare workers [Brussels-Capital and Flemish Regions]
Belgium	Beutels, 1998 / Beutels, 1997	1993-1994	5.4% (age 0-14), 17.5% (age 15-24), 31.7% (age 25-34), 60.8% (age 35-44), 73.4% (age 45-54), 84.0% (age 55-64), 83.2% (age 65+)	3186	Belgian hospital patients without hepatitis [Flemish Region]
Belgium	Jacques, 1994	1991	10.6% (age 20-24), 25.5% (age 25-29), 35.9% (age 30-34), 52.5% (age 35-39), 60.9% (age 40-44), 70.0%	560	healthy female blood donors [Flemish Region]

			(age 45-49), 87.5% (age 50-54), 90.9% (age 55-59), 100% (age 60-64)		
Belgium	Vranckx, 1993	1990-1992	4.8% (age 1-2), 8.4% (age 3-5), 16.2% (age 6-10), 29.0% (age 11-15), 33.9% (age 16-20)	1008	children sampled at hospital [Brussels]
Belgium	Vranckx, 1990	1979; 1989	1979: 32% (age 20-25), 53% (age 25-30), 66% (age 30-35), 75% (age 35-40), 83% (age 40-45), 88% (age 45-63); 1989: 32% (age 20-25), 41% (age 25-30), 43% (age 30-35), 66% (age 35-40), 68% (age 40-45), 78% (age 45-50), 84% (age 50-63)	520	volunteer blood donors [Antwerp, Flemish Region]
Belgium	Coester, 1984	1981-1982	homosexual men: 43% (age 18-61); heterosexual men: 55% (age 16-61)	289	homosexual and heterosexual men attending a sexual health clinic [Antwerp, Flemish Region]
Belgium	Vranckx, 1984	1982	23.9% (age <20), 30.6% (age 20-24), 50.9% (age 25-29), 57.8% (age 30-34), 71.8% (age 35-39), 83.2% (age 40-44), 88.8% (age 45-65)	1164	volunteer blood donors [Antwerp, Flemish Region]
Cyprus	Hadjipanayis, 1999	1998	0.0% (age 6-12), 1.6% (age 13-18)	385	healthy school children [Larnaca district]
Denmark	Christensen, 2005	2003	4.3% (age <30), 0.0% (age 30-39), 4.1% (age 40-49), 9.2% (age 50-59), 25.0% (60+)	376	non-vaccinated volunteer blood donors [Odense, Region Syddanmark]
Denmark	Linneberg, 2003	1990-1991	2.1% (age 15-34), 15.9% (age 35-39), 51.0% (age 50-69)	1101	population-based sample [Copenhagen, Region Hovedstaden]
Denmark	Scheutz, 1985	--	11% (age 29-61)	27	dentists [Århus, Region Midtjylland]
Denmark	Skinhøj, 1984	--	43.5% (age 30-69)	60	hospital nursing staff [Copenhagen and Fredriksborg, Region Hovedstaden]

Denmark	Skinhøj, 1982	1976	1.1% (age 7-10), 0.0% (age 11-14), 1.3% (age 15-17)	285	population-based sample of healthy school children [Copenhagen, Region Hovedstaden]
Denmark	Mathiesen, 1980	1977	6% (age 18-20), 0% (age 21-25), 4% (age 26-30), 26% (age 31-35), 19% (age 36-40), 44% (age 41-45), 37% (age 46-50), 40% (age 51-55), 81% (age 56-60), 71% (age 61-65); no differences by sex	225	volunteer blood donors [Copenhagen, Region Hovedstaden]
Faeroe Islands	Skinhøj, 1980	1975-1977	0% (age 0-9), 0% (age 10-17), 33% (age 18-29), 50% (age 30-39), 50% (age 40-46), 89% (age 47+); no differences by sex	399	random sample of patients and their family members and randomly sampled children [Thorshavn (Tórshavn), Streymoy and Klaksvik, Borðoy]
Finland	von Hertzen, 2006	1997	10.4% (age 25-54)	775	population-based sample [North Karelia, Eastern Finland Province]
Finland	Pohjanpelto, 1984	1970; 1982-1983	1970: 24% (age 20-24); 1982-1983: 0.3% (age 20-24)	100; 643	1970: population-based sample [Tornio]; 1982-1983: patients without apparenty liver symptoms and military conscripts [nationwide]
France	Denis, 2003	1994-2002	28.5% (age 20-29), 47.4% (age 30-39), 64.8% (age 40-49), 82.1% (age 50-59), >90% (age 60+), 97.0% (age 80+)	15329	hospital patients (including some with hepatitis) [Limoges, Limousin Region]
France	Nalpas, 2000	1994-1996	>60% (age <35), >90% (age 45-50)	303	rural adults [Aisne, Picardie Region; Aube and Marne, Champagne-Ardenne Region]
France	Domart, 1999	--	29.8% (age <30), 50.3% (age 30-39), 77.3% (age 40-59); no differences by sex	1516	healthy unvaccinated hospital workers [Paris, Île-de-France Region]

France	Joussemet, 1999	1997	11.5% (age 18-26)	1052	male army recruits [nationwide]
France	Lucht, 1996	--	10% (age 21-25), 30% (age 26-30), 60% (age 31-35), 60% (age 36-40), 70% (age 41-45), 100% (age 46-50), 90% (age 51-55), 100% (age 56-60)	76	healthy urban hospital workers [Saint-Étienne, Rhône-Alpes Region]
France	Cadilhac, 1996	1993	14.3% (age <30), 37.0% (age 30-39), 61.1% (age 40+)	70	healthy workers in low-risk occupations (not sewage workers)
France	Djeriri, 1996	1993-1994	28% (age 20-34), 59% (age 35-49), 93% (age 50-64); no differences by sex	440	unvaccinated hospital workers [Clermont-Ferrand, Auvergne Region]
France	Nguyen-Khac, 1996	1994	16% (age 20-29), 49% (age 30-39), 66% (age 40-49), 92% (age 50-59), 100% (age 60-69); no differences by sex	525	hospital workers [Amiens, Picardie Region]
France	Lagarde, 1995	1992-1993	18.6% (age 18-20), 14.1% (age 21-26)	946	male military recruits [nationwide]
France	Joussemet, 1992	1989-1990	21.4% (age 17-19)	215	male military recruits [nationwide]
France	Germanaud, 1992	--	24.8% (age 20-29), 50.9% (age 30-39), 67.4% (age 40+)	405	healthy hospital personnel [Orléans, Centre Region]
France	Dubois, 1992	1991	3% (age 6-10), 5% (age 11-15), 13% (age 16-20), 26% (age 21-25), 39% (age 25-30), 57% (age 31-35), 71% (age 36-40), 77% (age 41-45), 86% (age 46-50), 94% (age 51-55), 95% (age 56-60); no differences by sex	5641	healthy outpatients [West-Central France]
France	Joussemet, 1987	1985	30.5% (18-20)	1000	male military recruits [nationwide]
France	Lemaire, 1980	--	36% (age 0-14), 74% (age 15-17), 85% (age 18-59), 100% (age 60-75)	1157	[Montpéllier, Languedoc-Roussillon Region]
Germany	Hafner, 2008	1999-2003	24% (age <50), 55% (age 50+)	186	unvaccinated patients with minor endocrine disorders [Regensburg, Bavaria]

Germany	Ongey, 2004	1998	36.0% (age 40-49), 75.0% (age 50-59), 86.6% (age 60-69), 90.7% (age 70-79)	4285	national health survey participants [nationwide]
Germany	Nübling, 2002	--	28% (age 19-50)	511	unvaccinated hospital employees [southwestern Germany]
Germany	Thierfelder, 2001	1998	14.1% (age 18-29), 20.5% (age 30-39), 40.8% (age 40-49), 64.1% (age 50-59), 83.0% (age 60-69), 89.2% (age 70-79); males: 44.1%, females: 48.7%; higher rate in females than males	6748	national health survey participants [nationwide]
Germany	Thierfelder, 1999	1998	7.0% (age 18-19), 15.4% (age 20-29), 20.5% (age 30-39), 40.8% (age 40-49), 64.1% (age 50-59), 83.0% (age 60-69), 89.2% (age 70-79)	6748	population-based sample [nationwide]
Germany	Rudi, 1997	--	7.0% (age 16-25), 17.9% (age 26-35), 42.4% (age 36-45), 59.7% (age 46-73); males: 17.2%, females (29.2%); higher rate in females than males	434	hospital workers [southwestern Germany]
Germany	Bölke, 1995	1987-1988	3.9% (age 19-27), 40.3% (age 50-60)	2000	medical and nursing students and practitioners
Germany	Abb, 1994	--	3.5% (age <20), 3.7% (age 21-30), 17.0% (age 31-40), 42.7% (age 41-50), 76.1% (age 51+)	643	hospital employees and volunteer blood donors [Ludwigsburg, Baden-Würtemberg]
Germany	Bienzle, 1993	1991	5% (age 12-20), 5% (age 21-30), 13% (age 31-40), 28% (age 41-50), 50% (age 51-60), 44% (age 60-81)	2030	unvaccinated persons attending travel clinics
Germany	Hofmann, 1992	1990	4.4% (age <30), 35.7% (age 30-40), 71.2% (41+)	247	general population (non-hospital workers) [Freiburg and Reutlingen County, Baden-Würtemberg]

Germany	Koster, 1990	--	medical staff: 3.5% (age <30), 23.5% (age 30-40), 66.1% (age 41+); kitchen staff: 13.2% (age <30), 47.1% (age 30-40), 72.0% (age 41+)	835	routinely-collected blood samples from hospital workers [Baden-Würtemberg]
Germany	Ebell, 1983	--	31.8% (adults)	198	medical staff [Munich, Bavaria]
Germany	Lasius, 1983	--	40.0% (age 0-0.5), 6.5% (age 0.5-1), 1.6% (age 1), 5.6% (age 2-3), 5.3% (age 4-5), 1.9% (age 6-7), 4.2% (age 8-9), 2.0% (age 10-11), 9.5% (age 12-13), 11.1% (age 14-17)	366	German-born children [West Berlin]
Germany	Frösner, 1980	1977	12% (age 18-19), 32% (age 20-29), 62% (age 30-39), 85% (age 40-49), 92% (age 50+)	1966	volunteer blood donors [Bavaria]
Greece	Kyrka, 2009	2006-2007	17.1% (age 2-5), 16.9% (age 6-9), 16.5% (age 10-14)	585	population-based sample of unvaccinated Greek-born children [nationwide]
Greece	Michos, 2008	2002	Roma: 98% (age 5-15); non-Roma: 33% (age 5-15); no differences by sex	216	suburban public schoolchildren [Athens]
Greece	Mazokopakis, 2003 / Mazokopakis, 2000	1998	males: 0.0% (age 20-28.8); females: 17.5% (age 17-23)	463	Navy members serving on a warship [nationwide]
Greece	Lionis, 1997 (Eur J Epid)	1993	2.0% (adolescents); males: 2.0%, females: 2.0%; no differences by sex	304	rural senior and junior high school students [Agios Vassilios Province, Southern Crete]
Greece	Lionis, 1997 (J Viral Hepat)	1993-1995	0.0% (age 1-14), 82.2% (age 15-45), 100% (age 45-64), 100% (age 65+); no differences by sex	421	rural outpatients and randomly selected households [Spili, Mixorrouma, and Dariviana villages in Agios Vassilios Province, Southern Crete]

Greece	Dalekos, 1995	--	refugees: 93.2% (age 0-9), 98.8% (age 10-19), 99.5% (age 20-29), 97.9% (age 30-39), 100% (age 40-49), 85.7% (age 51-81); non-refugees: 1.2% (age 0-9), 1.5% (age 10-19), 39.1% (age 20-29), 70.8% (age 30-39), 84.6% (age 40-49), 90.5% (age 51-80)	1200	apparently healthy Albanian refugees and local volunteer blood donors with no history of liver disease [Epirus, Ioannina Prefecture]
Greece	Kremastinou, 1984	1980-1982	0.0% (age 0-4), 3.6% (age 5-9), 7.2% (age 10-14), 16.3% (age 15-19); no differences by sex	1113	healthy urban child and adolescent outpatients [Athens]
Greece	Papaevangelou, 1980	1978	83.3% (age 19-25)	877	Air Force recruits (mandatory national service) [nationwide]
Greenland	Langer, 1997	1994	0% (age 7-9), 9% (age 10-19), 50% (age 20-29), 57% (age 30-39), 65% (age 40-49), 98% (age 50-59), 100% (age 60-69), 100% (age 70-79)	503	Inuits without signs of acute hepatitis [Sisimiut and Ilulissat, West Greenland]
Iceland	Asbjoernsdottir, 2006	1999-2001	6.7% (age 28-34), 3.7% (age 40-44), 5.6% (age 51-52)	505	randomly selected people [Reykjavik]
Iceland	Briem, 1991	1987	0.0% (age 10-19), 3.8% (age 20-29), 4.1% (age 30-39), 1.7% (age 40-49), 22.1% (age 50-59), 65% (age 60+); no differences by sex	445	outpatients without liver disease [Reykjavik and rural regions]
Iceland	Briem, 1982	1979	1.6% (age 10-19), 6.0% (age 20-29), 8.1 (age 30-39), 19.5% (age 40-49), 44.2% (age 50-59), 66.2% (age 60-86); no differences by sex	623	outpatients without liver disease [Reykjavik and rural regions]
Ireland	Rajam, 1998	1993-1996	46% (age 10-19), 40% (age 20-29), 71% (age 30-39), 77% (age 40-49), 91% (age 50-80)	233	volunteers outpatients [Dublin, Leinster Province]

Ireland	Fry, 1993	1986-1991	(estimated from graph) 28% (age <30), 43% (age 30-39), 60% (age 40-49), 73% (age 50-59), 78% (age 60+); no differences by sex	1084	outpatients attending a travel health clinic prior to international travel [Dublin, Leinster Province]
Israel	Hasin, 2007	1996	65.8% (age 11-15); no differences by sex	240	unvaccinated children from a variety of socioeconomic backgrounds [southern Israel]
Israel	Samuels, 2005	--	62.8% (age 16-20), 58.4% (age 21-30), 68.1% (age 31-40), 72.0% (age 41-50), 81.6% (age 51-60), 86..4% (age 61-70), 97.3% (age 71+); no differences by sex	1017	outpatients from two primary health clinics [Jerusalem]
Israel	Chodick, 2003	--	58.7% (age 18+); no differences by sex	927	healthcare workers [central Israel]
Israel	Livni, 2002	1997-1999	(estimated from graph) 30% (age 21-29), 45% (age 30-39), 65% (age 40-49), 70% (age 50-59), 100% (age 60-70); no differences by sex	499	staff of a pediatric hospital [Petah Tikva, Center District]
Israel	Gillis, 2002	1998-1999	32% (age 22-24), 36% (age 24-26), 44% (age 26-28), 54% (age 28-30), 61% (age 30-32), 67% (age 32 to 34), 72% (age 34-36), 78% (age 36-38), 83% (age 38-40); higher rate in males than females	4806	military members completing compulsory service [nationwide]
Israel	Ashkenazi, 2001	--	50.0% (age 20-29), 53.0% (age 30-39), 61.1% (age 40-49), 41.0% (age 50+); no differences by sex	115	dental workers [Tel Aviv]
Israel	Katz, 2000	1996	41.4% (age 18); no differences by sex	222	military recruits beginning compulsory service [nationwide]

Israel	Almog, 1999	1992-1993	45.2% (age 17-19), 51.7% (age 20-24), 74.0% (age 25-29), 57.6% (age 30-34), 79.5% (age 35-49)	987	immigrants from the former USSR reporting for compulsory military service [nationwide]
Israel	Gdalevich, 1998	1995-1996	38.4% (mean age 18.7)	578	military recruits beginning compulsory service [nationwide]
Israel	Schwartz, 1998	1993-1995	26% (age 21-30), 37% (age 31-40), 68% (age 41-50), 76% (age 51-60), 82% (age 61-70)	389	visitors to a travel clinic prior to an extended international trip [Jerusalem]
Israel	Karetnyi, 1995	1992-1993	36.7% (age 1-9), 51.7% (age 10-19), 86.7% (age 20-29), 90.0% (age 30-39), 83.3% (age 40-49), 86.7% (age 50+); no differences by sex	240	Israeli Jewish controls in a study of health in recent immigrants to Israel from other countries
Israel	Green, 1992	1989	58.4% (age 21-30); males: 59.2%, females: 54.3%; no differences by sex	1153	military members [Israel]
Israel	Kark, 1992-1993	1977; 1984	1977: 69% (age 18-19); 1984: 54% (age 18-19)	751; 383	male military recruits beginning compulsory service [nationwide]
Israel	Green, 1990	1987	45.5% (age 18-19); no differences by sex	457	military recruits beginning compulsory service [nationwide]
Israel	Green, 1989	1987	69.5% (age 25-29), 77.6% (age 30-34), 86.8% (age 35-39), 93.0% (age 40-44)	522	military members [nationwide]
Israel	Fattal, 1987 / Margalith, 1986 / Morag, 1984	1980-1981	3% (age 0.5-1), 2% (age 1), 5% (age 2-4), 7% (age 5-17), 68% (age 18-24), 54% (age 25-34, 91% (age 35-49), 98% (age 50+); higher rate in males than females	777	residents of agricultural communities
Israel	Kark, 1985 / Kark, 1980	1977	64.0% (age 18-19); no differences by sex	1147	military recruits beginning compulsory service [nationwide]

Israel	Elkana, 1982	1980	3.0% (age 1) 4.7% (age 2-3)	185	urban children attending healthy child clinics who had no family history of HAV during their lifetimes [Ramat-Gan, Tel Aviv District]
Italy	Gentile, 2009	1992; 1998; 2004	1992: 2.7% (age 1-5), 7.5% (age 15-20); 1998: 6.2% (age 1-5), 11.3% (age 15-20); 2004: 16.7% (age 1-5), 5.5% (age 15-20)	556	children and young adults [Tuscany Region]
Italy	Beggio, 2007	--	8.7% (mean age 22.3 years)	449	graduate medical students born in Italy [Padova, Treviso, Venezia, and Vicenza in the Veneto Region with some students from south-central Italy]
Italy	Ansaldi, 2008	1996-1997	34.9% (age 0-1), 12.9% (age 2-5), 13.9% (age 6-11), 14.6% (age 12-19), 19.5% (age 20-29), 50.4% (age 30-39), 74.4% (age 40-49), 89.0% (age 50-59), 97.4% (age 60+); no differences by sex	3561	hospital patients without acute infection [nationwide]
Italy	D'Amelio, 2005	2003	5.3% (age 18-26)	323	air force recruits [nationwide]
Italy	De Silvestri, 2002	1999	17.5% (age 17-37)	121	healthy mothers of newborns [Pavia, Lombardy Region]
Italy	Calabri, 1999	1998	6.2% (age 18)	430	unvaccinated male military recruits [Florence area, Tuscany Region]
Italy	Matricardi, 2000 / Stroffolini, 1998 / Matricardi, 1997	1990-1991	26.7% (age 17-24)	1659	male military cadets [Caserta, Campania Region]

Italy	Patti, 1999	1998	9% (age <21), 16.4% (age 21-30), 45.9% (age 31-40), 71.7% (age 41-50), 89.5% (age 51-60), 95% (age 61-70), 96.5% (age 71-80), 94.5% (age 81+)	4916	apparently healthy urban residents [Rome area, Lazio Region]
Italy	Trevisan, 1999	--	25.9% (age <41), 62.2% (age 41+); higher rate in males than females	1051	biomedical scientists working at university laboratories [Padua, Veneto Region]
Italy	Moschen, 1997	1994	0.7% (age 10-19), 6.0% (age 20-29); higher rate in females than males	620	apparently healthy outpatients [Pordenone area, Friuli-Venezia Giulia Region]
Italy	Luzza, 1997	1995	16.7% (age 1-10), 30.0% (age 11-20), 77.4% (age 21-30), 96.5% (age 31-40), 96.1% (age 41-50), 95.1% (age 51-60), 98.9% (age 61-70), 97.8% (age 71-80), 100% (age 81-87); males: 27%, 29%, 80%, 100%, 92%, 96%, 100%, 94%, 100%; females: 0%, 31%, 77%, 94%, 98%, 94%, 98%, 100%, 100%; no differences by sex	466	rural outpatients [Cirò, Calabria Region]
Italy	Russo, 1997	--	13.0% (age 0-2), 0.0% (age 3-5), 0.0% (age 6-10), 3.2% (age 11-13), 3.5% (age 14-18), 21.2% (age 19-24), 41.6% (age 25-29), 56.2% (age 30-39), 75.0% (age 40-49), 85.5% (age 50-59), 84.1% (age 60-64), 95.1% (age 65-69), 100% (age 70+); males: 16.7%, 0.0%, 0.0%, 6.7%, 0.0%, 21.7%, 37.5%, 51.3%, 78.9%, 80.9%, 80.0%, 88.9%, 100.0%; females: 10.0%, 0.0%, 0.0%, 0.0%, 6.9%, 19.5%, 44.7%, 61.1%, 71.4%, 89.9%, 87.9%, 100%, 100%; higher rate in males than females	1000	outpatients without liver or acute gastrointestinal disease [Piedmont Region]

Italy	Ripabelli, 1997	1994	3.3% (age 12-15); males: 2.9%, females: 3.6%; no differences by sex	368	rural adolescents recruited from a thalassemia screening program [Campobasso area, Molise Region]
Italy	Castelli, 1996	1994	18.0% (age 20-29), 58.0% (age 30-39), 75.8 (age 40-48), 89.5% (age 50-59); males: 17.0%, 63.1%, 78.5%, 86.4%; females: 18.9%, 51.8%, 72.9%, 93.0%; no differences by sex	744	attendees of a travel clinic prior to international travel [Bergamo, Brescia, Cremona, Mantova, Varese, Ponte San Pietro, Salò, Gardone Val Trompia, Iseo, and Saronno, all in the Lombardy Region]
Italy	Romano, 1996	1995	5.3% (age <21), 14.9% (age 21-25), 28.2% (age 26-30), 57.4% (age 31-35), 85.7% (age 36-40), 89.2% (age 41-45), 99.1% (age 46+); no differences by sex	464	healthy food handlers [Pescara area, Abruzzo Region]
Italy	Catania, 1996	--	33.3% (age 0-0.25), 5.4% (age 0.25-2), 10.8% (age 2-6), 16.4% (age 6-12); higher rates in males than females	278	apparently healthy child outpatients [Rome, Lazio Region]
Italy	Zanetti, 1994	1958; 1977; 1992	1958: 35.7% (age 1-5), 78.6% (age 6-15), 93.3% (age 16-30), 97.0% (age 31-40), 96.5% (age 41-50), 96.0% (age 51+); 1977: 3.6% (age 1-5), 26.9% (age 6-15), 79.0% (age 16-30), 87.0% (age 31-40), 93.0% (age 41-50), 95.5% (age 51+); 1992: 2.2% (age 1-5), 3.3% (age 6-15), 8.1% (age 16-30), 44.7% (age 31-40), 70.5% (age 41-50), 93.7% (age 51+); no differences by sex	236; 436; 1109	healthy individuals in 1992 compared to previous studies [Milan, Lombardy Region]

Italy	Stroffolini, 1993	1989-1990	29.4% (age 18-24)	1000	male air force recruits beginning compulsory service [nationwide]
Italy	Nuti, 1993	--	49.2% (age 18-54)	325	adults working in river-related jobs along the Tiber river [Rome, Lazio Region]
Italy	Chiaramonte, 1991	1979; 1989	1979: 7.8% (age 6-7), 16.8% (age 10-11), 30.5% (age 13-15), 70.7% (age 17-18); 1989: 1.0% (age 6-7), 0.5% (age 10-11), 0.0% (age 13-15), 5.2% (age 17-18); no differences by sex	462; 850	healthy schoolchildren [Padua area, Padua Region]
Italy	Stroffolini, 1991 (Infection)	1987-1989	2.3% (age 3-5), 3.9% (age 6-7), 10.0% (age 11-12), 9.7% (age 14-16), 16.3% (age 17-19); no differences by sex	5507	healthy schoolchildren [Sardinia; Padua, Veneto Region; Udine, Friuli-Venezia Giulia Region; Bari, Apulia (Puglia) Region; Palermo, Sicily Region]
Italy	Stroffolini, 1991 (Microbiologica)	1989	12.3% (age 14-16), 27.4% (age 17-19); no difference by sex	1350	healthy high-school children [Sardinia]
Italy	Stroffolini, 1990	1988	6.3% (age 6-10), 14.7% (age 11-13)	490	schoolchildren [Palermo, Sicily Region]
Italy	Stroffolini, 1989	1987	0.0% (age 3), 1.5% (age 6), 7.2% (age 11)	1662	schoolchildren [Sardinia]
Italy	D'Argenio, 1989	1980; 1988	1980: 17.2% (age 7), 18.9% (age 8), 20.5% (age 9), 20.5% (age 10), 23.0% (age 11-12); 1988: 5.2% (age 7), 7.4% (age 8), 10.1% (age 9), 9.1% (age 10), 28.2% (age 11-12)	396; 484	apparently healthy schoolchildren [Naples, Campania Region]
Italy	Masia, 1989	1987-1988	44.0% (age 14-19), 74% (age 20-24), 82.7% (age 25-29), 96% (age 30-34), 96% (age 39-39)	299	healthy workers attending an outpatient clinic [Cagliari, Sardinia]

Italy	Contu, 1989	1988	16.5% (age 13-16), 24.8% (age 17-20); males: 10.3%, 22.9%; females: 21.8%, 26.8%; higher rate in females than males	794	school children [South Sardinia]
Italy	Franco, 1988	1987	1.7% (age 1-5), 5.0% (age 6-10), 3.1% (age 11-15)	391	outpatients without hepatitis [Rome, Lazio Region]
Italy	Patti, 1987	--	2.2% (age 1-5), 14.5% (age 6-10), 22.0% (age 11-15), 45.2% (age 16-20), 64.6% (age 21-25), 76.6% (age 25-30), 81.8% (age 31-40), 70.5% (age 41-50), 77.2% (age 51-60), 78.5% (age 61+)	531	apparently healthy subjects [Rome, Lazio Region]
Italy	Leonardi, 1985	--	32% (age 0-15), 65% (age 16-30), 90% (age 31-45), 100% (age 46-60), 100% (age 61+); males: 14%, 80%, 100%, 100%, 100%; females: 0%, 63%, 100%, 100%, 100%	86	[Ginostra on Stromboli Island and Alicudi Island, all part of the Aeolian Islands]
Italy	Pasquini, 1984	1981	62% (age 18-19), 67% (age 20-21), 62% (age 22-23), 63% (age 24-26)	5005	naval recruits reporting for compulsory service [nationwide]
Italy	Utili, 1983	1979-1980	73% (age 10-14), 98% (age 45-65)	857	asymptomatic outpatients [Naples, Campania Region]
Italy	Chiaramonte, 1983	1979-1980	70.0% (age 1), 25.0% (age 2), 2.5% (age 3), 5.2% (age 4), 5.8% (age 5), 8.9% (age 6), 6.3% (age 7), 11.7% (age 8), 18.4% (age 9), 19.2% (age 10), 14.5% (age 11), 19.3% (age 12), 20.8% (age 13), 29.7% (age 14), 35.0% (age 15); no differences by sex	658	outpatients without overt liver disease [Padova area, Veneto Region]
Italy	Pasquini, 1982 (Int J Epidemiol)	1979-1980	68.2% (age 0-0.5), 12.7% (age 0.5-1), 9.9% (age 1-4), 7.1% (age 5-9), 38.5% (age 10-12); no differences by sex	493	inpatients without hepatitis or blood diseases [Rome, Lazio Region]

Italy	Meloni, 1982	1978-1980	27.4% (age 1-10), 41.8% (age 11-20), 61.8% (age 21-40), 92.8% (age 41-60), 92.7% (age 61+); males: 20.6%, 47.0%, 66.7%, 97.9%, 97.6%; females: 33.3%, 39.4%, 59.1%, 90.1%, 88.6%	1747	apparently healthy rural and urban residents [Pavia, Stradella, and Casreggio, all in the Lombardy Region]
Italy	Pasquini, 1982 (Ann Sclavo)	1980	78.2% (age <25), 86.2% (age 25-34), 95.0% (age 35-44), 97.2% (age 45+); no differences by sex	1212	hospital personnel [Lazio Region]
Italy	Tarsitani, 1981	--	0% (age 6-7), 7.3% (age 8-10), 10.8% (age 11-12)	230	elementary school children from diverse socioeconomic groups [Rome, Lazio Region]
Italy	Romano, 1981	--	68.2% (age 6-9), 71.6% (age 10-19), 89.3% (age 20-29), 95.0% (age 30-39), 92.6% (age 40-49), 82.2% (age 50-78)	670	apparently healthy people [Sassari, Sardinia Region]
Italy	Biglino, 1980	--	57.2% (adults)	187	heavy industry workers [North Italy]
Italy	Vendramini, 1980	1979	4.1% (age 0-5), 11.0% (age 6-10), 33.3% (age 11-15), 61.7% (age 16-20), 67.3% (age 21-25), 68.3% (age 26-30), 75.0% (age 31-35), 91.2% (age 36-40), 96.0% (age 41-45), 95.4% (age 46-50), 90.9% (age 51-55), 93.7% (age 56-60), 97.2% (age 61-65), 100% (age 66-70), 93.4% (age 71-75), 97.8% (age 76-80), 98.3% (age 81+); males: 3.9%, 11.2%, 32.5%, 70.7%, 66.1%, 67.5%, 86.2%, 88.2%, 97.3%, 100%, 93.6%, 96.5%, 100%, 100%, 93.9%, 100%, 96.1%; females: 4.4%, 10.9%, 34.2%, 48.1%, 67.9%, 68.9%, 68.0%, 94.2%, 94.2%, 86.8%,	1812	outpatients [Padova, Veneto Region]

			86.6%, 89.4%, 90.9%, 100%, 92.8%, 96.0%, 100%; no differences by sex		
Italy	Merletti, 1980	--	0% (age 0.5-5), 16.6% (age 6-10), 41.7% (age 11-20), 85.0% (age 21-30), 94.4% (age 31-40), 94.7% (age 41-50), 100 (age 51-60), 100% (age 61-70), 100% (age 71+)	148	healthy subjects [Umbria Region]
Italy	Federico, 1980	--	68.9% (age 0-0.5), 6.2% (age 0.5-5), 27.6% (age 6-11), 45.4% (age 12-17), 76.8% (age 18-25), 82.2% (age 26-45), 90.2% (age 46-65); no differences by sex	383	patients with no history of hepatitis [Rome, Lazio Region]
Luxembourg	Mossong, 2006	2000-2001	(estimated from graph) 3% (age 5-11), 10% (age 12-19), 20% (age 20-29), 30% (age 30-39), 30% (age 40-49), 40% (age 50-59), 80% (age 60+); no differences by sex	2679	schoolchildren and volunteer blood donors [nationwide]
Malta	Borg, 1999	--	26.9% (adults)	119	hospital workers
Netherlands	Veldhuijzen, 2009	2004	Dutch-born: 0% (age 18-29), 30% (age 30-44), 54% (age 45-64); total: 39% (age 18-29), 70% (age 30-44), 85% (age 45-64); no differences by sex	1787	population-based study in a multi-ethnic neighborhood [Rotterdam, Zuid-Holland Province]
Netherlands	Baaten, 2007	2004	51.8% (age 18-34), 48.7% (age 35-44), 57.5% (age 45-54), 73.1% (age 55-64), 72.3% (age 65+); no differences by sex	1355	population-based sample [Amsterdam, Noord-Holland Province]
Netherlands	Richardus, 2004	2001	Dutch ethnicity: 0.8% (age 5-7), 3.1% (age 14-16); Turkish / Moroccan ethnicity: 6.2% (age 5-7), 17.7% (age 8-10), 24.7% (age 11-13), 39.6% (age 14-16)	248; 648	randomly-sampled school children [Rotterdam, Zuid-Holland Province]

Netherlands	Termorshuizen, 2000	1995-1996	13.5% (age 0), 1.7% (age 1-14), 20.2% (age 15-49), 77.3% (age 50-79); no difference by sex	6569	population-based sample of residents of Dutch origin [nationwide]
Norway	Andenaes, 2000	1995-1996	3.9% (age 20-51)	611	airline workers underoing routine health exams [Oslo]
Norway	Siebke, 1989	1985-1986	5% (age 19-40), 33% (age 41-64)	373	merchant seamen [Oslo]
Norway	Siebke, 1982	1978-1979	14% (age 34-38), 45% (age 39-43), 43% (age 44-48), 52% (age 49-53), 54% (age 54-58), 67% (age 59+); no differences by sex	625	healthy blood donors and blood samples for routine testing from people without liver disease [Drammen, Buskerud County; Oslo]
Norway	Hurlen, 1980	1979	2.9% (age 20-29), 3.5% (age 30-39), 4.3% (age 40-49), 3.4% (age 50-59), 15.8% (age 60+)	1188	dentists and controls [nationwide]
Portugal	Antunes, 2004	1999-2003	1.6% (age 5), 3.9% (age 8), 32.5% (age 14); no differences by sex	536	healthy children [Braga, Braga District]
Portugal	Cunha, 2001	1996	7.0% (age 1-4), 15.8% (age 5-9), 26.9% (age 10-14), 51.2% (age 15-19), 85.5% (age 20-29), 72.5% (age 30-39), 87.8% (age 40-49), 88.7% (age 50+)	381	outpatients without actue hepatitis [Norte Region]
Portugal	Barros, 1999	--	20.9% (age 6-7), 22.6% (age 8-9), 25.4% (age 10-11), 36.1% (age 12-13), 34.1% (age 14-15), 30.8% (age 16-17), 37.8% (age 18-19); no differences by sex	667	randomly-sampled school children [Porto, Porto District]
Portugal	Macedo, 1998	1993	95% (age 18-25), 99% (age 26-45), 99% (age 46+)	300	healthy volunteer blood donors [Porto, Porto Disrict]
Portugal	Marinho, 1997	1990-1992	29% (age 18-19), 55.7% (age 20-29), 69% (age 30-39), 81% (age 40-49), 77% (age 50-67)	526	medical students and healthcare workers [Lisbon, Lisbon District]

Portugal	Lecour, 1984	--	23.6% (age 1-4), 61.3% (age 5-9), 76.4% (age 10-14), 93.4% (age 15-19), 96.5% (age 20-29), 99.2% (age 30-39), 99.0% (age 40-49), 99.1% (age 50-84)	1770	population-based sample of apparently healthy people [nationwide]
San Marino	Matricardi, 1999	1990-1991	9.0% (age 20+)	1509	population-based sample [nationwide]
San Marino	Pretolani, 1997 / Stroffolini, 1997	1990-1991	28.6% (age 20-30), 65.0% (age 31-40), 92.9% (age 41-50), 98.9% (age 51-60), 97.0% (age 61-85); no differences by sex	1528	population-based sample [nationwide]
Spain	Domínguez, 2007	2002	15.4% (age 15-24), 34.9% (age 25-34), 75.1% (age 35-44), 93.8% (age 45-54), 97.3% (age 55-64), 98.2% (age 65+); no differences by sex	1292	population-based sample [Catalonia]
Spain	Cilla, 2007	2004	2.8% (age 1-9), 6.7% (age 10-19), 35.6% (age 20-29), 43.5% (age 30-39), 70.9% (age 40-44)	1356	outpatients with minor illnesses and pregnant women, all without acute liver disease [Gipuzkoa Province, Basque Country]
Spain	Gonzalez-Quintela, 2005	--	39.4% (age 18-29), 82.0% (age 30-39), 93.2% (age 40-49), 97.4% (age 50-59), 100% (age 60-69), 97.1% (age 70-79), 97.9% (age 80-92)	465	population-based sample [A-Estrada, Pontevedra Province, Galicia]
Spain	Junquera, 2004	2002	5.5% (age 1-19), 23.5% (age 20-29), 28.1% (age 30-36), 64.2% (age 37-44), 93.2% (age 45-65)	557	patients without a history of hepatitis or liver disease [Madrid]
Spain	Domínguez, 2004	2001	4.2% (age 5-9), 3.4% (age 10-12), 11.6% (age 13-15); males: 4.5%, 3.2%, 13.4%; females: 3.8%, 3.6%, 10.1%	1324	population-based sample of unvaccinated school children [Catalonia]

Spain	Soriano, 2004	1995-1996	9.1% (age 16-19), 35.3% (age 20-29), 77.8% (age 30-39), 97.3% (age 40-49), 98.6% (age 50-59), 97.5% (age 60-69), 99.3% (age 70-79), 100% (age 80+); males: 78.8%, females: 79.7%; no differences by sex	1426	population-based sample [Navarra]
Spain	González-Praetorius, 2001	--	1.7% (age 0-14), 5.0% (age 15-29), 81.6% (age 30-44), 98.3% (age 45-59), 100% (age 60-74); no differences by sex	284	patients without acute hepatitis [Guadalajara Province, Castile-La Mancha]
Spain	de Juanes, 2001	1999-2000	4.1% (age 20-25), 21.8% (age 26-30), 29.9% (age 31-35), 84.3% (age 36-45), 92.2% (age 46-55)	423	healthy unvaccinated hospital personnel [Madrid]
Spain	Santana, 2000	1995-1996	2.3% (age 0.67-4), 3.2% (age 5-9), 8.1% (age 10-14), 10.6% (age 15-19), 16.2% (age 20-24), 38.9% (age 25-29), 83.6% (age 30-39), 98.9% (age 40-63); higher rate in males htan females	547	healthy children, students, hospital workers, and volunteer blood donors [Gran Canaria, Canary Islands]
Spain	Dal-Ré, 2000	1992-1993	11.5% (age 5-12), 25.4% (age 13-19), 54.2% (age 20-29), 90.3% (age 30-39), 95.5% (age 40-49), 88.1% (age 50-59); no differences by sex	2774	population-based sample [nationwide]
Spain	Gil Miguel, 1999	1998	1998: 6.2% (age 6-7)	160	urban school children [Madrid]
Spain	de Juanes, 1999	1996	13.5% (age 18-24), 28.6% (age 25-31), 74.5% (age 32-45)	182	healthy hospital workers and outpatients [Madrid]
Spain	Bruguera, 1999	1995-1996	3.4% (age 5-9), 3.5% (age 10-14), 31.4% (age 15-24), 56.9% (age 25-34), 86.9% (age 35-44), 95.5% (age 45-54), 99.1% (age 55-64), 98.8% (age 65+)	2142	population-based sample [Catalonia]
Spain	Gil, 1998	1993	5.1% (age 14-17)	1173	school children [Madrid]

Spain	García de Pesquera, 1998	1981; 1998	1981: 22.4% (age 1-6), 31.0% (age 7-12), 52.2% (age 13-18), 77.1% (age 19-24), 87.2% (age 25+); 1998: 2.8% (age 1-6), 5.4% (age 7-12), 11.2% (age 13-18), 32.2% (age 19-24), 74.5% (age 25+)	797; 1562	hospital patients without hepatitis or digestive diseases [Seville, Seville Province, Andalusia]
Spain	Suárez, 1997 / Suárez, 1996	1995	0.0% (age 6-10), 4.4% (age 11-17), 13.7% (age 18-25), 17.9% (age 26-30), 54.7% (age 31-35), 73.6% (age 36-40), 90.0% (age 41-45), 93.6% (age 46-50), 92.3% (age 51-55), 100% (age 56-65)	453	population-based sample [Gijón, Asturias Province]
Spain	Benito Ruesca, 1997	1994-1996	11.1% (age 23-25), 34.6% (age 26-30), 46.7% (age 31-35), 80.0% (age 36-40)	163	medical residents [Zaragoza, Aragon]
Spain	García-Fulgueiras, 1997	1992-1993	42.3% (age 18-29), 91.4% (age 30-49), 98.8% (age 50-65); males: 74.3%, females: 78.6%; no differences by sex	2203	population-based random sample [Murcia Region]
Spain	Gil, 1997	--	7.7% (age 14-17)	298	healthy school children [Madrid]
Spain	Garcia Erce, 1996	1996	14.6% (age 18-20), 54.1% (age 21-40), 100% (age 41+)	200	volunteer blood donors [Aragon]
Spain	Gil Miguel, 1996	1995	1995: 7.3% (age 14), 8.1% (age 15), 9.2% (age 160), 4.7% (age 17)	307	urban school children [Madrid]
Spain	Bayas, 1996	1992-1994	13.9% (young adults); no differences by sex	669	university students studying health sciences [Catalonia]
Spain	Montes Martínez, 1996	1993-1994	0.8% (age 4-5), 32.8% (age 9-10), 38.2% (age 13-15); no differences by sex	411	population-based sample [Plasencia, Cáceres Province, Extremadura]
Spain	Menéndez, 1996	1994-1995	20.0% (age 17-25), 44.4% (age 26-35), 88.9% (age 36-47)	109	pregnant women [Gijón, Asturias Province]
Spain	Buti, 1996	--	18.5% (age 17-23); no differences by sex	129	unvaccinated medical and nursing students [Barcelona]

Spain	Amela, 1995	1988	2.3% (age 2), 7.4% (age 3), 8.3% (age 7), 10.3% (age 8), 16.0% (age 9), 13.3% (age 10), 18.5% (age 11), 52.2% (age 20-24), 75.8% (age 25-29), 92.2% (age 30-34), 95.8% (age 35-39), 99.1% (age 55-59), 100% (age 60-64), 100% (age 65-69)	1632	healthy outpatients [Madrid]
Spain	Rodriguez-Iglesias, 1995	--	4.1% (age 1-2), 11.5% (age 3-10), 24.3% (age 10-14)	399	healthy children [Cádiz, Cádiz Province, Andalusia]
Spain	Cilla, 1995	1991-1993	Roma: 50.0% (age 2-5), 97.0% (age 6-10), 86.4% (age 11-16); non-Roma: 0.0% (age 2-5), 7.3% (age 6-10), 20.0% (age 11-16)	438	Roma (gypsy) and non-Roma school children [San Sebastian, Gipuzkoa Province, Basque Country]
Spain	Bolumar, 1995	1988-1989	13.5% (age 0.5-4), 24.8% (age 5-9), 27.0% (age 10-14), 47.4% (age 15-19), 45.1% (age 20-24), 80.4% (age 25-29), 91.7% (age 30-39), 92.9% (age 40-49), 91.6% (age 50-60); females higher than males (ages 5-24 only)	1223	population-based sample [Burjassot, Valencia Province]
Spain	González, 1994	1992	39.4% (age 20-25), 49.8% (age 26-30), 60.7% (age 31-35), 59.7% (age 36-40)	1204	pregnant women [nationwide]
Spain	Lasheras Lozano, 1994	1990-1991	5.1% (age 6), 1.2% (age 7), 1.2% (age 8), 1.2% (age 9), 2.5% (age 10), 9.3% (age 11), 3.8% (age 12), 9.8% (age 13), 8.3% (age 14), 11.4% (age 15), 4.3% (age 16), 30.7% (age 17); no differences by sex	729	healthy public school children [Madrid]
Spain	Perez-Trallero, 1994	1986-1987; 1992	1986-1987: 7.7% (age 1-9), 37.9% (age 10-19), 80.6% (age 20-29), 98.1% (age 30-39); 1992: 2.4% (age 1-9), 21.0% (age 10-19), 57.6% (age 20-29), 87.5% (age 30-39)	1003; 1211	outpatients with minor diseases and pregnant women, all without acute liver disease [Guipuzcoa Province, Basque Country]

Spain	Morales, 1992	1990	Roma (gypsy): 38% (age 1-2), 42% (age 3-6), 77% (age 7-10), 92% (age 11-14); white: 8% (age 1-2), 14% (age 3-6), 29% (age 7-10), 38% (age 11-14); Orphans: 36% (age 1-2), 36% (age 3-6), 62% (age 7-10), 54% (age 11-14)	156	outpatients [Madrid]
Spain	Salleras, 1992	1985-1986; 1989	4.4% (age 6-7), 14.1% (age 10-11), 18.2% (age 13-14), 43.1% (age 15-24), 82.1% (age 25-34), 93.8% (age 35-44), 95.4% (age 45-54), 91.0% (age 55-64), 96.1% (age 65+); no differences by sex	1822	population-based sample [Catalonia]; children surveyed in 1985-1986 and adults in 1989
Spain	Jiménez Rodríguez-Vila, 1992	1988	19.5% (age 0-9), >90% (age 31+)	726	population-based sample of healthy urban residents [Valladolid, Valladolid Province, Castile and Leon]
Spain	Dal-Ré, 1991	1989	9% (age 0-9), 12% (age 10-19), 55% (age 20-29), 85% (age 30-39), 98% (age 40-49), 92% (age 50-59), 100% (age 60+)	439	unvaccinated pharmaceutical company employees [Zaragoza and Madrid]
Spain	Gil, 1991	1990	0% (age 6), 6.1% (age 7), 3.6% (age 8), 7.9% (age 9), 1.1% (age 10), 4.4% (age 11), 8.5% (age 12), 8.8% (age 13), 6.3% (age 14), 9.0% (age 15), 9.1% (age 16), 7.6% (age 17), 15.7% (age 18); no differences by sex	707	school children [Madrid]
Spain	Ruiz Moreno, 1988	--	1.5% (age 2-4), 10.4% (age 5-7), 18.8% (age 8-10), 32.8% (age 11-13); no differences by sex	286	children attending outpatient clinics, day care centers, and schools [Madrid]
Spain	Perez Trallero, 1988	1986-1987	2.2% (age 1-4), 12.1% (age 5-9), 24.2% (age 10-14), 49.2% (age 15-19), 72.0% (age 20-24), 87.3% (age 25-29), 98.0% (age 30-34), 98.2% (age 35-39)	1003	rural and urban outpatients without liver disease [Guípuzcoa, Basque Country]

Spain	Carreño García, 1983	--	25.0% (age 0.5-10), 69.5% (age 11-20), 94.0% (age 21-30), 93.8% (age 31-40), 91.4% (age 41-50), 97.4% (age 51-79)	340	workers [Madrid]
Spain	Grau, 1982	--	9.9% (age 5-10), 61.5% (age 11-20), 80.7% (age 21-30), 91.6% (age 31-40), 80.0% (age 41-50), 93.0% (age 51-60), 100% (age 61-67)	118	patients without acute hepatitis [Tortosa, Tarragona]
Sweden	Böttiger, 1998 / Böttiger, 1997	1990-1991	1.8% (age 18-20), 2.3% (age 21-30), 2.2% (age 31-40), 6.0% (age 41-50), 16.6% (age 51-60), 25.3% (age 61-70), 45.4% (age 71-80), 69.0% (age 81-90)	3249	population-based sample [nationwide]
Sweden	Weiland, 1980	1968	4% (age 15-19), 16% (age 20-29), 21% (age 30-39), 35% (age 40-49), 58% (age 50-59), 87% (age 60-69)	489	population-based sample [nationwide]
Switzerland	Studer, 1993	1990	5.9% (age 16-19), 5.9% (age 20-29), 11.8% (age 30-39), 21.4% (age 40-49), 49.1% (age 50-59), 50.9% (age 60-69), 81.8% (age 70-83); no differences by sex	1091	healthy outpatients vising a travel clinic prior to international travel [Zürich]
Switzerland	Holdener, 1982	1979-1980	8.2% (age 20-29), 23.3% (age 30-39), 52.7% (age 40-49), 45.2% (age 50+); no differences by sex	1384	airline personnel undergoing compulsory medical exams and blood donors
Switzerland	Stadelmann, 1980	1978-1979	14.8% (age 11-20), 23.9% (age 21-30), 45.7% (age 31-40), 72.2% (age 41-50), 61.2% (age 51-60), 81.5% (age 61-70), 89.3% (age 71-90)	763	patients without acute liver infection [Basel, Basel-Stadt Canton]
United Kingdom	Dalton, 2008	2005-2006	45.0% (adults)	487	volunteer blood donors [South West England]
United Kingdom	Jarvis, 2004	--	5.1% (age 20-24), 11.9% (age 25-34), 18.9% (age 35-44); no differences by sex	772	population-based sample [Cambridge, Ipswich, and Norwich, all in East England]

United Kingdom	Morris-Cunnington, 2004 (Commun Dis Public Health)	--	18.8% (age 7-12); no differences by sex	257	multi-ethnic urban children [North West England]
United Kingdom	Morris-Cunnington, 2004 (Am J Epidemiol)	2001-2002	4.0% (age 1-4), 10.6% (age 5-14), 14.1% (age 15-19), 23.8% (age 20-24), 26.2% (age 25-44); males: 4.5%, 10.2%, 15.6%, 17.6%, 22.3%; females: 3.6%, 11.1%, 13.1%, 28.0%, 29.2%	5391	population-based sample [England and Wales]
United Kingdom	Ross, 2002	2000	17% (age 16-20), 6% (age 21-25), 26% (age 26-30), 32% (age 31-35), 49% (age 36+)	136	male outpatients [Birmingham, West Midlands]
United Kingdom	Morris, 2002	1996	8.6% (age 0-9), 11.0% (age 10-19), 16.9% (age 20-29), 32.9% (age 30-39), 37.3% (age 40-49), 58.1% (age 50-59), 73.5% (age 60-99)	4188	sera from routine blood tests [England and Wales]
United Kingdom	Bernal, 1996	1988-1989	(estimated from graph) 8% (age 14-23), 29% (age 24-33), 39% (age 34-43), 67% (age 44-53), 78% (age 54-63), 79% (age 64+); no differences by sex	710	sera from routine blood tests from UK-born urban outpatients [Camberwell, London]
United Kingdom	Zuckerman, 1994	1991-1993	31% (age 20-29), 45% (age 40-49), 70% (age 60+)	525	outpatients of travel clinics [London]
United Kingdom	Nandwani, 1994	1993	31.8% (adults)	255	male urban outpatients without HIV [London]
United Kingdom	Gay, 1994	1986-1987	6.5% (age 1-4), 10.5% (age 5-9), 13.9% (age 10-14), 19-6% (age 15-19), 29.3% (age 20-24), 36.5% (age 25-29), 42.5% (age 30-34), 42.5% (age 35-39), 55.3% (age 40-44), 73.9% (age 45-49), 81.0% (age 50-54), 75.8% (age 55-59), 89.5% (age 60-99); no differences by sex	7196	routine blood tests [Ashford, Kent County, South East England; Manchester and Preston, North West England; Leeds, Yorkshire and the Humber, England]

United Kingdom	Cumberland, 1994	1989-1992	8.0% (age 17-35); males: 12.2%, females: 6.5%; higher rate in males than females	2790	Army and Air Force recruits [nationwide]
United Kingdom	Masterton, 1991	1987-1988	14.0% (age <36), 21.9% (age 36-45), 41.8% (age 46+)	1111	international travelers including both military personnel and civilians [England]
United Kingdom	Scott, 1989	--	57% (age 18-29), 66% (age 30-39), 68% (age 40-49), 73% (age 50-59), 75% (age 60-65); no differences by sex	1786	volunteer blood donors [northeast Thames]

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ANDEAN LATIN AMERICA
(Bolivia, Ecuador, Peru)

REGIONAL SUMMARY

Studies conducted in the same rural area of Bolivia in 1987 and ten years later in 1997 showed a significant decrease in the seroprevalence rates in children, which decreased from 86.9% to 28.4% in children under 5 years old although rates in older children and adults remained very high in both study years [Bartoloni, 1989; Bartoloni, 1999]. The infection rate in a recent study was equally high, with about 50% of 5-year-olds showing evidence of past exposure to HAV [Gandolfo, 2003]. Studies in Peru showed a very high seroprevalence rate, with nearly all adults in both rural and urban areas immune to HAV in studies from the late 1970s through the late 1990s [Vildósola, 2000; Cabezas, 1994; Méndez, 1989; Kilpatrick, 1986; Nath, 1980]. A study conducted in 1977 found a seroprevalence of 99.4% in Ecuador and is the only HAV seroprevalence study from that country [Nath, 1980]. Although too few studies have been conducted in this region in the past decade to be certain about trends, the included studies suggest a high incidence rate that may be decreasing and causing an increase in the age at infection from very early childhood to middle childhood. Since most children become infected in early childhood, very few adults are at risk of infection.

SUMMARY AGE-PREVALENCE ESTIMATES

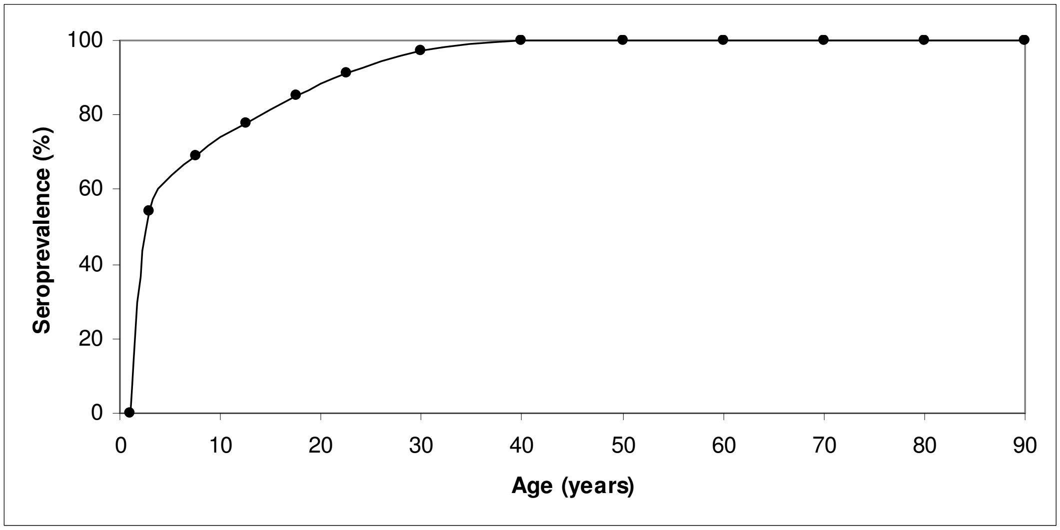
Table 27. Summary Prevalence Estimates by Age in Andean Latin America.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	54	69	78	85	91
% at risk	--	--	46	31	22	15	9

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	97	100	100	100	100	100	100
% at risk	3	0	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 60. Plot of Estimated Seroprevalence by Age in Andean Latin America.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 61. Plots of Age-Seroprevalence Data from Studies from Andean Latin America.

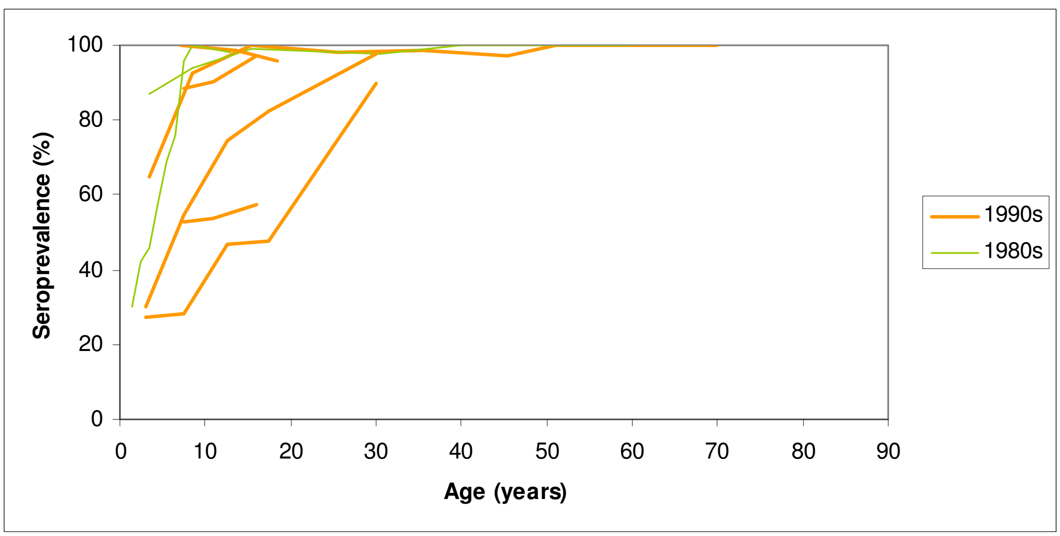


TABLE OF INCLUDED PREVALENCE STUDIES

Table 28. Information about Included Studies from Andean Latin America.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Bolivia	Gandolfo, 2003	--	high-income area: 52.6% (age 6-8), 53.6% (age 9-12), 57.5% (age 13-18); low-income area: 88.5% (age 6-8), 90.3% (age 9-12), 97.2% (age 13-18); males: 86.0%, females: 72.7%	952	schoolchildren [Santa Cruz de la Sierra, Santa Cruz Department]
Bolivia	Bartoloni, 1999	1997	64.7% (age 1-5), 92.4% (age 6-10), 100% (age 11-20), 98.3% (age 21-30), 98.4% (age 31-40), 97.4% (age 41-50), 100% (age 51-60), 100% (age 61+); males: 68.0%, 89.8%, 100%, 100%, 96.0%, 95.0%, 100%, 100%; females: 61.5%, 94.6%, 100%, 97.0%, 100%, 100%, 100%, 100%; no differences by sex	490	rural south-eastern Bolivia [Camiri, Cordillera Province, Santa Cruz Department; Villa Montes, Tarija Department]
Bolivia	Bartoloni, 1989	1987	86.9% (age 1-5), 94.2% (age 6-10), 99.0% (age 11-20), 97.7% (age 21-40), 100% (age 41+); males: 77.7%, 91.1%, 98.5%, 100%, 100%; females: 92.8%, 96.2%, 99.3%, 97.0%, 100%; no differences by sex	448	rural south-eastern Bolivia [Camiri, Boyuibe, and Javillo in Santa Cruz Department]
Peru	Vildósola, 2000	1999	28.4% (age 1-4), 42.9% (age 5-9), 61.8% (age 10-14), 65.7% (age 15-19), 75.0% (age 20-29), 94.1% (age 30-39)	859	outpatients without hepatitis [Lima Metropolitana]
Peru	Cabezas, 1994	--	100% (age 7-10), 98.4% (age 11-15), 95.9% (age 16-20); males: 97.8%, females: 98.0%	143	healthy school children [Huanta Province, Ayacucho Region]

Peru	Méndez, 1989	1979-1984	92.2% (all ages)	3601	serum samples from apparently healthy donors to a national reference laboratory [nationwide]
Peru	Kilpatrick, 1986	1983-1984	77% (age 0-3 months), 43% (age 4-6 months), 7% (age 7-11 months), 30% (age 1), 42% (age 2), 46% (age 3), 58% (age 4), 69% (age 5), 76% (age 6), 96% (age 7), 100% (age 8), 98% (age 9-16), 98% (adults)	1136	healthy adults in the rural Amazon and in urban Lima; children living in an orphanage, barrio, or hospitalized without hepatitis [Amazon basin; Lima]

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CENTRAL LATIN AMERICA

(Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Venezuela)

REGIONAL SUMMARY

The average age at infection among Mexican children hospitalized with hepatitis increased from 6 years in 1991-1993 to 10 years in 2003-2005 [García-Juárez, 2008] and most seroprevalence studies from Mexico from the 1990s and 2000s also show about 50% of 10-year-olds have had a prior infection with HAV [García-Juárez, 2008; Tapia-Conyer, 1999; Tanaka, 2000]. Studies from Venezuela in the 1990s also showed that about 50% of 10-year-olds are immune [Tapia-Conyer, 1999; Tanaka, 2000; Amesty-Valbuena, 1989], and noted significant differences in seroprevalence by socioeconomic status [Albornoz-Monque, 1995; Pujol, 1994]. However, not all countries in central Latin America report rising ages at infection: a 1999 study in rural Guatemala [Steinberg, 2004] and a 1990-1992 study in Nicaragua [Pérez, 1996] found that more than half of children had developed immunity by their second birthdays.

The immunity rate in adults remains very high, even in Mexico where rates in children are decreasing [Tapia-Conyer, 1999; Tanaka, 2000; Ortiz-Ibarra, 1996; Redlinger, 1998]. In the 1980s, about half of young children had prior infection [Bustamante-Calvillo, 1986; Ruiz-Gomez, 1985; Bustamante-Calvillo, 1983; Kumate, 1982]. Most studies from the region in the 1970s show a very high seroprevalence rates. A 1977 study found a 97.3% seroprevalence rate in Colombia, a 98.4% rate in Mexico, and a 96.0% rage in Venezuela [Nath, 1980], and studies from the late 1970s in Costa Rica reported a high seroprevalence rate [Nath, 1980; Villarejos, 1982]. However, not all studies show such a high rate: a study published in the mid 1980s from Colombia reported a 71% seroprevalence rate.

No studies were identified from El Salvador, Honduras, or Panama. The studies from the other countries indicate that the average age at infection is about 10 years old and rising in some populations; few adults are currently at risk of hepatitis A infection, but that proportion will likely rise with increasing socioeconomic development.

SUMMARY AGE-PREVALENCE ESTIMATES

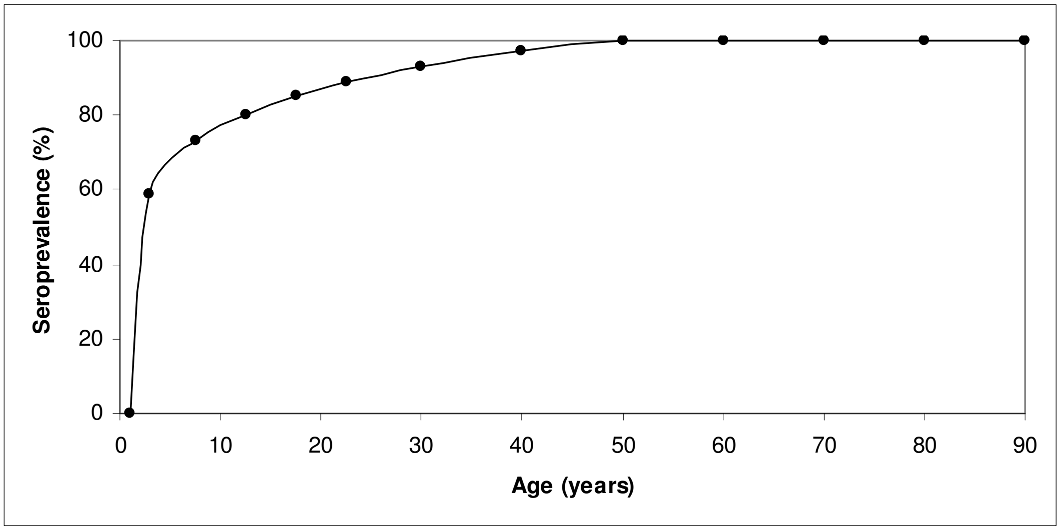
Table 29. Summary Prevalence Estimates by Age in Central Latin America.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	59	73	80	85	89
% at risk	--	--	41	27	20	15	11

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	93	97	100	100	100	100	100
% at risk	7	3	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 62. Plot of Estimated Seroprevalence by Age in Central Latin America.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 63. Plots of Age-Seroprevalence Data from Studies from Central Latin America.

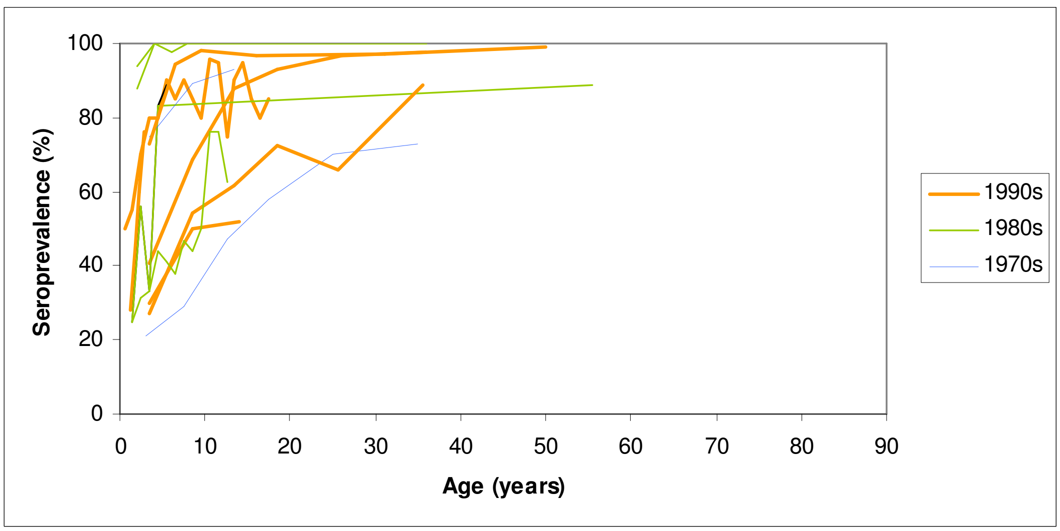


TABLE OF INCLUDED PREVALENCE STUDIES

Table 30. Information about Included Studies from Central Latin America.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Colombia	Ljunggren, 1985	--	71% (all ages)	108	serum samples from healthy blood donors and volunteers [Bogotá, Distrito Capital and nationwide]
Costa Rica	Villarejos, 1982	1976-1978	0% (age 4-11 months), 21% (age 1-4), 29% (age 5-9), 47% (age 10-14), 58% (age 15-19), 70% (age 20-29), 73% (age 30-39), 71% (age 40+); after the outbreak more than 90% of residents in each age group (age 1-40+)	1201	rural residents prior to outbreak [San Ramón and Palmares districts, Alajuela province]
Guatemala	Steinberg, 2004	1999	40% (age 6-12 months) 28% (age 13-18 months), 46% (age 19-24 months), 60% (age 25-30 months), 76% (age 31-36 month); no differences by sex	522	population-based sample of rural children [San Juan Sacatepéquez municipality, Guatemala department]
Mexico	García-Juárez, 2008	1991-2005	50% (age 1-5), 50% (age 6-10), 52% (age 11-16)	259	[Chiapas; Guerrero; Morelos; Mexico City, Distrito Federal]
Mexico	Tapia-Conyer, 1999; Tanaka, 2000	1996-1997	40.5% (age 1-5), 68.6% (age 6-10), 88.0% (age 11-15), 92.9% (age 16-20), 96.5% (age 21-30), 97.8% (age 31-40); males: 39.8%, 67.2%, 84.5%, 92.6%, 96.5%, 98.2%; females: 41.2%, 70.0%, 91.0%, 93.1%, 96.5%, 97.7%	5212	population-based sample [nationwide]
Mexico	Redlinger, 1998	1996	91.7% (age <22), 98.6% (age 22+), 100% (age 29+)	307	healthy pregnant women [Ciudad Juárez, Chihuahua]
Mexico	Ramirez Mayans, 1997	1992-1993	50% (age 0.25-1), 55% (age 1, 70% (age 2), 80% (age 3), 80% (age 4), 90% (age 5), 85% (age 6), 90% (age 7), 85% (age 8), 80% (age	450	outpatients without history of hepatitis [Mexico City, Distrito Federal]

			9), 96% (age 10); 95% (age 11), 75% (age 12), 90% (age 13), 95% (age 14), 85% (age 15), 80% (age 16), 85% (age 17); males (age 0.25-17): 85.1%, females: 81.9%		
Mexico	Ortiz-Ibarra, 1996	1995	93.3% (adults)	1500	pregnant women attending pre-natal clinics [Mexico City, Distrito Federal]
Mexico	Bustamante-Calvillo, 1986	--	Guatemalans: 100% (age <1), 87.8% (age 1-2), 100% (age 3-4), 97.5% (age 5-6), 100% (age 7-8), 100% (age 9-10), 100% (age 11-15), 100% (age 16-20), 100% (age 21-30), 100% (age 31-40), 100% (age 41+); Mexicans: 100% (age <1), 93.8% (age 1-2), 100% (age 3-4), 100% (age 5-6), 100% (age 7-8), 100% (age 9-10), 100% (age 11-15), 100% (age 16-20), 100% (age 21-30), 100% (age 31-40), 100% (age 41+)	1127	Guatemala refugees and local residents of rural Mexico [Chiapas]
Mexico	Ruiz-Gomez, 1985; Bustamante-Calvillo, 1983	--	100% (age 1 month), 81.3% (age 2 months), 68.4% (age 3 months), 55.6% (age 4 months), 50.0% (age 5 months), 26.3% (age 6 months), 11.1% (age 7 months), 0.0% (age 8 months), 17.6% (age 9 months), 11.8% (age 10 months), 12.5% (age 11 months), 25.0% (age 1 year), 56.3% (age 2), 33.3% (age 3), 83.3% (age 4), 88.9% (age 5)	275	children attending a clinic [Mexico City, Distrito Federal]
Mexico	Kumate, 1982	1973	75.0% (age 1-5), 89.3% (age 6-10), 92.8% (age 11-15)	890	urban children [Mexico City, Distrito Federal; Morelia, Michoacán; Hermosillo, Sonora; La Paz, Baja

					California Sur; Chihuahua, Chihuahua; Mérida, Yucatán]
Nicaragua	Pérez, 1996	1990-1992	72.7% (age 2-4), 94.5% (age 5-7), 98.1% (age 8-10), 96.6% (age 11-20), 97.4% (age 21-40), 98.9% (age 41+)	499	sera randomly selected from urban population-based serum bank [León, León department]
Venezuela	Tapia-Conyer, 1999; Tanaka, 2000	1996-1997	27.3% (age 1-5), 54.1% (age 6-10), 61.7% (age 11-15), 72.3% (age 16-20), 66.0% (age 21-30), 88.9% (age 31-40); males: 29.8%, 68.3%, 60.4%, 70.0%, 62.5%, 77.7%; females: 25.0%, 42.4%, 62.7%, 75.0%, 67.6%, 92.6%	469	random sample from preschools, public schools, colleges, and businesses [Caracas, Distrito Capital]
Venezuela	Albornoz Monque, 1995	1994-1995	27% (age 14-30); high-middle income: 12%, low-middle income: 18%, low income: 38%, very low income: 40%	200	outpatients without occupational risk for HAV [Caracas, Distrito Capital]
Venezuela	Pujol, 1994	1991-1992	low-income 96% (adults); high-income 48% (adults)	211	pregnant women attending urban clinics [Caracas, Distrito Capital]
Venezuela	Amesty-Valbuena, 1989	1984-1986	31.2% (age <1), 25.0% (age 1), 31.2% (age 2), 33.3% (age 3), 43.7% (age 4), 41.1% (age 5), 38.0% (age 6), 46.6% (age 7), 43.7% (age 8), 50.0% (age 9), 76.4% (age 10), 76.4% (age 11), 62.5% (age 12)	209	urban children visiting outpatient clinics [Maracaibo, Zulia]

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SOUTHERN LATIN AMERICA

(Argentina, Chile, Falkland Islands (Malvinas), Uruguay)

REGIONAL SUMMARY

This region has an intermediate endemicity rate. About half of all teenagers in Montevideo, Uruguay in the 1990s had evidence of prior infection, based on a 1997-1998 study of 896 children that found that 26.7% of children 2 to 14 years old had anti-HAV [Montano, 2001] and a study of 214 adults in 1996 showed that most adults had immunity by age 40 [Cruells, 1997]. Argentina and Chile are discussed in the paragraphs below.

ARGENTINA

A seroprevalence survey conducted in Argentina in 1977 found an overall immunity rate of 94.2% [Nath, 1980]. Most seroprevalence studies conducted in Argentina in the 1990s and early 2000s found immunity more than half of 5- to 10-year-old children and a high immunity rate in adults [Foussal, 2002; Gonzalez, 1997; Soria, 2006; Tanaka, 2000; Tapia-Conyer, 1999], but a study in a middle-class urban area that found that fewer than half of 30-year-olds had immunity indicated the emergence of vulnerable adult population groups. A single-dose universal hepatitis A immunization program aimed at 12-month-old children was initiated in Argentina in 2005 [Vacchino, 2008; Gentile, 2008]. The vaccination program was deemed to be important because of the growing number of urban residents at significant risk of exposure to HAV and because HAV was a leading cause of acute liver failure in children and adolescents [Gentile, 2008]. The annual incidence rate in the decade before the vaccination program began (1995-2004) ranged from 70.5 to 173.8 per 100,000. The incidence rate decreased sharply after the initiation of the immunization program to 10.2 per 100,000 in 2007 [Vacchino, 2008].

CHILE

A seroprevalence survey conducted in Chile in 1977 found an overall immunity rate of 98.0% [Nath, 1980]. Studies from the 1980s showed similarly high rates, with half of all children developing immunity by their tenth birthdays and nearly all adults immune [Ibarra, 1988; Riedemann, 1987; Riedemann, 1984; Zacarias, 1981]. In the 1990s, most studies showed that more than half of all teenagers showed immunity to HAV but less than one-third of children less than 10 years of age had anti-HAV [Fix, 2002; Ibarra, 2006; Ibarra, 1999; Lagos, 1999; Riedemann, 1998; Tanaka, 2000; Tapia-Conyer, 1999].

SUMMARY AGE-PREVALENCE ESTIMATES

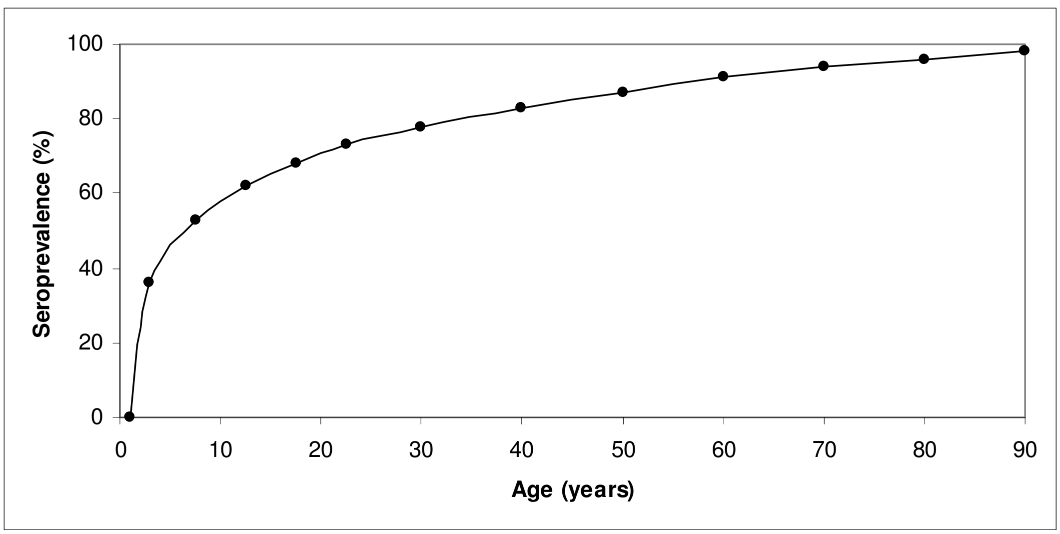
Table 31. Summary Prevalence Estimates by Age in Southern Latin America.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	36	53	62	68	73
% at risk	--	--	64	47	38	32	27

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	78	83	87	91	94	96	98
% at risk	22	17	13	9	6	4	2

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 64. Plot of Estimated Seroprevalence by Age in Southern Latin America.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 65. Plots of Age-Seroprevalence Data from Studies from Southern Latin America.

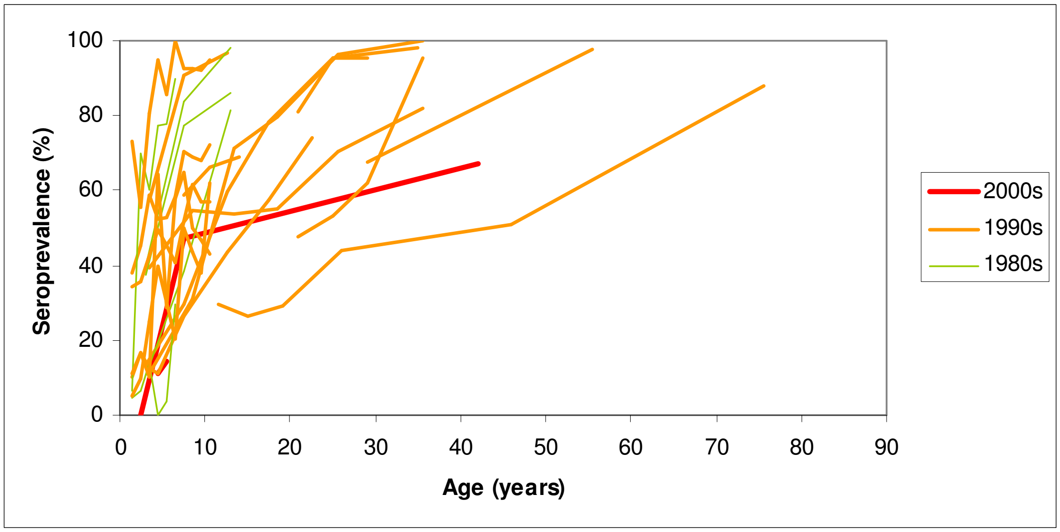


TABLE OF INCLUDED PREVALENCE STUDIES

Table 32. Information about Included Studies from Southern Latin America.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Argentina	Soria, 2006	2002	0% (age <5), 47% (age 5-10), 67% (age 10+)	102	rural residents in a mountainous area [Lara, Tucumán province]
Argentina	Foussal, 2002	--	57.3% (age 2-4), 90.8% (age 5-9), 96.6% (age 10-14); no differences by sex	288	children attending municipal day care or social services [Resistencia, Chaco province]
Argentina	López, 2000	1995-1996	29.8% (age 10-12), 26.6% (age 13-16), 29.3% (age 17-20), 44.0% (age 21-30), 50.9% (age 31-60), 88.0% (age 61-89); no differences by sex	360	urban middle-class residents [Buenos Aires]
Argentina	Tapia-Conyer, 1999; Tanaka, 2000	1996-1997	39.5% (age 1-5), 54.6% (age 6-10), 53.6% (age 11-15), 54.9% (age 16-20), 70.5% (age 21-30), 81.8% (age 31-40); males: 52.5%, 54.1%, 53.2%, 54.7%, 30.5%, 80.9%; females:	1454	attendants of outpatient clinics at public hospitals

			38.9%, 55.1%, 54.1%, 55.0%, 75.8%, 82.1%		
Argentina	Gonzalez, 1997	--	Buenos Aires: 16.1% (age 6-11 months), 5.0% (age 1), 9.8% (age 2), 25.0% (age 3), 40.0% (age 4), 30.0% (age 5), 20.6% (age 6), 50.0% (age 7), 43.5% (age 8), 38.1% (age 9), 62.1% (age 10); San Justo: 43.8%, 38.1%, 45.5%, 58.9%, 52.5%, 52.9%, 58.5%, 70.4%, 68.8%, 68.2%, 72.3%; Trelew: 18.2%, 11.1%, 16.7%, 10.0%, 64.3%, 28.5%, 58.1%, 64.9%, 50.0%, 46.7%, 42.9%; Rosario: 29.1%, 34.4%, 35.5%, 42.5%, 49.5%, 45.6%, 40.8%, 52.0%, 61.4%, 56.9%, 57.1%; Tucumán: 68.4%, 73.1%, 55.6%, 80.6%, 94.7%, 85.7%, 100%, 92.6%, 92.8%, 92.3%, 94.7%	3699	urban pediatric outpatients without liver disease [Buenos Aires, Capital Federal; San Justo, Santa Fe province; Trelew, Chubut province; Rosario, Santa Fe province; Tucumán, Tucumán province]
Chile	Ibarra, 2006	1999-2000	1999: 11.3% (age 4); 2000: 14.3% (age 5); no differences by sex	168	low socioeconomic status children attending outpatient clinics [Valdivia, Valdivia Province, Los Ríos Region]
Chile	Fix, 2002	1998	10.3% (age 1), 16.7% (age 2), 12.5% (age 3), 10.9% (age 4), 26.2% (age 5-9), 43.4% (age 10-14), 57.4% (age 15-19), 73.9% (age 20-24); no differences by sex	784	[Santiago de Chile, Santiago Metropolitano]
Chile	Ibarra, 1999	1996-1997	blood donors: 81.0% (age 19-22), 95.2% (age 23-26), 95.6% (age 27-30); medical students: 47.9% (age 19-22), 53.2% (age 23-26), 61.9% (age 27-30), 95.2% (age 31-39); no differences by sex	510	volunteer blood donors and medical students [Valdivia, Valdivia Province, Los Ríos Region]

Chile	Tapia-Conyer, 1999; Tanaka, 2000	1996-1997	11.0% (age 1-5), 31.0% (age 6-10), 71.1% (age 11-15), 79.4% (age 16-20), 96.2% (age 21-30), 100.0% (age 31-40); males: 10.0%, 27.5%, 62.3%, 87.5%, 100.0%, 100.0%; females: 12.5%, 34.7%, 86.1%, 73.7%, 95.3%, 100.0%	496	population-based sample of urban households [northern Santiago de Chile, Santiago Metropolitano]
Chile	Lagos, 1999	1996	13.2% (age 1-4), 29.5% (age 5-9), 59.6% (age 10-14), 78.1% (age 15-19), 95.6% (age 20-29), 98.2% (age 30-39)	503	urban residents [Recoleta, Huechuraba, Quilicura, Independencia, and Conchalí, all in the north of Santiago Metropolitano]
Chile	Riedemann, 1998	1991-1992	58.8% (age 6-8), 66.4% (age 9-11), 69.2% (age 12-15)	2333	schoolchildren [Valdivia, Valdivia Province, Los Ríos Region]
Chile	Ibarra, 1988	--	Chaitén: 10.5% (age 1-4), 38.5% (age 5-9), 81.5% (age 10-15); Pucón: 37.5% (age 1-4), 77.2% (age 5-9), 86.1% (age 10-15)	154	healthy children in rural areas [Pucón, Cautín Province, Araucanía Region; Chaitén, Palena Province, Los Lagos Region]
Chile	Riedemann, 1987	1984-1985	40% (age 1-4), 84% (age 5-9), 98% (age 10-15), 99% (age 16+); no differences by sex	227	Mapuche Indians [Huapi Island, Ranco Lake, Valdivia Province, X Region]
Chile	Riedemann, 1984	--	96.9% (age 30-70)	95	healthy adults [Valdivia, Valdivia Province, Los Ríos Region]
Chile	Zacarias, 1981	--	low socioeconomic status: 97.6% (newborn), 13.3% (age6 months), 6.7% (age 1), 70.0% (age 2), 60.0% (age 3), 77.4% (age 4), 77.8% (age 5), 90.0% (age 6); high socioeconomic status: 32.3% (age 6 months), 4.8% (age 1), 6.7% (age 2), 13.8% (age 3), 0.0% (age 4), 3.6% (age	524	healthy school children and outpatients without liver disease [Santiago de Chile, Santiago Metropolitano]

			5), 29.6% (age 6)		
Uruguay	Cruells, 1997	1996	67.5% (age 18-39), 97.8% (age 40-70); males: 85%, females: 87%; no differences by sex	214	outpatients without hepatitis [Montevideo, Montevideo Department]

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TROPICAL LATIN AMERICA
(Brazil, Paraguay)

REGIONAL SUMMARY

The vast majority of studies conducted in Brazil in the 2000s show that about 50% of children 5- to 9-years-old have immunity to HAV [Matos, 2009, de Alencar, Ximenes, 2008; Kozlowski, 2007; Almeida, 2006; Dinelli, 2006; Almeida, 2006; Zago-Gomes, 2005; Moreira, 2005; Luiz, 2003; de Almeida, 2002; Gaze, 2002; Santos, 2002] and indicate that the vast majority of adults are immune by about 30 years of age [Matos, 2009; Kozlowski, 2007; Almeida, 2006; Bortoliero, 2006; Almeida, 2006; Luiz, 2003; de Almeida, 2002;Gaze, 2002; Santos, 2002; Lewis-Ximenez, 2002]. These rates do not appear to be substantially different from those from studies conducted in the 1990s [Almeida, 2001; Niel, 2001; Trinta, 2001; Tapia-Conyer, 1999; Tanaka, 2000; Clemens, 2000; Saback, 1999; Struchiner, 1999; Pinho, 1998; Vitral, 1998; Ferreira, 1998], although some studies from the 1980s and 1990s show a higher seroprevalence rate in young children [Assis, 2002; Quieróz, 1995; Abuzwaida, 1987]. Rates appear to have declined from very high population seroprevalence rates in the 1970s [Nath, 1980; Vitral, 1998].

Although the seroprevalence rates in children have been noted to be higher in the northern and north-eastern parts of the country than in the south and south-eastern regions [Vitral, 2008; Carrilho, 2005], the studies included in this systematic review reveal a fairly uniform picture, as shown by the plot of age-seroprevalence curves below. Seroprevalence rates in Amerindian and Amazonian populations tend to be higher [de Souza, 2007; Lafer, 2007; de Paula, 2001], except for some extremely isolated villages [Black, 1986].

No articles were identified from Paraguay, but the dozens of studies of hepatitis A virus prevalence conducted in Brazil show an intermediate prevalence rate. About 50% of schoolchildren remain susceptible to infection. Outbreaks have been reported from schools and day care centers [Vitral, 2008; Vitral, 2006; Morais, 2006]. The incidence rate (based on reported cases in Rio de Janerio in 1999 to 2001) is about 30 to 40 per 100,000 in children under 10 years of age and much lower in adult populations [Silva, 2007]. Few adults are susceptible to infection, but a growing number of adolescents are at risk.

SUMMARY AGE-PREVALENCE ESTIMATES

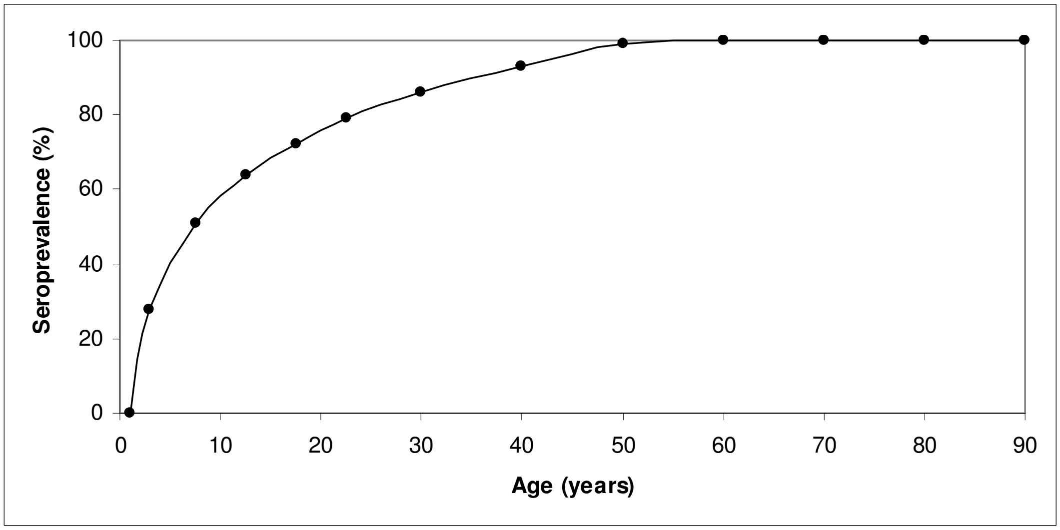
Table 33. Summary Prevalence Estimates by Age in Tropical Latin America.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	28	51	64	72	79
% at risk	--	--	72	49	34	28	21

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	86	93	99	100	100	100	100
% at risk	14	7	1	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 66. Plot of Estimated Seroprevalence by Age in Tropical Latin America.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

This graph includes only data from studies conducted after 1990.

Figure 67. Plots of Age-Seroprevalence Data from Studies from Tropical Latin America.

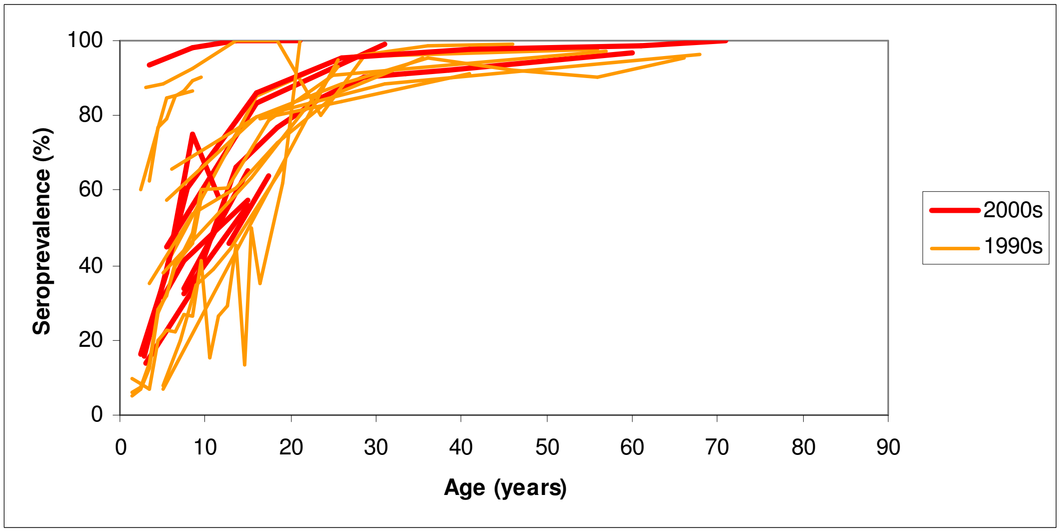


TABLE OF INCLUDED PREVALENCE STUDIES

Table 34. Information about Included Studies from Tropical Latin America.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Brazil	Matos, 2009	2004	44.8% (age 0-10), 83.4% (age 11-20), nearly 100% (ages 30-88)	878	randomly sampled residents of Kalunga community [near Cavalcante, Monte Alegre, and Teresina de Goiás in Goiás state]
Brazil	de Alencar Ximenes, 2008	2004-2005	Northeast region: 31.5% (age 5), 41.4% (age 5-9), 57.4% (age 10-19); Midwest region: 32.3% (age 5-9), 56.0% (age 10-19); Federal District: 33.8% (age 5-9), 65.1% (age 10-19); no differences by sex	1937	population-based sample of urban children [Salvador, Bahia; Aracaju, Sergipe; Maceio, Alagoas; Recife, Pernambuco; João Pessoa, Paraiba; Natal, Rio Grande do Norte; Fortaleza, Ceara; Teresina, Piaui; São Luis, Maranhão; Goiania, Goias; Campo Grande, Mato Grosso do Sul; Cuiaba, Mato Grosso; Brasilia, Federal District]
Brazil	de Souza, 2007	2003-2004	Amerindians: 98.2%; non-Amerindians: 91.2%	520	members of four ethnic groups (Mawayana, WaiWai, Katwena, and Xerew) [Mapuera village on the Trombetas River, Para State]
Brazil	Lafer, 2007	2001	93.7% (age 1-5), 98.2% (age 6-10), 100% (age 11-15), 100% (age 16-20), 100% (age 21+)	220	members of two ethnic groups (Kaiabi and Kuikuro) [Afukuri, Kuikuro, Capivara, Guarujá, and Tuiararé villages, Xingu indigenous National Park, Mato Grosso state]

Brazil	Kozlowski, 2007	2002-2003	13.8% (age 0-5), 33.3% (age 6-10), 66.1% (age 11-15), 76.9% (age 16-20), 76.9% (age 16-20), 84.8% (age 21-25), 90.3% (age 26-30), 91.3% (age 31-35), 91.9% (age 36-40), 96.6% (age 41-108); males: 52.6%, females: 47.4%; no differences by sex	947	isolated rural and urban Afro-Brazilian communities [Furnas dos Dionísios, Jaraguari county; Furnas da Boa Sorte, Corguinho county; Malaquias, Camapuã county; Jerônimos, Terenos county; São Miguel, Maracaju county; Furnas dos Baianos, Aquidauana county; Quintinos, Pedro Gomes county; Orolândia, Rio Negro county, São Miguel, Nioaque county; Amarelinhos, Sidrolândia county; Morro do Limão, Campo Grande county; all in Mato Grosso do Sul state]
Brazil	Almeida, 2006	1999	40.5% (age 0-10), 85.0% (age 11-20), 95.5% (age 21-30), 98.8% (age 31-40), 98.9% (age 41+); males: 81.6%, females: 84.9%; no differences by sex	1452	sera from a study of leishmaniasis [Cavunge, Ipacaetá district, Bahia state]
Brazil	Morais, 2006	1999	71.4% (age 1-6 months), 60.0% (age 7-12 months), 87.3% (age 2-3), 88.3% (age 4-5), 92.7% (age 6-10), 100% (age 11-15), 100% (age 16-20), 80.0% (age 21-25), 95.8% (age 26-30), 97.8% (age 31-80)	418	children and employees of a public child care center where 2 clinical case of HAV was diagnosed [Rio de Janeiro, Rio de Janeiro state]
Brazil	Bortoliero, 2006	1999	81.1% (age 18-60)	996	volunteer blood donors [Londrina, Paraná state]
Brazil	Dinelli, 2006	2001	46% (age 10.4-14), 64% (age 15-19.9)	253	outpatients [São Paulo, São Paulo state]

Brazil	Almeida, 2006	2000	15.9% (age 0.5-4), 60.8% (age 5-10), 86.0% (age 11-20), 95.5% (age 21-30), 97.5% (age 31-50), 98.5% (age 51-70), 100% (age 71+); no differences by sex	891	community residents without chronic disease [Cavunge, Ipacaetá district, Bahia state]
Brazil	Zago-Gomes, 2005	--	38.6% (age 6-14); no differences by sex	606	urban public school children [Vila Velha, Metropolitan Vitória, Espírito Santo state]
Brazil	Moreira, 2005	2001-2002	16.3% (age 1-3), 38.0% (age 4-6), 75.0% (age 7-9), 58.3% (age 10-12); no differences by sex	121	pediatric inpatients without life-threatening diseases [Salvador, Bahia state]
Brazil	Luiz, 2003 / de Almeida, 2002	1997	6.1% (age 1), 7.6% (age 2), 13.9% (age 3), 28.1% (age 4), 32.1% (age 5), 40.8% (age 6), 43.9% (age 7), 48.6% (age 8), 60.3% (age 9), 60.8% (age 10-14), 78.9% (age 15-19), 90.8% (age 20-29), 97.4% (age 30-83)	3068	random population-based sample [Duque de Caxias, Rio de Janeiro, Rio de Janeiro state]
Brazil	Ferreira, 2002	1999-2000	4.7% (age 1-12)	64	healthy children [Porto Alegre, Rio Grande do Sul state]
Brazil	Gaze, 2002	1998	65.6% (age 1-10), 79.7% (age 11-20), 88.5% (age 21-40), 96.2% (age 41-95)	1100	routine blood testing [Macaé municipality, Rio de Janeiro state]
Brazil	Santos, 2002	1999	57.4% (age 0-10), 79.4% (age 11-20), 88.4% (age 21-30), 95.4% (age 31-40), 92.2% (age 41-50), 90.4% (age 51-60), 95.2% (age 61+)	699	[Manguinhos, Rio de Janeiro state]
Brazil	Lewis-Ximenez, 2002	1998	79% (age 12-20), 84% (age 21-30), 91% (age 31-50)	874	healthy ante- and post-partum women [Rio de Janeiro, Rio de Janeiro state]
Brazil	Assis, 2002	1998	62.5% (age 3), 76.9% (age 4), 79.2% (age 5), 85.0% (age 6), 86.8% (age 7), 89.5% (age 8), 90.1% (age 9); no differences by sex	487	school children [Mato Grosso state]

Brazil	de Paula, 2001	1997	90.9% (age 3-10), 93.0% (age 11-20), 93.3% (age 21-30), 94.5% (age 31-40), 94.1% (age 41-50), 95.0% (age 51-73)	349	communities along the Acre and Purus rivers [Acre and Amazonas states]
Brazil	Almeida, 2001	1997	5.0% (age 1), 7.1% (age 2), 12.7% (age 3), 27.5% (age 4), 32.4% (age 5), 39.7% (age 6), 42.9% (age 7), 45.7% (age 8), 58.1% (age 9)	3271	children [Duque de Caxias county, Rio de Janeiro, Rio de Janeiro state]
Brazil	Niel, 2001	--	86.1% (age 25-35)	137	volunteer blood donors [Rio de Janeiro state]
Brazil	Trinta, 2001	1994-1998	urban: 7.0% (age <10), 51.5% (age 10-20), 95.0% (age 21+); rural: 38.1% (age <10), 63.3% (age 10-20), 93.0% (age 21+)	405	volunteer blood donors, pregnant women, schoolchildren, outpatients, and urban and rural residents without hepatitis [Rio de Janeiro state]
Brazil	Saback, 2001	1999	76.2% (age 16-82)	1330	volunteer blood donors and healthy outpatients [Rio de Janeiro, Rio de Janeiro state]
Brazil	Tapia-Conyer, 1999; Tanaka, 2000; Clemens, 2000	1996-1997	35.1% (age 1-5), 53.9% (age 6-10), 60.7% (age 11-15), 72.8% (age 16-20), 85.9% (age 21-30), 95.3% (age 31-40); males: 35.1%, 53.4%, 60.1%, 73.0%, 84.9%, 93.7%; females: 35.1%, 54.3%, 61.2%, 73.3%, 86.3%, 97.4%	3653	volunteers from outpatient clinics in low- and middle-class areas [4 regions: north, northeast, southeast, and south]
Brazil	Saback, 1999	1997-1998	88% (age 0-80)	223	urban outpatients and blood donors without liver disease [Rio de Janeiro, Rio de Janeiro state]

Brazil	Struchiner, 1999	1996	9.9% (age 1), 8.2% (age 2), 6.8% (age 3), 20.0% (age 4), 22.9% (age 5), 22.2% (age 6), 26.7% (age 7), 26.3% (age 8), 41.3% (age 9), 15.5% (age 10), 26.3% (age 11), 29.3% (age 12), 45.5% (age 13), 33.3% (age 14), 50.0% (age 15), 35.0% (age 16), 62.2% (age 17-20), 100% (age 21+)		randomly sampled urban micro-regions [Campos Elyseos in Duque de Caxias and Ilha do Governador, both in Rio de Janeiro, Rio de Janeiro state]
Brazil	Pinho, 1998	1995-1996	medical students: 19.6% (age 18-30), blood donors: 95.0% (age 18-30)	183	high socio-economic status medial students and low socio-economic blood donors [Campinas, São Paulo state]
Brazil	Vitral, 1998	1978; 1995	1978: 95.1% (newborn), 90.2% (age 1-3 months), 55.0% (age 4-6 months), 20.4% (age 7-9 months), 4.0% (age 10-12 months), 23.2% (age 2), 88.1% (age 3), 93.9% (age 4), 90.4% (age 5), 98.1% (age 6); 1995: 4.5% (age <3), 7.8% (age 4-5), 19.7% (age 6-7), 34.7% (age 8-9), 38.7% (age 10-11), 44.3% (age 12-13), 66.0% (age 14-23)	520; 720	low socio-economic status urban healthy outpatients (1978) and public schoolchildren (1995) [Rio de Janeiro, Rio de Janeiro state]
Brazil	Ferreira, 1998	--	low socio-economic: 51% (children); high socio-economic: 11% (children)	387	outpatients [Porto Alegre, Rio Grande do Sul state]
Brazil	Quieróz, 1995	1991-1992	9.1% (age 3-12 months), 60.0% (age 1-3), 84.5% (age 4-6), 86.7% (age 7-9); no differences by sex	310	children attending public day care [Goiania, Goias state]
Brazil	Abuzwaida, 1987	1986	53% (age 0-5), 65% (age 6-10), 72% (age 11-15), 78% (age 16-20), 89% (age 21-30), 92% (age 31-40), 96% (age 41-50), 97% (age 51-60), 88% (age 61+)	513	random population-based sample [Niterói and Nova Iguaçú, Rio de Janeiro, Rio de Janeiro state]

Brazil	Black, 1986	1984	Parakanã: 7.8% (age 0-4), 10.5% (age 5-9), 10.3% (age 10-49), 100% (age 50+); Asurini: 100%, 100%, 100%, 100%	153	isolated rural Parakanã and Asurini tribal members [Bom Jardim, Novo and Trocará villages in the Jardim river area of Amazonas]
Brazil	Sutmoller, 1982	1980	76% (adults)	60	healthy controls in a case-control study of hepatitis [Fundão Island, Rio de Janeiro, Rio de Janeiro state]

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NORTH AFRICA / MIDDLE EAST

(Algeria, Bahrain, Egypt, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Morocco, Occupied Palestinian Territory, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, Turkey, United Arab Emirates, Western Sahara, Yemen)

REGIONAL SUMMARY

This region has an intermediate level of anti-HAV seroprevalence, and the plots of age-seroprevalence studies from included studies from this region (Figure 71) show a remarkable consistency. In general, urban areas in this area have experienced a declining rate of hepatitis A infection, but rates in rural areas remain high [Tufenkeji, 2000]. Studies from the 1980s showed nearly universal immunity in many countries. For example, a 100% immunity rate by age 10 was found in Algeria [Hamdi-Cherif, 1986; Khalfa, 1984] and nearly 100% rates in adult populations were found in studies in Morocco [Nejmi, 1984] and Yemen [Scott, 1988]. Studies from some countries in the 2000s show a lower rate in children, with only about half of teenagers immune in studies in Kuwait [Alkhalidi, 2009], Tunisia [Letaief, 2005], and the United Arab Emirates [Sharar, 2008]. Child infection rates remain high in other countries, such as in Syria [Antaki, 2000] and Tunisia [Rezig, 2008] and in some special populations, such as those living in the occupied Palestinian territory [Yassin, 2001] and Kurdish refugees [Chironna, 2003]. Studies from Egypt, Iran, Jordan, Lebanon, Saudi Arabia, and Turkey are presented in the paragraphs below. No studies were available from Bahrain, Libya, Oman, Qatar, or Western Sahara.

EGYPT

Seroprevalence surveys conducted in Egypt in the 1990s generally found a high immunity rate, with more than 90% of 5-year-olds already demonstrating anti-HAV [Darwish, 2001; Darwish, 1996; Kamel, 1995]. Studies from the 2000s showed that more than 50% of 5-year-olds had immunity [Al-Aziz, 2008; Salama, 2007].

IRAN

A serosurvey from Tehran in the late 1970s found that more than 90% of 10-year-olds had immunity to HAV [Farzadegan, 1980]. Studies from the 2000s show a much lower seroprevalence, with the majority of children and teenagers remaining susceptible to hepatitis A infection [Ataei, 2008; Mehr, 2004].

JORDAN

A study conducted in Jordan in the 1980s found that nearly 100% of young children and adults had immunity to HAV [Toukan, 1988]. The incidence rate in Amman between 1991 and 2001 was about 2 to 10 per 100,000 annually, and the vast majority of cases of acute hepatitis occurred in children [Battikhi, 2004]. This indicates that few adults are susceptible to hepatitis A infection.

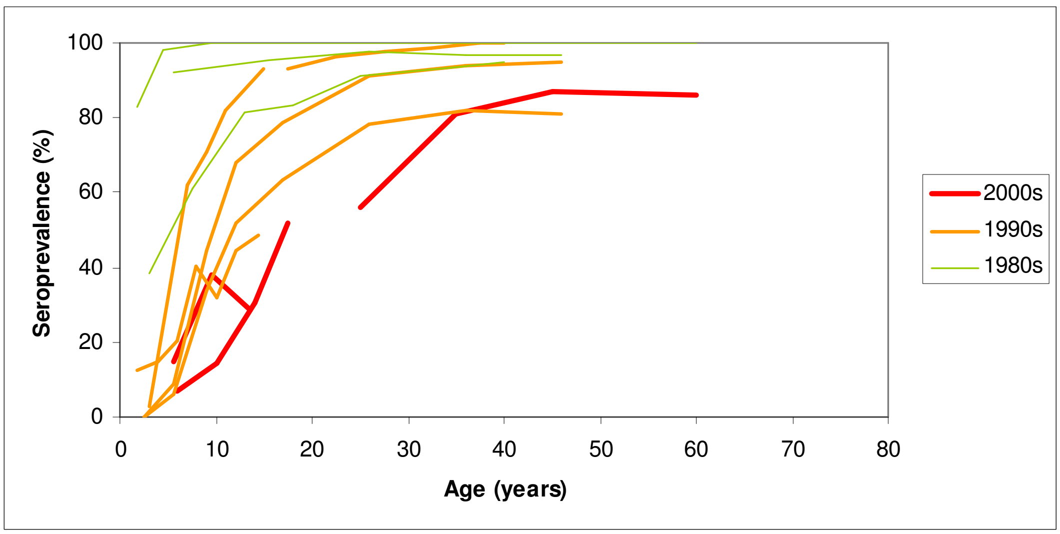
LEBANON

A study conducted in Lebanon in the early 1980s found that more than half of children had anti-HAV by age 5 [Shamma'a, 1982]. Studies conducted in 1999 and 2000 found that more than half of teenagers had immunity, but about 20% of young adults remained susceptible to infection [Bizri, 2006; Sacy, 2005].

SAUDI ARABIA

Seroprevalence surveys conducted in Saudi Arabia in the 1980s usually found a prevalence rate of nearly 90% by age 10 [Al Ghamdi, 1984; Ashraf, 1986; El-Hazmi, 1989; Ramia, 1986; Shobokshi, 1986; Talukder, 1983]. Studies from the 1990s generally found that more than half of children under the age of 10 and more than 90% of teenagers had immunity [Al Rashed, 1997; Fathalla, 2000; Memish, 2001], but noted some lower-prevalence groups in urban areas [Arif, 1996; Khalil, 1998]. Studies from the 2000s generally find that only about one-third of teenagers and half of residents in their 20s have immunity [Al Faleh, 2008; Almuneef, 2006 (ICHE); Almuneef, 2006 (Vaccine); Jaber, 2006].

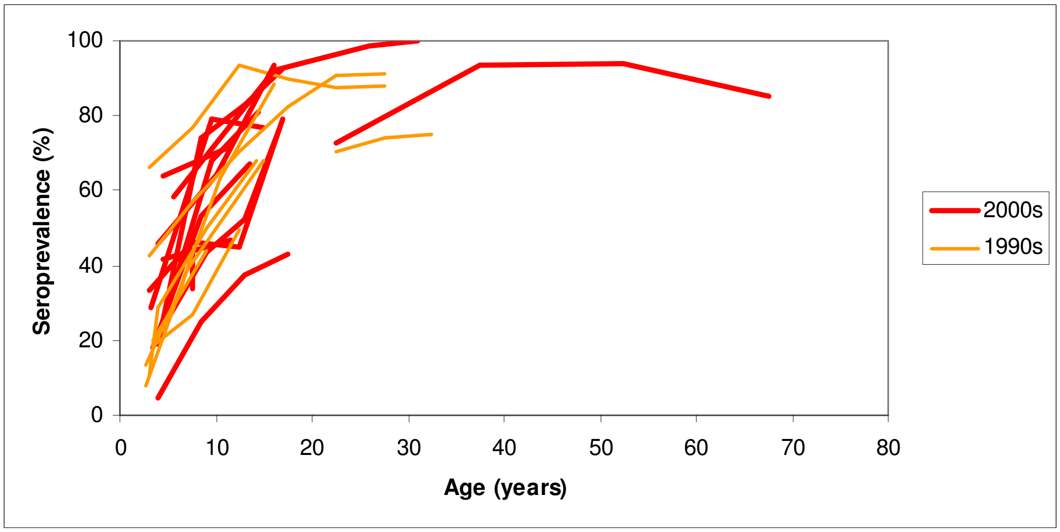
Figure 66. Plots of Age-Seroprevalence Data from Studies from Saudi Arabia.



TURKEY

Studies from the 1990s in Turkey showed that more than half of all early adolescents had immunity [Baki, 1992; Colak, 2002; Ersoy, 1998; Kanra, 2002; Sidal, 2001; Ungan, 2002 (EJGH); Vancelik, 2006; Yapicioglu, 2002]. Studies conducted in the 2000s showed similar rates, with most studies indicating that about half of adolescents and more than 90% of adults over 30 years of ages immune [Atabek, 2004; Cesur, 2002; Ceyhan, 2008; Coksun, 2008; Egemen, 2006; Erdoğan, 2004; Kaya, 2008; Kaya, 2007; Oncu, 2005; Sencan, 2004; Tosun, 2004; Tosun, 2003]. However, most studies – especially in urban areas – found that less then one-third of children under 5-years-old had immunity [Atabek, 2004; Egemen, 2006; Erdoğan, 2004; Kaya, 2008; Kaya, 2007; Sencan, 2004; Soysal, 2007; Tosun, 2004; Tosun, 2003; Ungan, 2002 (JTP)].

Figure 69. Plots of Age-Seroprevalence Data from Studies from Turkey.



SUMMARY AGE-PREVALENCE ESTIMATES

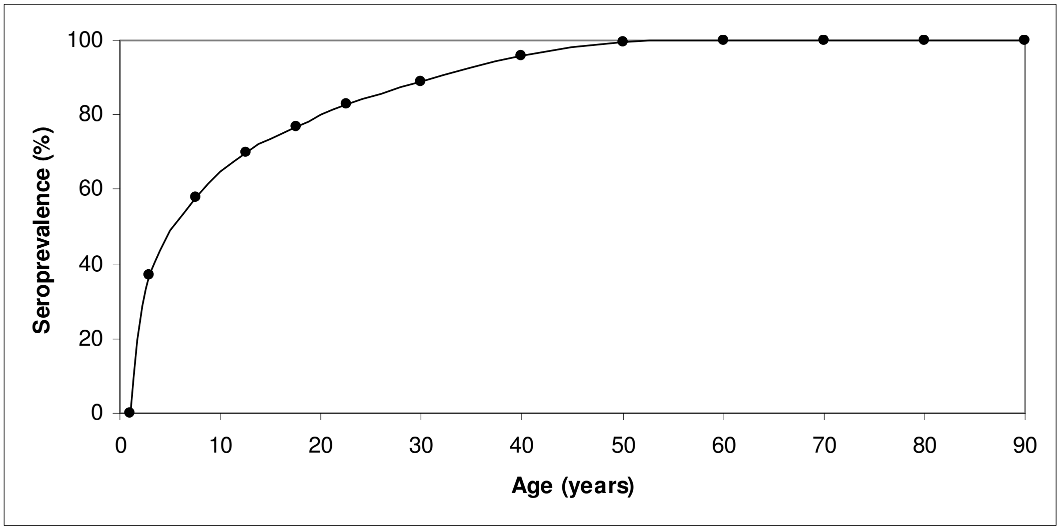
Table 35. Summary Prevalence Estimates by Age in North Africa and the Middle East.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	37	58	70	77	83
% at risk	--	--	63	42	30	23	17

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	89	96	100	100	100	100	100
% at risk	11	4	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 70. Plot of Estimated Seroprevalence by Age in North Africa and the Middle East.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 71. Plots of Age-Seroprevalence Data from Studies from North Africa and the Middle East.

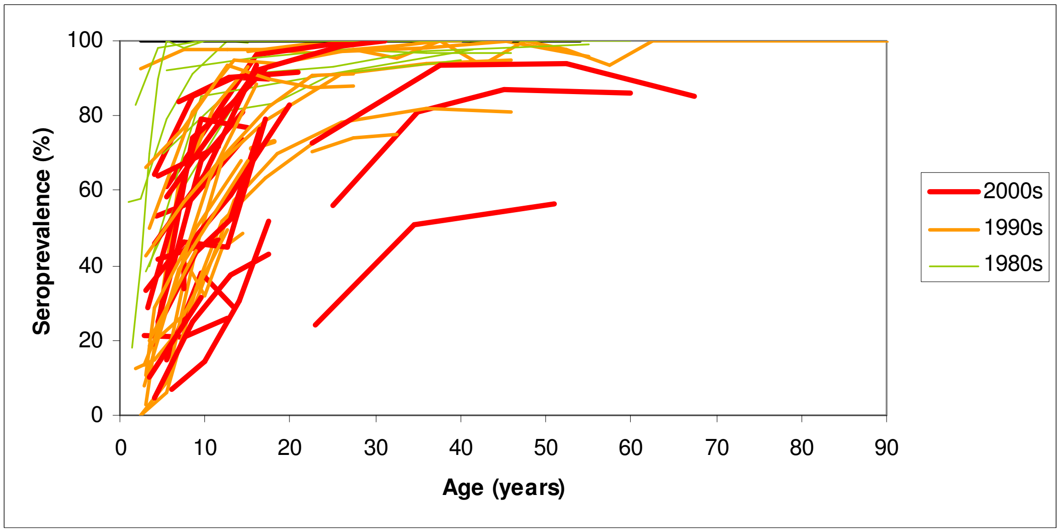


TABLE OF INCLUDED PREVALENCE STUDIES

Table 36. Information about Included Studies from North Africa and the Middle East.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Algeria	Hamdi-Cherif, 1986	--	100% (age 10-12), 100% (age 13-15), 100% (age 16-18), 100% (age 19-20); no differences by sex	186	school children [Sétif, Sétif province]
Algeria	Khalfa, 1984	1983	100% (newborns), 57% (age 1), 58% (age 1-3), 79% (age 4-6), 91% (age 7-9), 100% (age 10-15), 99.5% (age 15+)	1012	residents
Egypt	Al-Aziz, 2008	2002-2003	53.1% (age 2.5-6), 56.4% (age 6-9), 73.8% (age 10-18); no differences by sex	296	outpatients with minor illnesses and children of hospital employees [Cairo]
Egypt	Salama, 2007	2003-2004	64.3% (age 3-5), 85.3% (age 6-10), 90.3% (age 11-15), 90.0% (age 16-18); males: 85.3, females: 86.9%; no differences by sex	568	urban and suburban outpatients [Cairo, Cairo governorate]
Egypt	Omar, 2000	--	26.3% (age 2-5); males: 20.3%), females: 34.0%; higher in females than males	228	randomly selected preschool children [Ma'awa El-Sayadeen, West District, Alexandria, Alexandria governorate]
Egypt	Darwish, 2001	1994	97% (age 10-19), 100% (age 20-29), 100% (age 30-39), 100% (age 40-49), 96% (age 50+)	194	randomly-sampled suburban residents [Kalama, Qalyub district, Qualyabia governorate]
Egypt	Darwish, 1996	--	100% (age 1-3), 100% (age 4-9), 100% (age 10-19), 100% (age 20-39), 100% (age 40-67)	155	non-randomly-sampled healthy suburban residents [Kalama, Qalyub district, Qualyabia governorate]

Egypt	Kamel, 1995	1992	92.7% (age 0-4), 97.8% (age 5-9), 97.9% (age 10-14), 97.5% (age 15-19), 96.6% (age 20-24), 97.9% (age 25-29), 95.5% (age 30-34), 100% (age 35-39), 93.3% (age 40-44), 100% (age 45-49), 97.6% (age 50-54), 93.3% (age 55-59), 100% (age 60-64), 100% (age 65-69), 100% (age 70-95); males: 91.9%, 97.8%, 99.1%, 97.3% , 97.4%, 100%, 94.1%, 100%, 94.1%, 100%, 93.8%, 87.5%, 100%, 100%, 100%; females: 93.6%, 97.8%, 96.5%, 97.6%, 96.0%, 96.5%, 96.9%, 100%, 92.9%, 100%, 100%, 100%, 100%, 100%, 100%,	1259	rural residents [Saada, Kafr El Sheikh governorate]
Iran	Ataei, 2008	2006	8.3% (age 6+); no differences by sex	816	population-based sample of urban and rural residents [Isfahan Province]
Iran	Nassrolahei, 2004	--	higher in females than males	374	healthy outpatients [Sari city, Hamid Abad, Soorak, Asram, and Zoghal Chall Counties in Mazandaran Province]
Iran	Mehr, 2004	2002	21.1% (age 0.5-5), 21.0% (age 5-10), 25.9% (age 10-15); males: 18.8%, 19.7%, 31.3%; females: 24.0%, 23.4%, 18.8%; no differences by sex	1018	outpatients [Tehran, Tehran Province]
Iran	Farzadegan, 1980	--	70% (age 0-9), 91% (age 10-19), 93% (age 20-29), 97% (age 30-39), 98% (age 40-49), 99% (age 50+); no differences by sex	619	volunteer blood donors and healthy family members [Tehran, Tehran Province]

Iraq	Chironna, 2003	2000	61.2% (age 0-10), 96.4% (age 11-20), 99.7% (age 21-30), 100% (age 31+); no differences by sex	605	Kurdish refugees from Iraq living in Puglia, Italy
Jordan	Toukan, 1988	--	(estimated from graph) 18% (age 1), 40% (age 2), 70% (age 3), 90% (age 4), 100% (age 5), 98% (age 5-9), 100% (age 10-14), 100% (age 15-19), 100% (age 20-40), 100% (age 41+); no differences by sex	1115	asymptomatic rural and urban residents
Kuwait	Alkhalidi, 2009	2003-2004	24.2% (age 18-27), 50.7% (age 28-40), 56.5% (age 41-60)	2851	healthy outpatients applying for civilian or military jobs [countrywide]
Lebanon	Bizri, 2006	1999-2000	71.3%% (age 14-16), 73.2% (age 17-18); males: 73.7%, females: 69.8%; no differences by sex	902	randomly selected school children from randomly selected secondary schools [countrywide]
Lebanon	Sacy, 2005	1999-2000	10.5% (age 1-5), 27.7% (age 6-10), 57.4% (age 11-15), 70.1% (age 16-20), 78.1% (age 21-30); no differences by sex	606	healthy outpatients [Beirut; Tripoli, North Governorate; Saida, South Governorate]
Lebanon	Shamma'a, 1982	--	100% (age 1-120 days), 55.6% (age 5-11 months), 40% (age 1-5), 85% (age 6-12), 97.7% (adults); no differences by sex	772	pregnant women, blood donors, pediatric inpatients without liver disease, and healthy hospital staff [Beirut]
Morocco	Nejmi, 1984	--	97.7% (age 18-43)	288	army recruits [nationwide]
Occupied Palestinian Territory	Yassin, 2001	--	87.8% (age 6), 97.4% (age 14); males: 94.5%, females: 92.9%; no differences by sex	396	randomly sampled school children [throughout the Gaza Strip]
Saudi Arabia	Al Faleh, 2008	2007-2008	18.6% (age 16-18); no differences by sex	1357	high school (grade 10-12) students [Madina (Al Madinah), Al-Qaseem (Al Qasim), and Aseer (Asir) Provinces]

Saudi Arabia	Almuneef, 2006 (ICHE)	2001-2005	56% (age 20-29), 81% (age 30-39), 87% (age 40-49), 86% (age 50-69); males: 76%, females: 60%; higher rate in males than females	4006	newly hired healthcare workers [Riyadh, Riyadh Province]
Saudi Arabia	Jaber, 2006	2004	14.8% (age 4-6), 38.1% (age 7-11), 28.6% (age 12-14)	527	healthy urban children from randomly selected schools [Jeddah, Makkah Province] (Participating children were asked to indicate if they had been vaccinated for HAV; although about half said they had been vaccinated, the seroprevalence rate for "vaccinees" and "non-vaccinees" was not different, so the accuracy of child recall is highly questionable. Thus, grouped results are presented here.)
Saudi Arabia	Almuneef, 2006 (Vaccine)	2005	7.1% (age 4-7), 14.5% (age 8-11), 30.6% (age 12-15), 52.0% (age 16-18); males: 28.2%, females: 29.5%; no differences by sex	2399	school children randomly selected from those attending National Guard schools [nationwide]
Saudi Arabia	Fathalla, 2000	1987-1999	3% (age 0-5), 62% (age 6-7), 71% (age 8-9), 83% (age 10-11), 93% (age 12-17), 93% (age 18+)	11,674	healthy child outpatients, healthy adult blood donors, healthy pregnant women [Damman, Eastern Province]
Saudi Arabia	Memish, 2001	1997-1998	93.1% (age 15-19), 96.4% (age 20-24), 97.5% (age 25-29), 98.8% (age 30-34), 100% (age 35-39), 100% (age 40+)	443	blood donors at a military hospital

Saudi Arabia	Khalil, 1998	1995-1996	12.5% (age 0.5-2), 14.7% (age 3-4), 20.3% (age 5-6), 40.4% (age 7-8), 32.0% (age 9-10), 44.3% (age 11-12), 48.6% (age 13-15); no differences by sex	592	urban pediatric outpatients and inpatients and their healthy siblings [Riyadh, Riyadh Province]
Saudi Arabia	Al Rashed, 1997	1989-1990	52.4% (age 1-10); Central Province: Riyadh 39.0%, Qassim 62.7%, Hail 56.0%; Eastern Province: Al Hafouf / Dammam 38.4%; Northwestern Province: Qarayat 64.7%, Tabouk 76.9%, Madina 59.7%; Southwestern Province: Makkah 55.0%, Jeddah 51.1%, Taif 19.0%; Southern Province: Asir 44.4%, Al-Baha 43.2%, Gizan 81.7%, Najran 79.1%; males: 51.3%, females: 53.5%; no differences by sex	4375	population-based sample [nationwide]
Saudi Arabia	Arif, 1996	--	Riyadh: 0.0% (age 1-3), 6.0% (age 4-6), 33.7% (age 7-10), 51.7% (age 11-12), 63.5% (age 13-20), 78.3% (age 21-30), 82.1% (age 31-40), 80.8% (age 41-50), 78.8% (age 51+); Gizan: 0.0%, 9.0%, 44.4%, 68.0%, 78.7%, 91.0%, 94.0%, 95.0%, 93.0%	1418	urban and rural residents [Riyadh, Riyadh Province; Gizan (Jizan), Jizan Province]
Saudi Arabia	El-Hazmi, 1989	--	92.2% (age 1-9), 95.4% (age 10-20), 97.7% (age 21-30), 96.7% (age 31-40), 96.7% (age 41+); males: 92.4%, 96.1%, 98.2%, 96.1%, 96.3%; females: 92.0%, 93.2%, 96.6%, 97.4%, 98.1%; no differences by sex	2582	Blood donors, school children, and outpatients with minor illnesses [Najran and Jaizan in South-Western Province; Eastern Province, North-Western Province; Central Province]

Saudi Arabia	Ashraf, 1986	1984-1985	100% (newborn), 66% (age <6 months), 60% (age 0.5-2), 83% (age 3-5), 98% (age 6-12), 100% (age 13-59), 100% (age 60+)	395	Voluntary blood donors and outpatients with minor illnesses [Gizan (Jizan) Province]
Saudi Arabia	Ramia, 1986	--	67.9% (age <1), 38.6% (age 1-4), 61.3% (age 5-9), 81.5% (age 10-15), 83.5% (age 16-19), 91.0% (age 20-29), 93.5% (age 30-39), 95.0% (age 40+); no differences by sex	1015	medical students, blood donors, hospital employees, and pediatric inpatients without liver disease [Riyadh, Central (now Riyadh) Province]
Saudi Arabia	Talukder, 1983	--	92.9% (all)	184	military members and their dependents attending a military hospital [Riyadh, Riyadh Province]
Syria	Antaki, 2000	--	50% (age 1-5), 81% (age 6-10), 95% (age 11-15), 94% (age 16-20), 97% (age 21-30), 98% (age 31-40), 100% (age 41-50)	849	volunteers without evidence of acute liver disease
Tunisia	Rezig, 2008	--	84.0% (age 5-9), 90.5% (age 10-15), 91.7% (age 16-25); no differences by sex	3357	apparently healthy school children and university students
Tunisia	Letaief, 2005	2002	44.2% (age 5-9), 58.9% (age 10-15), 83.0% (age 16-23); males: 57.7%, females: 62.2%; higher in females than males	2400	representative sample of private and public school children [Sousse Governorate]
Turkey	Ceyhan, 2008	2005-2006	Southeastern Anatolia: >80% (age 5-9), >90% (age 14+); Marmara region: 44% (age 5-9), <80% (age <25); Agean region: 36% (age 5-9), <80% (age <25); Central Anatolia: 34% (age 5-9), >72% (age 40-60), <80% (<60)	1773	28 randomly selected health centers in 5 different geographic regions [Aegean, Central Anatolia, Eastern Anatolia, Marmara, and Southeastern Anatolia Regions]

Turkey	Coksun, 2008	1998-2007	1998-2002: 42%; 2003-2007: 54%; no differences by sex	2418	military hospital patients without icterus or a history of HAV vaccination [Eskişehir, Eskişehir Province, Central Anatolia Region]
Turkey	Kaya, 2008	2003	28.8% (age 6 months-5 years), 79.0% (age 6-12), 76.8% (age 13-17); no differences by sex	589	random sample of children [Düzce, Düzce Province, Black Sea Region]
Turkey	Kaya, 2007	2005	35.5% (age 6-23 months), 19.2% (age 2-5), 74.3% (age 6-10), 83.0% (age 11-14), 92.8% (age 15-18); no differences by sex	1142	urban children [Kahramanmaraş; Kahramanmaraş Province, Mediterranean Region]
Turkey	Soysal, 2007	2003	18.1% (age 1-5), 53.2% (age 6-10), 66.9% (age 11-15)	1017	healthy school children and outpatients (baseline testing for a vaccine trial) [Istanbul, Istanbul Province, Marmara Region]
Turkey	Egemen, 2006	--	33.3% (age 1-4), 46.4% (age 5-9), 45.0% (age 10-14), 79.2% (age 15-18); males: 55.8%, females: 48.1%; no differences by sex	102	population-based sample of asymptomatic rural and urban children [İzmir, İzmir Province, Aegean Region]
Turkey	Vancelik, 2006	1998	76.9% (age <1), 66.0% (age 1-4), 77.0% (age 5-9), 93.3% (age 10-14) 90.0% (age 15-19), 87.5% (age 20-24), 87.9% (age 25-29); males: 83.4%, females: 85.0%; no differences by sex	392	population-based sample [Erzurum Province, East Anatolia Region]
Turkey	Derya, 2005	1999-2002	93.9% (newborn), 90.5% (age 3 months), 84.4% (age 6 months), 62.6% (age 9 months), 36.1% (age 12 months), 13.6% (age 15 months), 6.1% (age 18 months), 0.7%	147	prospective study of babies delivered at an urban hospital [Adana, Adana Province, Mediterranean Region]

			(age 21 months), 0.0% (age 24 months)		
Turkey	Oncu, 2005	2003-2004	64.0% (age 17-27); males: 65.8%, females 61.4%; no differences by sex	247	medical students [Aydin city, Aydin Province, Aegean Region]
Turkey	Tosun, 2004	2000-2001	47.8% (age 6-23 months), 23.7% (age 2-6), 43.4% (age 7-10), 52.4% (age 11-14), 76.6% (age 15-17)	1395	healthy outpatients [Manisa, Manisa Province, Aegean Region]
Turkey	Sencan, 2004	--	Düzce: 41.8% (age 2-6), 46.7% (age 7-15); Golyaka: 63.9% (age 2-6), 71.9% (age 7-15)	476	random sample of displaced children living in camps following an earthquake [Düzce and Golyaka, Düzce province, Black Sea Region]
Turkey	Erdoğan, 2004	--	0.0% (age 7-23 months) 4.4% (age 2-5), 25.0% (age 6-10), 37.3% (age 11-14), 43.2% (age 15-19)	645	population-based sample [central settlement of Edirne, Edirne Province, Marmara Region]
Turkey	Atabek, 2004	2001-2002	45.7% (age 1-6), 64.3% (age 7-12), 93.5% (age 13-18); rural: 67.8% (age 1-6), 91.4% (age 7-12), 97.2% (age 13-18); urban: 25.7% (age 1-6), 39.4% (age 7-12), 90.8% (age 13-18); no differences by sex	210	healthy outpatients [Konya, Konya province, Central Anatolia Region]
Turkey	Tosun, 2003	--	25% (age 2-6), 68% (age 7-11), 81% (age 12-16); males: 21%, 70%, 77%; females: 27%, 66%, 85%; no differences by sex	90	random sample of healthy outpatients [Manisa, Manisa Province, Aegean Region]
Turkey	Chironna, 2003	2000	58.3% (age 0-10), 91.9% (age 11-20), 98.7% (age 21-30), 100% (age 31+); no differences by sex	344	Kurdish refugees from Turkey living in Puglia, Italy
Turkey	Cesur, 2002	2000-2001	72.7% (age 15-30), 93.4% (age 30-45), 94.2% (age 45-60), 85.1% (age 61-75)	1046	outpatients without acute hepatitis [Ankara, Ankara Province, Central Anatolia Region]

Turkey	Yapicioglu, 2002	1998	10.6% (age 2-4), 28.8% (age 2-5), 49.8% (age 6-11), 68.0% (age 12-16.5)	711	population-based sample [Adana, Adana Province, Mediterranean Region]
Turkey	Kanra, 2002	1998	70.2% (age <1), 42.7% (age 1-4), 57.0% (age 5-9), 70.6% (age 10-14), 82.5% (age 15-19), 90.9% (age 20-24), 91.1% (age 25-29); males: 69.2%, females: 73.1%; no differences by sex	4462	[İstanbul, Ankara, İzmir, Adana, Diyarbakir, Samsun, Srzurum, Trabzon, and Edirne Provinces]
Turkey	Ungan, 2002 (Eur J Gast Hep)	1998	70.4% (age 20-24), 74.3% (age 25-29), 74.9% (age 30-35)	1000	university students and staff and their family members [Ankara, Ankara Province, Central Anatolia Region]
Turkey	Ungan, 2002 (J Trop Ped)	2000	11.4% (age 4-6)	114	preschool and day care children [Ankara, Ankara Province, Central Anatolia Region]
Turkey	Colak, 2002	1996-1997	19.9% (age 1-5), 43.9% (age 6-11)	338	preschool and school children [Ahatli, Antalya Province, Mediterranean Region]
Turkey	Sidal, 2001	1997-1998	12.2% (age 0.5-2), 18.6% (age 2-4), 26.7% (age 5-9), 49.6% (age 10-15)	909	urban children [Istanbul, Istanbul Province, Marmara Region]
Turkey	Ersoy, 1998	--	7.8% (age 0.5-4), 39% (age 5-8), 68% (age 13-16)	227	healthy outpatients [Alsancak, İzmir Province, Aegean Region]
Turkey	Baki, 1993	1991	13.4% (age 0.5-3), 32.1% (age 4-7), 63.4% (age 8-12), 88.6% (age 13-18); males: 14.2%, 28.9%, 58.6%, 85.3%; females: 12.1%, 34.6%, 68.0%, 92.0%; no differences by sex	363	outpatient children without chronic or liver disease [Trabzon, Trabzon Province, Black Sea Region]

Turkey	Doǵanci, 1992	--	80.1% (age 15-52)	116	healthy Turkish adults just arriving in Belgium
United Arab Emirates	Sharar, 2008	2004-2005	10.2% (age 1-5), 31.5% (age 6-12)	367	inpatients and outpatients without liver disease [Abu Dhabi]
Yemen	Scott, 1990	1988	99.7% (age 3-95)	879	urban patients without evidence of acute liver disease [Sanaa; Hajja; Hodeidah; Taiz]

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HIGH INCOME NORTH AMERICA

(Canada, United States of America)

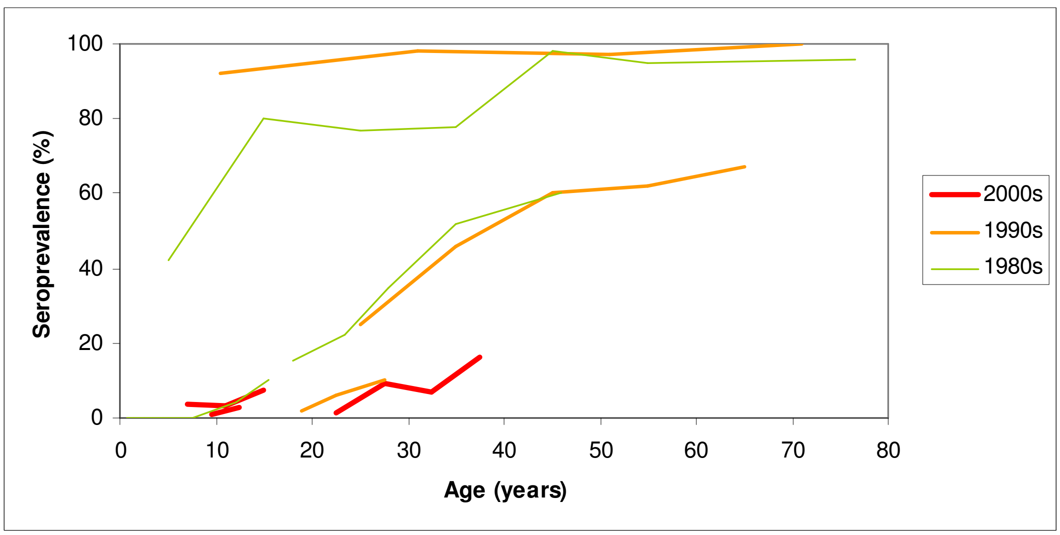
REGIONAL SUMMARY

This region has a low endemicity. The two countries – Canada and the United States of America – are discussed below.

CANADA

Studies conducted in the early 1980s found that very few young children, only about 10% to 15% of adolescents, and about two-thirds of older adults had immunity to HAV [Crewe, 1983; Embil, 1989; McFarlane, 1980]. Studies from the mid-1990s and early 2000s found that only about 5% to 10% of adolescents had anti-HAV [Duval, 2005; Levy, 2001; Ochnio, 2007; Ochnio, 2005; Ochnio, 2001; Ochnio, 1997; Roy, 2002]. First Nations (indigenous) communities have an elevated prevalence rate, as noted by the prominently higher lines of Figure 72 [Minuk, 2003; Minuk, 1982 (CMAJ); Minuk, 1982 (JMV)]. In the 1990s, the reported incidence rate was 4 per 100,000 [ElSaadany, 2002], which means that Canada has a low endemicity for hepatitis A virus [Pham, 2005].

Figure 72. Plots of Age-Seroprevalence Data from Studies from Canada.

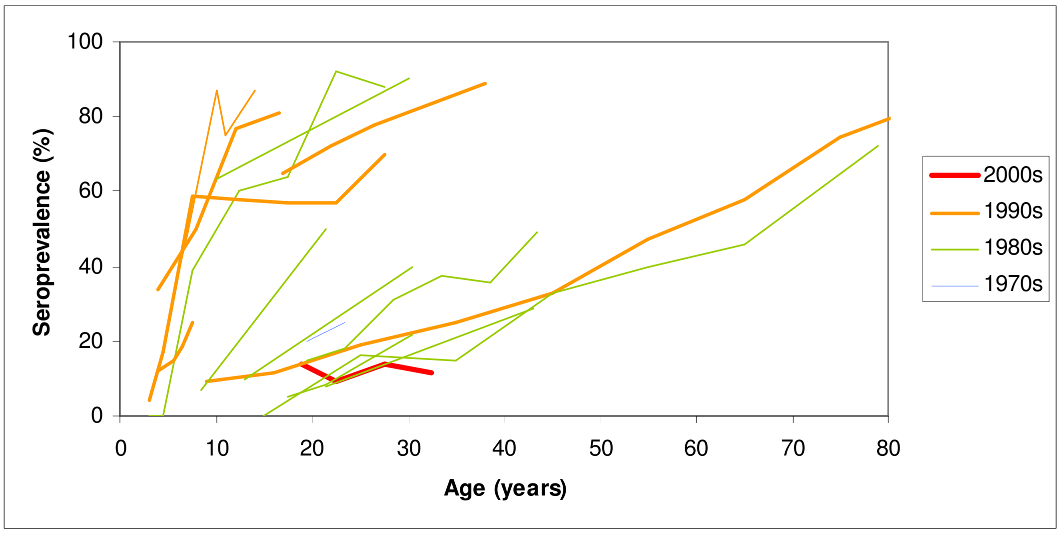


UNITED STATES OF AMERICA

Seroprevalence studies conducted in the United States in the 1970s found that about one-quarter of teenagers and half of 30- to 40-year olds had anti-HAV [Cherubin, 1978; James, 1981; Maynard, 1976; Stevens, 1977; Szmuness, 1976; Villarejos, 1976]. Studies from the 1980s and 1990s usually found that only about 10% of 20-year-olds had anti-HAV [Ansdell, 1996; Bell, 2005; Hawkins, 1992; Hirota, 2002; Hooper, 1988; Hyams, 1992; Kruszon-Moran, 2005; Matricardi, 2002; McQuillan, 2004; Pepe, 1986; Thomas, 1997; Weldon, 2000]. The reported incidence rate was about 10 per 100,000 in the 1980s [Koff, 1995; Shapiro, 1992]. The infection rate in children dropped significantly after the introduction of the hepatitis A vaccine to higher-risk areas in the late 1990s [Averhoff, 2001;

ACIP, 1999; Bell, 1998], and regional differences in incidence have largely disappeared [Jenson, 2004]. By the 2000s, only about 10% of both 20-year-olds and 30-year-olds had immunity [Nevin, 2007]. In 2004, the reported annual incidence rate in the United States was 2 per 100,000 [Wasley, 2006], which is estimated to be about 10% of the total number of cases [Armstrong, 2002]. All of the higher-seroprevalence curves on Figure 73 are from special high-risk populations, including indigenous communities [Bulkow, 1993; Peach, 2002; Shaw, 1990; Siebke, 1986; Williams, 1986], communities on the U.S.-Mexico border [Leach, 1999; Redlinger, 1998; Redlinger, 1996], and migrant populations [Dentinger, 2001]. The overall seroprevalence rate is low.

Figure 73. Plots of Age-Seroprevalence Data from Studies from the United States of America.



SUMMARY AGE-PREVALENCE ESTIMATES

Table 37. Summary Prevalence Estimates by Age in High Income North America.

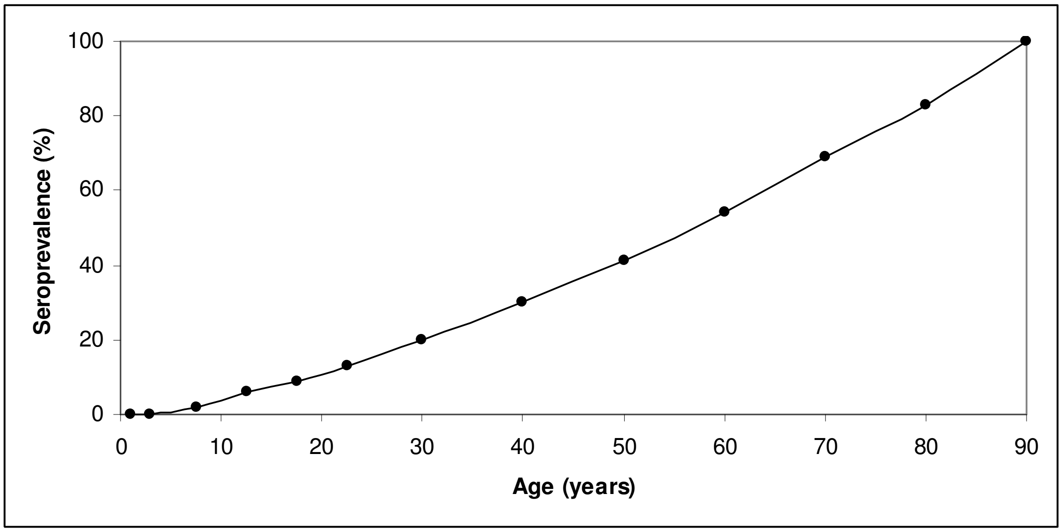
	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	0	2	6	9	13
% at risk	--	--	100	98	94	91	87

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	20	30	41	54	69	83	100
% at risk	80	70	59	46	31	17	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

These estimates are based only on data from studies published in or after 1990.

Figure 74. Plot of Estimated Seroprevalence by Age in High Income North America.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

This plot includes only data from the 1990s and 2000s that were not conducted in high-risk populations (such as some indigenous communities and among migrant populations).

Figure 75. Plots of Age-Seroprevalence Data from Studies from High Income North America.

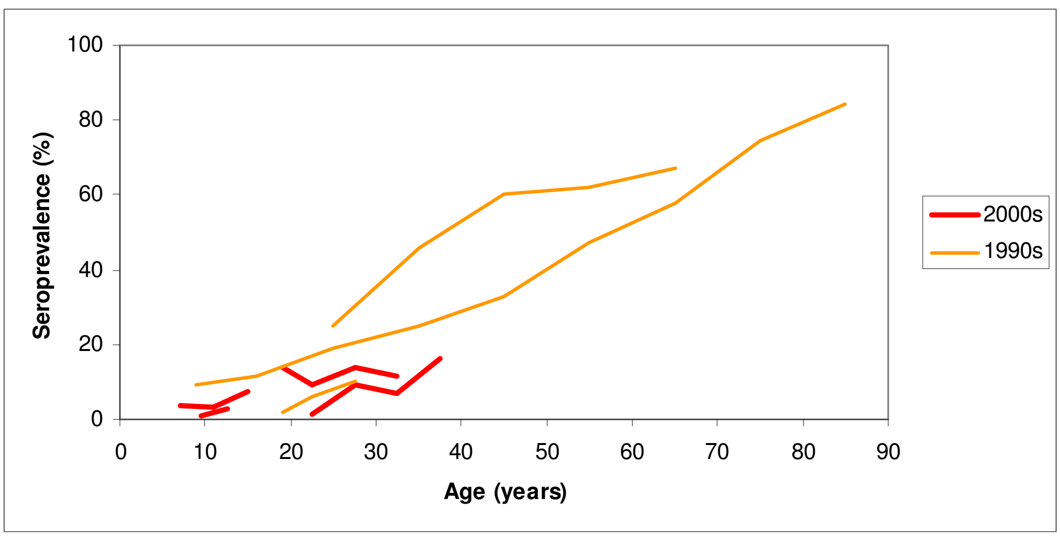


TABLE OF INCLUDED PREVALENCE STUDIES

Table 38. Information about Included Studies from High Income North America.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Canada	Ochnio, 2005	2000	3.9% (age 6-7), 3.1% (age 10-11), 7.2% (age 14-15)	1287	unvaccinated rural school students [British Columbia]
Canada	Ochnio, 2007	--	1.2% (age 20-24), 9.4% (age 25-29), 6.8% (age 30-34), 16.4% (age 35-39)	409	unvaccinated Canadian-born residents [British Columbia]
Canada	Duval, 2005	2003	0.9% (age 8-10), 2.9% (age 11-13); higher rate in females than males	1003	population-based sample of unvaccinated children [nationwide]
Canada	Minuk, 2003	1999	92% (age 0-20), 98% (age 21-40), 97% (age 41-60), 100% (age 61+); no differences by sex	315	First Nations community [central Manitoba]
Canada	Roy, 2002	1995-1996	4.7% (age 14-25); no differences by sex	427	urban street youth [Montreal, Quebec]
Canada	Ochnio, 2001	1998	6.3% (young adults)	494	urban street youth [Vancouver, British Columbia]
Canada	Levy, 2001	1997	2% (age 18-19), 6% (age 20-24), 10% (age 25-29), 15% (age 30+)	698	Canadian-borne university students [Toronto, Ontario]
Canada	Ochnio, 1997	1995-1996	7.1% (age 11-12); males: 2.9%, females: 10.8%; higher rate in females than males	224	school children in grade six [Vancouver, British Columbia]
Canada	Kocuipchyk, 1995	1991-1992	25% (age 20-29), 46% (age 30-39), 60% (age 40-49), 62% (age 50-59), 67% (age 60+); males: 47%, females: 45%	506	outpatients attending a travel clinic before international travel [Edmonton, Alberta]
Canada	Embil, 1989	1981-1983	15.1% (age 15-20), 22.3% (age 21-25), 34.8% (age 26-30), 51.9% (age 30-39), 60.4% (age 40-53)	3853	military personnel and recruits [nationwide]
Canada	Crewe, 1983	1981-1982	0% (age 0.5-1), 0% (age 1), 0% (age 2), 0% (age 3), 0% (age 4), 0% (age 5-9), 4% (age 10-13), 10% (age 14-16); no differences by sex	304	outpatient children [Nova Scotia]

Canada	Minuk, 1982 (Can Med Assoc J) / Minuk, 1982 (J Med Virol)	1980	42% (age 0-9), 80% (age 10-19), 77% (age 20-29), 78% (age 30-39), 98% (age 40-49), 95% (age 50-59), 97% (age 60-86)	660	Inuit community [Baker Lake, Northwest Territories]
Canada	McFarlane, 1980	--	13.0% (age 16-26), 69.1% (age 51+)	727	volunteer blood donors and nursing students [Halifax, Nova Scotia]
United States	Nevin, 2007	2004	14.1% (age 18-19), 9.3% (age 20-24), 14.0% (age 25-29), 11.8% (age 30-34); males: 12.3%, females: 10.8%; no differences by sex	2026	military recruits [nationwide]
United States	Bell, 2005 / Kruszon-Moran, 2005 / McQuillan, 2004 / Matricardi, 2002	1988-1994	9.4% (age 6-11), 11.6% (age 12-19), 19.2% (age 20-29), 24.9% (age 30-39), 33.0% (age 40-49), 47.3% (age 50-59), 57.8% (age 60-69), 74.6% (age 70+), 84.4% (age 80+); males: 30.3%, females: 31.0%; no differences by sex	21260	population-based sample [nationwide]
United States	Hirota, 2002	1999	13.7% (age 18-33); males: 13.8%, females: 13.3%; no differences by sex	1332	military recruits [nationwide]
United States	Peach, 2002	1983-1987; 1993-1994	1983-1987: 0% (age 2-3), 0% (age 4), 39% (age 5-9), 60% (age 10-14), 64% (age 15-19), 92% (age 20-24), 88% (age 25-29); 1991-1994: 4% (age 2-3), 17% (age 4), 59% (age 5-9), 58% (age 10-14), 57% (age 15-19), 57% (age 20-24), 70% (age 25-29)	85; 604	Alaska natives [Bristol Bay, Alaska] (note: epidemics in 1976-1977 and 1989-1990)
United States	Fishbain, 2002	1997-1998	46.7% (age <30), 41.2% (age 30-60), 45.2% (age 61+)	115	army medical center outpatients [Honolulu, Hawaii]
United States	Alagappan, 2001	1998-1999	67% (age 20-66); males: 58%, females: 54%; no differences by sex	119	hospital kitchen workers [New Hyde Park, New York]

United States	Dentinger, 2001	1998	34% (age 2-5), 50% (age 6-9), 77% (age 10-13), 81% (age 14-18); males: 49%, females: 53%; no differences by sex	244	migrant children [Okeechobee County, Florida]
United States	Weldon, 2000	1996-1997	27.5% (adults)	468	water and sanitation workers [Texas]
United States	Chien, 1999	1996-1997	79.9% (age 61+)	199	nursing home residents [St. Louis, Missouri]
United States	Leach, 1999	1989; 1996-1997	1989: 33% (age 4-17); 1996-1997: 20% (age 0.5-13)	194; 285	children living on the U.S.-Mexico border [Hidalgo County, Texas]
United States	Redlinger, 1998	1995	65% (age 14-19), 72% (age 20-23), 78% (age 24-28), 89% (age 29-46)	557	healthy pregnant women, mostly Latinas [El Paso, Texas]
United States	Redlinger, 1997	1996	12.0% (age 3-4), 14.9% (age 5), 18.7% (age 6), 24.8% (age 7)	523	school children living on the U.S.-Mexico border [San Elizario, Texas]
United States	Thomas, 1997	--	16.0% (adults)	476	volunteer blood donors [New York, New York; Sacramento, California]
United States	Ansdell, 1996	1987-1990	0.0% (age 10-19), 16% (age 20-29), 15% (age 30-39), 33% (age 40-49), 40% (age 50-59), 46% (age 60-69), 71.7% (age 70-87); no differences by sex	476	outpatients attending a travel clinic before travel [Honolulu, Hawaii]
United States	Bulkow, 1993	1980-1986	7% (age 5-11), 50% (age 16-26), 85% (age 56+); no differences by sex	4030	population-based sample of Alaskan Natives [Alaska]
United States	Hyams, 1992	1989	4.9% (age 17), 8.2% (age 18-24), 21.8% (age 25-35)	1538	Navy and Marine recruits [nationwide]
United States	Hawkins, 1992	1989-1990	7.8% (age 18-24), 28.7% (age 35-50)	2072	male Navy ship personnel prior to international deployment [nationwide]

United States	Levine, 1991	1989	0.0% (adults)	264	trauma patients who were not clinically icteric [Chicago, Illinois]
United States	Shaw, 1990	1985	63.4% (age 0-19), 90.2% (age 20+)	467	Sioux Indians [Pine Ridge and Rosebud Reservations, South Dakota] (note: outbreaks in 1983-1984 and in 1985-1986)
United States	Hooper, 1988	--	14.9% (age 18-20), 18.0% (age 21-25), 30.8% (age 26-30), 37.7% (age 31-35), 35.6% (age 36-40), 49.2% (age 41+); higher rate in males than females	2592	Navy and Marines forces during international deployment [nationwide]
United States	Pepe, 1986	--	16.0% (age 22-57)	344	emergency medical service personnel [Houston, Texas]
United States	Williams, 1986	1983-1984	37.2% (age 5-6), 48.6% (age 6-7), 87.1% (age 9-10), 75.0% (age 10-11), 87.2% (age 13-14)	278	Navajo boarding school children [Crownpoint, New Mexico]
United States	Siebke, 1986	1982-1983	9.9% (6-19), 39.6% (age 20-40), 69.0% (age 41+)	289	Eskimos [Akhiok, Larsen Bay, Old Harbor, and Ouzinkie villages on Kodiak Island, Alaska]
United States	James, 1981	1979	19.7% (age 18-20), 25.0% (age 21-25), 36.4% (age 26+); males: 24.7%, females: 25.5%	622	Army blood donors [nationwide]

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OCEANIA

(American Samoa, Cook Islands, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Wallis and Fortuna Islands)

REGIONAL SUMMARY

There are no recent seroprevalence studies from Oceania. A study in 1988 to 1990 of U.S. military recruits from Micronesia found a 9% seroprevalence rate [Withers, 1994] and a study of children in New Caledonia found an 8.5% seroprevalence rate [Duval, 1997]. A prospective study in Papua New Guinea that followed a rural cohort from 1963 to 1972 found that about 50% of 10-year-olds had immunity [Hawkes, 1981]. Two studies conducted between 1960 and 1975 on multiple Pacific islands – including Viti Levu (Fiji), Funafuti (Tuvalu), Niue, Rarotonga (Cook Islands), Upolu (Samoa), Ponape (Micronesia), Bougainville (Papua New Guinea), New Caledonia, Tahiti, American Samoa, and Bora Bora (French Polynesia) – also that by 10 years of age more than half of children in most populations had evidence of prior infection [Gust, 1979; Wong, 1979]. (These studies are not included in the data extraction table because they were published before 1980.) Although it is not possible to make accurate estimates of current seroprevalence from the data, it is likely that most adults are immune and the average age at infection is in middle childhood. Support for this estimate comes from New Caledonia, which experienced an outbreak in 2005-2006 after noting decreasing incidence rates for two decades [Berlioz-Arthaud, 2008].

SUMMARY AGE-PREVALENCE ESTIMATES

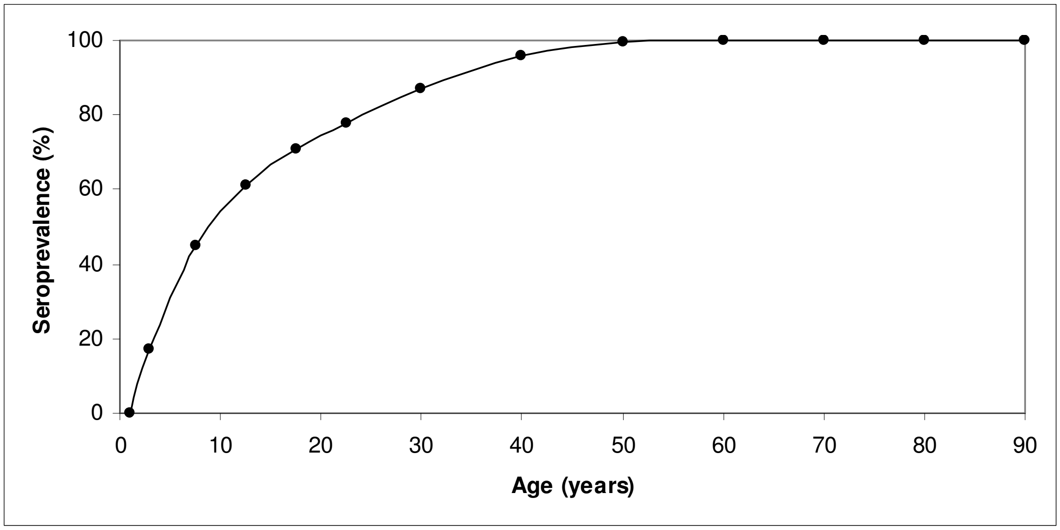
Table 39. Summary Prevalence Estimates by Age in Oceania.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	17	45	61	71	78
% at risk	--	--	83	55	39	29	22

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	87	96	100	100	100	100	100
% at risk	13	4	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 76. Plot of Estimated Seroprevalence by Age in Oceania.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 77. Plots of Age-Seroprevalence Data from Studies from Oceania.

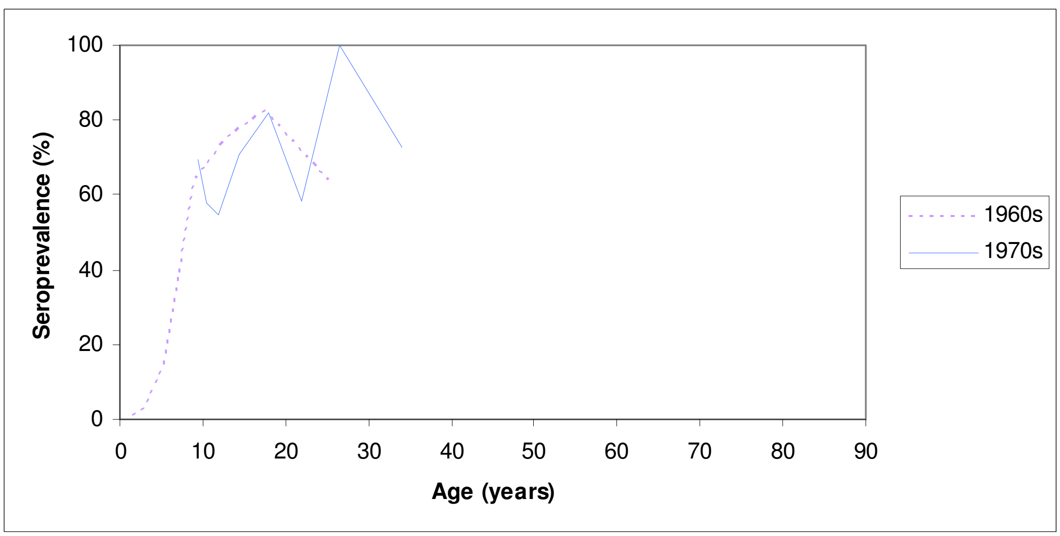


TABLE OF INCLUDED PREVALENCE STUDIES

Table 40. Information about Included Studies from Oceania.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Marshall Islands / Micronesia	Withers, 1994	1988-1990	9% (young adults)	66	military recruits
New Caledonia	Duval, 1997	--	8.5% (age 7-13)	213	baseline data from healthy children recruited for a vaccine study
Papua New Guinea	Hawkes, 1981	1963-1972	1963: 2.1% (age 3-12 months), 0.9% (age 13-23 months), 2.7% (age 2-3), 14.9% (age 4-6), 63.9% (age 7-10), 75.3% (age 11-14), 82.5% (age 15-19), 64.1% (age 20-29); males: 2.2%, 0.0%, 2.5%, 18.4%, 65.1%, 78.1%, 81.1%, NA; females: 2.1%, 1.7%, 2.8%, 11.3%, 61.1%, 50.0%, 100%, 64.1%; no differences by sex; 1972: 69.3% (age 9), 57.7% (age 10), 54.7% (age 11-12), 71.0% (age 13-15), 81.8% (age 16-19), 58.3% (age 20-23), 100% (age 24-28), 72.5% (age 29-38); no differences by sex	1207	rural residents, including school children [Sepik district and Bismarck range area]

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CENTRAL SUB-SAHARAN AFRICA

(Angola, Central African Republic, Congo,
Democratic Republic of the Congo, Equatorial Guinea, Gabon)

REGIONAL SUMMARY

Only one study from central Africa was identified, a survey conducted in a rural area of the Democratic Republic of the Congo in the early 1980s [Werner, 1985; Werner, 1984]. A very high seroprevalence rate was found, and the annual incidence rate was estimated to be about 19% in children 1 to 4 years old and 55% in children 5 to 7 years old [Werner, 1985]. There were no significant differences by sex [Werner, 1985]. No studies were identified from Angola, Central African Republic, Congo, Equatorial Guinea, or Gabon.

Although no recent studies are available from Central Africa, the most likely scenario is that at present there is a very high HAV incidence rate that allows the vast majority of children to develop immunity in early childhood and leaves very few adults susceptible to infection.

SUMMARY AGE-PREVALENCE ESTIMATES

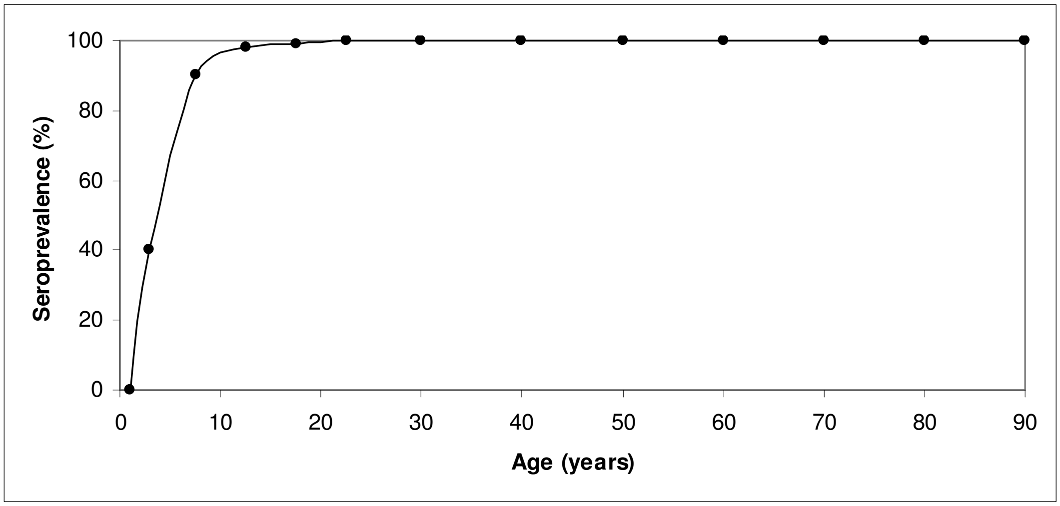
Table 41. Summary Prevalence Estimates by Age in Central sub-Saharan Africa.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	40	90	98	99	100
% at risk	--	--	60	10	2	1	0

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	100	100	100	100	100	100	100
% at risk	0	0	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 78. Plot of Estimated Seroprevalence by Age in Central sub-Saharan Africa.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 79. Plots of Age-Seroprevalence Data from Studies from Central sub-Saharan Africa.

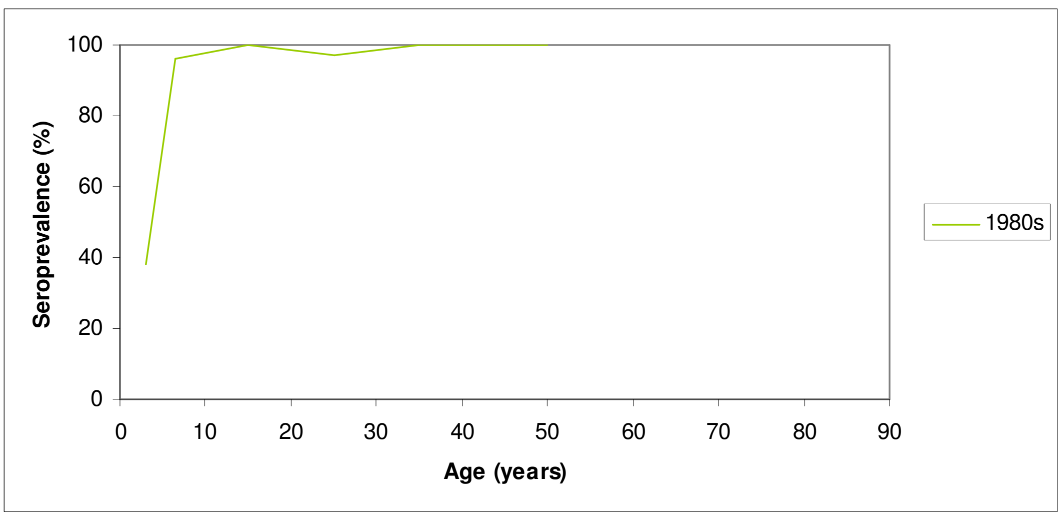


TABLE OF INCLUDED PREVALENCE STUDIES

Table 42. Information about Included Studies from Central sub-Saharan Africa.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
DR Congo	Werner, 1985; Werner, 1984	--	38% (age 1-4), 96% (age 5-7), 100% (age 10-19), 97% (age 20-29), 100% (age 30-39), 100% (age 40+)	203	healthy persons from the rural north [Province du Nord-Ubangi (formerly Équateur Province)]

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EAST SUB-SAHARAN AFRICA

(Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, Sudan, Uganda, United Republic of Tanzania, Zambia)

REGIONAL SUMMARY

Studies of adults or the general population of East Africa generally find a very high prevalence rate. A study in Djibouti in 1987 found a prevalence of 98.5% [Fox, 1988], a study in Burundi in the early 1990s found an adult prevalence of 97.7% [Aubry, 1997], a study of adults in Tanzania in 1992 found a prevalence of 99.0% [Miller, 1998], a study in rural Madagascar in 1993 found a 96.4% prevalence [Morvan, 1994], and a study in Ethiopia in 1996 found a prevalence of 87.5% [Scrivener, 2001].

Studies of children were a bit more variable, but nearly all studies found that the vast majority of children had evidence of previous infection with HAV: studies in Ethiopia in the 1980s found that more than 90% of children had immunity by age 10 [Gebreselassie, 1983; Tsega, 1986; Tsega, 1990], studies conducted in Somalia in the 1980s found that more than 90% of children had antibodies by age 5 [Bile, 1986; Bile, 1992; Mohamud, 1992], a study of Kenyan schoolchildren in 1998-1999 found a prevalence of 63.2% [Siekmann, 2003], a study conducted in urban Madagascar in 2004 found that more than 90% of children had immunity by the early teenage years [Raharimanga, 2008], and a study of outpatients at an urban hospital in Uganda found that 100% of patients ages 10 and older had antibodies to HAV [Mayama, 1998].

Too few recent studies have been conducted in eastern Africa to identify current country-level prevalence rates and trends. No eligible studies were identified from Comoros, Eritrea, Malawi, Mozambique, Rwanda, Sudan, or Zambia. However, the existing studies suggest that this region has a very high incidence rate and a very high seroprevalence rate. Most children become infected in early childhood, and very few adults are at risk of infection.

SUMMARY AGE-PREVALENCE ESTIMATES

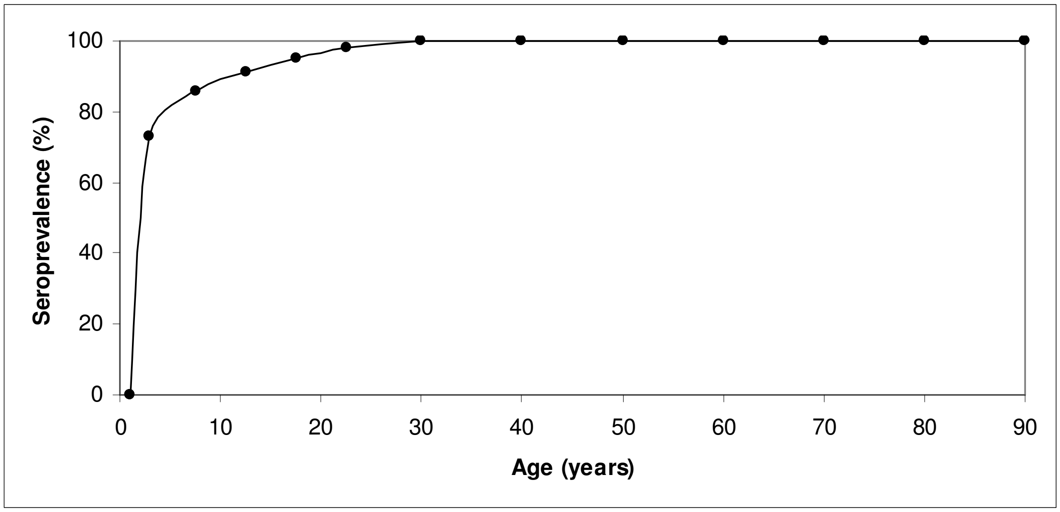
Table 43. Summary Prevalence Estimates by Age in East sub-Saharan Africa.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	73	86	91	95	98
% at risk	--	--	27	14	9	5	2

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	100	100	100	100	100	100	100
% at risk	0	0	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 80. Plot of Estimated Seroprevalence by Age in East sub-Saharan Africa.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

Figure 81. Plots of Age-Seroprevalence Data from Studies from East sub-Saharan Africa.

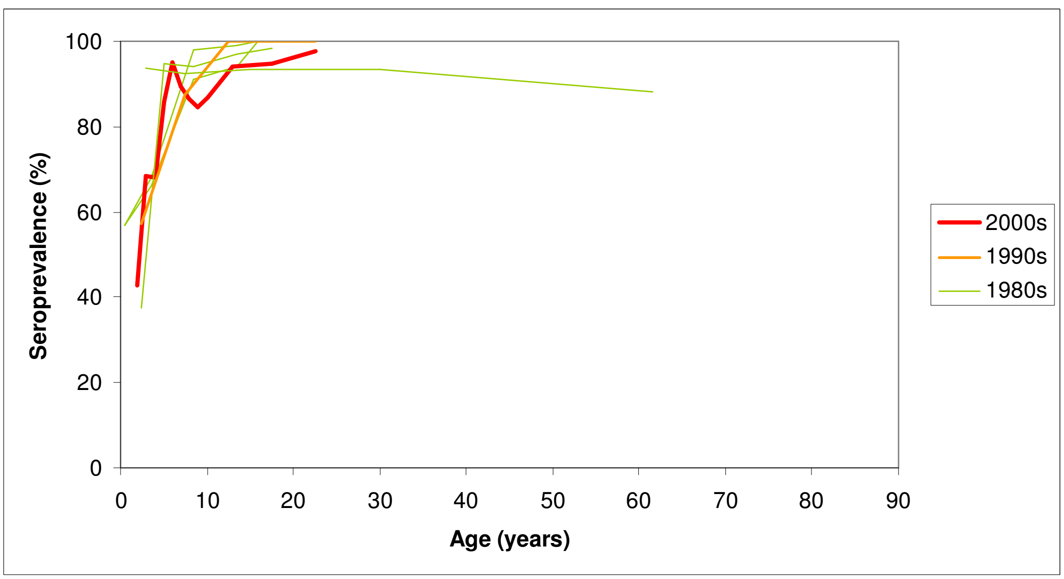


TABLE OF INCLUDED PREVALENCE STUDIES

Table 44. Information about Included Studies from East sub-Saharan Africa.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Burundi	Aubry, 1997	1992-1993	97.7% (adults)	129	outpatients without liver disease [Bujumbura, Bujumbura Mairie Province]
Djibouti	Fox, 1988	1987	98.5%	400	hospital patients and healthy controls [Djibouti city]
Eritrea	Tsega, 1986	1984	88% (all ages, mostly children)	100	outpatients [Asmara, Eritrea]
Ethiopia	Scrivener, 2001	1996	87.5% (age 16+)	560	population-based study in rural and urban communities [Jimma, Oromia region]
Ethiopia	Tsega, 1990	--	57% (age <1), 66% (age 1-5), 91% (age 6-10), 94% (age 11-15), 100% (age 16+)	959	children in urban and rural settings with a variety of socioeconomic statuses [North, South, East, West, and Central Provinces; Addis Ababa]
Ethiopia	Tsega, 1986	1984	57% (age <1), 68% (age 1-5), 98% (age 6-10), 99% (age 11-15), 100% (age 16+)	500	outpatients at sites in several provinces [Yirga Alem, Sidamo Province; Harar, Hararghe Province; Nekempte, Welega Province; Addis Ababa; Asmara, Eritrea, which is listed separately above but included in the age-specific rates reported]
Ethiopia	Gebreselassie, 1983	--	99% (age 3-60)	396	representatives from four population groups [Wollega Province; Addis Ababa; nationwide]

Kenya	Siekmann, 2003	1998-1999	63.2% (age 5-14)	200	schoolchildren [Embu District, Eastern Province]
Madagascar	Raharimanga, 2008	2004	42.9% (age 2), 68.4% (age 3), 68.2% (age 4), 85.7% (age 5), 95.0% (age 6), 89.5% (age 7), 86.4% (age 8), 84.6% (age 9), 86.8% (age 10), 94.0% (age 11-14), 94.7% (age 15-19), 97.7% (age 20-24); no differences by sex	926	population-based survey of urban residents [Antananarivo city, Antananarivo province]
Madagascar	Morvan, 1994	1993	96.4% (age 1-86)	653	population-based study in rural villages [Morarano, Miandrivazo district, Toliara Province; Belagera, Tsiroanomandidy, Antananarivo Province]
Somalia	Bile, 1992	1987	37.5% (age 1-3), 94.7% (age 4-5), 94.1% (age 6-10), 96.9% (age 11-15), 98.2% (age 16-18)	596	children living in orphanages [Mogadishu area]
Somalia	Mohamud, 1992 / Bile, 1986	--	87.7% (age 0-3 months), 51.3% (age 4-11 months), 93.7% (age 1-4 years), 92.5% (age 5-9), 93.5% (age 10-19), 93.3% (age 20-39), 88.1% (age 40-83)	593	population-based healthy rural and urban volunteers, child outpatients [Mogadishu area: Buur-Full Vlilage, Jowahar District; Mooda Moode, Bur-Hakaba District; Bajuni Islands, Kisimaio District]]
Uganda	Mayama, 1998	--	57.1% (age 0-4), 87.5% (age 5-9), 100% (age 10-14), 100% (age 15-19), 100% (age 20-24)	215	outpatients of urban hospital [Kampala city]
Tanzania	Miller, 1998	1992	99.0% (adults)	403	healthy urban adult workers [Dar es Salaam]

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SOUTH SUB-SAHARAN AFRICA

(Botswana, Lesotho, Namibia, South Africa, Swaziland, Zimbabwe)

REGIONAL SUMMARY

Studies were identified from only two countries in southern Africa. The studies from Namibia indicated that nearly all children are exposed at an early age [Joubert, 1985; Steele, 1995]. The results from South Africa are shown below. No eligible studies were identified from Botswana, Lesotho, Swaziland, or Zimbabwe, although a study of acute hepatitis patients in Zimbabwe noted a very high seropositivity rate for anti-HAV in patients with non-A viral hepatitis infections [Crocchiolo, 1984]. Although a considerable proportion of adults remain susceptible to infection well into adulthood in some of the population groups in South Africa, the majority of residents of the region appear to experience a very high incidence rate and a very high seroprevalence rate, with most children infected in early childhood and very few adults are at risk of infection.

SOUTH AFRICA

The results from South African studies varied significantly by race and suggest a very high seropositivity in black populations [Abdool Karim, 1993; Botha, 1994; Dibisceglie, 1986; Martin, 1994; Sathar, 1994; Vardas, 2002; Waner, 1997], slightly lower rates in mixed race populations [Sathar, 1994; Waner, 1997] and Asian populations [Sathar, 1994; Song, 1994; Waner, 1997], and intermediate rates in white populations [Martin, 1994; Sathar, 1994; Taylor, 1995; Waner, 1997]. Since the most recent data were collected more than ten years ago, the rates from these studies may no longer be accurate, and the differences between population groups may have narrowed or increased during the intervening years.

Figure 82. Plots of Age-Seroprevalence Data from Studies from South Africa by Population Group.

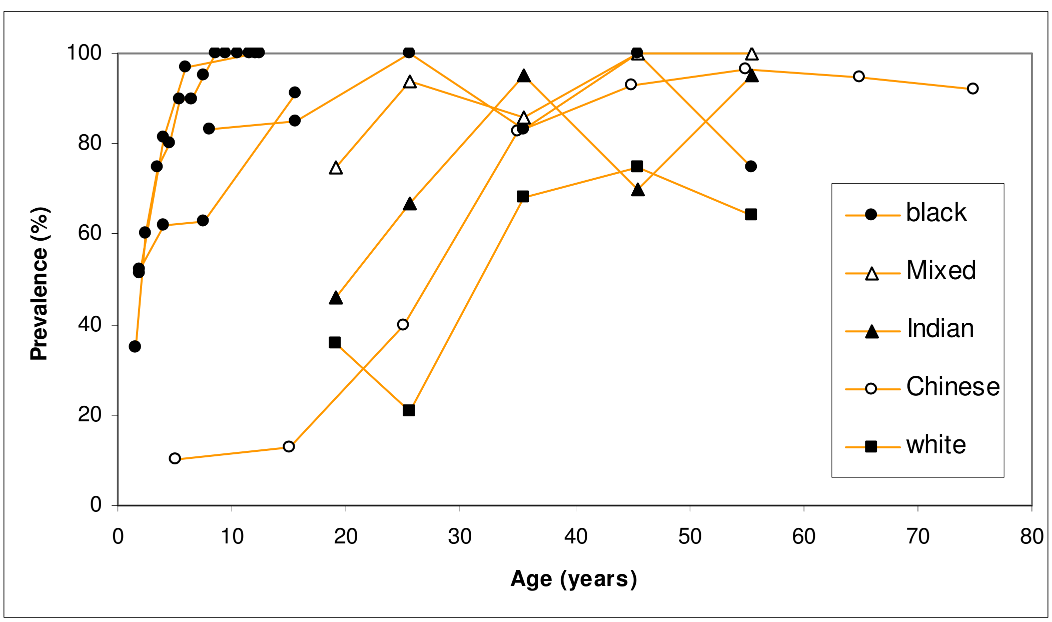
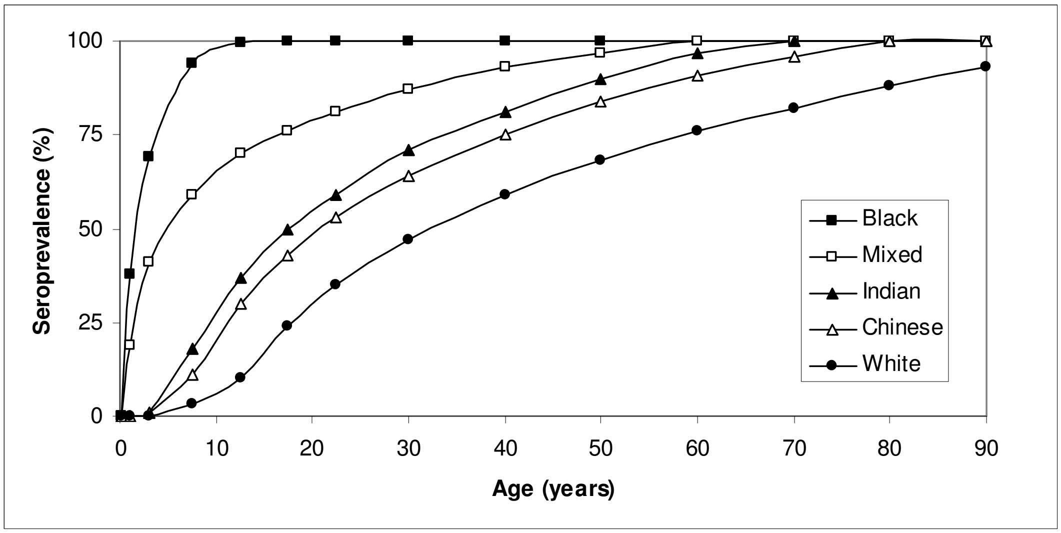


Figure 83, created by fitting logarithmic curves to the population-specific data above, shows estimated age-seroprevalence curves for various populations in South Africa and highlights the differences in seropositivity between these population groups.

Figure 83. Plot of Estimated Seroprevalence by Age and Population Group in South sub-Saharan Africa.



SUMMARY AGE-PREVALENCE ESTIMATES

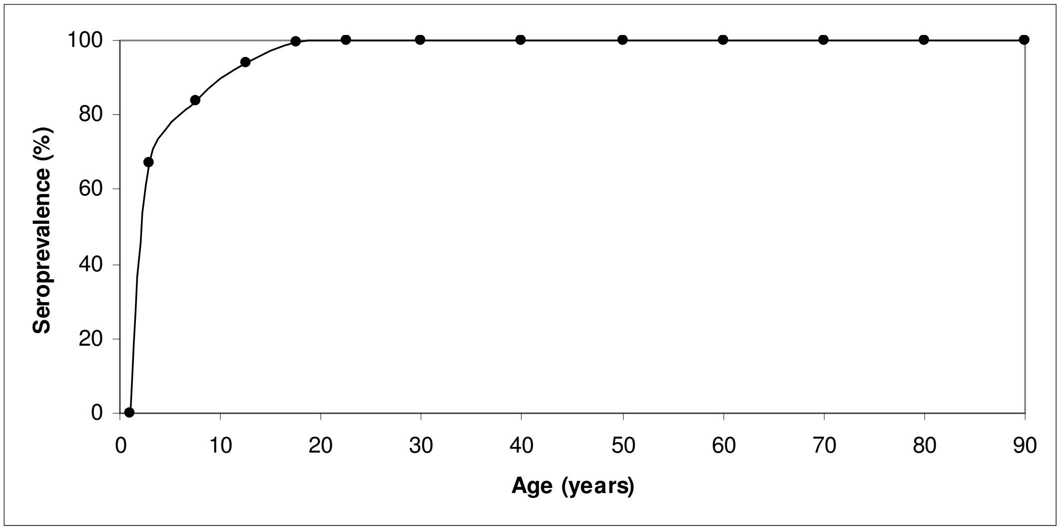
Table 45. Summary Prevalence Estimates by Age in South sub-Saharan Africa.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	67	84	94	100	100
% at risk	--	--	23	16	6	0	0

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	100	100	100	100	100	100	100
% at risk	0	0	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 84. Plot of Estimated Seroprevalence by Age in South sub-Saharan Africa.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

All of the studies plotted below are from black populations, since the vast majority of residents of southern Africa are black.

Figure 85. Plots of Age-Seroprevalence Data from Studies from South sub-Saharan Africa.

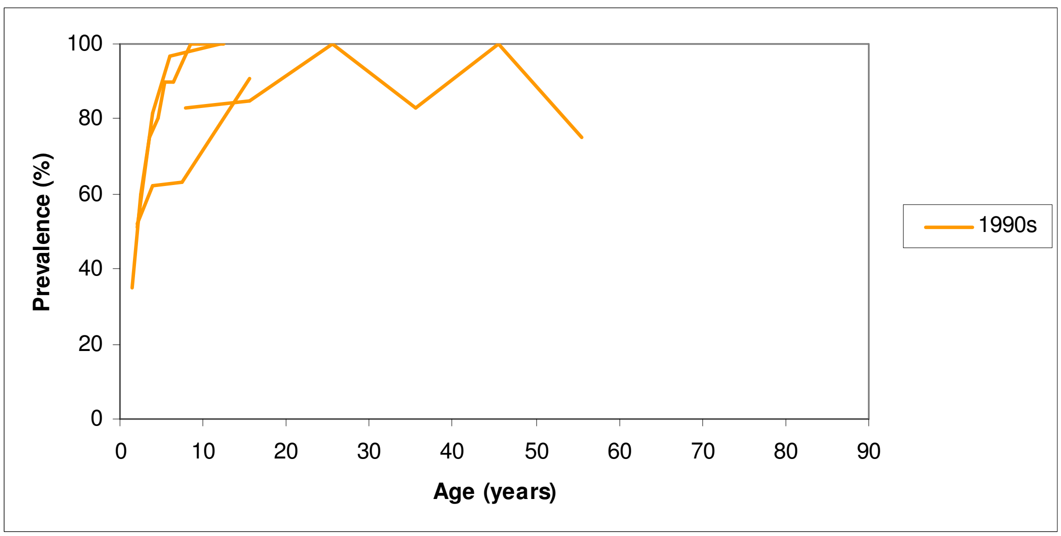


TABLE OF INCLUDED PREVALENCE STUDIES

Table 46. Information about Included Studies from South sub-Saharan Africa.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Namibia	Steele, 1995	--	100% (children), 97.1% (adults)	115	Bushmen (Barakwena) [West Caprivi region]
Namibia	Joubert, 1985	1983	100% (age 7-70)	95	volunteers from hospitals, schools, and village residents [Kavango Province]
South Africa	Vardas, 2002	1996	blacks: 96.2%; higher rates in females than males	402	urban healthcare workers (primarily black nurses) [Johannesburg, Gauteng Province]
South Africa	Waner, 1997	--	whites: 24% (age 0-40), 51% (age 40+); Indians: 68%; blacks: 88%; mixed race: 67%	301	travel clinic patients without a history of clinical hepatitis A [Johannesburg, Gauteng Province]
South Africa	Taylor, 1995	1992	canoeists: 37.2% (age 15-33), 37.3% (male), 28.6% (female); non-canoeists: 19.4% (age 18-54), 22.1% (male), 14.3% (female)	784	participants in a canoe race (mostly white and high economic status) and volunteer controls [KwaZulu-Natal Province]
South Africa	Sathar, 1994	--	hospitalized black children: 33% (age <6 months), 40% (age 6-12 months), 52% (age 1-2), 62% (age 3-4), 63% (age 5-9), 91% (age 10-19); rural blacks: 83% (age 6-10), 85% (age 11-20), 100% (age 21-30), 83% (age 31-40), 100% (age 41-50), 75% (age 51-60); white blood donors: 36% (age 17-20), 21% (age 21-30), 68% (age 31-40), 75% (age 41-50), 64% (age 51-60), 70% (age 60+); Indian blood donors: 56% (age 17-20), 67% (age 21-30), 95% (age 31-40), 70% (age 41-50), 95% (age 51-	786	hospital patients without jaundice, rural volunteers, and healthy volunteer blood donors [KwaZulu-Natal Province]

			60), 50% (age 60+); mixed race blood donors: 75% (age 17-20), 94% (age 21-30), 86% (age 31-40), 100% (age 41-50), 100% (age 51-60), 100% (age 60+); black blood donors: 92% (age 17-20), 92% (age 21-30), 92% (age 31-40), 91% (age 41-50), 79% (age 51-60)		
South Africa	Martin, 1994	1988-1991	black urban females: 100% (age 17-57); black rural females: 100%; black urban males: 98.3% (age 17-52); black rural males: 100% (age 20-72); black clinic staff and medical students: 97.8% (age 17-62); white females: 47.5% (age 14-59); white males: 58.0% (age 17-69); white laboratory staff: 27.2% (age 20-60); white medical students: 42.7% (age 18-42)	839	anonymous samples collected at STD, family planning, and antenatal clinics; samples from clinic staff [Johannesburg, Gauteng Province and Acornhoek, Mpumalanga Province]
South Africa	Song, 1994	1983-1985	10.0% (age 0-9), 12.8% (age 10-19), 39.9% (age 20-29), 82.9% (age 30-39), 92.8% (age 40-49), 96.6% (age 50-59), 94.6% (age 60-69), 92.0% (age 70-79); males: 57.5%, females: 58.0%; no differences by sex	949	healthy Chinese volunteers [Gauteng Province]
South Africa	Botha, 1994	1981-1983	(estimated from graph) 35% (age 7-12 months), 35% (age 1), 60% (age 2), 75% (age 3), 80% (age 4), 90% (age 5), 90% (age 6), 95% (age 7), 100% (age 8), 100% (age 9), 100% (age 10), 100% (age 11), 100% (age 12); no differences by sex	614	rural black children (Owambo)
South Africa	Abdool Karim, 1993	1985	68.6% (age 0-5 months), 2.5% (age 6-11 months), 51.2% (age 2), 81.4% (age 4), almost 100% (age 6), 100% (age 12); no differences by sex	782	urban black children [Umlazi, KwaZulu-Natal Province]
South Africa	Dibisceglie, 1986	--	97% (age 3-19)	179	urban black schoolchildren [Soweto, Gauteng Province]

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WEST SUB-SAHARAN AFRICA

(Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Saint Helena, São Tomé and Príncipe, Senegal, Sierra Leone, Togo)

REGIONAL SUMMARY

Very little recent data from West Africa has been published. Studies conducted in Liberia in the late 1970s found that more than 80% of 4- and 5-year-old children had antibodies to HAV, which suggested an incidence rate of 45% per year between the first and fourth birthdays [Prince, 1985; Willcox, 1980]. Studies conducted at about the same time in Senegal found that nearly 100% of children had antibodies to HAV by age 5 [Barin, 1980; Baylet, 1981], and a study conducted in Nigeria found that more than 90% of adults had HAV antibodies [Ayoola, 1982]. Others studies conducted in the 1980s found slightly lower rates in Cape Verde [Sixl, 1987] and Guinea [Ivanov, 1990]. Studies conducted in Cameroon around 1990 found an adult prevalence of greater than 90% [Ndumbe, 1989; Ndumbe, 1994; Skalsky, 1995; Stroffolini, 1991]. A 1998 study of urban schoolchildren in Sierra Leone found a 97% prevalence rate [Hodges, 1998]. No eligible studies were identified from Benin, Burkina Faso, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea-Bissau, Mali, Mauritania, Niger, Saint Helena, São Tomé and Príncipe, or Togo.

Although recent studies are not available, it is likely that West Africa continues to have a very high HAV incidence rate and, correspondingly, a very high seroprevalence rate, with most children continuing to develop immunity in early childhood and very few adults at risk of infection.

SUMMARY AGE-PREVALENCE ESTIMATES

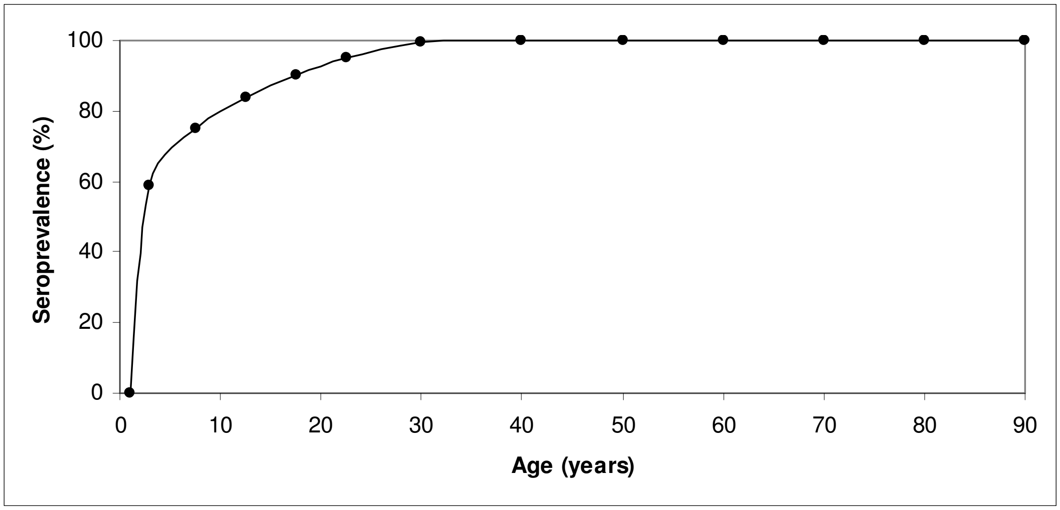
Table 47. Summary Prevalence Estimates by Age in West sub-Saharan Africa.

	<1 month	1-11 months	1-4 years	5-9 years	10-14 years	15-19 years	20-24 years
% immune	--	--	59	75	84	90	95
% at risk	--	--	41	25	16	10	5

	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-84 years	85+ years
% immune	100	100	100	100	100	100	100
% at risk	0	0	0	0	0	0	0

ESTIMATED REGIONAL AGE-SEROPREVALENCE PLOT

Figure 86. Plot of Estimated Seroprevalence by Age in West sub-Saharan Africa.



PLOT OF AGE-SEROPREVALENCE DATA FROM INCLUDED STUDIES

The data from Guinea were excluded from Figure 87 because of a significant decrease in seropositivity with increasing age, which does not follow the expected pattern.

Figure 87. Plots of Age-Seroprevalence Data from Studies from West sub-Saharan Africa.

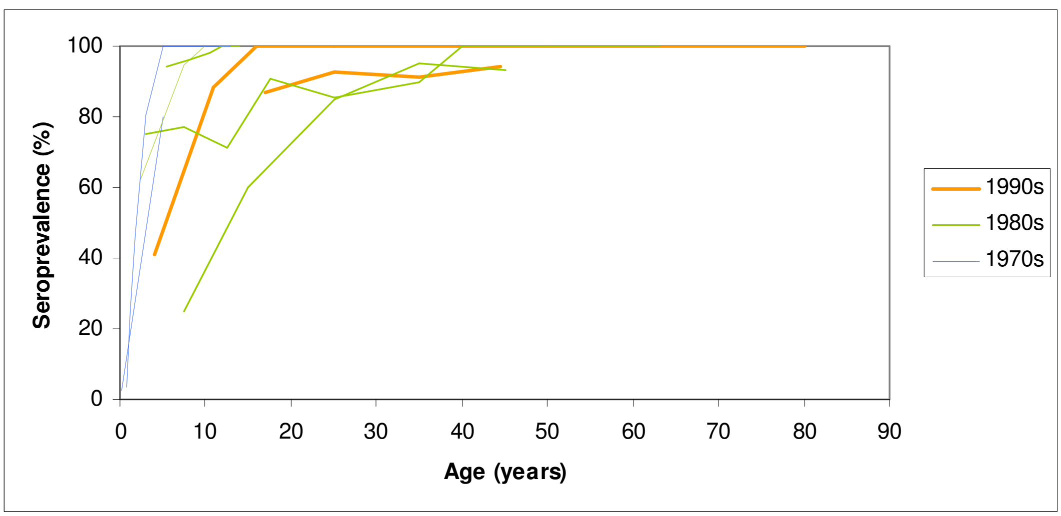


TABLE OF INCLUDED PREVALENCE STUDIES

Table 48. Information about Included Studies from West sub-Saharan Africa.

Country	Citation	Study Year	Seroprevalence Data	Sample Size	Population / Comments
Cameroon	Skalsky, 1995	1990-1992	26.3% (age 0-1), 41.2% (age 2-5), 88.5% (age 6-15), 100% (age 16-25), 100% (age 25-80)	757	blood donors, pregnant women, and patients without liver disease [Manyemen, Sud-Ouest]
Cameroon	Ndumbe, 1994	1991-1992	86.8% (age 14-19), 92.6% (age 20-29), 91.3% (age 30-39), 94.0% (age 40-48)	384	rural pregnant women [Manyemen, Sud-Ouest]
Cameroon	Stroffolini, 1991	1989	94.0% (age 4-6), 96.1% (age 7-8), 97.9% (age 9-11), 100.0% (age 12-14); males: 91.3%, 97.3%, 97.3%, 100.0%; females: 97.3%, 95.2%, 98.4%, 100.0%	702	urban children [Kumba City, Sud-Ouest]
Cameroon	Ndumbe, 1989	--	75.0% (age 1-4), 77.2% (age 5-9), 71.2% (age 10-14), 90.5% (age 15-19), 85.2% (age 20-29), 89.7% (age 30-39), 100.0% (age 40-49), 100.0% (age 50-63); males: 63.3%, 83.3%, 79.4%, 100.0%, 85.7%, 86.4%, 100.0%, 100.0%; females: 90.0%, 67.7%, 55.6%, 75.0%, 83.3%, 100.0%, 100.0%, 100.0%	272	blood donors and patients with minor ailments [Yaoundé, Province de Centre]
Cape Verde	Sixl, 1987	1982-1983	28.6% (ages not reported)	380	patients with acute fevers; methods not reported [Santa Cruz, Santiago]
Guinea	Ivanov, 1990	1987-1988	0% (age <1), 75% (age 1-5), 82% (age 6-10), 74% (age 11-15), 84% (age 16-20), 74% (age 21-30), 57% (age 31-40), 61% (age 41-50), 41% (age 51-60), 19% (age 61-70), 18% (age >70)	812	healthy urban and rural residents [Kindia, Kindia Region]
Liberia	Prince, 1985	1978-1979	2.5% (age 0-6 months), 80% (age 4-5 years); no differences by sex	658	villages in the coastal rainforest [Grand Cape Mount County]

Nigeria	Ayoola, 1982	--	25.0% (age 5-9), 60.0% (age 10-19), 85.0% (age 20-29), 95.0% (age 30-39), 93.3% (age 40-49), 92.5% (age 50-70)	250	healthy blood donors and others [Ibadan, Oyo State]
Senegal	Baylet, 1981	--	62.5% (age 0-4), 94.8% (age 5-9), 100.0% (age 10-14), 92.1% (age 15+)	513	rural communities [Casamance]
Senegal	Barin, 1980	--	100.0% (age <1 month), 22.7% (age 1-6 months), 3.5% (age 7-12 months), 25.0% (age 13-18 months), 46.9% (age 19-24 months), 80.4% (age 2-3), 100% (age 4-5), 100% (age 6-7), 100% (age 8-9), 100% (age 10-11), 100% (age 12-13)	413	rural children [Sine-Saloum, Fatick]
Sierra Leone	Hodges, 1998	--	97% (age 6-12)	120	urban middle-class schoolchildren [Freetown, Western Area]

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APPENDIX: ABSTRACTS

Abstracts of the articles that were extracted into the tables in each regional section in the main text are provided in this appendix.
Abstracts are presented by world region in order of appearance on the tables.

ASIA PACIFIC, HIGH INCOME
(Brunei, Japan, Republic of Korea, Singapore)

Kiyohara, 2007

Background: Hepatitis A infection is caused by hepatitis A virus (HAV) contracted through fecal-oral transmission. Life-long immunity is conferred after infection. Improved sanitary conditions have generally resulted in a significant decline in the incidence of hepatitis A. However, a low incidence of infection results in increased HAV susceptibility. The present study investigates the prevalence of anti-HAV antibody and clarifies the current HAV status and HAV susceptibility in Japan at 2003. Methods: A total of 2430 serum specimens collected during 2003 from Japanese individuals ranging in age from 0-92 years, were tested for anti-HAV antibody using an inhibition enzyme linked immunosorbent assay. All specimens were obtained from the WHO and the National Serum Reference Bank/National Institute of Infectious Diseases, Tokyo, Japan. Results: The overall seroprevalence was 12.2%. Anti-HAV antibodies were rarely detected in individuals between 0-44 years of age. Starting from the age of 45-49 years, seropositivity gradually increased through age 65 years and above. Seroprevalence was not affected by gender, and geographic distribution did not affect age-specific seroprevalence until the age of 60 years. Conclusions: HAV susceptibility in Japan is increasing annually. Particularly, the prevalence of anti-HAV antibody in individuals older than 50 years in 2003 was 50.3%, which is significantly lower than that of corresponding studies in 1994 (74.3%), 1984 (96.9%) and 1973 (96.9%). The growing susceptible population of advanced age results in more frequent HAV infection among them. The surveillance of anti-HAV antibody prevalence is useful for implementing preventive measures and for controlling the spread of HAV.

Mitsui, 2006

To compare the epidemiologic profiles of hepatitis A virus (HAV) and hepatitis E virus (HEV) infections in Japan, the prevalence of clinical or subclinical HAV and HEV infections was investigated serologically and molecularly among 128 consecutive patients (age, mean ± standard deviation, 37.5 ± 14.7 years) who contracted acute hepatitis between 1989 and 2005 in a city hospital, and among 416 hemodialysis patients (60.1 ± 12.6 years) and 266 medical staff members (34.6 ±- 11.4 years) at the same hospital, using stored periodic serum samples collected since the start of hemodialysis or employment, respectively. Between 1989 and 1995, among 93 patients with acute hepatitis, 51 (54.8%) were diagnosed with hepatitis A and only one patient with hepatitis E. Between 1996 and 2005, however, among 35 patients, only 3 (8.6%) were diagnosed with hepatitis A and 2 (5.7%) with hepatitis E. Although subclinical HEV infection was recognized in four hemodialysis patients (one each in 1979, 1980, 1988, and 2003) and two medical staff members (1978 and 2003) in previous studies, none of the 191 hemodialysis patients who had been negative for anti-HAV at the start of hemodialysis contracted HAV infection during the observation period of 7.6 ± 6.4 years. Only one (0.4%) of the 246 medical staff members who had been negative for anti-HAV at the start of employment acquired hepatitis A during the observation period of 7.9 ± 8.0 years: none had subclinical HAV infection. Clinical or subclinical HEV infection has occurred rarely during the last three decades, while HAV infection has markedly decreased at least since 1996.

Nishise, 2003

Background: *Helicobacter pylori* infection is related to several gastro-duodenal diseases, though the route of transmission remains unclear. Methods: A cross-sectional study that included 695 healthy people (males 308, females 387; median age 60 years) participating in a health checkup program in

Yamagata Prefecture was conducted. *H. pylori* status was determined in all subjects by evaluation of serum anti-*H. pylori* immunoglobulin G antibody. Antibody against hepatitis A virus was used as a marker of fecal-oral exposure to assess the agreement between *H. pylori* infection and hepatitis A virus infection. Data on other factors known or suspected to be related to infection status were also collected using a questionnaire. Results: Seroprevalence of *H. pylori* and hepatitis A virus was 60% and 70%, respectively. Kappa values for subjects aged 20-49 and aged 50 or older were 0.07 and 0.02, respectively, and agreement between the presences of both infections was assessed as slight. In the multivariate logistic regression analysis, *H. pylori* infection was significantly associated with availability of a sewage system in childhood (presence [reference], absence [odds ratio (OR) = 4.06, 95% confidence interval (CI): 1.36-13.94]) and the number of gastrointestinal endoscopies undergone (none [reference], once [OR = 1.64, 95% CI: 0.83-3.27], 2-3 times [OR = 3.11, 95% CI: 1.65-5.99], or 4 or more times [OR = 3.18, 95% CI: 1.71-6.03]), (p<0.01 for trend). Conclusions: Our results suggest that poor hygiene in childhood is related to *H. pylori* infection. The fecal-oral route does not seem to be an important mode of transmission, but the possibility of transmission by gastrointestinal endoscopic examination exists.

Malaty, 2003

We compared the seroepidemiologic patterns of Helicobacter pylori and hepatitis A virus (HAV) infections among participants in 2 independent cross-sectional studies conducted in Japan in 1986 and 1994. Subgroups were monitored with successive blood sampling. H. pylori and HAV infection status was defined by results of enzyme-linked immunosorbent assay. In 1986, the prevalence of H. pylori infection and HAV infection, respectively, were 80% and 70% among adults and 31% and 5% among children. The prevalence of both infections increased with age. Concordant infections were found in 74.5% of adults (kappa=0.2) versus 2% of children (kappa=0.05). During the 9-year study period, the incidence of H. pylori infection was 1.1% among adults and 2% among children. The seroprevalence of HAV remained constant. The disparity between the increase in prevalence of H. pylori and HAV infection with age is likely associated with improvements in hygienic practices. The discordance between the presence of the infections among younger persons is evidence against a common source and/or vehicle for transmission.

Fujisawa, 1999

Objective: The age groups most susceptible to infection and the mode of transmission of *Helicobacter pylori* (*H. pylori*) are not yet clear. To contribute to a better understanding of this disease, this study was undertaken to evaluate changes in the seroepidemiological pattern of *H. pylori* in a group of Japanese people over the last 20 yr sampled in 1974, 1984, and 1994 in comparison with that of the hepatitis A virus (HAV), which was used as a marker of the fecal-oral route of transmission. Methods: A total of 1015 serum samples were obtained from the National Institute of Infectious Diseases in Tokyo. All of these samples were from healthy persons aged 0-89 yr (442 male and 573 female; median age 35.6 yr), living in seven prefectures in the central part of Japan in 1974, 1984, and 1994. All serum samples were assayed for *H. pylori* IgG by means of enzyme-linked immunosorbent assay (ELISA). Further, anti-HAV antibodies were assayed by blocking ELISA in the same samples. We investigated the prevalence of *H. pylori* and HAV for all ages, and the positive rate of *H. pylori* for infants and children separately. Results: The overall prevalence of *H. pylori* antibodies was 72.7% (CI 95%, 68.0-77.3) in 1974, 54.6% (CI 95%, 49.1-60.0) in 1984 and 39.3% (CI 95%, 34.1-44.4) in 1994. That of HAV was 57.7% (CI 95%, 52.5-62.8) in 1974, 41.7% (CI 95%, 36.3-47.0) in 1984, and 23.4% (CI 95%, 18.9-27.8) in 1994. The prevalence of both *H. pylori* and HAV was found to increase with age, whereas there have been clear cohort shifts in the seroepidemiological patterns of both infections over the last 20 yr in Japan. This study shows that there is a slight similarity in the concordance of positive and negative populations between *H. pylori* and HAV. However, it was very difficult to determine the concordance between *H. pylori* and HAV infection in this study. Conclusions: Our data strongly suggest that the highest infection rates for both *H. pylori* and HAV occur among infants and children in Japan. This study provides evidence that *H. pylori* and HAV may share a common mode of transmission but that changes in environmental conditions make this very difficult if not impossible to prove with seroepidemiological data.

Furusyo, 1998

Serial changes in hepatitis A virus (HAV) and B virus (HBV) markers were determined from 1970 to 1996 in healthy Japanese residents of a rural area of Okinawa, Japan. All 190 serum samples taken in 1970, 791 in 1980, 708 in 1988, and 523 in 1996 from residents 0 to more than 60 years of age were tested for antibody to HAV (anti-HAV), antibody to hepatitis B core antigen (anti-HBc), and hepatitis B surface antigen (HBsAg). The age-adjusted prevalences of anti-HAV and anti-HBc decreased significantly from 83.9% and 74.9%, respectively, in 1970 to 39.7% and 36.6%, respectively, in 1996. In residents < or = 29 years of age, the prevalences of anti-HAV and anti-HBc decreased significantly from 65.3% and 83.8%, respectively, in 1970 to 0.7% and 8.2%, respectively, in 1996. The age-adjusted HBsAg prevalence decreased significantly from 8.2% in 1980 to 4.1% in 1988. These results indicate that exposure to HAV and HBV infections among Okinawa residents less than 29 years of age is decreasing, probably because of improvements in socioeconomic conditions since 1970. Infection with HBV may be eliminated there in the near future.

Noguchi, 1991

In 1988 1282 serum samples were collected from healthy Japanese persons living on Hateruma Island (574 samples) and Iriomote Island (708 samples) in Okinawa, Japan. Serological markers of hepatitis B virus (HBV) infection [hepatitis B surface antigen (HBsAg), antibody to hepatitis B core antigen (anti-HBc) were investigated and the findings compared with samples taken in 1980 on Hateruma Island and in 1970 and 1980 on Iriomote Island. The samples collected in 1988 on Iriomote Island were also tested for antibody to hepatitis A virus (anti-HAV) and the findings compared with the results of the 1970 and 1980 surveys. The overall prevalence of HBsAg and anti-HBc was 3.7 and 64.8% for Hateruma Island and 3.8 and 44.9% for Iriomote Island. In both areas the overall prevalence of anti-HBc was lower than in 1980, the decrease being significant for the 10-19 year age group on Hateruma Island and the age groups under 39 years on Iriomote Island. The overall prevalence of anti-HAV had fallen to 50.9%. This remarkable decrease had occurred in children and young adults. These data suggest that Virus A (HAV) and HBV infections have dramatically decreased among children in Okinawa within the past 2 decades.

Furuta, 1997

The seroprevalence of Helicobacter pylori in a group of 1,043 healthy Japanese people was compared with that of hepatitis A virus (HAV), which was used as a marker of fecal-oral exposure. No statistically significant relationship was observed between seropositivity for HAV and that for H. pylori. Therefore, the fecal-oral spread of H. pylori is of limited relevance in Japan.

Kiyohara, 1997

Age-specific prevalence of anti-hepatitis A virus antibody (anti-HAV) was surveyed with 2,708 sera collected in 1994 in various areas of Japan. By age-group analyses, we found strong association of anti-HAV antibody with higher age group. The prevalence ratios of antibody in the groups of 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64 and 65 years or older were 0, 4.2, 22.0, 44.8, 57.6, 76.4, 84.5 and 91.4%, respectively. Geometric mean titers of anti-HAV antibody in the positive age groups were approximately 6,000 mIU/ml. The seropositives among older population were ascribed to the infections more than 40 years ago and the high anti-HAV titers have been maintained since that time. In Japan, people younger than 40 years of age are extremely risky to HAV infection, since 99% have no antibody.

Those in forties are also risky since two-thirds of them are seronegative. In Japan, an inactivated vaccine was licensed in 1994. Vaccination may be recommended for such high-risk groups as travelers going to endemic areas, patients who have received blood product medication and child-care staffs.

Fujiyama, 1994

The overall prevalence of anti-hepatitis A virus antibodies was 49.6% in 385 inhabitants in Honda City, Japan in 1991. An approximately 50% prevalence rate occurred between 40 and 49 years of age. The prevalence of anti-HAV antibodies was significantly lower in 1991 than in 1982 in the age groups 20 to 29 years and 30 to 39 years ($p < 0.01$), suggesting there has been no significant HAV infection since 1982. In addition, anti-HAV antibody titers of sera from convalescent hepatitis. A patients were compared with those from seropositive healthy subjects and from healthy subjects following administration of a lyophilized inactivated hepatitis A vaccine or immune serum globulin. Titers after vaccine administration were considerably higher than after immune serum globulin and, although lower than those obtained after natural infection, should be sufficient for protection against hepatitis A virus.

Akbar, 1992-1993

Sera collected from 1118 healthy children and adults aged between four years and 90 years during the period 1989 to 1990, were tested for serological markers of hepatitis A virus (HAV) [antibody to HAV (anti-HAV)] and hepatitis B virus (HBV) [hepatitis B surface antigen (HBsAg) and antibody to hepatitis B surface antigen (anti-HBsAb)]. The overall prevalence rates of anti-HAV, HBsAg, and anti-HBV were 20.2%, 0.36%, and 5.1%, respectively. No body was found to be positive for anti-HAV below 30 years of age but more than 70% of the adults aged 50 years or over were positive for anti-HAV. The level of exposure of HAV infection is declining in Japan and paradoxically at the same time a vast majority of people are becoming susceptible to more severe illness. The fall in prevalence of HBsAg possibly represents the positive impact of ongoing vaccination programs and other preventive measures against HBV.

Kiyosawa, 1989

To evaluate the prevalence of hepatitis virus markers and human T-cell lymphotropic virus infections among drug abusers in Japan, serum samples were collected from 91 male drug abusers at the Shinshu University Hospital and the rehabilitation facility in Matsumoto and from 519 healthy male blood donors as controls. Sera were tested for antibody to hepatitis A virus (anti-HAV), hepatitis B surface antigen (HBsAg), antibody to HBsAg (anti-HBs), antibody to hepatitis B core antigen (anti-HBc), immunoglobulin M anti-HBc (IgM anti-HBc), antibody to hepatitis D virus (anti-HDV), antibody to HTLV type 1 (anti-HTLV 1), and antibody to human immunodeficiency virus (anti-HIV). The prevalence of anti-HAV was 13.2% in drug abusers and 10.8% in controls (not significant). The prevalences of HBsAg, anti-HBs, anti-HBc and exposure rate to hepatitis B virus (HBV) were 4.4%, 24.2%, 31.9%, and 35.2%, respectively, in drug abusers and 0.8%, 6.7%, 9.6%, and 9.6% in controls. The exposure rate to HBV was significantly different (P less than 0.001). IgM anti-HBc and anti-HDV were not detected in any sera. Anti-HTLV I was detected in three drug abusers (3.3%) and in one (0.2%) of the controls (P less than 0.01). All sera were negative for anti-HIV in all subjects. Infection with HBV and HTLV I is more common among drug abusers than in the general population of blood donors in Japan.

Ikematsu, 1987

To investigate the endemic situation of hepatitis A virus infection in the past in Okinawa, Japan, the authors analyzed two sets of cross-sectional data on age-specific prevalence of antibody to hepatitis A virus (anti-HAV) obtained in 1968-1973 and 1980-1981 by fitting a catalytic model. For these two sets of data, the asymptotic level of infectious force of hepatitis A virus, namely lambda infinity, was estimated as 0.121 and 0.149, the maximum slope of the time-dependent force of hepatitis A infection, namely alpha, was 0.566 and 0.529, and the year when the force of hepatitis A infection had decreased to the half of lambda infinity, namely beta, was 1966 and 1964, respectively. In the test for the equality of parameters for the two applications, the difference was not significant. Furthermore, the fitness of the catalytic model to the data on anti-HAV prevalence was good. The results of the analysis by fitting the catalytic model show that hepatitis A infection had been highly endemic, that is, 136 infections per 1,000 persons per year in the area studied before 1955, and it decreased rapidly during the 1960s. Since 1975, hepatitis A has been a rare disease (infection is almost zero per 1,000 persons per year) in Okinawa, Japan.

Kashiwagi, 1983

Between 1968 and 1981, a total of 1955 serum samples from healthy subjects chosen at random in seven districts of Okinawa and two districts of Kyushu were surveyed for antibody to hepatitis A virus (anti-HAV) by radioimmunoassay. Overall prevalence of anti-HAV was 55.1% in Okinawa and 35.9% in Kyushu. Prevalence of less than 10% was observed in subjects less than or equal to 14 years of age in Okinawa and less than or equal to 24 years of age in Kyushu. In three of the districts of Okinawa, second serum samples were collected after intervals of eight, 10, and 12 years, respectively. Overall prevalence of anti-HAV decreased significantly over these time periods. When the age-specific prevalence of anti-HAV on the first occasion is compared with that on the second occasion, it can be seen that there have been few new cases of hepatitis A infection. These data suggest that hepatitis A infection among children has declined dramatically in recent years, and that young people may be highly susceptible to hepatitis A virus.

Taylor-Wiedeman, 1987

A seroepidemiologic study to detect class-specific antibody against hepatitis A virus (HAV) was made with 831 randomly collected sera (415 in 1973 and 416 in 1984) from healthy Japanese. Competitive-inhibition, IgG, IgA, and IgM anti-HAV enzyme-linked immunosorbent assays (ELISA) were used. Both collections showed a low prevalence of IgG anti-HAV in young age groups and it increased rapidly at middle age and plateaued at greater than or equal to 94% prevalence in the older age groups. However, two age groups spanning ages 25-34 demonstrated statistically lower IgG anti-HAV age prevalences in 1984 vs 1973 (P less than 0.001), with an average 10-year prevalence shift. These data suggest that there has been no significant level of HAV infection to alter antibody prevalences in Japan from 1973 to 1984. The markedly decreased incidence of HAV infection in Japan has created a presently large and growing population of HAV susceptibles.

Kashiwagi, 1985

Between 1980 and 1983, a total of 1,883 serum samples from employees of four prefectural hospitals in Miyazaki prefecture, Japan were surveyed for antibody to hepatitis A virus (anti-HAV) and for the following hepatitis B virus markers: hepatitis B surface antigen (HBsAg), antibody to HBsAg (anti-HBs), and antibody to hepatitis B core antigen (anti-HBc). Overall prevalences were 36.9% for anti-HAV, 3.4% for HBsAg, 23.3% for anti-HBs, and 36.6% for anti-HBc. In the control group of 233 healthy persons, prevalences were 51.5% for anti-HAV, 3.0% for HBsAg, 28.3% for anti-HBs, and 33.5% for anti-HBc. No significant difference in the distribution of HBsAg was seen among five work categories. Anti-HBc prevalence was significantly higher in nurses than in office workers (p less than 0.05), other medical personnel (p less than 0.05), and controls (p less than 0.01). The differences between nurses and office workers and other medical personnel became greater with age, but a difference between nurses and the control group was recognized in every age group. A significant difference in the distribution of anti-HBc was seen between surgical physicians (36.7%) and nonsurgical physicians (27.1%). Prevalence of anti-HAV in physicians (32.8%), nurses (29.6%), and laboratory technicians (40.1%) was significantly lower than in the control group (51.5%). These data suggest that in the hospitals studied, hepatitis B is an occupational hazard to nurses and surgical physicians, but that hepatitis A is not.

Togashi, 1982

Serum specimens drawn at random from Hokkaido inhabitants were tested for antibody to the hepatitis A virus (anti-HAV) by radioimmunoassay. The prevalence in different age groups was as follows, cord blood and newborn infants 44.4%, under one year 0%, 1-9 years 5.3%, 10-19 years 0%, 20-29 years 9.1%, 30-39 years 80%, 40-49 years 90%, and over 50 years 100%. This survey confirmed that antibody against HAV could pass through placenta and HAV had been very common virus by the 1950's in Hokkaido.

Ichida, 1981

In order to estimate age specific prevalence of Anti HA in Japan, 1757 serum samples from healthy subjects or patients with nonhepatic disease taken in 6 different districts of Japan were tested for Anti HA using HAVAB Kit. Very low prevalence, less than 10%, was observed in young adults or children. These facts indicate the young Japanese are quite susceptible to HAV infection and the effective preventive measures are urgently needed. Over all prevalence of Anti HA was 56.2%. Comparing the age specific prevalence of Anti HA in Japan with those in other countries, the situation in Japan was in intermediate between highly endemic South-East region and developed European countries.

Lee D, 2008

Objective: The number of adult hepatitis A cases has progressively been increasing during the last several years in Korea. The aim of the present study was to describe the recent clinical features of hepatitis A and the seroprevalence of hepatitis A virus (HAV), and to discuss HAV vaccine strategy in Korea. Methods: Retrospective analysis of clinical characteristics of hepatitis A from 109 patients consecutively enrolled at a community hospital between 2003 and 2006 as well as cross-sectional study of seroprevalence of HAV from 307 patients of hospital population group during the same period were performed. Results: Most hepatitis A cases were young adults in their twenties or thirties, and the severity of the disease was related to the age of patients. The seroprevalence of HAV was 62%, which was dependent on the age of patients. HAV seroepidemiology in Korea is rapidly changing and a growing number of young adults are susceptible to HAV infection. Conclusions: The clinical features and the epidemiological shift of HAV urge Korea, as well as other countries which are experiencing similar issues, to promote childhood vaccination and consider catch-up vaccination for adolescents and young adults.

Kim, 2007

Background / Aims: Recently, the incidence of acute hepatitis A has increased nationwide and is related to the low rate of IgG anti-HAV. This study compared the prevalence of IgG anti-HAV in two university hospitals located in a large city and in a small city including a rural region according to age, gender, and the year of diagnosis. Methods: IgG anti-HAV was measured in a total of 4299 patients, who visited Seoul or Guri Hanyang University Hospital between January 2002 and December 2006. Results: The positive rates of the antibody in Seoul and Guri hospitals were 52.7% vs. 57.1% in under the age of 1, 40.7% vs. 42.2% in age of 1 to 4, 31.8% vs. 30.3% in age of 5 to 9, 24.8% vs. 27.1% in age of 10 to 14, 11.6% vs. 18.2% in age of 15 to 19, 23.0% vs. 20.3% in age of 20 to 24, 40.5% vs. 42.9% in age of 25 to 29, 67.5% vs. 75.0% in age of 30 to 34, 86.5% vs. 88.1% in age of 35 to 39, 95.3% vs. 93.6% in age of 40 to 44, 97.0% vs. 98.7% in age of 45 to 49, and 98.5% vs. 98.6% in patients who were more than 50, respectively. The positive rates of the antibody were not significantly different between two sites according to each age group and gender. Conclusions: The results confirmed the low rates of IgG anti-HAV, particularly in the ages of 10-24 that match the age group of recently increased incidence of acute hepatitis A nationwide. Therefore, measurement of the antibody and vaccination should be considered in this age group.

Kang, 2007

This study was performed to determine the incidence and seroprevalence of hepatitis A virus (HAV) infections in young soldiers in the Republic of Korea Army. From January 2000 through December 2004, a total of 147 hepatitis A cases were reported to the Armed Forces Medical Command. The annual incidence rates were 7.4 per 100,000 persons in 2000, 1.6 in 2001, 4.4 in 2002, 9.8 in 2003, and 6.2 in 2004, based on the reported cases among approximately 500,000 soldiers. All patients were males with a median age of 21 yr (range, 19-27). The most common symptom was nausea (86.5%), and all patients had recovered without complications. In addition, in order to evaluate the seroprevalence of HAV infection in young adults, serum samples were obtained from randomly selected young subjects among those who had been admitted to the Armed Forces Capital Hospital from September 2005 to February 2006. A total of 200 subjects were enrolled in the study to analyze the anti-HAV immune status. The overall anti-HAV IgG seropositive rate was 2% (4/200, 95% CI, 0.60-5.21%). Given the changing epidemiology of the disease and the associated increase in morbidity, it was suggested that routine HAV vaccination for Korean military personnel might be necessary.

Song, 2007

Background and Aims: The epidemiology of hepatitis A is associated with socioeconomic and hygiene status. Recently, the prevalence of hepatitis A in young adults has been steadily increasing in Korea. This study is to investigate the age-specific seroprevalence of hepatitis A virus in Korea. Methods: Stored sera from 250 healthy adult subjects who visited the health promotion center in Samsung Medical Center between July and August 2006 were tested for IgG hepatitis A virus antibody (anti-HAV). Results: The prevalence of anti-HAV was 2%, 72%, 92%, 94%, 100% in 20's, 30's, 40's, 50's, and 60's, respectively. The prevalence of anti-HAV was significantly lower in subjects below age 40 compared to those above 40 (37.0% vs.. 95.3%, $p<0.001$). The seroprevalence was higher in area outside of Seoul compared to those living in Seoul in age group below 40 (25.6% vs.. 55.6%, $p=0.01$). In Seoul area, the prevalence was significantly lower in Kangnam-Gu, Seocho-Gu, and Songpa-Gu district compared to the other areas of Seoul in the age group below 40 (20.0% vs.. 42.1%, $p<0.05$). Conclusion: The seroprevalence of hepatitis A virus antibody in Korean population below 40 is quite low and immunity to hepatitis A virus in those subjects can be a public health issue. In view of changing seroepidemiology, a policy for hepatitis A vaccination in population below 40 might be warranted.

Park, 2006

The changing patterns in seroprevalence rates of hepatitis A virus antibodies among children and adolescents from 1988 to 1997 reflect the cohort effects that occurred over 10 years in South Korea. Our results suggest that the majority of adolescents and young adults are at risk of symptomatic hepatitis A virus infection and morbidity.

Sohn, 2000

Currently, Korea is a low endemicity country for HAV, especially in children. However, recent reports of hepatitis A outbreaks show that there has been a shift of disease incidence to adolescents and young adults, with 2 cases of acute liver failure in one reported outbreak. We need to study the immune status for HAV in order to provide information for the establishment of preventive measures and possible consequences of HAV in Korea. A total of 334 infants, children and adolescents less than 20 years of age living in rural areas of Kyonggi Province, Korea were evaluated for anti-HAV immune status in 1996. Five hundred and eighty-four primary school children living in the same area were separately evaluated for the natural seroconversion rate between 1993 and follow-up samples taken in 1996. Anti-HAV IgG antibody was measured by enzyme immunoassay (HAVAB EIA kit, Abbott Laboratories, Chicago, Illinois, USA). In comparison with previous reports of seroprevalence rates, our data confirmed a dramatic drop in seroprevalence rates among children and adolescents under 20 years of age living in rural areas, from over 63.8% two decades ago to 4.6% in 1996. Natural acquisition of HAV antibody in primary school children rarely occurs, registering only 0.5% during three years. Several outbreaks in young adults during 1996-1998 suggested that immunity against HAV in this population is so low that massive outbreaks are unavoidable. Teenagers and young adults, especially soldiers, who are likely to be exposed to contaminated food or water, would also have a greater risk of hepatitis A. Immunizing children with HAV vaccine as a routine schedule should also be considered in Korea in the future, particularly if the disease burden could be estimated and the cost-effectiveness of the vaccine could be proved.

Chow, 1996

The seroprevalence of anti-HEV IgG was determined in a hospital-based population in a general medical unit. Patients who were otherwise well but admitted for acute, non-hepatological conditions represent the “healthy” general population, and those admitted primarily with liver disorders were studied. The seroprevalence of anti-HEV IgG was found to be 10.5% in the "healthy" population and 14.7% amongst those with liver diseases. The lack of travel history and past history of jaundice suggests presence of local cases and subclinical manifestation in some of the infected patients. There is an association between seroprevalence of hepatitis A and E, suggesting common predisposing factors for both infections. Anti-HAV IgG has a higher seroprevalence. Retesting of anti-HEV IgG in those who were initially positive found persistence of antibodies beyond twelve months. Both anti-HAV IgG and anti-HEV IgG were found more commonly in the older age groups.

Fock, 1995

At the 4th National Foundation for Digestive Disease (NFDD) Day in 1991 where public lectures on prevention of hepatitis and early detection of hepatocellular carcinoma were given, screening of sera obtained from 364 registrants for antibodies to Hepatitis A (IgG) was undertaken. The overall sero-prevalence rate was 50%, with 55% for males and 46% for females with antibodies for HAV. None of the subjects below 20 years old had antibodies to HAV. This rose to 16% for those 21-30 years old and 92% for those above 61 years. This study shows that in Singapore, prevalence of anti-HAV antibodies rise with age and is approaching the low endemicity pattern that is seen in developed countries.

Heng, 1994

To determine whether or not occupational exposure to sewage is associated with a higher seroprevalence of hepatitis A virus (HAV) infection, 600 sewage workers in Singapore were tested for total (IgG and IgM) antibody to HAV by enzyme immunoassay. Using logistic regression with stepwise procedure, the adjusted seroprevalence of sewage workers was 2.2 times higher than that of another non-occupationally exposed population group. Seroprevalence was significantly correlated with age and educational levels, the association being independent of the occupational association. The epidemiological data in the study show that sewage workers have an increased occupational risk of acquiring HAV infection and should be protected by active immunization.

Yap, 1993

Sera from 896 healthy volunteers between 16 and 56 years old were tested in 1987-1991 for immunoglobulin G antibody against the hepatitis A virus (IgG anti-HAV). The overall seroprevalence rate of IgG anti-HAV was 27%: it increased from 0.9% in the 10-19 years age group to 48.1% in the 40-49 years age group and was 100% in subjects over 50 years. There was no difference in anti-HAV seroprevalence between the sexes (29% among men and 26% among women) and races. A downward trend in anti-HAV seroprevalence was seen from 1987 (33%) to 1991 (21.4%). The level of exposure to the hepatitis A virus has decreased when compared with data obtained in 1975 and 1984-1985. Hepatitis A virus infection is no longer an infection of children and adolescents locally.

Goh, 1987

Sera collected from 1630 healthy children and adults aged between six months and 55 years during the period 1984 to 1985 were tested for hepatitis A virus (HAV) immunoglobulin G antibody by enzyme immunoassay. The overall antibody prevalence rate was 31.8%. It increased from 0% in children under five years old to 15.5% in adolescents and young adults (15 to 24 years) and reached the highest level of 88.2% in adults over 55 years of age. No statistically significant differences in the overall prevalence by sex and ethnic group were observed. None of the 938 samples tested for HAV immunoglobin M antibody was positive. Compared with the data in 1975, the survey showed that the level of exposure of Singapore children to HAV was declining as the result of vast socio-economic progress made during the past decade.

ASIA, CENTRAL

(Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan)

Asratian, 2005

The survey of the population immunological structure with respect to parenteral hepatitis showed a wide circulation of hepatitis B (HB) and hepatitis C (HC) viruses among the adult population of Armenia. During the 5 year period of observation the number of persons having antibodies to HC virus increased 2.7-fold. High occurrence of antibodies to HBsAg of HB virus among the healthy population in 2002 (12.0%) in comparison with 1997 (5.4%) reflected a decreased infection rate with HB virus as well. Antibodies to hepatitis A (HA) virus were isolated, on the average, in 64 % of persons. Simultaneously with a decrease in the proportion of HA cases an increased number of HC patients was registered. No circulation of hepatitis E virus was detected. A high percentage of hepatitis cases of mixed etiology was established, as well as an increased number of combined parenteral hepatitis cases was registered (57.1%).

Victor, 2006

In the rapidly developing city of Almaty, Kazakhstan, rates of hepatitis A have fallen, but no data on prevalence of antibody to hepatitis A virus (anti-HAV) exist with which to interpret incidence data. In the autumn of 2001, we determined the anti-HAV prevalence among household and school contacts of hepatitis A cases. For contacts aged 0-4 years, 5-9 years, 10-14 years, 15-19 years, or 20-30 years, immune prevalences were 9, 12, 33, 33 and 77% respectively, among immediate-family household contacts and 15, 28, 49, 52 and 77% respectively, among community contacts. Child community contacts were more likely to be immune than their immediate-family household counterparts (odds ratio 2.0, 95% confidence interval 1.3-3.2). Almaty is experiencing an epidemiological shift in hepatitis A incidence. Feasible and effective prevention strategies using hepatitis A vaccine should be explored.

Nurgalieva, 2002

The epidemiology of *Helicobacter pylori* infection and risk factors associated with its transmission are not well understood. Kazakhstan is country with two ethnic groups, Asian (Kazakhs) and Western (Russians), living under similar socioeconomic conditions. The aim of this study was to examine the seroepidemiologic pattern of *H. pylori* and hepatitis A among the same individuals from both ethnic groups, with emphasis on water source and household sanitation practices. This was a cross-sectional seroepidemiologic study conducted among unrelated healthy individuals in Kazakhstan. From May through August 1999, individuals between the ages of 10 and 60 years from Almaty, Kazakhstan, were invited to participate. Demographic information, socioeconomic factors, living conditions, and various aspects of the local household environment including access to water were collected. A clean water index (CWI) was created based on combined factors, consistency of boiling water before drinking, frequency of storing and reusing water, and frequency of bathing and showering. *H. pylori* and hepatitis A antibodies were assessed by enzyme-linked immunosorbent assay. Two hundred eighty-eight individuals between the ages of 10 and 60 years participated. The prevalence of *H. pylori* infection was almost identical among the two ethnic groups (Russians 79% and Kazakhs 80%). *H. pylori* infection was inversely correlated with the CWI (i.e., 56%, 79%, and 95% for high, middle, and low, respectively ($P < .05$). Drinking river water had highest risk of *H. pylori* infection (OR = 13.6, 95% CI = 1.8-102.4; $P < .01$, compared with tap water). Crowding showed no significant effect on *H. pylori* prevalence. Anti-HAV antibodies were found in 86% of the population, 90% among the Russians versus 82% among the

Kazakhs (OR = 1.8, 95% CI = 1.1-3.8, P = .05). Although the two infections were highly correlated (P < .001), antibody to both infections were present simultaneously in only 74%. The prevalence of *H. pylori* infection in Kazakhstan is very high. The data suggest that transmission of *H. pylori* can be water borne, related to poor sanitary practices, or both. The high prevalence of antibodies to *H. pylori* and HAV among this population is a marker for poor sanitation and hygienic practices. Reducing the rate of H. *pylori* transmission will require improvements in overall sanitation including clean water, waste disposal, as well as in household hygienic practices.

Kompaniets, 1984

On the basis of data obtained by seroepidemiological studies general regularities, as well as essential differences, in the manifestations of the epidemic processes characterized by the active and sluggish spread of infection induced by hepatitis A virus have been revealed.

Tsatsralt-Od, 2007

To compare the epidemiologic profiles of hepatitis A virus (HAV) and hepatitis E virus (HEV) infections in children in Mongolia, the prevalence of HAV and HEV infections was investigated serologically and molecularly among 717 apparently healthy individuals of 0-20 years of age (mean +/- standard deviation, 8.6 +/- 4.9 years) using serum samples obtained between October 2005 and January 2006. Total antibody against HAV (anti-HAV [total]) was detected in 494 (68.9%) of the 717 subjects, while IgG antibody against HEV (anti-HEV IgG) was detected in only five subjects (0.7%) (P < 0.0001). All five subjects who had anti-HEV IgG, were negative for anti-HEV IgM and HEV RNA. Anti-HAV was detectable in 24 (75.0%) of the 32 infants aged 7 days to 6 months, but not in any of the 8 infants aged 7 to <12 months. The prevalence of anti-HAV was 19.5% (17/87) in the age group of 1-3 years, and it increased to 50.0% (69/138) in the age group of 4-6 years, and further to 81.4% (105/129) in the age group of 7-9 years. Of note, 97.2% of the subjects in the age group of 16-20 years had anti-HAV. The presence of HAV RNA was tested in all 717 subjects, and three children of 1, 4, or 8 years of age were found to have detectable HAV RNA (subgenotype IA). No subject had a history of hepatitis or jaundice. In conclusion, HEV infection was uncommon, but HAV infection lacking overt clinical features was prevalent among children in Mongolia.

Takahashi, 2004

The prevalence of infection with hepatitis A virus (HAV), HBV, HCV, HDV, and HEV was evaluated in 249 apparently healthy individuals, including 122 inhabitants in Ulaanbaatar, the capital city of Mongolia, and 127 age- and sex-matched members of nomadic tribes who lived around the capital city. Overall, hepatitis B surface antigen (HBsAg) was detected in 24 subjects (10%), of whom 22 (92%) had detectable HBV DNA. Surprisingly, HDV RNA was detectable in 20 (83%) of the 24 HBsAg-positive subjects. HCV-associated antibodies were detected in 41 (16%) and HCV RNA was detected in 36 (14%) subjects, none of whom was co-infected with HBV, indicating that HBV/HCV carriers account for one-fourth of this population. Antibodies to HAV and HEV were detected in 249 (100%) and 28 (11%) subjects, respectively. Of 22 HBV DNA-positive subjects, genotype D was detected in 21 subjects and genotype F was detected in 1 subject. All 20 HDV isolates recovered from HDV RNA-positive subjects segregated into genotype I, but these differed by 2.1 to 11.4% from each other in the 522- to 526-nucleotide sequence. Of 36 HCV RNA-positive samples, 35 (97%) were genotype 1b and 1 was genotype 2a. Reflecting an extremely high prevalence of hepatitis virus infections, there were no appreciable differences in the prevalence of hepatitis virus markers between the two studied populations with distinct living place and lifestyle. A nationwide epidemiological survey of hepatitis viruses should be conducted in an effort to prevent de novo infection with hepatitis viruses in Mongolia.

Rafiev, 1999

The characteristic feature of the Republic of Tajikistan, as well as other republics of Central Asia, is the wide spread of virus hepatitis E. The epidemiology of this grave disease, recently known as virus hepatitis non A, non B with the fecal-oral mechanism of transmission of this infection, has been yet insufficiently studied. The article points out to the specific character of this infection which essentially differs, both epidemiologically and clinically, from other enteric hepatitis (hepatitis A), also hyperendemic for the republic. The results of the study of the immunostructure of the population with respect to both hepatitis E and hepatitis A are presented.

Doroshenko, 1990

The dynamics of post-infection immunity to hepatitis A (HA) in preschool children was studied for 2 years in an area with a high activity of the epidemic process. In primary examinations by radioimmunoassay, anti-HAV were found in 82% of the subjects. The degree of the immunity intensity was found to be markedly variable: in 21% of the children the titer of anti-HAV was 1:10, in 28%-1:40, in 37%-1:160, in 14%-1:640. One year later, in the group of children with titers 1:10-1:40 the antibody level increased from 4- to 64-fold in 66% of the subjects. The rate of increase expressed in mean coefficients of antibody rise were the higher the lower the initial anti-HAV titers were. In the children with the initial titer below 1:10 this value approached 100, and anti-HAV-IgM were found in half of the examined subjects, one third of them having experienced the jaundice form of HA. The children with titers of 1:10-1:40 were found to have both manifest (14% and 11%, respectively) and asymptomatic (only anti-HAV-IgM) forms of HA. In the group of children with titers of antibody of 1:160-1:640 neither manifest HA forms nor anti-HAV-IgM could be detected. In this group the anti-HAV titer increased 4-fold or more in only 9% whereas a decrease was observed in 59% (with titer of 1:160) and in 73% (with titer of 640). No changes in anti-HAV levels were observed in 32% and 18%, respectively. Thus, the results of the study indicate that at low levels of post-infection immunity re-infection with HAV is possible and may run both manifest and asymptomatic course.

ASIA, EAST

(China, Democratic People's Republic of Korea, Hong Kong, Taiwan)

Li, 1998

To study the prevalence and the epidemiologic features of viral hepatitis in Fujian, a seroepidemiological survey on five kinds of viral hepatitis infection has been carried out in Fujian province since 1992. Using stratified multistage random cluster sampling, 3,809 serum samples were collected from 1,237 families in general population in the disease surveillance points in Fujian province. HBsAg, anti-HBs and anti-HBc were screened by RIA and HBeAg, anti-HAV, anti-HCV anti-HDV anti-HEV were by EIA. The results showed that the standardized prevalence rates of HAV, HBV, HCV, HDV, HEV, HBsAg, anti-HBs, anti-HBc and HBeAg were 76.60%, 77.26%, 3.99%, 2.10%, 18.80%, 17.25%, 34.33%, 68.58% and 8.42% respectively. The HAV, HBV, and HEV prevalence rates in rural were higher than in urban areas. The HBsAg prevalence rate among males was higher than females, with peaks evidenced in 5-9 years old and 20-29 years old. There seemed to be significant family clustering of HBV and HEV infection. There was higher HEV prevalence rate among the young-robusts but lower HAV prevalence rate among children in urban areas. These results suggested that Fujian is a highly prevalent area for HAV, HBV, HCV and HEV infections. Thus HA and HB vaccination should play as the most effective strategy in the prevention of HAV and HBV infections.

Geng, 1998

Background: In The People's Republic of China in 1990, the age-specific seroprevalence of hepatitis A was investigated in eight large cities. Methods: A stochastic model, the two-state Markov chain, was applied to hepatitis A virus seroprevalence data by age group. An age-specific risk rate, Markov Risk Rate (MRR), and its weighted sum, Total MRR, are defined and used as novel measure indices to prioritize age groups for allocating vaccine or to decide in which cities vaccine should be used to prevent hepatitis A. Results: In 1990, the MRR_{1-} in Xi'an, Jinan, Ha'erbin, and Huhehaote, and the MMR_{10-} in Xi'an, Nanjing, Jinan, and Ha'erbin and the MRR_{20-} in Chongqing and Nanjing were over 20. The Total MRR in Chongqing and Ha'erbin were over 160, which was higher than the warning value. Conclusions: All age groups whose MRR was over 20 are strongly recommended to be vaccinated first. Chongqing and Ha'erbin are cities at high risk of hepatitis A virus epidemic in the 1990s and therefore should be under close surveillance.

Hazell, 1994

Seroprevalence data from 1501 subjects was used to test the hypothesis that *Helicobacter pylori* may be transmitted by the fecal-oral route. Antibody to hepatitis A virus was used as a marker of fecal-oral exposure. Of the 1501 subjects, 35.5% were seropositive for both *H. pylori* and hepatitis A, 19.1% were seronegative for both, 36.5% were seropositive for hepatitis A only, and 8.8% were seropositive for *H. pylori* only. Cross-sectional data from rural areas supported an association between hepatitis A and *H. pylori*. However, in the urban area there was no evidence of hepatitis A infection in persons < 10 years old, yet the seroprevalence of *H. pylori* was high in this group (approximately 32%). From our data, we suggest that communitywide fecal-oral spread of *H. pylori* may be of limited importance.

Song, 1991

The positive rate of Anti-HAV in 1663 general Guangzhou population were investigated by ELISA in 1988. The total positive rate of anti-HAV antibody ways 65.1%. There are great differences between the overall positive rate of anti-HAV antibody and those in different districts and counties. Among them, the highest rate was 90.2%, the lowest was 46.7%. The overall positive rate of anti-HAV antibody of rural population (79.3%) was significant higher than that of urban population (53.9%). The rates in scattered children (46.5%) were higher than in the organized children (20.8%). Among the less than 4 years old children, boys (39.0%) were higher than the girls (13.3%). Among 0-10 years old children, it presented a tendency of anti-HAV antibody rate from 15.4% to 44.4%, it increased rapidly to 29.73% in children aged 0-4. Among 10-49 years old group, the rate was going up with age. The value of the peak of positive rate of anti-HAV antibody situated on 45-49 years of age, and after fifty the rate slowly decreased.

Li, 1989

Hepatitis A was prevalent in 43 villages of the suburbs of Jinan, Shandong Province in 1986. The annual morbidity rate was 1,104.46/100,000. The authors studied the development of anti-HAV among children of under 14 years of age during the early epidemic and post-epidemic periods, compared the prevalence of anti-HAV between epidemic and non-epidemic villages, and analyzed the types of HAV infection. The positive rate of anti-HAV was 35.42% during the early epidemic period and was 82.1% during the post-epidemic period, while it was 79.75% in non-epidemic villages. The result indicates that, in rural area, hepatitis A is chiefly influenced by the prevalence of anti-HAV in the population. If it remains at about 80%, the occurrence of an epidemic can be prevented. The ratio of clinical, sub-clinical and apparent infection during the epidemic was 1:0.75:0.81.

Sun, 1985

Eighty-two cases of hepatitis A occurred in a village of Qing Yuan County, Hebei Province in 1980, with a morbidity rate of 6.3% (82/1032). All the patients were children aged from 9 months to 10 years. The actual attack rate was 24.5% (82/335). Serum samples collected from 13 patients during their acute and convalescent phases of illness showed a four-fold rise in titers of anti-HAV. The anti-HAV was positive in 87.1% of healthy individuals, including 90% in those above 5 years of age. The results indicated that the infection rate of hepatitis A were very high in these rural areas.

Xu, 1985

(no abstract)

Wang, 1985

The natural history of hepatitis A virus (HAV) infection was studied in a rural production brigade in the suburbs of Beijing from June 1982 to June 1983. 491 serum samples were collected from 83.6% of the brigade members and tested for antibody to hepatitis A virus (anti-HAV) by solid-phase radioimmunoassay (SPRIA) in 1982. The prevalence rate of anti-in the sampled population was 91.6% and nearly 100% age 15 years of age. There was no significant difference in the age-specific and overall antibody prevalence rates between the two sexes. The titers of 292 serum samples were measured and the results showed that they decreased with increase of age. The geometric mean titer of this group of people was 1:1560. Of 33 persons who were anti-HAV negative in June 1982, 9 became antibody positive in June 1983, only one of whom attended the hospital and was diagnosed as an HA case. The rest did not have any symptoms. The ratio between the clinical and subclinical infection of HAV is 1:8. 365 individuals who were anti-HAV positive in June 1982 were found to harbor the antibody still in 1983. These data suggest that HA is a disease of children and a large proportion of adult hepatitis cases are not hepatitis A in Beijing rural area, that anti-HAV may persist life-long in those living in endemic areas, and that the majority of HAV infections are subclinical.

Zou, 1984

Sera of 543 persons from urban and rural areas in Guiyang, Guizhou province, were tested for antibody against hepatitis A antigen (anti-HAV IgG) by means of immune adherence hemagglutination. Among them 84.8% were anti-HAV positive. There was no significant difference in antibody level between males and females (p>0.05). Although the anti-HAV positive rates in the rural population were much higher than that in the urban population (p<0.001), the infection rates increased as age went up. Half of the persons under 10 years were infected. Among adults, the anti-HAV positive rates were more than 80%. However, there were differences in two areas. Hepatitis A mainly infected older children in urban areas while it mainly involved the younger ones (including the youngest) in rural areas.

Hu, 1984

Different population groups from the Shanghai area were surveyed by radioimmunoassay for serologic markers of previous infections with hepatitis A virus and hepatitis B virus. There were no significant differences in the prevalence of antibodies to hepatitis A virus (anti-HAV) in males and females, or in persons living in rural or urban areas. The prevalence of anti-HAV showed a biphasic increase with age, approaching 100% above age 50 years whereas the geometric mean titers declined. The rate of infection (attack rate) with hepatitis A among susceptibles in Shanghai declined appreciably between 1950 and 1960. The prevalence of hepatitis B markers also did not differ in the sexes, or in rural and urban populations. The patterns of prevalence of hepatitis B markers at different ages were compared to various theoretical mathematical models, and the data fitted best a model constructed from the assumption that two subpopulations of approximately equal size, one at low and the other at high risk, existed in the population groups studied. It was estimated that in Shanghai up to 12% of all individuals infected with hepatitis B became chronic hepatitis B surface antigen (HBsAg) carriers, although the overall prevalence of HBsAg carriers was only 6.9%. All HBsAg-positive individuals subtyped had been infected with hepatitis B virus of the subtype ad; 41.7% of HBsAg carriers also had hepatitis B e antigen (HBeAg), whereas in 32% of HBsAg carriers antibodies to HBe were present. Antibodies to HBsAg appeared to be lower in titer than in Western populations and to decline with age, and age-specific prevalence data indicated a relatively longer persistence of antibodies to hepatitis B core antigen.

Hu, 1983

(no abstract)

Wong, 2004

Current epidemiology of hepatitis A virus (HAV) and hepatitis E virus (HEV) in Hong Kong was evaluated in 936 adult Chinese subjects recruited through a telephone interview in 2001. Some 15% of the subjects had IgG antibodies to both HAV and HEV while 665 (71.0%) and 176 (18.8%) had anti-HAV and anti-HEV, respectively. Age was the most significant independent factor. Six hundred thirty-eight (79.8%) and 165 (20.7%) subjects aged > or =30 had anti-HAV and anti-HEV, respectively, as compared with 27 (19.7%) and 11 (8.0%) in people aged <30. The corresponding adjusted Odds ratio (OR) was 14.94 (95% CI: 9.13-24.44; P<0.001) for anti-HAV positivity and 2.99 (95% CI: 1.58-5.67; P=0.001) for anti-HEV positivity. Subjects born outside Hong Kong were more likely to have anti-HAV (adjusted OR: 3.41; 95% CI: 2.21-5.26; P<0.001) but not anti-HEV. Non-labor work people were less likely to have anti-HAV-adjusted OR, 0.40 (95% CI: 0.26-0.62; P<0.001). Age-specific HAV prevalence right shifted in the last 20 years. Anti-HAV positivity was less frequent, across all age groups, in subjects >21-years-old in the present study than another study done in 1987-89 (P<0.001). HAV prevalence only increased slightly in every 10-year age groups of people aged 21-50 when compared with their corresponding 10-year-younger age groups (P=0.11), suggesting an ageing cohort effect with no major infections in the last decade. For HEV, both the overall and age-specific prevalence decreased over the last decade (P<0.001).

The increasing proportion of susceptible population to enterically transmitted viral hepatitis has implications to future prevention and control programs, including vaccination strategies.

Lee, 1999 (Vaccine)

Hong Kong is a well developed city in the center of an endemic region for hepatitis A. The age at which hepatitis A occurs has shifted from childhood and adolescence to adults like many western countries. There is a high chance of outbreaks with the introduction of infection from neighboring countries. Reducing the susceptibility of a population by vaccination can eliminate the diseases but updated seroepidemiological data is needed to analyze the level of natural immunity, and identify those susceptible to infection for preventive measures. This study conducted amongst secondary school children seeks to identify those who are at risk and to obtain data on the present seroprevalence of anti-HAV. Overall prevalence of anti-HAV in this age group was 7% increasing with age. Analyzed by multiple regression model, those students living in mainland China over 3 years had odds ratio of 31.6 (95% c. i. 17.4-57.3) compared with those born in Hong Kong. Students with a father in a skilled occupation and an education level of secondary school or above, and both parents with secondary education or above, had an odds ratio of 0.22 (95%CI 0.07-0.7) and 0.35 (95%CI 0. 17-0.72) associated with presence of anti-HAV, respectively. Improved socio-economic state exposes higher proportion of the population at risk. Immunization is worthwhile to be considered for the adolescents in Hong Kong. Pre-vaccination screening is cost effective only for those adolescents who are most likely to have natural immunity.

Lee, 1999 (Public Health)

Objective: The study the seroepidemiology of hepatitis A virus (HAV) among adolescents in Hong Kong and analyze the changing patterns of the infection rates. Design: Cross sectional study. Setting: Secondary school students. Subjects: One thousand, five hundred and eighty students were randomly selected from 12 schools in four regions of Hong Kong. Main outcome measures: Anti-HAV status. Results: The overall prevalence of anti-HAV is 7%. The seroprevalence for age group 11 – 20 y has fallen compared with 44.8% in 1978, 17.1% in 1987 and 11.2% in 1989. Those adolescents born in mainland China, who are frequent travelers and had a longer period of residence in mainland China were shown to have a higher prevalence of anti-HAVE. Conclusion: The changing epidemiology of HAV indicates that Hong Kong will have a large proportion of susceptible young adults. Because of its geographic situation and import of most of its food supplies from less developed countries, for epidemiological purposes the inhabitants can be compared to western travelers staying in a five star hotel in a less developed country. The risk of an outbreak of HAV is to be expected. Vaccination has the potential to serve as an effective prevention for adolescents living in countries whose circumstances are similar to Hong Kong.

Li, 1991

The aim of this study was to determine the prevalence of previous hepatitis A virus (HAV) and B virus (HBV) infection which is in 64 transfusion-dependent (TD) patients with thalassemia including 26 patients who were transfused before blood donors were screened for HBV. Serial blood samples taken from these 64 patients and 10 non-TD beta-thalassemia intermedia patients during a 3 year period, were tested for antibody to HAV (anti-HAV), hepatitis B surface antigen (HBsAg), antibody to HBsAg (anti-HBs), antibody to core antigen (anti-HBc) and when indicated, antibody to Delta virus (anti-Delta) and HBV DNA. Liver function tests were performed also. Similar tests were conducted on 50 donor blood units. None of the 64 TD patients had evidence of past HAV infection, but 50% of blood donors had evidence of past infection (P less than 0.001). Only 2 brothers and their mother were positive for HBsAg, and 38 patients (59.4%) had persisting HBV antibodies compared with 26% of blood donors (P less than 0.001). Our TD thalassemic patients acquired passive immunity from donor plasma, which protected them against HAV and possibly modified the outcome of HBV infection.

Chin, 1991

The current seroepidemiology of hepatitis A in Hong Kong was examined by testing stored sera from 702 healthy subjects, collected between 1987-1989, for antibody to hepatitis A virus (anti-HAV). The overall prevalence of anti-HAV antibody was 45.6%. There were significant increases in prevalence of anti-HAV antibody with every 10-year increase in age up to age 40. The prevalence of anti-HAV antibody was 24% for subjects below age 30 and 89.2% for those above age 30 (P less than 0.0001). Socioeconomic factors did not appear to have any influence on the prevalence of anti-HAV antibody. In comparison with another study conducted in Hong Kong 10 years ago, the prevalence of anti-HAV antibody in the current study was significantly lower in every age group from 0 to 30 years. In summary, it was shown that HAV infection is no longer highly endemic in Hong Kong. In view of the changing epidemiology, post-exposure prophylaxis will be necessary for young adults and children, and hepatitis A vaccine may be indicated for high risk groups when it is generally available.

Lin, 2006

Taiwan was a hyperendemic area for hepatitis A and B viruses (HAV and HBV) infection before late 1980s. To study the seroprevalence of hepatitis A, B, C, and E viruses (HCV and HEV) infection among preschool children in Taiwan, a community-based survey was carried out in 54 kindergartens in 10 urban areas, 10 rural areas, and 2 aboriginal areas randomly selected through stratified sampling. Serum specimens of 2,538 preschool children were screened for the hepatitis A, C, and E antibodies by a commercially available enzyme immunoassay and for HBV markers by radioimmunoassay methods. The multivariate-adjusted odd ratios (OR) with their 95% confidence intervals (CI) were estimated through the multiple logistic regression analysis. Females had a statistically significantly higher HAV seroprevalence than males. The seroprevalence of HCV infection increased significantly with age. The larger the sibship size, the higher the seroprevalence of HBV infection. Aboriginal children had a significantly higher seroprevalence of HBV and HEV infection and lower seroprevalence of HCV infection than non-aboriginal children. A significantly higher seroprevalence of HBV infection was found in rural children than urban children. There was no significant association between serostatus of HAV and HEV infection and between serostatus of HBV and HCV infection among preschool children in Taiwan. The poor environmental and hygienic conditions in the aboriginal areas might play a role in infection with HBV and HEV.

Lin, 2005

Helicobacter pylori and hepatitis A virus (HAV) share a common fecal-oral transmission route. The aim of this study was to investigate the prevalence of and risk factors for *H. pylori* and HAV infection in primary school students in Taiwan. We studied 289 Grade 1 to 6 students from a single primary school in Taipei County in 2003. The students volunteered for blood tests for *H. pylori* immunoglobulin G (IgG) antibody and anti-hepatitis A antibody after consent from their parents. Questionnaires were administered to the parents to investigate possible risk factors. The seroprevalence rates of *H. pylori* IgG antibody and anti-hepatitis A antibody were 21.5% (62/289) and 1.4% (4/289), respectively. No statistically significant relationship was found between seropositivity for *H. pylori* and for HAV. If parents had knowledge of H. pylori and HAV, their children were significantly more likely to be seronegative for *H. pylori* (p=0.020, odds ratio [OR] 2.1, 95% confidence interval [CI] 1.2-3.7) and HAV (p=0.012, OR 11.2, 95% CI 1.5-83.4). Students whose family members had no history of HAV infection were significantly less likely to be seropositive for HAV (p=0.001, OR 0.04, 95% CI 0.004-0.5). No other factors were found to be significantly associated with seropositivity, including blood type; age; gender; family members' history of *H. pylori* infection; travel to China; parents' educational level; sources of water supply; family members' use of tobacco, alcohol, or betel nut; family members' history of peptic ulcer or gastritis; and students' history of recurrent abdominal pain. Lack of public health knowledge appears to be related to seroprevalence of H. pylori in primary school students. The low seroprevalence of anti-HAV antibodies demonstrates the lack of protection against this infection in school-age children in Taiwan and suggests that universal administration of HAV vaccine would be wise.

Yang, 2003

Background and Purpose: *Helicobacter pylori* infection is primarily acquired in early childhood and its transmission routes are debated. The aims of this study were to determine the seroprevalence of anti-*H. pylori* immunoglobulin G (IgG) in Taiwanese and to investigate whether a common mode of transmission could be shared between *H. pylori* and hepatitis A virus (HAV). Methods: An enzyme-linked immunosorbent assay (ELISA) was used to investigate the prevalence of *H. pylori* among 924 healthy volunteers aged less than 40 years, and radioimmunoassay for HAV infection was conducted in 500 subjects from the same population. The kappa statistic was used to measure the difference in positivity for the 2 infections in a subgroup of 500 subjects who had their sera simultaneously tested for anti-*H. pylori* and anti-HAV antibodies. Results: The seroprevalence of anti-*H. pylori* IgG was 16.7% in subjects aged < 16 years and 38.3% at ages >or= 16 years. Most children (99%) under the age of 16 were seronegative for HAV. The prevalence of *H. pylori* infection increased rapidly with age, at 1%/year and 0.8%/year for children and adults, respectively. The rate of *H. pylori* infection was higher in male (21%) than in female (12%) children (p < 0.01; OR, 2.0; 95% confidence interval, 1.2 to 3.0). No significant difference in seroprevalence between genders was noted in subjects aged >or= 16 years. The agreement in the trend of seropositivity between both infections in the age groups 1 to 10 years and 10 to 20 years was worse than chance (kappa = -0.56) and little better than chance (kappa = 0.01), respectively. Conclusions: Acquisition of *H. pylori* infection occurs at a young age, and male children are more likely to develop the infection. The main transmission route of HAV, the fecal-oral route, did not seem to be responsible for H. pylori transmission in this Taiwanese cohort.

Chen, 2003

Background: The transmission routes of *Helicobacter pylori* and hepatitis A virus (HAV) infections have been extensively discussed in previous literature. However, whether *H. pylori* and HAV shared the same transmission pattern or not remains unclear. Lower socioeconomic status was recognized as a consistent risk factor to both infections. However, whether fecal-oral transmission was a risk factor to both infections is still under debate. Materials and Methods: In 1996, we conducted a cross-sectional study to evaluate the seroprevalence of antibody to *H. pylori* and HAV among the randomly selected school-aged children (age between 13 and 15) on Green Island (n = 91) and Lanyu Island (n = 138) (two isolated neighborhood islands near Taiwan Main Island). Results: The seroprevalence of *H. pylori* and HAV on the Green Island were 82.4% and 5.5%, respectively. The seroprevalence of *H. pylori* and HAV on Lanyu Island were 71.0% and 90.6%, respectively. *H. pylori* seroprevalence of all children and the subgroup of 13-year-olds was significantly lower on Lanyu Island than Green Island. However, it was not significantly different in subgroups of 14- and 15-year-olds. HAV seroprevalence was significantly higher on Lanyu Island than Green Island among all children and in each age subgroup. The correlation of *H. pylori* infection and HAV infection did not demonstrate significant linear correlation on both islands. Conclusions: In conclusion, *H. pylori* and HAV infections in school-aged children of 13-15 years of age on Green Island and Lanyu Island did not demonstrate significant correlation. The results of this study imply that H. pylori and HAV may share different transmission routes of infection.

Tseng, 2001

Background and Purpose: Hepatitis A is a disease that is heavily affected by sanitation status. Hepatitis A is much less prevalent compared with decades ago in Taiwan, as in many rapidly developing regions. Hepatitis A vaccine is still self-paid under the National Health Insurance program and is still not widely utilized by the general public in Taiwan. This seroepidemiologic study evaluated the prevalence of antihepatitis A virus (anti-HAV) seropositivity in Taipei in 1999. Methods: A total of 1017 serum samples from healthy inhabitants in Taipei were examined for anti-HAV antibody by qualitative enzyme immunoassay. Results: The overall seroprevalence rate was 25.2% (255/1013) in the non-vaccinated population. The seropositivity rate for anti-HAV antibody among children younger than 12 months old was 23.3%. The rates dropped to between 1% and 4.8% among subjects between 1 and 20 years of age. A markedly higher rate of 40% was observed in subjects aged between 20 and 30 years. The seropositivity rate in subjects aged 31 to 50 was 80%. More than 90% of subjects older than 50 years were seropositive. The vaccination rate was low (0.5%). Conclusion: Our findings indicate that Taipei is an area of intermediate endemicity for hepatitis A virus. To achieve better herd immunity, a more active approach to the adoption of hepatitis A vaccine is warranted.

Lin, 2000 (Am J Trop Med Hyg)

Helicobacter pylori and hepatitis A virus (HAV) are documented to share common transmission routes including fecal-oral. This study examined the association between seropositivity of antibodies against *H. pylori* (anti-HP) and HAV (anti-HAV) via a community-based survey of 40 randomly selected kindergartens in 10 urban and 10 rural areas. Serum samples from 2,047 healthy preschool children and 104 teachers were screened for anti-HP by enzyme-linked immunosorbent assay, and for anti-HAV by microparticle enzyme immunoassay. In children, a low prevalence of anti-HAV (0.44%) was found, in contrast to a high prevalence in their teachers (78.8%); anti-HP seroprevalence was 6.4% for children and 30.8% for teachers. Anti-HAV and anti-HP seropositivities were significantly associated in teachers after adjustment for age, sex, and residential area through multiple logistic regression analysis (multivariate-adjusted odds ratio = 7.3; 95% confidence interval [CI] = 1.4-36.8, $p<0.001$). Our findings suggest that HAV and *H. pylori* may have shared transmission routes in central Taiwan 15 years or more ago, but not any recently.

Lin, 2000 (Southeast Asian J Trop Med Public Health)

Taiwan was a hyperendemic area for hepatitis A virus (HAV) infection before the late 1980s. The seroprevalence of HAV infection was higher than 90% with most HAV infection occurring during childhood. This study was to estimate the seroprevalence of HAV infection among preschool children in central Taiwan. A community-based survey was carried out in 54 kindergartens in 10 urban areas, 10 rural areas and 2 aboriginal areas randomly selected through stratified sampling. Serum samples of 2,549 healthy preschool children and 104 teachers in study kindergartens were screened for the HAV antibodies (anti-HAV) by means of a commercially available microparticle enzyme immunoassay (AxSYM HAVAB). Among aboriginal kindergarten children, more than 96% of them were anti-HAV seropositive due to a mass HAV vaccination program. In urban and rural areas, kindergarten children had a very low prevalence of anti-HAV (0.4%) in contrast to a high seroprevalence in their teachers (78%). There was no gender difference in seroprevalence of anti-HAV, while the anti-HAV seroprevalence was significantly higher in urban areas than in rural areas. Crowdedness of living in urban areas might facilitate the person-to-person transmission of infectious agents.

Wang, 2001

Hepatitis A, the predominant reported etiologic form of viral hepatitis in Taiwan, continues to be a disease primarily of children and young adults. A seroepidemiologic study was performed to assess the seroprevalence of hepatitis A (HAV) antibodies in the southern Taiwan general population in 1998 and is compared with results of a similar study in 1992. A total of 948 subjects (477 male and 471 female) with ages ranging from 0.3 to 63 years were stratified into 14 age-specific groups. The presence of anti-HAV antibodies was detected using a commercially available radioimmunoassay. 15% of the subjects were positive for anti-HAV antibodies, which is lower than that in 1992 ($p<0.001$). Seroprevalence rates were 14.1% for males and 22.6% for females ($p=0.006$). The pattern of anti-HAV seroprevalence was distinguishable from that found in 1992; minimum seroconversion occurred at ages ranging from 1 to 30 years. Prevalence of seropositive subjects decreased markedly for the < 1, 13-15, 16-19, 20-24, 25-29, and 30-39 year age groups in comparing 1998 with 1992. The current study demonstrates a continuing decline in the prevalence of HAV among children, adolescents, and young adults. The findings can be ascribed to the improvement of socioeconomic status and modernization of environmental sanitation. As a consequence of this changing trend of endemicity and the resulting lack hepatitis A antibodies among the general population in Taiwan, the risk of sudden major outbreaks is increased because of increasing international travel and immigration, particularly during and after natural disasters. HAV vaccination will be important for the prevention and control of HAV outbreaks in the community.

Yu, 2000

Background: With the improvement in the socioeconomic situation and general hygiene standards in Taiwan, the prevalence of antibodies to the hepatitis A virus (anti-HAV) in the general population has declined markedly in recent years. To avoid food-borne outbreaks of HAV infection caused by susceptible food handlers in Taiwan, we investigated the seroprevalence of anti-HAV among the target population and also evaluated the immunogenicity and reactogenicity of the inactivated hepatitis A vaccine in this study group. Methods: Two hundred and forty-four food handlers employed in four restaurants at Taipei Veterans General Hospital participated in the anti-HAV serologic screening program in July 1997. Of them, 48 susceptible food handlers received three doses of 720 enzyme-linked immunosorbent units of inactivated hepatitis A vaccine at 0, 1, and 6 months. Results: Of the 244 food handlers who underwent anti-HAV serologic screening, 169 (69.3%) were anti-HAV positive. The seroprevalence of anti-HAV was related to age: 91.5% of food handlers over 30 years of age were positive for anti-HAV but only 22.8% of food handlers younger than 30 were anti-HAV positive. Anti-HAV response was observed in all vaccinees after a booster vaccination at month 6. The response persisted to 1 year. The side-effects of the vaccinations were minimal. Conclusions: Susceptible food handlers should receive hepatitis A vaccination. Hepatitis A vaccine is safe and immunogenic in this target population.

Lin, 2000 (Infection)

Background: Taiwan is endemic for viral hepatitis infections. A field survey was performed in the isolated aborigines in Hualien, eastern Taiwan, to investigate the geographic and ethnic variations in hepatitis epidemiology. Materials and Methods: From 1996 to 1998, blood was drawn from 1,748 subjects from two southern Ami and two northern Atayal villages for serum markers of hepatitis A, B, and C. Results: Hepatitis A infection approached 100% in all groups. Hepatitis B infection and carrier rates were higher in the Atayal than in the Ami (92.3% vs. 49.1% and 20.8% vs. 5.3%; $p<0.01$). Hepatitis C infection rates were higher in three villages (27.5%, 20.1% and 25.4% vs. 3.6%; $p<0.01$). Hepatitis C infection increased with age ($p<0.01$) while hepatitis B infection did not. Conclusion: Hepatitis A infected most aborigines before the age of 15 years. Hepatitis B seldom infected people after the age of 15 years, while hepatitis C continued to infect people who were older. Geographic factors are important for hepatitis C infection, whereas for hepatitis B infection, in addition ethnicity is also important.

Liu, 1994

Hepatitis A virus infection was common in Taiwan. Most of the Taiwan data on the prevalence of Hepatitis A virus antibody (anti-HAV), however have derived from the Taipei area and few reports are available on the age-specific prevalence in other parts of Taiwan. Sera of 738 healthy inhabitants in

Tainan District, a rural southern Taiwan, were collected from January to December, 1992, and screened the anti-HAV IgG by radioimmunoassay. The prevalence rate of anti-HAV among infants was 64.6%, which decreased to 3.3% in preschool and school-age children up to 12 years old. The prevalence rate of anti-HAV antibodies was over 92% in adult subjects beyond 30 years of age, and 82.4% among 34 pregnant women. Compared to the data obtained from the children living in Taipei City, our results showed that the prevalence rate of anti-HAV in age group 1 to 10 years in Tainan area was higher than Taipei City (2.3-3.7% vs. 0-0.5%, $0.03<p<0.09$). The data also indicated that the age of primary infection in children has extended to an older age group. The rarity of HAV infection in Taiwan has created a large growing population of susceptible young adults. Mass vaccination for this population should be considered in the preventive program of public health.

Wu, 1993

In Taiwan, hepatitis A virus (HAV) infection is hyperendemic, and prior to the late 1970s more than 85% of the population was infected by 15 years of age. In this study, the prevalence of HAV infection in two regions of Taiwan with differing standards of living is evaluated. Serum antibody to HAV (anti-HAV) was determined by enzyme immunoassay. A total of 4,218 subjects under the age of 16 years were enrolled. The first group of 1,581 subjects were residents of the prosperous western plain region where the socioeconomic status and living environment have improved greatly in the past 20 years; the second group of 2,637 subjects were aborigines inhabiting the eastern and central mountain regions where improvement in the standard of living lags far behind the western region. All serum samples were collected in 1991 except for 1,100 samples collected in 1989 from elementary and junior middle school students in Tainan city. The prevalence of HAV infection was 11.9% for the western region and 81.0% for the eastern and central regions. In the eastern and central regions, 80% of the subjects had been infected with HAV before the age of six years, in contrast to 0% in the western region. By the age of 13 years, only 6% of the subjects were infected in the western region; however 97% had been infected in the eastern and central regions. Among children under the age of 10 years, only 10.6% (10/94) of the IgM-anti-HAV positive cases had clinical symptoms. These findings indicate that HAV infection has a close relationship with socioeconomic status and environmental sanitation.

Wang, 1993

During the last two decades an economic boom has occurred in Taiwan, a region where the prevalence of both hepatitis A and B virus infection was formerly very high. To examine the impact of socioeconomic developments on the secular trend and geographical variation in hepatitis A and B virus infection, 875 adolescents selected randomly from 20 junior high schools were studied. Serum samples collected from the subjects were tested for hepatitis A antibody (anti-HAV) and hepatitis B surface antigen (HBsAg) by enzyme immunoassay using commercial reagents. The anti-HAV prevalence increased from northern through central to southern Taiwan; the prevalence was highest in aboriginal townships and lowest in metropolitan precincts. This striking variation in anti-HAV prevalence in different geographical locations and at different urbanization levels remained significant in multiple logistic regression analysis. The HBsAg prevalence was significantly higher in aboriginal townships than in rural and urban townships and metropolitan precincts. In addition, HBsAg prevalence was related inversely to the number of physicians per 1,000 population. The prevalence of both anti-HAV and HBsAg declined significantly during the last decade in Taipei City and County. The decrease in anti-HAV prevalence may be due to improvements in environmental hygiene, water supply, and food sanitation, while the decline in the HBsAg carrier rate may result from the use of disposable needles and syringes as well as screening for HBsAg in blood banks.

Tzen, 1991

To evaluate the current status of hepatitis A virus (HAV) infection, a seroepidemiologic study to detect the prevalence of antibodies against HAV (anti-HAV) has conducted in Taipei City, from March to July, 1989. Serum specimens were collected from 602 male and 503 female apparently healthy children age 12 and under. The prevalence rate of anti-HAV was 27.5% in infants, and decreased to nearly 0% in preschool and early school children up to 10 years old. Compared to a previous study in the same area of Taipei in 1984, our study indicated a further and significant reduction in the prevalence of anti-HAV in almost every age group from 2 to 14 years of age. There was an average of a 5-year prevalence shift. These data suggest that there has been no significant endemic of HAV infection from 1984 to 1989. The antibody prevalence change in the different age groups represents an ongoing trend of HAV seroepidemiology in Taiwan where HAV infection is becoming rare. The age of primary infection in children has been extended to an older age group. The rarity of HAV infection in Taiwan has created a large and growing population of young adults susceptible to hepatitis A virus infection. The effective prevention of hepatitis A virus infection will become a major public health concern.

Hsu, 1985

Hepatitis A antibody (anti-HAV) in serum was studied from June to October, 1984, by radioimmunoassay in 647 male and 553 female apparently healthy children under 15 years of age in Taipei City. The prevalence rate of anti-HAV was 27.0% in infants, decreased to around 1% during the preschool age, then increased and remained around 5% until 11-12 years of age, when another increase was noted, and reached 13.6% among the early teenagers. The age-specific prevalence of anti-HAV increased with age but differed in three age ranges, which reflected three apparently different calculated annual incidences. Compared with previous studies in Taipei, the results showed a significant reduction in the prevalence of anti-HAV in almost every age group from 3 to 14 years. This fact probably reflects the marked improvement of hygienic conditions and progress in health education in recent years, which reduced the exposure to HAV infection among young children. The age of primary infection in the children was older than in previous studies, and it is expected that the susceptibility of HAV will extend to early adulthood.

Chiou, 1984

A survey of 2985 apparently healthy Taiwanese in southern Taiwan revealed a high prevalence (18.2%) of hepatitis B surface antigen (HBsAg). It was significantly higher in males (22.3%) than in females (13.6%), but no correlation with family origin, socioeconomic status or residence was established. About one-third of the breeding female HBsAg carriers were HBeAg-positive, and these may be an important source in the spread of HBV. Subtyping of HBsAg in 63 subjects showed adw to be dominant in this area, and 8 subjects with suspicious results had overlapping heterotypic HBV's (7 adwr and 1 adyw) in addition to 2 subjects in which coexistence of HBsAg and anti-HBs was recognized. The association between HBsAg positivity and serum transaminase elevation was significant, especially in the older groups who had a higher abnormal rate. Hepatitis A virus infection was serious too, with nearly 100% of people above 20 years of age being anti-HA antibody positive.

Hwang, 1983

To understand the prevalence and incidence of hepatitis A virus (HAV) infection in Chinese children in Taiwan, we determined the age-specific prevalence of hepatitis A antibodies (anti-HAV) in 823 children, ranging from birth (cord blood) to 19 years of age. The frequency of anti-HAV rose with increasing age with three different slopes, probably reflecting different age-specific incidences: lowest under 4 years of age, intermediate between 4 and 10 years, and highest above 10 years. We obtained follow-up specimens on 618 of the preschool children under 6 years of age. 11 (1.9%) of the 573 without antibodies had seroconversions after an average of 1.9 years of follow-up. The annual incidence was 1.0% and increased with advancing age of the children after infancy. None of the 11 seroconversions had clinical hepatitis. Among the 28 children 1-24 months of age who had antibodies, only 1 was positive on follow-up, reflecting loss of passively acquired maternal antibody in most children.

Wu, 1982

To investigate the prevalence of hepatitis A virus infection in Taiwan, 1210 samples of sera were collected from healthy subjects from birth to 78 years of age. Antibody to hepatitis A virus (Anti-HA) was detected by solid phase radioimmunoassay (HAVAB, Abbott Laboratories). The presence fo Anti-HA in the cord blood and early infancy signifies that it was acquired transplacentally from the mother. After the infancy period, the prevalence of Anti-HA gradually increased throughout childhood. There was a steep rise from 10 years of age to young adulthood and it reached its peak level in the third decade of live (97%). Of 911 subjects from 1 to 24 years of age, there were 378 (41.5%) Anti-HA positive. Only 11 of them had a history of clinically recognizable hepatitis. The majority had subclinical infection.

Sung, 1980

One hundred and thirty-four healthy subjects and 220 patients with liver diseases were studied for antibody to hepatitis A virus (anti-HAV) with radio-immunoassay. The frequency of anti-HAV related closely to the age of healthy subjects; the rate of positivity increased with age, being 5.9% in those under four years, 13.3% in the late first decade and over 90% after the third decade. Taking meals at stalls with poor sanitary standards is suspected to cause the prevailing infection in teenagers, although a cohort effect due to environmental and socio-economic improvement can not be excluded. Anti-HAV was present in most patients with frequencies comparable to healthy subjects of the same age. It is concluded that in Taiwan the prevalent chronic liver diseases and hepatocarcinoma are unrelated to HAV infection and the patients are infected to an extent similar to healthy people of the same age.

Wu JS, 1980

Anti-HAV was detected, by RIA technique, in a total of 805 serum specimens including 522 from healthy subjects and patients without liver disease, and 283 from patients with liver disease. Of 522 specimens, 19 were from children. The positive rate of Anti-HAV was 95.04% for adult healthy subjects and patients without liver disease, and 92.7% for patients with liver disease. No significant difference was noted between subjects with and without liver disease. No relationship between HAV infection and chronic liver disease was noted. It is highly possible that there would be no cases of acute HAV infection among adults over 30 years of age in Taiwan today if no re-infection by overwhelming HAV could occur. The very high prevalence of HAV infection in Taiwan at the present time appears to make Anti-HAV detection useless for the diagnosis of acute HAV infection among adult population. However, the detection of Anti-HAV might be of some use in the case of children at the present time, and for adults in the future when sanitation conditions improve. Detection of IgM-Anti-HAV rather than simple Anti-HAV was suggested in order to detect the acute phase infection.

Wu KW, 1980

195 sera from a random sample of primary school children of Taipei City were tested for antibody to hepatitis A virus by solid phase radioimmunoassay. The prevalence of anti-HAV was 26.9% in those 6-9 years of age, and 50.0% in those 10-13 years of age. The prevalence was higher in females, although not statistically significant. The prevalence of exposure to hepatitis A virus increases with age, decreases with increasing socioeconomic class, and is independent of sex and serologic evidence of prior hepatitis B virus exposure but is much more common than hepatitis B virus exposure.

Lu, 1980

Hepatitis B surface antigen (HBsAg) and anti-hepatitis A virus antibody (antiHAV) in sera or saliva of restaurant workers in Chung Shan District, Taipei, were tested by radioimmunoassay from October 1978 to March 1979. Among the 2006 serum samples 387 (19.3%) were HBsAg positive. While significant difference between male and female restaurant workers was observed, no age difference was noted. The workers originated from Taiwan demonstrated the highest frequency of hepatitis B antigenemia (20.9%). The next high group was the workers originated from southern mainland (16.5%). The lowest frequency was observed in those from northern mainland (9.4%). HBsAg was found in saliva of 40 out of 82 serum carriers (48.8%) Of the 946 workers 896 (94.7%) carried the anti-HAV antibody. There was no sex difference and the positive rates were 91.2%, 92.6%, 96.1%, 98.4% in 14-19, 20-24, 25-29 and >30 years old population, respectively, i.e. a trend of increase in the rates with age was observed.

ASIA, SOUTH

(Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan)

Ahmed, 2009

Serum samples from 465 subjects aged between 1 and 25 years were tested for antibody against hepatitis A virus (HAV) [anti-HAV IgG and IgM] to determine the seroprevalence of HAV antibody and do a cost-benefit analysis for decision making about vaccination against HAV among the general population of Bangladesh. A high prevalence of anti-HAV (74.8%) was observed in the study population; the whole study population was found positive for anti-HAV by the age of 25 years. On performing the cost-benefit analysis, it was found that the cost for vaccination with screening for anti-HAV was almost three times cheaper than vaccination without screening. Thus, in the present socioeconomic condition of Bangladesh, a policy based on screening for HAV antibody before vaccination is recommended.

Da Villa, 1997

A seroepidemiological study of the prevalence of markers related to the most common forms of viral hepatitis was carried out in Bhutan on 1,666 healthy people of both sexes, from the general population. A group of 440 pregnant women were screened separately. Our results suggest that in Bhutan, hepatitis A and hepatitis B are widespread, while there is a low prevalence of hepatitis C and E. Anti-HAV (anti-hepatitis A virus) was found in all 171 tested subjects over 12 years of age, and anti-HBc (anti-hepatitis B core antigen) in 63.1% of 1,666 tested people. On the other hand, anti-HEV proved positive in 2.0% of 257 tested subjects, and anti-HCV in only 1.3% of 611 tested subjects. Hepatitis B surface antigen (HBsAg) was found in 5.9% of the sample from the general population (5.2% in children, 5.6% in young people and 6.3% in adults) and in 5.4% of the pregnant women. Furthermore, 29.1% of HBsAg-positive pregnant women were HBeAg- and HBV DNA-positive, too. Comparing the pregnant women's prevalence data to those found in children, we suggest that the main route of HBV transmission in the Bhutanese population is vertical, from mother to child; this finding is important for the implementation of a correct anti-HBV vaccination strategy in Bhutan.

Gadgil, 2008

Recently, a changing pattern of hepatitis A epidemiology has been reported in the Indian population indicating a rise in the rate of hepatitis A infection among adults. The study's objective was to assess anti-HAV prevalence in voluntary blood donors from middle and high socioeconomic strata. Serum samples collected from voluntary blood donors from Pune city and its suburbs in the years 2002 and 2004-2005 were tested for anti-HAV IgG antibodies. Serum samples collected during 2004-2005 were examined for anti-HAV IgM antibodies. Positive samples were tested for HAV-RNA. Agewise anti-HAV positivity was significantly low in adults aged 18-25 years (90.4%) compared to those aged >25 years (97.4%) ($P<0.01$). A decline in anti-HAV prevalence was significant in 2004-2005 compared to that in 2002 (96.5% vs. 92.1%) ($P<0.01$). Overall, in both adult age groups, the proportion of anti-HAV positivity was remarkably low in the high socioeconomic group (HSG) (88.96%) compared to that of the middle socioeconomic group (MSG) (95.86%) ($P<0.01$). Anti-HAV IgM positivity was not significant (~1%), however, presence of HAV-RNA in one of the samples indicated the possibility of horizontal transmission of HAV. Increase in seronegativity to HAV in HSG implicates a rise in the susceptible pool and indicates the need for vaccination against hepatitis A.

Anand, 2004

Background: Hepatitis A virus (HAV) vaccination is recommended worldwide for patients with chronic liver disease to prevent decompensation due to superinfection with HAV. India being endemic for HAV, the prevalence of pre-existing antibodies against HAV due to subclinical exposure to the virus in childhood among patients with chronic liver disease may be high and, therefore, vaccination may not be needed. However, little data are available on the prevalence of HAV antibody among patients with chronic liver disease in India. Methods: All patients with chronic liver disease seen at Gastroenterology Center, Army Hospital R and R, New Delhi during the year 2002 and diagnosed to have either chronic liver disease were tested for the presence of IgG anti-HAV antibody in their sera (using a commercial ELISA kit). All patients with acute exacerbation or rapid deterioration of a preexisting chronic liver disease were separately studied for presence of IgM anti-HAV. In addition, a matched number of patients who attended the center due to diseases other than liver disease were also studied as controls. Results: One hundred and eighty seven patients of chronic liver disease and 89 controls were studied. Mean age of these two groups was 38.6 and 42.1 years and 153 (81.8%) and 78 (87.6%) of them were males respectively. Etiology of chronic liver disease was HBV infection in 91(48.7%), HCV infection in 62 (33.2%), autoimmune chronic hepatitis in 3 (1.6%), PBC in seven (3.7%) and cryptogenic 24 (12.8%). Of these 179 (95.7%) patients tested positive for IgG anti-HAV. A total of 37 hospitalizations in 29 patients were noted during the study period due to acute exacerbation of pre-existing chronic liver disease. None of these were positive for IgM anti-HAV, while 28 were positive for IgG anti-HAV. Among the controls, 87 controls (94.6%) were positive IgG anti-HAV. The prevalence of anti-HAV positivity was similar among patients with various etiologies. Conclusion: Vaccination against HAV is not routinely required among patients with chronic liver disease in India as there is a very high prevalence of pre-existing antibodies in these patients. HAV superinfection as a cause of acute exacerbation of chronic liver disease was not seen in this.

Ramachandran, 2004

Background and Aims: The adverse effect of acute hepatitis A in chronic liver disease is well known. The outcome of acute hepatitis E in chronic liver disease has not been extensively studied. The present study aimed to examine the clinical profile and outcome of patients with chronic liver disease and hepatitis E virus (HEV) superinfection, and the seroprevalence of hepatitis A and E infections in patients with chronic liver disease and controls in India. Methods: A retrospective study of patients with chronic liver disease and acute icteric hepatitis E was performed. Acute hepatitis E was diagnosed by immunoglobulin (Ig)M ELISA. Seroprevalence studies were carried out using IgG ELISA in 100 patients with chronic liver disease and 79 age- and sex-matched controls. Results: From June 2001 to December 2002, nine patients with chronic liver disease were found to have superinfection with HEV. Out of these, six patients died of advanced liver failure. The etiology of liver disease was Wilson's disease in six, hepatitis B virus in one, autoimmune in one and cryptogenic in one case. The seroprevalence of hepatitis A was 99 and 100% and 56 and 21% for HEV in cases and controls, respectively. Conclusions: Acute HEV in patients with chronic liver disease has a grave prognosis. Wilson's disease was the most common cause of chronic liver disease complicated by acute HEV. Seroprevalence studies showed that 44% of patients with chronic liver disease were at risk of developing hepatitis E. Hepatitis E vaccine, when available, is indicated for use in this group.

Acharya, 2003

Background: Universal vaccination against hepatitis A virus (HAV) has been recommended for children because of the changing epidemiological pattern of HAV. Vaccination has also been advised for patients with chronic liver disease as HAV superinfection in these patients can result in severe or even fatal disease. In India, the indications for HAV vaccination are not clear due to contradictory seroepidemiological data in children and lack of data on HAV seroprevalence in patients with chronic liver disease. Methods: Sera were collected from children studying in two government-run schools and from patients with chronic liver disease attending the Liver Clinic at the All India Institute of Medical Sciences (AIIMS). The sera were tested for anti-HAV antibodies. The incidence of HAV-induced acute hepatitis and acute liver failure at AIIMS over the last 10 years was also assessed. Results: A total of 93.2% (1328/1424) of the school children between 4-18 years of age who were included in the study had anti-HAV antibody in their sera. 80% of the children had antibodies against HAV in their sera by the age of 5 years, whereas all the children above 16 years were positive for anti-HAV antibody. A total of 256 patients with chronic liver disease (94 with cirrhosis of the liver, 160 with chronic hepatitis) were tested for the presence of anti-HAV antibody. Of them, 97.6% (248/254) had anti-HAV antibody in their sera. The annual frequency of HAV-induced acute viral hepatitis and acute liver failure at AIIMS during the last 10 years did not show any change. Conclusion: Mass vaccination against HAV is not required in north India because of the presence of protective antibodies against HAV in the majority of the population.

Mohanavallli, 2003

With similar feco-oral mode of transmission of Hepatitis A and E viruses, and improving levels of personal hygiene among higher socioeconomic population, periodic surveillance on HAV/HEV exposure pattern may be of immense public health value. One such attempt was made in Tamilnadu, India by analysing the presence of antibodies to HAV and HEV in 185 healthy children of 6 months to 12 years of age. While anti HAV positivity was 96.9% by 12 years of age, anti HEV positivity fluctuated between 5.3-16.7%. The study suggests the necessity for developing a vaccine for HEV to prevent the frequent occurrence of HEV outbreaks in India, since natural HEV exposure does not bestow significant protection as observed in HAV.

Xavier, 2003

Objective: Hepatitis A vaccine has been recommended for patients with chronic liver disease since they have high mortality following acute hepatitis. This study was done to assess the prevalence of antibodies to hepatitis A virus in Indian patients with liver cirrhosis to determine the relevance of this recommendation in India. Methods: Consecutive patients with cirrhosis of liver seen at two referral hospitals in southern India were tested for antibodies to hepatitis A virus using EIA. Age-matched non-cirrhotic adults attending the OPD served as controls. Results: Of the 52 patients (mean [SD] age 57.1 [11.0] years; 33 men) and 50 control subjects (52.0 [14.8] 5 years; 39 men), 51 patients and all the controls tested positive (p=ns). Conclusion: Most patients with liver cirrhosis have antibodies against hepatitis A virus and thus immunization against this infection without screening appears unnecessary in them.

Jindal, 2002

Background and Objectives: Recent seroepidemiological studies have demonstrated a decrease in the seroprevalence of hepatitis A virus (HAV) infection, thereby increasing the pool of susceptible adult population. Health care workers, especially those working in pediatric wards and nurseries, are at an increased risk of developing HAV infection. The present study was undertaken to determine the prevalence of antibody against HAV (IgG anti-HAV) among a batch of medical students of the Maulana Azad Medical College, New Delhi, so as to identify the proportion of students who would be susceptible to HAV infection and hence would benefit from a vaccination program against HAV. Methods: A total of 91 medical students were enrolled and divided into groups on the basis of sex. The serum samples were evaluated for the presence of immunoglobulin (IgG) against HAV (IgG anti-HAV) using a commercially available enzyme linked immunosorbent assay (ELISA) kit. Results: The mean age of all the subjects was 19.9 ± 1.5 yr and the male: female ratio was 1.2: 1. Fifty seven (62.6 ± 5.1%) students were positive for

IgG anti-HAV while 34 (37.4%) were seronegative and hence susceptible to HAV infection. No statistically significant difference was observed in the seroprevalence of HAV between males and females [64 ± 6.7% (32/50) versus 60.9 ± 7.6% (25/41)]. Interpretation and Conclusion: our results indicate that more than one-third of the medical students were seronegative for IgG anti-HAV and hence at an increased risk of developing HAV infection as a result of occupational exposure. Therefore, we suggest that students in a health care set up should undergo vaccination against HAV after pre-vaccination immunity screening.

Batra, 2002

Objective: To evaluate the current seroprevalence of antibodies against hepatitis A virus (HAV) in a sample of schoolchildren above 10 years of age and to determine the prevalence of HAV-induced hepatitis in adults at a tertiary care hospital in northern India between January 1992 and December 2000. Methods: Sera from 276 male and 224 female schoolchildren aged 10-17 years were tested for anti-HAV antibodies by enzyme-linked immunosorbent assay. Consecutive patients with a diagnosis of acute viral hepatitis who attended a liver clinic were tested for the serological markers of HAV, hepatitis B Virus, hepatitis C virus, hepatitis D virus, and hepatitis E virus. Findings: Of the male and female children, 96.3% and 98.2%, respectively had anti-HAV antibodies in their sera. The prevalence of these antibodies in the age groups 10-12, 13- 14, and 15-17 years were 98.6%, 94.8%, and 98.3% respectively. The frequency of HAV- induced acute viral hepatitis (69/870, 8%) in adults did not show an increasing trend. Conclusion: Mass HAV vaccination may be unnecessary in northern India because the seroprevalence of protective antibodies against HAV in schoolchildren aged over 10 years remains above 95% and there has been no apparent increase in HAV-induced acute viral hepatitis in adults.

Murhekar, 2002

The Andaman and Nicobar Islands, Union Territory of India, are home to six primitive tribes. Studies carried out earlier among these tribes revealed very high rates of hepatitis B infection. We have now studied hepatitis A and E infection among them. A total of 951 serum samples were collected from four accessible tribes (Nicobarese, Shompens, Onges and Great Andamanese) and tested for antibodies against hepatitis A and E viruses. In addition, 240 serum samples collected a decade earlier from age-stratified Nicobarese were also screened. Hepatitis A virus (HAV) infection was found to be highly endemic among all the tribes, whereas hepatitis E virus (HEV) infection was common among the Nicobarese and Shompens. The age group-wise prevalence of these infections among the Nicobarese showed different patterns, HAV prevalence rising significantly from those aged 10 years and thereafter reaching a plateau, whereas HEV prevalence was found to be more evenly distributed over all age groups, but rising somewhat after 30 years of age. Over the last decade, the prevalence of HAV among the Nicobarese has declined slightly, particularly in those aged 10 years or less whereas HEV infection has more than doubled over all age ranges. Different HEV prevalence observed among the tribes could not be attributed to differences in sanitation or water supply. This fact and the different age-wise patterns of HAV and HEV prevalences is suggestive of different modes of transmission of HEV that are not shared. The highest rates for HEV were among those tribes which reared pigs suggesting that pigs might serve as reservoir of HEV. Further studies are needed, however, to validate these findings.

Mall, 2001

Objective: Recent changes in the epidemiology of hepatitis A virus (HAV) infection and the availability of effective vaccines have renewed interest in this infection. We determined the age-related prevalence of anti-HAV antibodies in India and looked for differences by known risk factors for HAV infection. Methods: In this prospective study, serum samples obtained from 1612 subjects aged 1 to 60 at six centers in five cities (Calcutta, Cochin, Indore, Jaipur and Patna) during the period February to August 1998 were tested for anti-HAV antibodies. Demographic and socio-economic information was obtained by questionnaire. Results: The overall seroprevalence rate was 65.9%, varying from 26.2% to 85.3% in various cities; there was no difference between males and females. Seropositivity increased with age from 52.2% in the 1-5 year age group to 80.8% in those aged 16 years or more. Seroprevalence rates were significantly lower in those aged 1-5 years compared with other age groups ($p<0.0001$). There was no difference in seroprevalence between those with monthly family income <Rs 5000 and >Rs 5001. Multivariate analysis showed that anti-HAV seroprevalence varied significantly by source of water supply, being highest when the supply was municipal. Conclusion: Our results indicate an epidemiological pattern of intermediate endemicity. This finding has public health implications as it indicates that a significant proportion of the Indian adolescent and adult population is at risk of HAV infection.

Arankalle, 2001

The epidemiology of hepatitis A virus (HAV) and hepatitis E virus (HEV) was assessed among age-stratified urban high socioeconomic, lower middle socioeconomic status and rural populations from western India in 1998. When compared with previous surveys, a clear shift from high to intermediate endemicity of HAV was evident only for higher socioeconomic population (1982-98), raising the possibility of outbreaks of hepatitis A in this category. A decrease in anti-HAV positivity was noted in rural children aged 6-10 years. Lower circulation of HEV was noted among < 25-year-old urban higher socioeconomic and rural individuals. For both viruses, the lower middle socioeconomic populations were comparable in 1982 and 1998. Socioeconomic status and family size (odds ratio = 23 and 1.6, respectively) were independently associated with anti-HAV positivity. Age, lower middle socioeconomic status and well water were significant independent variables for HEV infection (odds ratio = 5.7, 2.4 and 1.9, respectively). Hence, vaccination policy for hepatitis A needs to be reviewed.

Das, 2000

The present study was undertaken to determine the seroprevalence of the antibody against hepatitis A virus (IgG anti-HAV) in an urban population sample from Delhi (India) and to assess any change in the epidemiological pattern of HAV infection in this part of the world. A total of 500 healthy subjects were enrolled and divided into groups on the basis of age, sex and per capita income and evaluated for the presence of IgG anti HAV antibodies using a commercially available kit. The mean age of all the subjects was 32.6 +/- 13.2 yr. and the male:female ratio was 1.5:1. The overall prevalence of IgG anti-HAV in all subjects was 71.2% (356/500). The prevalence in subjects >35 years (92.1% [186/202]) was significantly higher than that in subjects <35 years (92.1% [186/202]) was significantly higher than in subjects <35 years (57% [170/298]). No statistically significant difference was observed between male and female subjects (71.4% [217/304] vs. 70.9% [139/196]) or between subjects belonging to middle and low socioeconomic groups (68.9% [135/196] vs. 72.7% [221/304]). These findings when compared with the results that were obtained in 1982, showed a decreasing prevalence of IgG anti-HAV, most significantly in younger age groups (16-35 years). Thus, we may conclude that the seroepidemiology of hepatitis A virus infection in urban population of India seems to be changing with seroprevalence in the younger population approaching a figure similar to that of the more developed European countries.

Joshi, 2000

Background: Hepatitis A virus (HAV) is an enterically transmitted viral disease endemic in many developing countries including India. Infection is often subclinical or asymptomatic in children while with increasing age symptomatic acute infections are more common. In some developing countries improvements in living conditions have led to change in epidemiology of HAV infection. In our country there are very few reports on prevalence of HAV. Objective: The present study was undertaken to determine the seroprevalence of hepatitis A virus antibodies in relation to age in Hyderabad. Material and Methods: Serum samples were collected from 90 subjects in the age group 2-64 years in a mass vaccination camp for Hepatitis B. All the subjects were investigated with a uniform social and medical history questionnaire. Sera were tested for antibody to HAV (total anti-HAV) using enzyme immunoassay (General Biologicals, Taiwan). Results: The subjects included 48 males and 42 females. There were 54 children (< 12 yrs) and 36 adults. Of the 90 serum samples tested 51 (56%) were positive for anti HAV antibodies. The seropositivity in males and females was similar. The seroprevalence was 31.8% (17/54) in children (< 12 years) and 94.4% (34/36) in adults ($p < 0.001$). Age related seroprevalence revealed that a majority of children below 10 years (33/48, 69%) remain anti HAV negative, while only 25% of children below 15 years were anti HAV negative. The anti HAV antibody positivity was similar in different income groups. Conclusion: The prevalence of HAV is high in Hyderabad. A majority of children below 10 years and 25% of children < 15 years remain susceptible to HAV infection. Child immunization against HAV therefore should be considered in our population too.

Dutta, 2000

A prospective study was done to determine the age specific prevalence of anti-hepatitis A antibodies (anti-HAV Abs) among children in Delhi. Four hundred and twenty children aged 0-12 years attending outpatient department for vaccination or any minor illness were studied. Sera was tested by ELISA for anti-HAV Abs using a commercial kit (Hepvase A 96 TMB). Thirty samples of cord blood were similarly analyzed. All samples of cord blood were positive for anti-HAV Abs. Prevalence of anti-HAV Abs was 80% by 5 years of age. The most vulnerable age group was 0.5-1.5 years (anti-HAV Ab positivity). Cord blood had 100% positivity. Univariate and multivariate analyses taking anti-HAV antibody positivity as dependant variable demonstrated that age and father's education (socioeconomic status) significantly affect prevalence of anti-HAV Abs. Sex, water supply, history of jaundice in self or family did not have any significant effect on anti-HAV antibody positivity. Prevalence of anti-HAV antibodies is 80% by 5 years of age. Further studies in different strata of society and different regions in the country are required to assess the need and age for vaccination.

Chitambar, 1999

This report pertains to a retrospective study conducted between 1983 and 1995 at three time points to evaluate the prevalence of hepatitis A virus (HAV) infection in the population of Bhor Taluk, situated in western India. Serum samples from children and adults were tested for anti-HAV antibodies using blocking ELISA test. There was a significant decrease in anti-HAV prevalence among children aged 5-10 years in 1995 (87.36%) as compared to that of 1983 (97.58%) and 1987 (96.48%). All individuals >11 years of age were seropositive for anti-HAV antibodies. Anti-HAV prevalence was similar in the users of well water, but was significantly reduced in individuals supplied with piped water in 1995 (88.61%) compared with that in 1983 (98.77%). A significant decrease in anti-HAV positivity was noted in children from Bhor Taluk as compared to children from Pune bled in 1992. These results underline the need for periodic surveillance of seroepidemiology of hepatitis A to determine the measures for prevention and control of the disease.

Aggarwal, 1999

(no abstract)

Chadha, 1999

It is known that 90 per cent of children in India are exposed to hepatitis A virus (HAV) by the age of six years. The aim of the study was to determine when in early childhood maximum HAV infections take place and to deduce an appropriate age for vaccination against HAV. Blood samples of 499 children between the ages of three days and six years were collected and tested for the presence of antibodies against hepatitis A. A statistically significant negative correlation between IgG anti-HAV and age was observed ($P < 0.01$) up to 11.67 months when IgG anti-HAV positivity was found to be minimum (9.25%). Subsequently a significant positive correlation was noted ($P < 0.01$). Exposure to HAV was 28.9 per cent soon after the waning of maternal antibodies in the 13-15 month age group which increased to 52.5 per cent by two years of age and 90.9 per cent by 6 yr. It is concluded that in addition to other preventive measures, if children in India are to be vaccinated against hepatitis A they should be immunized against HAV by 9-10 months of age when the maternal antibodies disappear.

Mittal, 1998

(no abstract)

Das, 1998

(no abstract)

Dhawan, 1998

Objectives: Since epidemiologic trends of hepatitis A are changing worldwide, we studied its seroprevalence in Mumbai, which is thought to be a high-endemicity area. The immunogenicity and safety of a hepatitis A vaccine were also studied. Methods: Six hundred and seventy subjects (456 men; age range 6 mo-60 y) answered a questionnaire on social and medical history. Qualitative analysis of total anti-HAV was performed in all subjects by ELISA. One hundred and seven of 147 anti-HAV negative subjects received hepatitis A vaccine at months 0, 1 and 6. Subjects were followed up (months 1, 2, 6, 7) to look for side-effects and seroconversion. Results: The seroprevalence of HAV was 523/670 (78%); 38% of children < 5 years were anti-HAV negative. Seroprevalence rates of 80% were reached by 15 years. Prevalence was lower in the higher socio-economic group (151/234; 64.5%) compared with the lower socio-economic group (372/436; 85%) ($p < 0.001$). One month after doses 1, 2 and 3 of the hepatitis A vaccine, seropositivity was 92%, 99% and 100%, respectively. Minor self-limited side-effects occurred in 19.5% of subjects; there were no major side-effects. Conclusions: The seroprevalence of anti-HAV is high in Mumbai. Seroprevalence is lower in the higher socio-economic groups. The hepatitis A vaccine is safe and immunogenic.

Das, 1996

(no abstract)

Thapa, 1995

The pattern of viral markers in acute sporadic hepatitis in 329 children and those in 334 healthy school children from North West India were studied. Hepatitis A was found to be the commonest infection in sporadic cases (78 per cent). Of these, 86 per cent were under 10 years and 50 per cent less than 5 years of age. Hepatitis B was positive in 8 per cent, non-A non-B in 13 per cent, A as well as B in 1 per cent, and none had Delta virus infection. Viral markers in healthy school children showed anti-HAV IgG positivity in 96 and 85 per cent in those belonging to low and high socio-economic groups, respectively, indicating past infection. HBsAg was positive in 1 per cent of cases. Viral hepatitis is an important public health problem in children and warrants active immunization.

Arankalle, 1995

The age-specific seroprevalence of antibody to hepatitis A virus (HAV) and antibody to hepatitis E virus (HEV) were studied in persons in Pune, India, where both viruses are endemic. The data showed that HAV infected the majority of persons by age 3 years and virtually 100% by late childhood. In contrast, infection with HEV was rare in children and did not reach peak prevalence (33%-40%) until early adulthood. The reason for the differences in infection rates between HAV and HEV is not known. Age-specific antibody patterns in serum samples obtained 10 years apart show that neither HAV nor HEV has diminished in medical importance in this Indian community.

Graham, 1991

Helicobacter pylori (previously *Campylobacter pylori*) is now accepted as the major cause of type B gastritis and thus what is known about the epidemiology of type B gastritis can reasonably be transferred to *H. pylor*i. We used a specific ELISA for anti-*H. pylori* IgG to study the prevalence of *H. pylori* infection in a population of lower socioeconomic class from Hyderabad, India. The results from India were compared to studies from other parts of the world. Two hundred thirty-eight individuals ages 3 to 70 participated. The frequency of *H. pylori* infection increased with age (P less than 0.01) and was greater than 80% by age 20. *H. pylori* infection was present in 79% of the population studied; there was no gender-related difference in prevalence of *H. pylori* infection. IgG antibody against hepatitis A (HAV) was rapidly acquired in Hyderabad; in a subset of 58 children between the ages of 3 and 21 tested, the frequency of anti-HAV was 98.2%. The prevalence of H. pylori infection increases with age in both developed and developing countries. The high age-specific prevalence of *H. pylori* infection in developing countries is probably a reflection of the lower socioeconomic level of those areas.

Werner, 1990

(no abstract)

Werner, 1989

Sera from 385 healthy people aged 1-76 years from rural Punjab, India, were assayed in 1985-1986 for antibodies to hepatitis A, hepatitis B virus (anti-HBc) and hepatitis B serum antigen, and 175 of these sera were screened for HIV antibodies by ELISA. Commercial kits Havab, Ausrah II, and Ausab Test, (Abbott Laboratories, North Chicago, Ill, USA) were used. In cases of positive HBsAG, HBe-Antigen and HBV-DNA were determined by radioimmunoassay. over 98% of persons 20, 89% of those 10-19 and 88% of children 1-9 had hepatitis A antibodies. Markers for hepatitis B virus, anti-HBc, ranged from 3.12-36.9% over the age groups, with a total of 100 or 30% positive. HBsAG positives averaged 3.37%. These data are typical of Indian populations in which everyone 10 years has been exposed to hepatitis A. None of the sera were positive for HIV.

Tandon, 1984

The etiological spectrum of viral hepatitis and the prevalence of serological markers of hepatitis A and B virus infection in healthy persons in north India were studied. Hepatitis A virus was found to be the most common cause of acute hepatitis in children (67%). It was a less frequent cause of this disease in adults (14%). Hepatitis A virus was only rarely the cause of acute (12%) and sub-acute (4%) liver failure. It was recorded as the etiological agent in an epidemic among schoolchildren. Exposure to hepatitis A virus occurs in early childhood, and by the age of 10 years, 90% of healthy persons have serological evidence of hepatitis A virus infection. Hepatitis non-A non-B virus was the cause of acute hepatitis in 44% of adults and 24% of children with this disease. This virus was also the most important etiological agent in acute liver failure (55%) and sub-acute hepatic failure (51%). It was the cause of all the hepatitis epidemics in the general population. Only 9% of hepatitis cases in children were due to hepatitis B virus whereas 42% of cases in adults were attributable to this virus. Hepatitis B virus was the causative agent in 33% of cases of acute hepatic failure and 45% of cases of sub-acute hepatic failure. The carrier rate for hepatitis B virus was 5% and antibody to hepatitis B surface antigen was found in up to 38% of specific population groups.

Gandi, 1981

(no abstract)

Sawayama, 1999

Background: In 1987, we reported that the prevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) infection in Nepal was low, as compared to hepatitis A virus (HAV) infection, and that no human T-lymphotropic type-1 (HTLV-1) infection was found in Nepal. Objectives: To determine changes in the prevalence of HAV, HBV, and HCV infections between 1987 and 1996 in inhabitants of Bhadrakali (suburban) and Kotyang (rural) villages in Nepal. Study Design: We did a cross-sectional survey of 458 inhabitants of two Nepalese villages, to assess the prevalence of antibody to HAV (anti-HAV), antibody to hepatitis B core antigen (anti-HBc), hepatitis B surface antigen (HBsAg), antibody to HCV (anti-HCV), and antibody to HTLV-I (anti-HTLV-I). Results: Anti-HAV was detected in 454 (99.1%), HBsAg in 5 (1.1%), anti-HBc in 33 (7.2%) and anti-HCV in 8 (1.7%) of serum samples tested in 1996. Statistically significant differences by gender or age group were nil. The prevalence of HCV infection was significantly higher in 1996 than in 1987 after adjusting for age of subjects living in the two villages ($p < 0.01$). The prevalence of HBsAg was significantly higher in 1996 than 1987 in Bhadrakali after adjusting for the factor of age ($p<0.05$). Between 1987 and 1996, evidence for HTLV-1 positive residents was nil. Conclusion: These results suggest that HAV has been endemic in Nepal for long time while not of HBV, and that HCV infection tends to be increased recently.

Kitson, 1999

This Hepatitis A seroprevalence study aimed to determine the cost effectiveness of Hepatitis A vaccination for Gurkha soldiers. One hundred and sixty Gurkha recruits had serum analysed for Hepatitis A IgG. One hundred and fifty nine (99.4%) were IgG positive. Continuing to vaccinate Gurkha soldiers against Hepatitis A will confer little benefit and is not cost effective.

Nakashima, 1995

In 1987, 676 blood samples were collected from inhabitants of the Bhadrakali and Kotyang villages in Nepal. The samples were tested for the prevalence of antibody to hepatitis A virus (anti-HAV), hepatitis B surface antigen (HBsAg), antibody to hepatitis B core antigen (anti-HBc), second-generation antibody to hepatitis C virus (anti-HCV) and antibody to human T-lymphotropic virus type-I (anti-HTLV-I). Anti-HAV was present in 99.3% of the people surveyed. The prevalence of anti-HAV reached 100% in the <25 age group and was as high or only slightly lower in all other age groups. The prevalence of HBsAg was 0.3% and of anti-HBc 7.7%. Anti-HCV was found in 0.1% of the residents. No significant difference by gender or village was noted in the prevalence of anti-HAV, HBsAg, anti-HBc, or anti-HCV. No anti-HTLV-I-positive persons were identified. These data suggest that the prevalence of hepatitis B and C virus infections in Nepal is low in contrast to hepatitis A virus infection, and that human T-lymphotropic type-I infection may be absent in this population.

Aziz, 2007

Objective: To document the prevalence of Helicobacter pylori (H. pylori), Hepatitis A virus (HAV), Hepatitis C virus (HCV), Hepatitis E virus (HEV) antibodies and Hepatitis B virus surface antigen (HBsAg), in the pediatric age group of low socioeconomic urban communities of Karachi and to identify risk factors associated with these infections. Design: Cross-sectional survey. Place and Duration of Study: Three selected squatter settlements of Karachi during April 2002 to December 2004. Patients and Methods: Three hundred and eighty children, ages 5 months to 15 years were investigated. Venous blood samples were collected and questionnaire filled on sociodemographic characteristics (family income, number of dependents in the family, area of living, number of people per room per house, and number of children sharing bed with parents and siblings). Gastrointestinal symptoms were recorded. Anti-HAV IgG (Hepatitis A virus IgG antibody), anti-HCV (Hepatitis C virus antibody), anti-HEV (Hepatitis E antibodies) and HBsAg, were analyzed by enzyme immunoassays (EIAs). Samples were also screened for anti-HIV1/2 (human immunodeficiency virus 1 and 2 antibodies by EIA. IgG antibodies against H. pylori were detected by immunochromatography. Results: A correlation between increasing age and seroconversion was seen for hepatotropic viruses. At 14 years and above,100% of the children were found to be positive for anti-HAV, 26% for anti-HEV, and 1.4%, for anti-HCV while HBsAg was positive in 1.9%. H. pylori infection did not show a significant increase with age. Both anti-HAV and anti-H. pylori were present simultaneously in 30% of the population investigated. Conclusion: With age, increasing number of children acquired antibodies against hepatotropic viruses and H. pylori. Occurrence of HBsAg and anti-HEV at a later age suggests horizontal, rather than vertical transmission.

Qureshi, 2000

(no abstract)

Agboatwalla, 1994

A cross sectional study was conducted to determine the seroprevalence of Hepatitis A, B, and C virus in healthy Pakistani children. HAV IgG antibody was assayed in 258 subjects and it was found that 94% children by 5 years of age had HAV IgG-antibody. The overall seroprevalence of HAV IgG antibody was 55.8% and IgM 5.3%. HBVsAb levels assayed in 236 healthy children showed a seroprevalence of 2.97%. Similarly, HCV antibody seroprevalence was found to be a low 0.44% in healthy children. HAV is a major cause of Hepatitis, as compared to HBV and HCV which are of low endemicity.

Malik, 1988

A total of 630 apparently healthy volunteers were studied for seromarkers of hepatitis A and B by Enzyme Linked Immunosorbent Assay (ELISA) and Radioimmunoassay (RIA) techniques. A carrier rate of 5.3% for hepatitis B surface antigen (HBsAg) was found in young medical students while 10.7% recruits were positive for HBsAg. The pregnant females had BHsAg carrier rate of 7.8%. About 96.6% of young medical students and 100% of recruits revealed evidence of past exposure to hepatitis A. The serological evidence of past exposure to hepatitis B was found in 12.2% of medical students and 33.2% of recruits and pregnant females. Generally, substandard hygienic conditions and poor sanitation contributed to the transmission of hepatitis A virus (HAV) in young population. The use of unsterilized syringes in mass inoculation and vaccination and lack of HBsAg testing of the donor's blood in most blood banks were largely responsible for the spread of hepatitis B virus (HBV).

ASIA, SOUTHEAST

(Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Maldives, Mauritius, Mayotte, Myanmar, Philippines, Seychelles, Sri Lanka, Thailand, Timore Leste, Viet Nam)

Thüring, 1993

So far little was known on the epidemiology of hepatitis A, B, C, and of AIDS in Cambodia and especially not in the rural area of Takeo. Therefore serological markers for past or ongoing infections with the disease causing viruses were measured in 559 healthy individuals (305 adults, 200 children and 54 mothers of children with liver disorders) and in 185 individuals (103 adults and 82 children) with liver or kidney diseases. In none of the 744 samples tested was anti-HIV detected. 10-37% of the children and 73% of the adults showed HBV-markers, HBsAg being detectable in 2-14% of the children and in 8% of the adults. The prevalence for anti-HCV was 6.5% in the adults with a predilection in males (9%). No markers for HCV infections were found in children. Growing, age related proportions of children (27-97%) and 100% of the adults were anti-HAV IgG positive. HBsAg was detected in 46% of the adults with acute hepatitis, in 45% of those with chronic hepatitis/liver cirrhosis and in 90% of patients with hepatocellular carcinoma (HCC). In children the corresponding figures were 18% for acute hepatitis and 18% for chronic hepatitis. Patients with acute hepatitis or HCC had a similar prevalence of anti-HCV as healthy individuals. However, 34% of the adult patients with chronic hepatitis/cirrhosis showed signs of a HCV-infection. When the data were analyzed with respect to modes of viral transmission, crowding, transmission by unsafe sexual practice or contaminated injection material, and to a lesser extent vertical transmission, seem to be relevant for HBV. The main mode of acquiring HCV infection is probably through medical injections of all sorts, a habit which is very popular in Takeo. Prophylactic measures should concentrate on the prevention of HBV and HCV infections by hygienic means. HBV mass vaccination should be considered in the future.

Juffrie, 2000

Hepatitis A virus (HAV) cause an acute inflammation of the liver. Varicella-zoster virus (VZV) cause chickenpox (varicella) and herpes zoster. Effective vaccines against hepatitis A and varicella are available for children, adolescents and adults. In order to implement an appropriate vaccination policy, a baseline to assess the potential benefits and sections of the population who would benefit most are required. We investigated seroprevalence of hepatitis A virus and varicella zoster antibodies in a Javanese community. A total of 1,103 subjects were studied. The 600 subjects aged 4 to 9 years were sampled between 23 October and 2 November, 1995. The other subjects were sampled between 12 October and 1 November, 1996. The overall prevalence of anti-HAV in cohort was 28.7%. Anti-HAV seroprevalence rates were below 30% until the age of 15 and below 40% until the age of 25. The anti-varicella seroprevalence showed only in two thirds of seropositive population at the age of 15. The results of the study have implications for vaccination strategies for both hepatitis A and varicella zoster.

Corwin, 1997

A cross-sectional survey was conducted in West Kalimantan (Borneo), Indonesia to geographically profile hepatitis E virus (HEV) prevalence in the riverine areas recognized as the foci of epidemic HEV transmission in 1987. Additionally, a contiguous, although distinct, population with no identifiable historical exposure to epidemic HEV was surveyed downstream for comparative purposes. Eight hundred eighty-five sera were assayed by enzyme immunoabsorbent assay for anti-HEV IgG and anti-hepatitis A virus (HAV) IgG markers. A very high percent (90%) of both the outbreak and comparison populations was anti-HAV IgG positive by the age of nine years. In contrast, the prevalence of anti-HEV

IgG in the outbreak area (50%) was significantly higher than in the comparison area (23%) ($p<0.001$). In both the outbreak and comparison areas, anti-HEV IgG prevalence increased with age ($p<0.001$), except for the group > or = 50 years of age. The prevalence (53%) of antibody to HEV in the population ≥ seven years of age from the outbreak area (alive during the actual 1987 outbreak) was significantly ($p<0.001$) greater than among the children < seven years of age (born after the outbreak) (15%). However, anti-HEV IgG prevalence among the population from the comparison area did not differ significantly between the ≥ seven- (23%) and < seven- (20%) year-old age groups. The percentage of anti-HEV IgG-positive individuals among males (47%) from the outbreak area was lower ($p<0.05$) compared with females (55%). While overall usage of river water for drinking purposes was not universal, dependence on river water as a primary source was significantly higher ($p<0.001$) in households from the outbreak area (60%) compared with the comparison area (30%). This study indicates persistence of an anti-HEV IgG response in a large percentage of the population seven years after an epidemic of HEV infections. Also, the relatively high prevalence (15%) of anti-HEV in children < seven years of age from the outbreak area reflects continuing, sporadic infections.

Brown, 1985

A total of 343 sera from Balinese subjects in different age groups and geographic locations were tested by radioimmunoassay (RIA) for serum antibodies to hepatitis B surface antigen (anti-HBs) and hepatitis B core antigen (anti-HBc); most sera were also tested for hepatitis B surface antigen (HBsAg), and for antibody to hepatitis A virus (anti-HAV). 100% of the adult population was found to have anti-HAV, with antibody acquisition beginning in early childhood and reaching a level of 95% by the age of 10 years. Antibodies to hepatitis B virus were also frequent in young children, rapidly peaking to near 80% in older children and adolescents, then declining to a plateau that fluctuated between 40% and 60% throughout adult life. Overall, anti-HBc (49%) was detected slightly more often than anti-HBs (45%), but the relative frequencies of the 2 antibodies varied considerably from group to group. Despite these high antibody prevalences, HBsAg was detected in only 1.5% of the general population, and in no woman of child-bearing age. In utero infection is thus far less likely to account for the early acquisition of antibody to hepatitis B virus than inapparent percutaneous transmission occurring under conditions of close personal contact.

Tan, 1986

Sera from 494 non-icteric patients admitted with illnesses other than overt hepatitis into the various hospitals in rural and urban Malaysia were tested for IgG antibody to hepatitis A virus. The overall antibody prevalence rate was 67.0% with rates increasing steadily from childhood 10 years old and under (39.4%) to middle-age and above (96.0%). No significant differences were noted between males (68.4%) and females (65.3%). The highest rate was in the Indians (80.6%), the lowest in the Chinese (55.9%) with Malays occupying intermediate position (70.3%). The rate in the rural patients (74.7%) was higher than that in the urban patients (65.5%) especially in the 21 to 40 year age-group where the rural patients had a rate of 96.7% compared with that in urban patients (61.1%). A comparison of antibody prevalence rates in different countries was made.

Ton, 1983

100 normal, healthy adults were tested for antibody to hepatitis A (anti-HA) type IgG and 86 (78.2%) were found to be positive. An age-specific prevalence was found to be lowest in the lower age-group and highest in the higher age-group. Out of 24 IgG positive individuals, only one was found to have type IgM. No significant difference in the incidence of anti-HA type IgG was found between 42 patients in the Urology Unit, General Hospital, Kuala Lumpur and normal individuals ($p>0.10$). 15 patients diagnosed as viral hepatitis were investigated for HAV IgG and IgM antibodies. 13 (86.7%) were

positive for type IgG. Of this, only five (33%) were positive for the type IgM, suggesting that HAV is the cause of acute hepatitis in 33% of cases admitted to hospital as viral hepatitis.

Michault, 2000

We studied the prevalence of Hepatitis A, B, C in different groups in the population of the South of Reunion Island. The aims of this study were the following: to estimate the prevalence of Hepatitis C virus (HCV) (anti-HCV antibodies) and Hepatitis B virus (HBV) (anti-HBc, HBs Ag and anti-HBs) in a population of 1455 women, who delivered in the Centre hospitalier Sud Reunion (CHSR), to estimate the prevalence of these two viruses in a population selected for risk factors (100 prisoners), to estimate the prevalence of Hepatitis A in a group of 400 persons (aged 0 to 19) hospitalized in CHSR since 1st January 1998 (100 for each 5-year age bracket), to research risks factors in these populations and immunity. The overall prevalence of anti-HCV was 0.14% in pregnant women and risk factor associated was found in 28.9% of this population (2.9% history of transfusion, 0.21% drug users). In the group of prisoners seroprevalence was 2%, far below that of prisoners in France. Anti-HCV seroprevalence is weak in Reunion Island and very inferior to seroprevalence in the French population as in other Indian Ocean islands. This is due to the low risk of parenteral transmission. Anti-HBc was found in 90 serum samples from women (overall prevalence 6.35%) and of these 90 positive samples, 9 were positive for HBs Ag (overall prevalence 0.63%), 68 were positive for anti-HBs (4.81%) and 22 (1.54%) were anti-HBc isolated (without HBs Ag and anti-HBs). The overall prevalence of anti-HBs was 62.8%. In the population of 100 prisoners, 2 were HBs Ag positive, 10 anti-HBc positive (2 anti-HBc isolated, 2 associated with HBs Ag, 6 with anti-HBs). The prevalence of anti-HBs was 22%. The major risk factor observed in this population of prisoners was tattooing and/or piercing (46%). These results show that: Reunion island is an area of low endemicity for HBV virus. The measure of protective inoculation is well followed. i.v. drug abuse and previous transfusion are weak routes of transmission. In the group aged 0 to 19, overall prevalence of anti-HAV was 11.9% with the highest rate found among 15 to 19 year-olds (25%). Seroprevalence falls with socio-economic progress. At the present time, the endemic is intermediate in Reunion Island. Given immunity levels within the young population, there is a risk of outbreak. This risk is due to the conditions in Reunion Island, but also to people who travel to other Indian Ocean countries where endemicity is high. It is thus very important that a vaccination strategy be determined.

Schwarz, 1991

A seroepidemiological study on the prevalence of antibodies against hepatitis A virus (HAV), hepatitis B virus (HBV) and *Treponema pallidum* was conducted in various groups of the population of the state of Mauritus (Islands of Mauritus and Rodrigues). 618 sera were tested. The overall prevalence of anti-HAV was 86.1% and yielded and age-dependent increase. Serological evidence for acute or chronic HBV infection was found in 3.8%; 4.5% were positive for anti-HBc alone, and in 12.6% past HBV infection was detected. No age- or sex-dependent increase in the prevalence of anti-HBc was found. There were differences in the anti-HBc prevalence among the various groups of population ranging from 5.9 (flight personnel) to 58.3% (prison inmates). Treponemal antibodies were detected in 6.0% and showed a fairly marked age-dependent increase. Our study suggests that vaccination programs against HAV and HBV would be beneficial for the Mauritian population.

Lim, 1986

Dentists in the Philippines were surveyed for evidence of past hepatitis A and B virus infections. Of the 234 dentists examined, 201 (85.9 per cent) were found to have been infected by HA virus and 137 (58.5 per cent) had been infected by HB virus. The proportion with evidence of past HB virus infection increased as the years in dental practice increased. This increment with age was not found in the general population of the Philippines. It is considered that the incremental pattern could be attributed to the summation of risk during many years of providing dental treatment. Comparing the proportion of dentists with HBV antibodies (anti-HBs/c) in the Philippines, Japan, USA and Denmark, the Philippine dentists were found to be more frequently infected than dentists in the other countries. However, the increment in the proportion positive for HBV as the years in practice advanced was consistent with that found in Japan. The prevalence of post HA virus infection in Philippine dentists was higher than the proportion for dentists in Japan but in both countries it is probable that dentists are infected at the same rate as the general population.

Nuti, 1982

A batch of 417 serum samples obtained from native-born subjects were tested for the presence of hepatitis B surface antigen (HBsAg) and corresponding antibody (anti-HBs), by enzyme-linked immunosorbent assay (ELISA); and antibodies to hepatitis B core antigen (anti-HBc), e-antigen (anti-HBe), and hepatitis A virus (anti-HAV), by radioimmunoassay (RIA). HBsAg was found in only two of the 417 subjects studied. Anti-HBs was detected in 112 samples (26.8%), anti-HBc in 114 (27.3%) and anti-HBe in 31 samples (7.4%). Serologic evidence of a previous or present infection by hepatitis B virus (HBV) was found in 34.5% of the samples studied. Males showed a greater prevalence of anti-HBs and anti-HBc, while anti-HBe was more common in females; however, these differences were not significant. With regard to age, a significantly higher prevalence of anti-HBs (p less than 0.05), anti-HBc (p less than 0.025) and anti-HBe (p less than 0.025) was found in the older age groups. Anti-HAV antibodies were present in 90% of the subjects studied, with no variation between the sexes. The anti-HAV rate in the group under 20 years was similar to that found in the older age groups. The total infection rate of hepatitis B virus in the Seychelles is lower than in other tropical areas, HBs antigen/antibody ratio approaching that in temperate areas. Elucidation of the reasons for the low prevalence of hepatitis B virus carriers among the Sevchelles population requires further investigation.

de Silva, 2005

Introduction: Hepatitis A is a benign illness in children with the rare possibility of fatal complications. Although an endemic disease, very few studies have been done in children regarding the seroprevalence of hepatitis A antibodies in Sri Lanka. OBJECTIVES: (i) To document the seropositivity for hepatitis A in a group of children admitted to a pediatric ward. (ii) To determine the relationship of hepatitis A viral infection to social factors in these children. Method: A prospective, descriptive, cross-sectional study was carried out in a ward at the Lady Ridgeway Hospital for 7 months from September 2001. Children admitted on predetermined days, needing venipuncture for their presenting illness, were studied while those who were seriously ill were excluded. Written consent was obtained and a questionnaire with details of socio-economic conditions, personal hygiene practices of the mother, access to water and sanitation and health related behavior was administered. Total antibodies to hepatitis A were detected by ELISA on a sample of blood taken from each patient. Results: Two hundred and eighty eight samples of blood were analysed. None of the children were immunized against hepatitis A. There were 158 boys (54.9%). Thirty one (10.8%) of the 288 patients had antibodies against hepatitis A. The seroprevalence was 11.6% in children under 10 years of age. Majority (78%) were from families with a monthly income of less than Rs 10,000/-. Fifteen (48.4%) of the 31 seropositive children were from families earning less than Rs 5000/- per month. Belonging to social classes IV and V and having mothers with only primary education were factors significantly associated with seropositivity. No significant difference in the presence of antibodies was observed regarding the personal hygiene practices analyzed and access to basic amenities. Health related behavior practices analyzed were significantly associated with the presence of hepatitis A antibodies. Conclusions: Seroprevalence of 10.8% was observed in a selected group of children. Factors such as poor socio-economic background and having mothers with only primary education were associated with hepatitis A virus (HAV) antibodies as were certain health related behavior practices of children.

Samakoses, 2007

A cross-sectional study of 432 army college students comprising 278 medical cadets and 154 nursing students, ages ranging from 15 to 26 years, was conducted in 2001 to determine the seroprevalence of hepatitis A virus (HAV) antibody. Serum specimens were tested for HAV antibody by a commercial enzyme immunoassay method. Anti-HAV was detected in 14.0%, 17.5%, and 15.3% of medical cadets, nursing students, and the total cohort, respectively. There was no statistically significant difference in seroprevalence between medical cadets and nursing students. Increasing prevalence of HAV correlated with increasing age. Significantly higher seroprevalence was detected in students from provinces outside of Bangkok compared to those who were from Bangkok (18.7% vs. 9.8%). The highest HAV seroprevalence was observed in subjects from the northeastern region of Thailand, suggesting that this region may be associated with greater risk for infection and should be the focus of preventive health strategies.

Chatproedprai, 2007

Since the mid 1970s, infection with hepatitis A virus (HAV) in Thailand has shifted from hyper-endemic to mesoendemic. In 2004, to explore this trend in prevalence further, 3997 subjects from four geographically distinct provinces of Thailand were tested, in a commercial ELISA, for antibodies to HAV. The results indicate that the seroprevalence of HAV continues to fall, almost certainly because the profound socio-economic development that has occurred over the last few decades in Thailand has brought with it significant improvements in sanitation and personal hygiene. As exposure to HAV declines, however, the risks of symptomatic and potentially severe infection in adulthood (rather than asymptomatic infection during childhood) and of epidemics of such infection, which would lead to profound economic loss, increases. Improvements in hygiene and sanitation to reduce exposure to the virus and measures to reduce the incidence of symptomatic disease in those infected, such as vaccination (which may only be cost-effective when targeted at high-risk groups), need to be carefully considered.

Ratanasuwan, 2004

Hepatitis A, B, and C are important viral hepatitis infections in the Thai population. Hepatitis B vaccination was included in the Thai Expanded Program on Immunization (EPI) 10 years ago. In addition, the seroprevalence of hepatitis A has significantly changed in the last two decades. This study was done to evaluate current risk groups for hepatitis A and B infections and identify the magnitude of hepatitis C infection in the general population of Bangkok and six provinces in the Central Region of Thailand, during the period October 2000 to January 2002. This study revealed that the prevalence of anti-HAV in people younger than 25 years was low but very high in people older than 25 years. The prevalence of anti-HAV was 1.95% in Bangkok and 12.7% in other provinces in people younger than 25 years ($p<0.001$) while 90.9% in Bangkok and 88.2% in other provinces among people older than 25 years. Therefore, people who are older than 25 years should have a blood test for anti-HAV before getting a hepatitis A vaccination. Approximately 80% of people who are not covered by hepatitis B vaccination from EPI are at risk of hepatitis B infection and its complications. This group of people should receive hepatitis B vaccination. For hepatitis C, the prevalence is lower than 2% across age groups and areas. Therefore, current good primary prevention via blood donor screening and health education must be maintained.

Luksamijarulkul, 2003

A cross-sectional analytic study of 190 hill-tribe youth in a community in the north of Thailand was conducted to investigate the sero-prevalence of HAV and factors related to positive anti-HAV antibody. The studied youth, whose ages ranged from 15 to 24 years, were interviewed about socio-economic status and personal hygiene. Blood specimens were collected to detect anti-HAV by ELISA commercial kit. Household environmental sanitation conditions were observed and drinking water samples were screened for bacterial contamination using SI2 medium. Following the anti-HAV assay, the studied youth were divided into two groups: anti-HAV positive, and anti-HAV negative. The studied variables of the two groups were analyzed by chi2 test to find factors related to anti-HAV positivity. The results revealed that 87% of the studied youth were positive for anti-HAV. There was no statistically significant difference between age group/gender and anti-HAV positivity, $p = 0.46$ and 0.16, respectively. Approximately 35.79 to 45.79% washed their hands with soap before preparing food, before eating and after using the latrine. About 88% did not improve the potability of their drinking water. The results of screening for bacterial contamination in drinking water samples found that 73.53% were contaminated with coliform bacteria. Factors related to positive anti-HAV antibody included monthly income, number of household members, use of latrine, hand-washing with soap after using latrine, household refuse management and control of insects and rodents; $p = 0.04$, 0.007, 0.013, 0.008, <0.001 and <0.001, respectively. The findings suggested that appropriate household environmental management should be improved in this community to reduce HAV transmission.

Louisirirotchanakul, 2002

Sera from 269 Hmong people (102 males and 167 females, with mean age 35.4 years, range 16-63 years) were examined in order to determine the seroprevalence of hepatitis virus infection. The seroprevalence rates for HAV (hepatitis A virus), HBV (hepatitis B virus), HCV (hepatitis C virus), HDV (hepatitis D virus), HEV (hepatitis E virus), HGV (hepatitis G virus) and TTV (TT virus) infection were 87.8% (n=140), 76.0% (n=150), 2.0% (n=150), 0.7% (n=150), 6.5% (n=139), 5.3% (n=94) and 25.6% (n=121) respectively. The rate for carriers of HBV (HBsAg) was 13.8% (20.5% in males and 9.6% females) with a peak prevalence in the 21-40 year age group. A high rate of HAV seropositivity was found among the younger subjects. The rate of HEV seroprevalence was low. The prevalence of TTV-DNA was high with no difference between the sexes. HGV-RNA prevalence was low and seen primarily in males. This study indicates that the Hmong people are endemically infected with HAV and HBV infection and should be considered for targeted vaccination. The role of TTV and HGV in producing illness and hepatic disease has yet to be determined in this population.

Jutavijittum, 2002

Hepatitis A virus (HAV) infection is common in Southeast Asia, and most of the inhabitants acquire a lifelong immunity as a result of natural infection during childhood. However, the age-specific seroprevalence is changing with development of socioeconomic and hygiene status in this area and the infection is predicted to shift to adulthood with more severe clinical manifestations in the future. In this study, we report the present epidemiological pattern of antibody to HAV (anti-HAV) among schoolchildren in Chiang Mai, Northern Thailand. The overall prevalence rate of anti-HAV was 9.6% (11.4% in female and 7.5% in male children, and 10.8% in urban and 8.9% in rural schoolchildren, respectively). Our study, comparing with previous reports from other parts in Thailand, indicates a steady decline of anti-HAV prevalence among schoolchildren in Chiang Mai area, and discussed a possibility of an outbreak of HAV infection among urban schoolchildren.

Chatchatee, 2002

The severity of clinical symptoms following hepatitis A virus (HAV) infection is age dependent. Hepatitis A in children is mostly an asymptomatic disease while adolescents and adults usually show symptoms of clinical hepatitis. Improved personal hygiene and environmental sanitation has led to a decline in natural immunity acquired in childhood, creating a population of susceptible adults. In the past decade, the incidence and prevalence of hepatitis A disease in Thailand have decreased significantly. In this study, we used enzyme-linked immunosorbent assay to determine the prevalence of anti-HAV antibodies among medical students at two different time points in 1996 and 2001. We then compared these results with data from previous studies in 1981 and 1992. The seroprevalence was 73.01%, 30.23%, 16.67% and 6.67% in 1981, 1992, 1996 and 2001, respectively. A significant decline has happened over the past two decades ($p < 0.001$). Considering the decreasing immunity to HAV in the younger generations, more cases of symptomatic HAV infection could be anticipated. Further seroprevalence studies in other adolescence groups from different socioeconomic status are needed to elucidate the current situation of HAV infection in the young generation more comprehensively and to develop an appropriate prevention program.

Pancharoen, 2001

Objective: To determine the prevalence of hepatitis A virus (HAV) antibodies in various age groups of healthy children and young adults who have not received the hepatitis A vaccine. Method: Blood samples were collected from 825 volunteers aged 1-30 years from a well baby clinic and five academic institutions in the Don Mueang area from 1998 to 1999. Serum samples were assayed for specific HAV IgG antibodies using a commercial enzyme-linked immunosorbent assay (ELISA) kit. Results: The seropositivity rate (12.4% overall) in each age group was as follows: 1-3 years, 7.7%; 4-7 years, 6.6%; 8-11 years, 12.4%; 12-15 years, 10.7%; and 16-30 years, 25.9%. Conclusions: In the Don Mueang area of Bangkok, the majority of children (<16 years) do not have natural immunity against HAV. The use of hepatitis A vaccine for this population should be considered. Pre-vaccination serologic screening for HAV IgG in children may not be worthwhile.

Poovorawan, 2000

The prevalence of antibodies to hepatitis A virus was studied in 961 children and adolescents, randomly selected from five different provinces in Thailand (Chonburi, Lopburi, Udonthani, Nakhon Si Thammarat and Lopburi). The highest prevalence was found in Nakhon Si Thammarat, with 32.1% of those aged 10-14 years and 57.1% of those aged 15-18 years showing evidence of protective immunity. However, this high rate could be explained by an outbreak of hepatitis A in 1992. In the remaining four provinces, the pattern was typically age-related in that all individuals showed between 0% and 13% antibody prevalence until reaching the 15-to-18-year age group where it increased to between 5.6% and 22.7%. The overall seroprevalence among all age groups was 7.9%. Thus, the majority of the younger generation is susceptible to hepatitis A virus infection thereby enhancing the impact, should an outbreak occur. Preventive measures that might be taken are education aimed at better hygiene and sanitation, as well as vaccination of susceptible individuals within high-risk populations.

Pramoolsinsap, 1999

Due to improvements in socio-economic and sanitation conditions, Thailand has undergone a change from hyperendemicity to intermediate endemicity for hepatitis A virus infection, leaving a large part of the adult population without immunity. At the same time, the country is still highly endemic for hepatitis B and especially in the northeast, hepatitis C virus infection both of which when acquired during infancy or early childhood exhibit a strong tendency to turn towards chronic liver disease, although in particular with hepatitis B virus the asymptomatic carrier state is also rather common. As no cross-immunity exists between any of these viruses, double or triple infections do occur, a situation where previously acquired immunity to HAV becomes crucial as double infections have been shown to take a more severe or even fatal course. In the present study, we investigated 820 HBV- and/or HCV-related chronic liver disease (CLD) patients and 195 blood donors, both groups divided by 10-year age intervals, for the prevalence of anti-HAV. The results showed the same age dependence of immunity for all groups tested as can be expected for an area of intermediate endemicity, in that approximately 50% of those between 21 and 30 years of age had acquired anti-HAV. These findings indicate the immune response to HAV infection not to be altered by chronic infection with either HBV or HCV. Hence, vaccination against HAV should be considered, particularly in anti-HAV-negative patients with CLD.

Chub-uppakarn, 1998

(no abstract)

Issaragrisil, 1997

Aplastic anemia is more common in the Orient than in western countries, with an incidence in Thailand that is 2- to 3-fold higher than in Europe. Aplastic anemia after hepatitis is a well characterized clinical entity, and clinical hepatitis is also prevalent in the Far East. We performed a prospective case-control study to determine risk factors for aplastic anemia in Bangkok and two rural regions during 1989 to 1994. A total of 375 cases were identified, along with 1,174 hospital controls matched for age and sex. Historical data were collected by trained interviewers. Sera from a subset of cases (N = 177) and controls (N = 183) were tested for antibodies to hepatitis viruses A, B, and C and hepatitis B surface antigen. There was no evidence of association of aplastic anemia with hepatitis B or hepatitis C. Previous exposure to hepatitis A, as determined by immunoglobulin G (IgG) seropositivity, was significantly associated with aplastic anemia: the relative risk adjusted for confounding was 2.9 (95% confidence interval 1.2-6.7). The same association also existed for persons under age 25 years, in whom the prevalence of hepatitis A IgG was lower than in the total population. However, no patients showed evidence of recent infection with hepatitis A (immunoglobulin M [IgM] seropositivity). These results indicate that exposure to a hepatitis virus is a risk indicator for aplastic anemia in Thailand, and while itself unlikely to be etiologic, hepatitis A may be a surrogate marker for another enteric microbial agent.

Poovorawan, 1997 (Southeast Asian J Trop Med Public Health)

Hepatitis A virus (HAV) is a health problem in countries where seroepidemiology shows changes from hyperendemicity to intermediate endemicity. Throughout the last decade, we studied, in Bangkok, the seroprevalence of hepatitis A virus antibody (anti-HAV) among adolescents of different age groups. In 1996, 245 serum specimens from children aged between 10 and 19 were tested for anti-HAV by ELISA method. The results were compared to those obtained in 1987 and 1993 from students of the same age and attending the same school. Anti-HAV was detected in 31.4%, 14.6% and 12.7% of school children in the years 1987, 1993 and 1996, respectively. Each year, it was found that an increasing prevalence of anti-HAV was related to an increasing age. From 1987 to 1996, the age specific prevalence of anti-HAV was markedly decreased in younger children. The surveillance of the epidemiological trend of HAV infection is important for implementing preventive measures and for controlling the disease.

Poovorawan, 1997 (Ann Trop Med Parasitol)

(no abstract)

Kosuwan, 1996

Hepatitis A is a disease commonly found in Thai children. Since 1984, there have been very few reports on the age specific prevalence of hepatitis A virus infection in the northeastern part of Thailand, which has the largest population and is the poorest area of the country. We studied the seroprevalence of hepatitis A virus (HAV) antibody in 3 primary school children in different areas of Khon Kaen Province, northeastern Thailand. Anti-HAV level was assayed by ELISA. Four hundred and forty-one children age 6-12 years were selected from one primary school in the urban area and two from rural areas. The highest prevalence was 22.6% at age 12 years and 0 at age 6 years. The seroprevalence was highest, 45%, in rural school children of the lowest socioeconomic status as compared to 10.8% and 2.6% in other urban school children. The overall prevalence was 12.7% and the age specific prevalence with 95% CI are presented. These data indicated a much lower seroepidemiological prevalence than previously reported and might be related to the level of socioeconomic and standard of public sanitation and living conditions.

Kalayanarooj, 1995

Age-specific prevalence of anti-HAV was determined for 3 groups of children whose mean ages were 12.6, 20.7 and 52.5 months. There were 41, 43 and 99 children in the respective age groups. All children were healthy, from middle to low socioeconomic families in Bangkok and vicinity. None of the children in the two younger age groups had anti-HAV antibody while 2 of 99 children in the oldest age group did. One of them resided in central Bangkok (Amphoe Dusit) and the other in Nonthaburi Province. The overall prevalence of anti-HAV in children under 5 years old was 1.1%. This demonstrates that hepatitis A transmission rates in Bangkok are very low when compared to ten years ago when prevalence rates were as high as 50-65%. From this study hepatitis A vaccine is recommended for 4-5 years old children in Bangkok. We need more epidemiologic data concerning hepatitis A transmission in Thailand before we can consider hepatitis A immunization for the whole country.

Poovorawan, 1993

Hepatitis A is an infectious disease commonly found in many developing countries. The infection usually is asymptomatic in children and only a small percentage has clinical hepatitis of varying severity. Hepatitis A infection becomes more symptomatic with increasing age. We studied hepatitis A antibody prevalence in many population groups of Thailand and investigated the changing patterns of hepatitis A antibody in comparison with previous seroepidemiological surveys in the past decade. The antibody prevalence in Bangkok and in the rural areas of Thailand had markedly declined among the children and adolescents studied. Only one-fifth to one-fourth of children and adolescents had antibody to hepatitis A. The prevalence differed from that of a decade ago. These data probably reflect the marked improvement of hygienic conditions and effective health education, which have reduced exposure to HAV infection among young children. When an effective hepatitis A vaccine with long lasting immunity becomes available, subgroups of the populations at risk of infection will be the targets for immunization.

Innis, 1991

Hepatitis A antibody was almost universal among Thai children 10-15 years ago. To assess whether transmission of hepatitis A among Thai children had declined, contemporary antibody prevalence and seroconversion rates were determined. Antibody prevalence in 1987-1988 among children in Bangkok declined since 1977 for all ages studied, most markedly among young children. Among 453 low-income urban schoolchildren, there were no seroconversions over a 10- to 12-month period (95% confidence interval [CI] for incidence, 0-0.8%). Antibody prevalence among rural children also declined between 1985 and 1989, though rates were higher than those in Bangkok. Antibody prevalence differed by community. The annual rural infection rate was 1.1% (CI, 0.8%-1.6%). The pattern of rural hepatitis A transmission was focal. Increased numbers of susceptible children in Thailand, where hepatitis A virus still circulates, sets the stage for rising rates of symptomatic disease in adults.

Poovorawan, 1991

Hepatitis A is a disease commonly found in Thai children. However, there are very few reports on the age specific prevalence in Thailand. We studied the hapatitis A virus (HAV) antibody titer in a population in the rural eastern part of Thailand, using an anti-HAV ELISA test (Abbott Laboratories, North Chicago Ill). Three hundred and sixty four subjects from Pong Nam Ron, Chanthaburi Province and 236 of children and adults from Bo Thong, Chon Buri Province were studied for age specific prevalence of anti-HAV. The immunity against HAV increased with age. 50% of Pong Nam Ron children had anti-HAV antibodies at the age of 8-9 years and at the age of 12-13 years of Bo Thong children. The overall antibody prevalence rate was 67.9% in Pong Nam Ron and 59.3% in Bo Thong Districts. According to our data, less than 30% of children under 10 years old in the eastern part of Thailand were seropositive for HAV. This finding indicated a much lower incidence than previously reported which may reflect better personal and food hygiene.

Echeverria, 1983

A serological survey in rural Thailand demonstrated that inhabitants acquired antibody to rotavirus between the ages of 6 months and 6 years, to Norwalk virus between the ages of 4 and 5 years, and to hepatitis A between the ages of 6 and 35 years. Antibody of Escherichia coli heat-labile toxin was most prevalent between 1 and 4 years and 18 and 25 years of age.

Viranuvatti, 1982

(no abstract)

Burke, 1981

Serum specimens drawn at random from three geographically defined populations of healthy Thais were tested for antibody to the hepatitis A virus (anti-HAV) by radioimmunoassay. A total of 746 specimens were tested. The age by which 50 per cent were antibody positive was 4-5 years for residents of an urban Bangkok housing project, 8-9 years for rural villagers, and 10-11 years for urban Bangkok government school pupils. Overall, specimens from 97 per cent of Thai adults 16 years of age or older were anti-HAV positive. These data suggest widespread distribution of HAV in Thailand.

Hau, 1999

A study of antibody prevalence for hepatitis A virus (HAV) and hepatitis E virus (HEV) was carried out in southwestern Vietnam in an area adjacent to a known focus of epidemic HEV transmission. The purpose of this investigation was first to provide a prevalence measure of hepatitis infections, and second to determine the outbreak potential of HEV as a function of the susceptible population. Blood specimens collected from 646 persons in randomly selected village hamlets were examined by an ELISA for anti-HEV IgG and anti-HAV IgG. The prevalences of anti-HEV IgG and anti-HAV IgG were 9% and 97%, respectively. There was a significant increase ($p<0.01$) in age-specific anti-HEV IgG. A notable increase in anti-HAV IgG prevalence ($p<0.001$) occurred between child populations 0-4 (64%) and 5-9 (95%) years of age. No evidence of familial clustering of anti-HEV IgG-positive individuals was detected, and household crowding was not associated with the spread of HEV. Boiling of water was found to be of protective value against HEV transmission. A relatively low prevalence of anti-HEV indicates considerable HEV outbreak potential, against a background of 1) poor, water-related hygiene/sanitation, 2) dependence on a (likely human/animal waste)-contaminated Mekong riverine system, and 3) periodic river flooding.

Katelaris, 1995

(no abstract)

Skinhøj, 1981

Five hundred sixty-four Vietnam refugees were studied for past or present infection with hepatitis A and B virus (HAV and HBV) by sensitive serological assays for hepatitis B surface and e-antigen and antibodies to HBsAg, HBeAg, HBcAg, and HAV. 15% of the men and 6% of the women were HBsAg-positive. Of these 66% were also positive for HBeAg. Serum transaminase values did not effectively differentiate between the infectious HBeAg carriers and the less infectious anti-HBe carriers. The HBsAg carrier rate did not increase by age after infancy, and among children, carriers clustered around HBsAg carrier mothers only. In contrast, the distribution of antibodies to the three HBV-associated antigens suggested continuous exposure throughout childhood, and a 90% prevalence rate was found at the age of 20 years. Screening for HBeAg in this new population group is necessary if appropriate precautions are to be taken, and if medical management of these patients is to be optimal. The prevalence of antibody to hepatitis A increases with age to 90% at 15 years. Among anti-HAV-positive children and adults IgM- anti-HAV was found in 8% of the children and none of the adults, indicating that only a few children may be in an infectious stage at the time of study, and therefore no specific prophylactic precautions are necessary.

AUSTRALASIA
(Australia, New Zealand)

Amin, 2001

Objectives: To determine hepatitis A seroprevalence and notification rates in Australia in order to inform vaccination policy. Design: Seroprevalence was determined by cross-sectional survey of opportunistically collected sera; notifications were extracted from the National Notifiable Diseases Surveillance System. Participants: 3043 serum samples collected in 1998 were obtained from 46 laboratories around Australia. Sample size in each age group was based on expected seroprevalence, and States and Territories were sampled proportionally to their population size. Males and females were equally represented. Notifications were extracted for cases with onset between 1 January 1991 and 31 December 1998. Main Outcome Measures: Seroprevalence and notifications were analysed by age, sex and State/Territory. Results: 41.1% of serum samples were seropositive for hepatitis A (95% CI, 39.4%-42.9%) (population-weighted seroprevalence, 38.3%). Seroprevalence was significantly associated with increasing age (p<0.001), but did not differ between the sexes (male:female ratio, 1.04:1; 95% CI, 0.95-1.14). However, significantly more notifications were recorded for males than females (male:female ratio, 1.65:1; 95% CI, 1.60-1.70). The Northern Territory had the highest seroprevalence (68.8%; 95% CI, 52.7%-84.8%) and annual notification rates (48.7 per 100,000 population; 95% CI, 45.0-52.4 per 100,000). Conclusions: These data show that about half the Australian population has not been exposed to hepatitis A and is therefore susceptible to infection. However, any decision on national routine childhood hepatitis A vaccination requires a cost-benefit analysis. Routine vaccination of high-incidence communities remains controversial.

Crofts, 1997

To assess prevalence of exposure to hepatitis A virus (HAV) among injecting drug users (IDUs) and prison entrants in Victoria, and to compare this with prevalence of HAV among a reference population of blood donors, sera stored from two previous studies and from randomly selected blood donors were tested for total antibody to HAV. The first study was a longitudinal study of field-recruited IDUs from 1990 to 1992 and the second was a study of all prison entrants in 1991-92 (both studies were carried out in Victoria); blood donors were from the Australian Red Cross Blood Bank Victoria in 1995. Forty-five per cent of 2175 prison entrants and 51% of 293 IDUs were seropositive for HAV, compared with 30% of 2995 blood donors. When standardized for age against the blood donors, HAV seropositivity in IDUs was 44% and in prison entrants 60%. The strongest association of HAV seropositivity among the IDUs on multivariate analysis was a history of imprisonment. There are high rates of exposure to HAV among prison entrants, whether with a history of IDU or not, and among IDUs who have a prison history. The role of sharing contaminated injecting equipment in transmission of HAV seems to be less important than institutionalization per se. With adequate resourcing, both populations are appropriate targets for HAV vaccination, especially in a context of continuing decline of transmission of HAV in the general community.

Bowden, 1994

Objective: To determine the level of immunity to hepatitis A virus infection in rural Australian Aboriginal populations in the “Top End” of the Northern Territory. Methods: A total of 344 sera, for which details of donors’ age, sex and domicile were available, were collected and tested for hepatitis A total antibody in a delinked seroprevalence study. Results: Overall, 337/344 samples (97.97%) tested positive for hepatitis A total antibodies--18/20 samples (90%) in the 1-5 year age group; 85/88 (96.6%) in the 6-10 year age group; 98/98 (100%) in the 11-15 year age group; 32/33 (97.0%) in the 16-20 year age group and 104/105 (99%) in the older than 20 year age group. Conclusion: Hepatitis A is hyperendemic in the rural Aboriginal communities studied and the virus is acquired predominantly in the first five years of life. Symptomatic hepatitis A infection is uncommon in this population. We suggest that hepatitis A vaccination for rural Aboriginal children is not indicated as it would not reduce clinical disease rates and may produce a cohort whose immunity could decrease over the following 10 years. Although vaccination is appropriate for non-immune individuals working in remote communities, emphasis must be placed on the inequities in health infrastructure and education underlying the high transmission rates in Aboriginal children.

Boughton, 1980

The age-specific prevalence rates of hepatitis A and B virus markers in 683 patients of all ages with non-hepatitic illnesses admitted to a Sydney hospital over the period from 1971 to 1974 were determined. The pattern of prevalence rates of hepatitis A antibody (anti-HAV) appeared to be a cumulative one, with steadily increasing rates in patients up to the age of 40 years. Thereafter a large increase in prevalence occurred. In contrast, prevalence rates for hepatitis B virus (HBV) markers were fairly uniform for all age groups. Antibody to core antigen (anti-HBc) was the most frequent marker of HBV infection. Prevalence rates in subjects of non-Anglo-Saxon origin were higher for both HAV and HBV markers.

Chapman, 2000

Aim: To determine the prevalence of hepatitis A (HAV), hepatitis B (HBV) and hepatitis C (HCV) in adults randomly selected from the Christchurch community. Methods: A list of names was randomly generated from the Christchurch electoral roll and subjects were sequentially contacted and invited to participate. A blood sample was taken and tested for hepatitis A (IgG anti-HAV antibody), hepatitis B (HBsAg and anti-HBc) and HCV (anti-HCV antibody) using Abbott Elisa kits. Subjects positive for HBsAg were also tested for HBeAg/HBV DNA. Those positive for anti-HBc were tested for anti-HBs. HCV antibody positive samples were tested for HCV RNA using PCR. Results: 1064 subjects (30.3% of those invited) participated in the study. The prevalence of HAV antibodies was 27.9%, and increased with age. The overall prevalence of HBV markers was 42/1064 (4.2%), and of these 0.3% were HBsAg positive and 3.9% were considered immune. No gender or ethnic differences in these proportions were observed. The seroprevalence of HVC antibody was 3/1064 (0.3%), two of whom were also PCR positive for HCV RNA. Conclusion: In the Christchurch community there was a high prevalence of antibodies to HAV, which increased with age. The prevalence of HBsAg and antibody to HCV were both low at 0.3%.

Lucas, 1994

Aims. To determine if protection against hepatitis B is maintained in a cohort of children nine years after primary vaccination; To compare the prevalence of hepatitis B infection in 1984, before the introduction of hepatitis B vaccine, with that in 1993; To compare the prevalence of hepatitis A antibody (anti-HAV) in children in 1984 and 1993. Methods. Serum samples collected from children attending Kawerau Intermediate School in 1993 were tested for hepatitis B markers and anti-HAV, and the results were compared with those in children attending the same school in 1984. Results. Antibody to hepatitis B surface antigen (anti-HBs) was detected in 91.8% of children documented to have received hepatitis B vaccine in 1984. Seroconversion for antibody to hepatitis B core antigen (anti-HBc) had occurred in 5%. None had suffered a clinical illness. No vaccinee had a positive test for hepatitis B surface antigen (HBsAg). The prevalence of hepatitis B infection had fallen from 71.7% in 1984 to 24.2% in 1993. The prevalence of hepatitis A was 29.6% in 1984 and 0.4% in 1993. Conclusions. Protection against clinical disease and chronic hepatitis B infection is maintained nine years after primary vaccination. Hepatitis A has virtually disappeared among children in Kawerau.

Tobias, 1988

In April 1985 a national immunization survey was carried out, during which sera were collected from approximately 3000 randomly selected children throughout New Zealand. The sample comprised approximately equal numbers of new school entrants (mean age 5 years), standard 3 pupils (mean age 10 years) and form 4 students (mean age 15 years). This collection of sera was tested for antibody to hepatitis A virus, a marker of past infection with this virus, by means of a sensitive ELISA test. Prevalence of infection was found to be less than 1% in the 5 year olds, about 3% in the 10 year olds, and about 9% in the 15 year olds. Amongst the 10 and 15 year olds, but not the 5 year olds, Maori children were approximately three times more likely to have been infected than European children. Children resident in the eastern part of the North Island had a higher risk of infection than other children, even after controlling for ethnic distribution.

Tobias, 1986

Antibody to hepatitis A virus (anti HAV), a marker of past infection, was assayed in 2000 sera collected as part of a national survey in 1978 to 1979. The sera were obtained from children and young people aged 0-21 years, resident in all health districts of New Zealand. Anti HAV was detected in 307 sera, giving an overall prevalence of 15.4%. Prevalence increased steadily throughout childhood but more slowly during adolescence. There was no sex differential, the age-standardized rate/100 being 15.5 (95% confidence interval 13.2, 17.8) for males and 16.6 (14.4, 18.9) for females. However, the age-standardized rate for Maoris was 39.5 (33.2, 45.8) compared to 16.1 (12.8, 19.4) for Europeans, giving a risk ratio of 2.1. In addition, a marked north-south gradient in prevalence was demonstrated: the rate for children in the northern half of the North Island, when standardized for age and ethnicity, was 19.8 (16.8, 22.7) compared to 5.2 (3.2, 7.1) for South Island children, giving a risk ratio of 3.8. The higher prevalence of hepatitis A infection in Maori and northern North Island children mirrors our previously reported findings regarding markers of hepatitis B infection in this serum collection.

Austin, 1982

A sample of 97 sera from residents of Port Chalmers was tested for antibody to hepatitis A virus by enzyme immunoassay and to hepatitis B virus surface antigen and antibody by passive hemagglutination. Thirty-nine (40%) of the sera had antibody to hepatitis A virus and 21 (22%) had antibody to hepatitis B surface antigen.

CARIBBEAN

(Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cuba, Dominica, Dominican Republic, French Guiana, Grenada, Guadaloupe, Guyana, Haiti, Jamaica, Martinique, Montserrat, Netherlands Antilles, Saint Kitts and Nevis, St. Lucia, St. Vincent, Suriname, Trinidad and Tobago, Turks and Caicos Islands)

Craig, 1993

Little is known about the prevalence of infection with hepatitis viruses in Belize, Central America. We conducted a serologic survey among members of the Belize Defence Force (BDF), which is composed of the five major ethnic groups in Belize, to estimate prevalence rates of hepatitis A, B, and C among military-aged men and women in Belize. Of approximately 600 men and women in the BDF, 492 (82%) completed a questionnaire and blood collection. Antibody to hepatitis A was found in 94%, with similar rates by age, sex, rank, and ethnicity. Antibody to hepatitis B core antigen (anti-HBc) was found in 31%. Rates of anti-HBc varied significantly among the ethnic groups with the lowest rates in Mestizo (5%) and Mayan Indians (9%), and significantly higher rates among Creoles (30%) and Garifuna (56%). Rates increased with increasing age from 28% in those 18-24 years old to 35% in those > or = 35 years old (P = 0.07, by chi-square test for trend). Hepatitis B surface antigen was found in 21 (4%) overall. Antibody to hepatitis C was found in two (0.4%). In this young healthy population, exposure to hepatitis A before the age of 18 is almost universal, while exposure to hepatitis B is related to age and ethnic origin.

Quintana, 2005

A seroepidemiological study of hepatitis E virus (HEV) infection was conducted in a district of Havana, where hepatitis A virus (HAV) is considered endemic. The levels of anti-HEV antibodies were evaluated by enzyme-linked immunosorbent assay (ELISA) based on the recombinant protein GST-ORF2.1. Anti-HEV antibodies were detected in 11 of 209 (5.3%) of serum samples, compared to 71.3% for anti-HAV antibodies. No risk factors reported previously for HEV infection showed a significant association with the presence of anti-HEV antibodies, whereas anti-HAV antibodies were strongly associated with increasing age. HEV may be considered endemic in this area and is likely to have a significant clinical impact.

Tanaka, 2000

In the past, Latin America was considered to be an area of high endemicity for hepatitis A virus (HAV) infection, with most people infected in early childhood. A seroepidemiological study was recently undertaken in six countries to determine whether this pattern has changed. The highest seroprevalence of antibodies to HAV (anti-HAV) was found in Mexico and the Dominican Republic. Analysis of the different age groups showed that at age 6-10 years, 30% of children in Chile and 54-55% in Brazil, Venezuela and Argentina had been infected, compared with almost 70% in Mexico and 80% in the Dominican Republic. At age 11-15 years, nearly 90% in Mexico and 91% in the Dominican Republic had been infected, compared with 54% in Argentina, 62% in Venezuela, 60% in Brazil and 70% in Chile. By age 31-40 years, over 80% of the populations in all six countries had been exposed to HAV. In all of the countries except Brazil and Venezuela, the seroprevalence of anti-HAV was significantly higher in females than in males. In Mexico, Argentina and Brazil, anti-HAV seroprevalence was significantly higher in the low socioeconomic groups than in the middle/high socioeconomic groups. The results show that there has been a shift from high to medium endemicity of HAV infection throughout Latin America, which may result in more clinical cases in adolescents and adults and a greater potential for outbreaks. The vaccination strategy for hepatitis A should thus be reviewed.

Tapia-Conyer, 1990

In a multicenter study, hepatitis A virus (HAV) seroprevalence was surveyed in six countries in Latin America in which in 12,000 subjects were stratified for age. The highest rates of seroprevalence were recorded in the Dominican Republic (89.0%) and Mexico (81.0%), with lower rates in Brazil (64.7%), Chile (58.1%), Venezuela (55.7%), and Argentina (55.0%). The seroprevalence of HAV in children between 1 and 5 years of age was less than 50%, except in the Dominican Republic. In the 5-10-year-old age group, seroprevalence rates have also decreased compared with previous reports. This suggests that the epidemiology is shifting from high to intermediate endemicity, with the population susceptible to HAV infection shifting from children to adolescents and adults. Furthermore, data from Brazil, Argentina, and Mexico show that HAV seroprevalence is significantly lower in people living in medium and high socioeconomic conditions. This study suggests the need for appropriate vaccination programs to be implemented targeting children, adolescents, and adults, particularly in higher socioeconomic groups.

Talarmin, 1997

In order to determine the prevalence of antibodies to hepatitis A, C, and E viruses (HAV, HCV, and HEV) in the various ethnic groups and areas of French Guiana, sera (996 for HCV and HEV, 941 for HAV) were tested for antibodies to these viruses using ELISAs. Differences in HAV seroprevalence were found for different age groups, with a large increase in people aged 20-30 years in comparison with those under 20. After logistic analysis, significant differences were found between places of residence; the prevalence of anti-HAV was higher along the Maroni and Oyapock rivers than in the littoral area. The ethnic differences that were observed were generally due to differences in residence. Of all sera, 5.3% were positive for anti-HCV in preliminary tests, but only 1.5% remained positive after confirmation. Brazilians were significantly more frequently infected by HCV than other ethnic groups (4.7%). Sixty-four sera (6.4%) had antibodies to HEV, and differences were found between ethnic groups. Persons of ethnic groups who had emigrated recently to French Guiana had significantly higher seroprevalence rates: 14.6% for Chinese and Hmongs [odds ratio (OR), 4.4; 95% confidence interval (CI), 1.8-10.7], 13.5% for Brazilians (OR, 4.1; CI, 1.8-9.4), and 10.6% for Haitians (OR, 3.1; CI, 1.1-8.7).

Dulat, 1996

The purpose of this study was to ascertain the value of systematic vaccination of recruits from French overseas departments and territories (DOM-TOM) against hepatitis A. Between July 1994 and May 1995 tests to defect anti-HVA antibodies were performed on all new recruits from the French West Indies (Guadeloupe and Martinique). Of the 1685 subjects tested 346 presented type IgG anti-HVA antibodies, i.e. 20.5% overall. Seroprevalence increased from 4% in 18 year-olds to 35% in 25 year-olds and was significantly higher in recruits from Gaudeloupe (26.7%) than from Martinique (15.6%) ($p < 0.001$). The overall seroprevalence rate was similar to the rate observed in young recruits from mainland France in 1990. These findings indicate that hepatitis A has decreased in the French West Indies in agreement with improvements with sanitary and housing conditions. This study also supports vaccination of recruits from DOM-TOM against hepatitis A after control of their immune status.

Brown, 2000

Between January 1995 and August 1998, a study was conducted to elucidate the epidemiology of hepatitis A virus (HAV) in Jamaica. Participants were recruited from six sites across the island. The potential risk factors for transmission which were studied included age of the individual, gender, residence (urban v. rural area), sanitary facilities (flush toilet v. pit) and source of domestic water (indoor plumbing v. other). There were 128 male subjects and 211 female, aged 3-90 years. The mean ages of the males and females were 24.9 and 25.6 years, respectively. The seroprevalence of HAV in the study population, estimated by ELISA, was 59.9%. Logistic regression indicated that age ($P < 0.001$) and source of domestic water ($P = 0.006$) were the major contributors to exposure to HAV. The rate of exposure to the virus was seen to increase with age. By the age of 10 years, 30% of children had been exposed, and almost 100% of the oldest subjects were seropositive. Rates of exposure to HAV were higher among households which had external sources of water, including standpipes, rivers and tanks, than those with indoor plumbing. Although the seroprevalence of HAV in Jamaica is similar to that seen in developing countries, the age-related pattern of exposure mirrors the pattern seen in developed countries.

Monplaisir, 1988

In view of the ethnic and geographical peculiarities of the French department of Martinique and of the endemic character of hepatitis in tropical countries, we studied the prevalence of infections with hepatitis A, B and delta viruses in that region. A group of 10,109 blood donors and a group of about 100 patients were selected on account of their liver symptoms. As regards hepatitis A, the study of the 2 groups was completed by a sero-epidemiological survey of 509 children and teenagers aged from 1 to 18 years. The prevalence of the HB antigen among blood donors was 1.3 per cent, i.e. about 10 times higher than in Europe and 7 times lower than in hyperendemic tropical areas. It was 2.5 times higher in the male than in the female population; 84 per cent of HBs-positive donors had anti-HBe antibodies, 9 per cent had HBe antigen and 7 per cent had neither one nor the other. This distribution is coherent with a population of symptomless carriers. The prevalence of anti-HBs-positive sera was 34 per cent as against 70-95 per cent in highly endemic countries and 4-20 per cent in Europe; 1.9 per cent of the HBs donors studied and 8.8 per cent of the patients had anti-delta antibodies; 11 of the 13 anti-delta-positive subjects had anti-HBe antibodies and 2 had neither HBe nor anti-HBe. Between the ages of 1 and 3 years very few anti-HAV-positive subjects were observed. From 3 to 10 years, the percentage of seroconversions increased moderately. Between 10 and 20 years, the number of positive cases increased considerably reaching 67 per cent at 20 years and 100 per cent at and above 45 years. Among the patients, 97 were positive for IgG (96 per cent) and only 5 for IgM (4 per cent).

Blattner, 1990

Seroprevalence of human T-lymphotropic virus type 1 (HTLV-I) among a sample of persons selected from a government register of businesses in Trinidad was 3.2% in 1,025 persons of African descent compared to 0.2% among 487 persons of Asian descent and 0% among 46 persons of European-descent. In Tobago, from a coastal village, among persons of African ancestry ascertained as part of a cardiovascular survey, the rate was 11.4%, which was significantly higher when corrected for age and race than the rate in Trinidad. The seroprevalence rate of antibodies to hepatitis A and B was also significantly elevated in Tobago compared to Trinidad. HTLV-I seroprevalence rates were higher in females than males while hepatitis A and B rates were not significantly different in the two sexes. For males, age was a significant determinant of HTLV-I seropositivity, while for females, age, markers of poor sanitation, and hepatitis B were each independently linked to HTLV-I seropositivity. The frequent occurrence of multiple infectious exposures in persons of lower socioeconomic circumstances in this tropical environment may result in immune activation that heightens susceptibility to HTLV-I infection.

EUROPE, CENTRAL

(Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Serbia and Montenegro, Slovakia, Slovenia, The Former Yugoslav Republic of Macedonia)

Chironna, 2006

Patterns of endemicity of human herpesvirus 8 (HHV8) are still undefined in some European populations, such as those from Western Balkan countries. Serum samples from 605 human immunodeficiency virus-seronegative subjects (299 Albanians and 306 Kosovars) were tested for the presence of HHV8 antibodies to a capsid-related open reading frame (ORF65)-encoded protein and a latency-associated nuclear antigen (LANA) to determine HHV8 seroprevalence in populations from Albania and from the Kosovo region of former Yugoslavia. Levels of co- circulation with hepatitis A (HAV) and hepatitis B (HBV) viruses were also determined. HHV8 antibodies to at least one of the two antigens were detected in 28.8% of Albanians and 18% of Kosovars. The seroprevalence of HHV8 was found to be 25.0 and 16.8% in Albanian and Kosovar children (<or=15 years old), respectively. No association was found between HHV8 seropositivity and serological markers for hepatitis A (total anti-HAV) and hepatitis B (antibodies to the core antigen). HHV8 infection is widespread among Albanians and Kosovars, as is the case in populations of the Mediterranean basin. The high HHV8 seroprevalence observed in children as well as the lack of correlation with HAV and HBV infections suggest that intrafamilial, non-fecal-oral, and non-parenteral routes of HHV8 transmission may also be predominant in some populations from the Western Balkan countries. (c) 2006 Wiley-Liss, Inc.

Ventura, 2004

Background: Studies of immigrants represent an useful tool to determine the relative relevance of environmental vs. genetic factors in causing the reported rapid increase of the prevalence of sensitization and allergic diseases. Methods: A total of 152 Albanian migrants to Southern Italy responded to a questionnaire based on the European Community Respiratory Health Survey (ECRHS) and 139 of them underwent skin prick test, and 61 serological assays for total IgE and IgG antibodies against *Toxoplasma gondii* (TG), herpes simplex virus 1 (HSV-1), hepatitis A virus (HAV) and Helicobacter pylori (HP). Results: Reported asthma was rare (2/152; 1.3%) and reported nasal allergies rather frequent (24/152; 15.8%). Sensitization to common inhalant allergens occurred in 27/139 (19.4%) subjects. The frequency of skin sensitization to pollen (P = 0.003) and that of hay fever (p=0.004) increased with the time spent in Apulia. All the 61 sera had antibodies against HAV, 59/61 (96.7%) against HSV-1, 48/61 (78.7%) against HP and 34/61 (55.7%) against TG. The prevalence of skin sensitization and hay fever symptoms were correlated to the duration of residence in Southern Italy. Conclusions: Data presented indicate that Albanian migrants to Italy, in spite of the low prevalence of allergic diseases and sensitization in their country of origin, manifest with time an increasing prevalence of sensitization to local allergens and nasal symptoms after immigration to Italy. This would suggest a permanent role of allergen exposure and lifestyle factors in influencing the appearance of sensitization and symptoms of allergic diseases.

Chironna, 2001

Objectives: To assess the prevalence of viral hepatitis infections in a sample of Kosovar refugees having arrived in southern Italy as a result of the 1999 war in the Balkans. Methods: The 526 subjects who enrolled on voluntary basis from all age groups were tested for the prevalence of serologic markers for hepatitis virus types A, B, C, D, and E (HAV, HBV, HCV, HDV, HEV). Results: Among the 526 refugees, the prevalence of total anti-HAV antibodies was 81%. A relevant finding was the presence of total anti-

HAV antibodies in 61% of the children up to 10 years of age. The prevalence of anti-HEV antibodies was 2.5% among the subjects. Fifteen subjects (2.9%) were positive for hepatitis B surface antigen (HBsAg), whereas 17.5% tested positive for anti-hepatitis B core antigen (anti-HBc). In children up to 10 years of age, the prevalence of HBsAg and anti-HBc was found to be 0.4% and 6%, respectively. In subjects aged 11 to 20 years, 4.2% tested positive for HBsAg and 20.2% for anti-HBc. In the age group 21 to 30 years, 7.1% of the subjects were found to be HBsAg carriers, whereas 25.9% were found to be positive for anti-HBc. Among the refugees over 30 years of age, the prevalence of HBsAg was 4.2%, whereas anti-HBc was 43.7%. None of the refugees tested positive for anti-HDV. The prevalence of anti-HCV antibodies was 0.7%. Conclusions: The results of this seroepidemiologic study indicate a high circulation of HAV in the Kosovar population, whereas the prevalence of HEV antibodies was low and comparable to that of other European countries. The HBV infection seems to be at an intermediate level of endemicity and an immunization policy against HBV infection, through vaccination of all newborns and children before adolescence, may be advisable. Results of this study indicate that the level of endemicity of HCV infection in the Kosovar population is low.

Malamitsi-Puchner, 1996

Aim of the study was to record the prevalence of the various types of viral hepatitis, especially hepatitis B, in pregnant Albanian refugees in Greece. The study comprised 500 pregnant refugees of mean age 25.1 ± 4.6 years. In Albania, all women had lived in overcrowded houses and had been exposed to non throw-away needles and syringes. Various indices for all hepatitis types were determined. The prevalence of HBsAg was 13.4%, of anti-HBs 53%, of total anti-HBc 70.8%, of anti-HBc IgM 0.4%, of HBeAg 1.2%, of anti-HBe 58.6%, of anti-HAV 96.2%, of anti-HAV IgM 1%, of anti-HDV 0.4%, of anti-HCV 0.6% and of anti-HEV 2%. HBeAg was found positive in 7.5% of HBsAg carriers. Prevalence of hepatitis B markers, as determined by HBsAg and/or anti-HBs and/or total anti-HBc was significantly higher in those with a history of previous hospitalization in Albania ($p = 0.01$) and those with previous history of hepatitis ($p=0.02$). The high prevalence of hepatitis B markers in pregnant Albanian refugees proves that HBV infection is highly endemic in Albania and the possibility of perinatal transmission to the offsprings urges for HBV vaccination programs. On the other hand improvements in the socioeconomic conditions and the sanitation system in Albania is anticipated to reduce the incidence of HAV and HBV infections.

Santantonio, 1993

A sample of 393 Albanian refugees, including both children and adults, was tested for serological HAV, HBV, HDV and HCV markers. A high prevalence of infection with both the hepatitis A and B viruses was found, while HDV and HCV infections were uncommon. The overall prevalence of anti-HAV was 96%; it was very high in children 0-10 years, suggesting that HAV infection is largely acquired during childhood and that poor ambiental conditions influence the spreading of this viral infection. One or more serological markers of HBV infection were found in 295 Albanians (75%), confirming the endemic nature of this virus in the Albanian community. The overall prevalence of HBsAg was 19%, and the carrier rate was higher in males than in females. The high HBsAg prevalence among children suggests that HBV infection is usually acquired in early childhood. The serological data obtained in the Albanian sample examined clearly indicate the urgent need for measures to reduce the incidence of HAV and HBV infections and to avoid the further spread of HDV and HCV infections. Finally, the high prevalence of type B hepatitis indicates the necessity of vaccination against HBV for all risk groups and for all children at birth.

Kaic, 2001

An outbreak of hepatitis A occurred among children of a refugee camp in Croatia. In order to disrupt the outbreak, we decided to vaccinate children from 1 to 15 years of age in the camp, in addition to intensified general preventive measures. Assuming high prevalence of hepatitis A virus antibodies within this population, we conducted anti-HAV testing of the children eligible for vaccination. Of 108 children tested, 74 (68.5%) were anti-HAV positive. We vaccinated 34 children. One month after vaccination 31 previously negative children were tested for anti-HAV and 30 of them were found positive, suggesting a seroconversion rate of 96.8%. One child fell ill 5 days after vaccination, after whom no new cases of hepatitis A occurred. Thus we conclude that active immunization is a successful means of stopping an outbreak of hepatitis A.

Puntarić, 1995

The naturally acquired immunity to hepatitis A virus (HAV) in a sample of 305 children, aged up to 15 years, in the municipality of Ivanić-Grad amounted to 18.7%. The study was conducted in September 1989. Of those 305 children, 16.8% of the boys and 20.7% of the girls were positive. No statistically significant difference was observed with regard to sex ($p < 0.01$) (chi 2 = 1.4). Of the children aged up to two years, 47.4% were exposed to the hepatitis A virus. Seropositive for anti-HAV were 8.3% in the group from 2-3 years of age, 6.4% in those aged from 4-5 years, 15.9% in the group from 6-7 years of age, 6.8% in those aged from 8-9 years, 20.0% in the group from 10-11 years of age, 27.8% in those aged from 12-13 years, and 29.0% in the group from 14-15 years of age. The spread of the infection by contact was predominant, reflecting the socioeconomic standards of the studied community ($p<0.01$) (chi 2 = 29.5). A relatively high prevalence of hepatitis A infection compared to that of the developed countries, the first peak immunity rates in first-graders, a low number of cases among infants aged up to 5 years (approximately 6.0%), availability of commercial vaccine, speak in favour of including hepatitis A vaccination into the obligatory community-wide immunization program. It appears that the target age for HAV vaccination would be the age of five.

Burek, 1985

In a study of the prevalence of hepatitis A virus antibody in urban Yugoslav children aged 0 to 7 years, 18.2% were positive; most of them were only a few months old. The maternal origin of antibody in these very young children could be inferred from the rapid decrease of antibody during the first 5 to 7 months of life, following which period until the age of 7 years, there was no significant increase in the proportion with antibody. It was concluded that the age range included in this study (0-7 years) does not represent a time of life when most urban Yugoslav children come into contact with hepatitis A virus.

Chlíbek, 2006

Study Objective: To determine prevalence rates of antibodies against hepatitis A virus (HAV) and hepatitis B virus (HBV) in the general adult male and female population over 40 years of age with no history of viral hepatitis A (VHA) and viral hepatitis B (VHB) who have never been vaccinated against hepatitis and to assess the cost-effectiveness of the pre-vaccination serological screening. Material and Methods: In 2003-2004, a total of 972 persons of three age categories: 41-50 years, 51-60 years, 61 and more years, were screened. Persons with a history of VHA and/or VHB and those who had been vaccinated against hepatitis were not included in the study. The following four indicators were determined from a 5 ml specimen of whole venous blood by electrochemiluminiscence assay: total anti-HAV antibodies, total anti-HBc antibodies, anti-HBs antibodies and HBsAg, as the most suitable markers of experienced hepatitis or previous vaccination. Results: The prevalence rates of anti-HAV antibodies were lower in females compared to males for all of the three age categories. These antibodies were detected in 16.8%, 52.9% and 77.5% of 41-50-year-olds, 51-60-year-olds and > or = 61-year-olds, respectively. The total prevalence rate for the three age groups was 61.6%. The anti-HBc antibody seroprevalence rates were 1.9%, 5.3% and 6.1%, respectively. Conclusion: The results show high prevalence of VHA in higher age groups. Such a high seroprevalence of antibodies in non-vaccinated persons with no history of viral hepatitis is suggestive of a very frequent incidence of asymptomatic infection. For this reason, the pre-vaccination screening of anti-HAV antibodies is cost-effective in the population over 50 years of age but is not justified in persons under 40 years of age. Pre-vaccination screening for anti-HBc antibodies appears not to be cost-effective regardless of age in view of their low prevalence in the Czech population.

Beran, 1999

Over recent decades, the epidemiology of hepatitis A has changed in most European countries: the age of infection has been shifting towards older age groups. In view of this evolution and the central location of the Czech Republic in Europe, we wanted to assess current anti-hepatitis A seroprevalence. We determined the anti-hepatitis A seroprevalence among three different groups: military personnel between 1991-1995, prior to their deployment as UN troops, civilians participating in a national serological survey in 1996 and volunteers for vaccine clinical trials in 1996. The anti-HAV prevalence <20 years of age was about 4%; in the age cohort 40-49 it ranged between 47 and 51%. Only over the age of 60 years was the seroprevalence rate >85%. The risk of acquiring HAV is low for younger age groups. We could demonstrate some regional differences with higher rates in some age strata for the North Bohemian region and the lowest rates in East Bohemia and Prague. Compared to archived sera from a previous serological survey in 1984 we demonstrate a shift towards low endemicity. For the first time it is shown that an Eastern European country, i.e. the Czech Republic, is a country with a low endemicity for HAV. Substantial parts of the population are or will be at an increased risk of HAV infection and active immunization against HAV should be considered.

Beran, 1996 (Cent Eur J Public Health)

Viral hepatitis A is a common disease, particularly in developing countries. All staff and troops of the U.N. (United Nations) are vaccinated by the Havrix vaccine. Till 1995 we did not vaccinate Czech troops which have operated in the area of former Yugoslavia. The main goal of this study was to obtain data about the seroprevalence of hepatitis A antibody among the Czech U.N. troops before their departure to the conflict area and to optimize the vaccination approach. The serum samples were examined by the MEIA (Microparticle Enzyme Immunoassay) method in the fully automated system for immunoassays IMx in the Military Institute of Health in Ceské Budějovice. We used HAVAB kits of Abbott Company. 692 serum samples (military staff of the Czech U.N. troops in Yugoslavia) were examined in 1991-1995. In the laboratory 19 samples were eliminated due to small amounts (less than 50 microliters) or hemolysis. 673 (1991 - 65, 1992 - 296, 1993 - 265, 1994 - 35, 1995 - 12) were investigated. The staff was divided into four age cohorts by decades (20-29, 30-39, 40-49, 50-59); 26.0%, 47.4%, 24.9% and 1.7%, respectively. There were 253 (37.4%) positive samples and 420 (62.6%) negatives ones, ratio 1:1.7. The ratio of the positive and negative samples--immunity rate and seroprevalence--were 1:0.4 (26.2%), 1:0.6 (37.9%); 1:0.9 (46.4%) and 1:2.7 (72.7%), respectively in the age cohorts. The results show a relatively low seroprevalence of the anti-HAV antibody in all the age cohorts and necessity to vaccinate the Czech U.N. troops by the special basic schedule--Havrix 2 x 720 E.U. at the same time. This regimen will be used in the new units that will be stationed in Bosnia. So far 200 persons have been vaccinated in this way.

Beran, 1996 (Acta Medica)

Viral hepatitis A is a common disease particularly in developing countries. That disease is endemic and it is always associated with poor standards of sanitation. All staff and troops in the U.N.

(United Nations) are vaccinated by the Havrix vaccine. Till 1995 we did not vaccinate the Czech troops which have operated in the area of the former Yugoslavia. The main goal of this study was to obtain data about the seroprevalence of hepatitis A antibody among the Czech U.N. troops before their departure to the conflict area. The serum samples were investigated by the MEIA (Microparticle Enzyme Immunoassay) method in the fully automated system for immunoassays IMx in the Military Institute of Health in Ceské Budějovice. We use the HAVAB investigation kits of the Abbott company. We obtained 884 serum samples (military staff of the Czech U.N. troops in Yugoslavia) in the years 1991-1995. In the laboratory we excluded 19 of the samples due to the small amount (less than 50 ul) or hemolysis. We investigated 865 of them (1991--65, 1992--296, 1993--265, 1994--35, 1995--204). The staff was divided into four age cohorts by ten years (20-29, 30-39, 40-49, 50-59), where the distribution of percentage was 32.6%, 43.6%, 22.5%, and 1.3% respectively. The positive samples were 287 (average seroprevalence was 33.2%, CI 30.1%-36.3%), the negative ones were 578 (66.8%). The seroprevalence 18.1% (CI 13.6%-22.6%), 36.1% (CI 31.3%-40.9%), 47.1% (CI 40.1%-54.1%), 72.7% (CI 46.4%-99.0%) in the age cohorts. The results show relatively low seroprevalence of the anti-HAV antibody in all the age cohorts and necessity to vaccinate the Czech UNPROFOR or IFOR units by Havrix before their departure to conflict area.

Beran, 1995

Viral hepatitis A is a frequent disease particularly in developing countries. All workers and UN forces (UNO) are vaccinated against VHA with Havrix vaccine. The Czech units which were and are engaged on the territory of former Jugoslavia are not yet vaccinated against this contagious disease. The main purpose of the present study was to assess the immunity rate of VHA among Czech soldiers of the UN forces before their departure to the site of action. Another objective was to assess a suitable vaccination procedure. Sera were examined by the MEIA method (Microparticle Enzyme Immunoassay) in a fully automated IMx system in the Military Health Institute, Ceské Budějovice. For investigation HAVAB kits of Abbott Co. were used. A total of 667 serum samples were assembled, 19 had to be discarded because of small amounts (less than 50 microliters or because of hemolysis. The positive titer of "total" antibodies was set at 35 mIU anti-HAV; thus a total of 648 specimens were examined in 1991 - 1994 (1991 - 65, 1992 - 296, 1993 - 265, 1994 - 22). Of these 249 (38.4%) were positive and 399 (61.6%) were negative. The examined subjects were divided into four age groups (20 - 29, 30 - 39, 40 - 49, 50 - 59), the approximate distribution being 23%, 50%, 25%, 2%. The ratio of negative and positive specimens in different age groups was 1:0.3, 1:0.6, 1:1, 1:2.7. The seroprevalence of anti-HAV antibody increases from 25.3% in the first age group, in the second one it is 37.9%, in the third one 49.5% and 72.7% in the last age group, i.e. in the age bracket of 50 - 59 years. The results indicate a very low immunity rate in the lower age brackets and the necessity to vaccinate them before they depart. It is beyond doubt that it pays to examine the soldiers for the presence of total anti-HAV and immunize only subjects with a negative antibody titer. The vaccination approach Havrix 2 x 720 EU was recommended.

Pohl, 2003

Sero-epidemiological surveys of serum samples taken in 1982, 1987, 1994 and 1999 have been performed with hepatitis A virus-specific (HAV-specific) serological tests. Results obtained during these surveys show that the proportion of seropositive blood donors decreased from 69% to 18% within 17 years. The authors have recognized a (mainly subclinical) epidemic, affecting about 115000 teenagers in 1992-1994 in Hungary, is a threatening phenomenon. It was calculated that only about 3600 clinical diseases were associated with the epidemic, recognized retrospectively from the findings of the four seroepidemiological surveys. Epidemiological data indicated that the excess clinical diseases caused by HAV concentrated in the southern counties of Hungary, which have been affected by the social and military activities between 1992 and 1994. Due to the decrease of subjects seropositive for HAV, sera from preselected or actively immunized donors will be required in the future and vaccination against HAV with killed virus is likely to be recommended for risk groups. Furthermore, health authorities might promote active immunization of young children against HAV infection; for that, promotion of manufacturing combination vaccines of HAV/HBV/DPT or, for certain countries, HAV/DPT would be desirable.

Kassas, 1995

The seroprevalence of Hepatitis A virus IgG antibody (Anti-HAV IgG) was assessed in 410 health-care workers, included 97 physicians, 174 nurses, 57 auxiliary staff, 23 cleaning staff, and 59 from various professions. The overall seroprevalence rate was 50.2% with a mean age of 38.2 years, physicians 41.9%, nurses 48.6%, auxiliary staff 47.4% cleaning staff 87.0%, various professions 57.6%. A low seroprevalence was found in young employees, while a high seroprevalence increasing with age was demonstrated in older employees. The low seroprevalence rate may be returned to improvements of the socioeconomic conditions in Hungary.

Dávid, 1983

175 patients with histological evidence of chronic diffuse liver disease, 67 patients with heart failure, diabetes and atherosclerosis, and 118 healthy adults under 30 years of age engaged in sports were studied for the prevalence of hepatitis A virus antibody (anti-HAV) by radioimmunoassay using a HAVAB (Abbott)-kit. Infection with hepatitis-A virus is highly prevalent in Hungary, anti-HAV having been demonstrated in a very high proportion of controls as well as of patients. Over the age of 40 the incidence is 100% in controls and 98% in patients with chronic liver disease. Infection with hepatitis-A virus must have been asymptomatic in the majority, since no more than 11.4% of the subjects had a history of acute hepatitis. The prevalence of acquired anti-HAV increases with age until it attains 100% in advanced age. The present results lend no support to the possibility that hepatitis-A virus infection might be involved in the production of chronic diffuse liver disease.

Janaszek-Seydlitz, 2007

The result of serological survey that was carried out on 895 subjects of Warsaw population at age 1-54 years showed the high proportion of susceptible to hepatitis A infection. It was shown about 90% susceptible among children at age 1-4 years, and about 80% among older children and adolescents aged below 19 years. The low endemicity of hepatitis A in Poland has been observed since 1997 and very low endemicity since 2002. Only 54 hepatitis A cases were reported in 2005. The morbidity was 0.18 per 100,000 habitants. Vaccination against hepatitis A by inactivated vaccine is recommended in Poland for travellers to regions that have high or intermediate endemicity of hepatitis A, for people whose employment includes production or distribution of food as well as for children and adolescents. Prevalence high proportion of susceptibles in population suggests the need of verification of the present recommendations for hepatitis A vaccination.

Grezeszczuk, 2003

Background: Vaccinating health care workers against hepatitis A has been suggested, but it has not been clearly shown that this group is at increased risk for HAV infection. The objective of our study was to evaluate the prevalence of anti-HAV antibodies among health care workers, and to assess the risk factors associated with anti-HAV seropositivity. Material/Methods: Total anti-HAV antibodies in serum were determined among 252 health care workers from three hospital departments (internal medicine, infectious diseases and surgery) in Białystok, in northeastern Poland. The control group consisted of 250 age and sex-matched healthy individuals who are not health-care professionals. Results: Anti-HAV antibodies were found in 180 of the 252 health care workers (71.4%) and in 153 of the 250 healthy controls (61.2%, p<0.05). The difference in anti-HAV prevalence between health care workers and the control group occurred only in individuals up to 40 years of age (59.2% and 43.4% respectively, p<0.05) while no difference could be seen in those older than 40 years (88.6% and 88.8% respectively). Among health care workers there was no association between anti-HAV seropositivity and sex, employment as a physician, nurse or ward attendant, or ward of employment. Health care workers older than 40 years were anti-HAV positive more frequently than younger (88.6 and 59.2% respectively, p<0.05). Conclusions: In northeastern Poland. Younger health care workers (<40 years) may be particularly prone to occupationally acquired hepatitis A infections.

Ryszkowska, 2000

Hepatitis A is a significant endemic and epidemic disease of global importance. There are few studies on the epidemiology of hepatitis A in Poland. The aim of this study was to investigate the prevalence of the antibodies to HAV (anti-HAV IgG) in children and adolescents living in urban and rural areas. Sera from 377 children were collected: 195 lived in Warsaw and 182 in rural area (Voyevodship Opolskie). The prevalence of anti-HAV was very low--9.3% and 3.8% respectively. This finding suggest that epidemiological shift from intermediate to low endemicity is possible in Poland and a new policy of prophylaxis hepatitis A may be necessary.

Polz-Dacewicz, 2000

A comparative seroepidemiological study (1990 vs. 1998/99) on HAV infection, was carried out in population from middle-eastern Poland. Anti-HAV was tested in 1450 subjects from 0 to over 50 years of age and the results were compared with those observed in 1990, in 1000 individuals of the same age range and from the same geographical area. Overall anti-HAV prevalence was 58.4% in 1990 vs. 30.6% in 1998/99. This decline of HAV infection in Polish population indicates that the number of non-immune adults is increasing, with higher risk of symptomatic infection in the near future. The surveillance and prevalence data presented here have implications for developing the strategy for use of hepatitis A vaccine.

Cianciara, 2000

The clinical morbidity of hepatitis A probably only represents 20% of cases of hepatitis A virus (HAV) infection. When it became possible to determine specific antibodies, a seroepidemiological survey of anti-HAV was undertaken in Poland, which showed that between 1979 and 1997 there was a shift in the peak age of infection from childhood to adulthood, concomitant with a substantial decline in the incidence of HAV infection. Data from the World Health Organization also indicate that there has also been a decline in the incidence of hepatitis A in Eastern European countries in general, over the 3 years from 1994 to 1996. The potential risk of epidemics still exists, however, when appropriate conditions are created. The available data show that fewer young people are becoming infected with HAV, and general preventive measures, including vaccination of children and high-risk groups (e.g. healthcare and childcare personnel and those living in 'closed communities') are needed to deal with HAV infections in Eastern Europe.

Zalewska, 1989

The frequency of markers of infection by hepatitis virus A and B was studied among the workers (physicians, nurses, auxiliary personnel) of the Chair and Department of Anesthesiology and Intensive Therapy, Medical Academy in Wroclaw. Serological tests were done by the immunoenzymatic method using kits of Abbott Diagnostics Division. IgG anti-HAV antibodies were found in 62.8% of the tested subjects. HBV markers were present in 44.3% of the subjects, that is several times more frequently than in the general population. HBsAg carriers accounted for 4.3% of the whole group, while in 40% of the group anti-HBV antibodies were present in various combinations suggesting an immunity against HBV infection.

Iacob, 1999

Objectives: Few studies have been carried out to evaluate the role of hepatitis A virus (HAV) as an occupational hazard. Our analysis of data on occupational diseases in Romania showed that hepatitis ranks as one of the first among infectious occupational diseases. Materials and Methods: Data on the role of hepatitis A, as occupational disease, were obtained by testing sera obtained from different occupational groups and compared results with the degree of immunity found among the normal population. An ELISA technique was used to determine the presence of each hepatitis marker (Murex kits for anti-HAV IgG). Results: The ratio of prevalence in each subset compared to the general population was used to express relative risk. The results of our study show that hepatitis A is an important hazard to sewerage workers. In view of these results, it should be considered whether the occupational differences alone account for the divergence in immunity between the groups or whether socioeconomic aspects and differences in the standard of hygiene are also responsible for HAV infections.

Beldescu, 1995

The study objective was to measure the characteristic serological markers prevalence for viral hepatitis A, viral hepatitis B and viral hepatitis Delta in a representative group from apparent healthy general population. Viral hepatitis infections represent through their frequency and gravity a public health problem, in our country. A total of 860 subjects from 13 districts sided in the south part of the country were investigated. The sample were distributed by 9 age group. By using a certain work algorithm we examined the following serological markers: HBs Ag, anti HBs, AgHBe/antiHBe, AgHD/antiHD. For the serologic investigation we used ELISA test with Wellcozyme and Sanofi Diagnostics Pasteur Kits. The results of our study confirm high prevalence values for HAV and HBV (65.8% respectively 44.9%). We could estimate that 73.5% from the population has passed through either HAV infection or HBV infection and 29.1% to 37.7% has passed through both infections. The study also proved a very high HBs Ag carriage (10.5% to 30.9%). The HBe Ag were detected only in HBs Ag carrier children (4.5% to 13%). The presence of anti HBe was 31.4%. From the investigated persons 10% had hepatitis Delta virus infection.

Paquet, 1993

A seroprevalence survey of viral hepatitis was conducted in Bucharest, Romania, between April and July 1990 on a systematic sample of 1355 persons drawn from the general population and groups at higher risk of infection. Sera were tested for hepatitis A, B, and C (HAV, HBV and HCV, resp.) markers using an enzyme-linked immunosorbent assay (ELISA) method. The prevalences of HAV and HBV markers were high in all groups. A total of 47% of the adults from the general population and 39.8% of the children aged 0-16 years had at least one HBV marker. Of the pregnant women 7.8% were positive for hepatitis B surface antigen. Among infants (0-3 years of age) living in orphanages, the prevalence of at least one HBV marker was 54.6%. The findings also confirmed that HCV was circulating in Romania. The results are consistent with national surveillance data and confirm that viral hepatitis is a major public health problem in Romania. Preventive measures will have to include HBV immunization of infants, with an appropriately targeted immunization strategy being determined through further epidemiological studies.

Rudin, 1990

(no abstract)

Sabău, 1983

The prevalence of the serologic markers of hepatitis B virus (HBV) and of antibodies to hepatitis A virus (HAV) were determined by radioimmunoassay in 200 healthy subjects. One hundred and seven persons (53.5%) were positive for at least one marker of HBV. The prevalence of each marker was: HBsAg - 9.0%, anti-HBs alone - 2.0%, anti-HBc alone - 2.5%, anti-HBs and anti-HBc - 29.0%, HBsAg and anti-HBc - 11.0%. Evidence of a previous infection with HAV was found in 155 persons (77.5%); three of them had anti-HAV type IgM. These findings indicate that in the area investigated HAV infection is endemic, and HBV infection has a trend towards endemicity.

Onesciuc, 1981

Anti-HA antibodies were determined by radioimmunoassay according to the HAVAB-ABBOTT technique in 244 subjects, of whom 194 without hepatic involvement, 25 with non B hva and 25 former non B hva patients. Anti-HA anti-bodies were found in 67% of the healthy subjects and 100% of the patients and former hva cases. The incidence of anti-HA antibodies increases with age being in 30% of children and 83.5% of adults. A peak incidence was found between the ages 21 and 30 years. In the district investigated subclinical infection with HVA was frequent, beginning in childhood and up to the age of 30 years. The qualitative HAVAB test is adequate for epidemiological investigations; a quantitative variant is necessary for the diagnosis.

Quaglio, 2008

The prevalence of hepatitis infection among the Kosovarian population is largely unknown. The aim of the study was to evaluate the prevalence and risk factors of hepatitis A, B, C, and D (HAV, HBV, HCV, HDV) infection among the general population and in a group of health care workers in the Kosovo region. Overall, 1287 participants were recruited, 460 males (36%) and 827 females (64%). Health care workers accounted for 253 individuals (20%), 301 were blood donor candidates (23%), 334 were pregnant women (26%), and 399 (31%) were subjects who had been examined in two clinics for routine laboratory testing. The prevalence of total anti-HAV was 88.6% (95% CI: 86.69-90.25). Prevalence of anti-HAV among children up to 10 years was 40.5% (95% CI: 29.6-53.15), reaching 70% (95% CI: 62.25-77.10) in the 11-20 age group. Age, living in rural areas and unemployment were factors associated with higher risk of HAV infection. HBsAg was detected in 2.4% (95% CI: 1.57-3.38%) of the study sample, with a significant age trend (P-value:0.0110). Positivity for total anti-HBc was detected in 18.4% (95% CI = 16.27-20.59) of the subjects. Ninety-three subjects (7.2%) were positive for anti-HBs alone. An association between age, HSV-2 positivity, working nurses and HBV infection has been observed. One patient was HDV positive. The prevalence for HCV was 0.5% (95% CI: 0.22-1.12%). HAV infection seems to be high-intermediate, while HBV shows an intermediate endemicity. It is necessary to highlight the importance of an immunization strategy against HAV and HBV in reducing the incidence of the infection. The prevalence for HCV was very low.

Sočan, 2001

(no abstract)

EUROPE, EASTERN

(Belarus, Estonia, Latvia, Lithuania, Republic of Moldova, Russian Federation, Ukraine)

Fisenka, 2008

Hepatitis A is a reportable disease in Belarus. Universal hepatitis A vaccination of children aged 6 years in Minsk City began in 2003. This analysis was conducted to evaluate the short-term impact of the program. Hepatitis A incidence data from 1954 to 2006 was compiled. Vaccination effectiveness was estimated by comparing the incidence of reported hepatitis A cases after 4 years of immunization (2006) with the incidence when the vaccination program started (2003). The vaccines used were Avaxim 160 or Avaxim 80 (95%) and Havrix 720 (5%). From 2003 through 2006, hepatitis A incidence in vaccinated children under 14 years was 20-fold lower than the incidence in unvaccinated children (0.3 cases/10000 vs 5.98/10000; odds ratio = 0.05, 95% CI: 0.012-0.202), for a vaccination effectiveness of 95%. The decreased incidence of hepatitis A in all age groups in 2006 (by 12 times in preschool children aged 1-5 years, 13 times in children aged 10-14 years and 4-6 times among adults), including those without high coverage by vaccination, suggest a herd effect. Routine vaccination also resulted in a shift of the age pattern of hepatitis A morbidity. The proportion of cases in children under 14 years decreased from 33% to 41% in 2000-2002 to 7% in 2005-2006. We conclude that introduction of universal hepatitis A vaccination in Minsk resulted in sharply reduced incidence in both vaccinated and unvaccinated children. Hepatitis A virus circulation might decrease further by beginning vaccination at a younger age.

Gudkov, 1992

The large immune stratum and intense collective immunity to virus hepatitis A among the urban population of Byelorussia are characteristic of hyperendemic territory. The geometric mean of the antibody titer has been noted to increase with age, which is probably due to repeated infections of persons who have already had the disease. The use of this value for the characterization of collective immunity and epidemiological situation has been proposed.

Kompaniets, 1984

On the basis of data obtained by seroepidemiological studies general regularities, as well as essential differences, in the manifestations of the epidemic processes characterized by the active and sluggish spread of infection induced by hepatitis A virus have been revealed.

Shliakhtenko, 2008

The epidemiological features of hepatitis A virus (HAV) infection were studied in eleven territories located in the north-western region of the Russian Federation. The dynamics of HAV infection in Russia and in the region were evaluated during a 17-year period. The age-specific incidence was calculated and 229 305 patients with acute HAV were identified. The analyzed database included HA mixed with other viral hepatitis infections: it included information about 8 809 HAV patients. Special attention has been paid to the seroepidemiological studies conducted in St Petersburg city. These studies included analysis of age-specific incidence in persons 20 years of age and older during 6 years and testing of blood sera from 1 892 healthy persons for IgG anti-HAV. In general there is a trend to reduction of HAV incidence in Russia, and in the north-western region, high indices were registered in some provinces in different years. It was established three types of age-specific incidence distribution: predominated incidence in 3-14 years of age (first type), 15-29 years of age (second type) and uniform distribution in different age groups (third type). It was shown that decrease of HAV incidence in children and young adults lead to the reduction of seropositivity level in the groups 20+ years of age. These characteristics should be taken in account to define indications for HAV vaccine prophylaxis. HAV infection in 10-13% of cases mixed with acute or chronic hepatitis B and C in the last 15 years in St Petersburg. In the middle of 1990s, HAV mostly mixed with acute viral hepatitis of different etiology, but in the modern time predominated type of mixture was presented by HAV and chronic HBV and HCV infections. The obtained results are useful for viral hepatitis surveillance and control.

Von Hertzen, 2006

Background: Evidence of the influence of pathogen exposure on the development of atopy and atopic disease is not unequivocal. We investigated the association between markers of infections and occurrence of atopy among adults in eastern Finland and western Russia, two adjacent areas with profound differences in living conditions and lifestyles. Methods: Randomly selected adults aged 25-54 years from Finland (n = 790) and from Russia (n=387) participated in the study. Skin prick tests were performed to 11 common airborne allergens, and at least one positive prick reaction was considered to indicate atopy. Antibodies to different pathogens including hepatitis A virus (HAV), *Helicobacter pylori*, *Toxoplasma gondii*, herpes simplex virus (HSV), *Chlamydia pneumoniae*, and the periodontal pathogens *Porphyromonas gingivalis* and *Actinobacillus actinomycetemcomitans* were measured. Results: In Finland 34.3% and in Russia 23.3% of the study population was atopic ($p<0.001$). Seroprevalences to all these pathogens were significantly higher among the Russians. In multivariate logistic regression analysis, only *H. pylori* was inversely associated with atopy in Russia. A further stepwise analysis revealed that *H. pylori* alone can explain 32% of the difference in atopy between the countries, and *T. gondii*, *A. actinomycetemcomitans*, HSV, and *C. pneumoniae* had a slightly additive effect, whereas, unexpectedly, seropositivity to HAV and, to a lesser extent, *P. gingivalis* had an opposite effect. The net result of the stepwise analysis showed that 44% of the difference in atopy between the countries could be explained by seropositivity to these seven pathogens. Conclusions: Seropositivity to select pathogens, particularly to *H. pylori*, could explain a substantial part of the difference in atopy prevalence between Finland and Russia. Exposure to HAV was not associated with protection against atopy in this adult population.

Mukomolov, 2001

Seroepidemiological study of hepatitis A (HA) morbidity was carried out in three Russian cities, with different levels of HA morbidity. The study included the analysis of HA morbidity for 22 years, the determination of antibodies to HA virus (anti-HAV) in 2,958 healthy persons aged 0 to 12 months to 40 years and older. In one of the cities 7 isolates of HA virus were obtained from unrelated sources and the genotypes of the virus were determined. The study revealed that the frequency of seropositive cases among persons of different ages correlated with the level and prolonged dynamics of HA morbidity. According to the occurrence of anti-HAV, such cities as St. Petersburg, Rostov-on-Don and Yakutsk may be at present classified as territories, moderately endemic in HA. At the same time in the 90 s the epidemic situation in HA was more favorable in Rostov-on-Don than in two other cities. The suggestion was made that a high proportion of seropositive persons among the population of St. Petersburg was linked with an almost twofold rise in HA morbidity in 1993-1995 caused by genotype 1 of the virus. Seroepidemiological studies in HA during the period of a drop in morbidity acquire special importance in the surveillance and control system of this infection.

Shliakhtenko, 1994

For the first time population immunity to virus hepatitis A has been studied during three different phases of prolonged morbidity cycles of this infection, and the results of this study have been compared with the data on morbidity in different age groups. Pronounced variability of the immunological structure of the population in different age groups, found to be related to the dynamics of hepatitis A morbidity, has been established. Fluctuations in immunity level are most pronounced among children aged 1-6 and 7-14 years, having the least proportion of seropositive persons. A new epidemic cycle is started among these groups of the population, and at the first stage this cycle is manifested by an increase in the intensity of the latently developing epidemic process. This is followed by the activation of registered morbidity among the whole of the population. Seroepidemiological study may be used both for prognostication purposes and in the system of surveillance on this infection.

Balayan, 1994

Background: Hepatitis E is a major cause of acute icteric disease widespread in tropical and sub-tropical regions but rarely occurring in industrialized countries. Recently solid-phase enzyme immunoassays with recombinant antigens have been introduced for diagnosis of this infection. Objectives: The aim of this study was to evaluate the diagnostic potential of a newly developed Abbott test for the detection of IgG class antibodies to hepatitis E virus (anti-HEV IgG) in hepatitis patients and 'normal' individuals. Study Design: Sera taken from hepatitis patients and individuals without liver disorders in endemic (Kyrgyzstan and Uzbekistan) versus non-endemic (Moscow) areas were investigated. In parallel IgG class antibodies to hepatitis A virus (anti-HAV IgG) were determined by an enzyme immunoassay with native HAV antigen. Restuls: In five groups comprising altogether 86 suspected hepatitis E patients from endemic area the rate of anti-HEV IgG seropositivity varied from 85% to 17%. In Moscow anti-HEV IgG was found in one patient (who also had acute hepatitis B) out of 19. Anti-HEV IgG persisted in an experimentally infected volunteer for at least 12 years after the acute disease. Among the individuals without liver disorders eight out of 173 (4.6%) showed anti-HEV IgG seropositivity in Kyrgyzstan while there was only one seropositive out of 165 (0.6%) in Moscow. In contrast, anti-HAV IgG were frequently present in the residents of both areas: in Kyrgyzstan over 90% of individuals from young age groups already had these antibodies; in Moscow the rate of anti-HAV IgG seropositivity constantly increased from 31% in the youngest age group to almost 85% in the oldest one. Conclusion: Prevalence of anti-HEV antibodies was unexpectedly low in endemic area; in Moscow anti-HEV IgG was found only in single cases. Anti-HEV IgG seropositivity in a single serum sample could be of certain diagnostic value in non-endemic areas.

Karetnyĭ, 1990

Additional observation on the formation of humoral immunity to hepatitis A virus has been carried out in 2375 adolescents aged 15-17 years and belonging to 12 groups at 3 areas of the USSR. This observation has shown that in the presence of a high level of the immune stratum the spread of infection occurs, as a rule, outside the group under observation. Besides, as revealed in this study, the risk of seroconversion and the loss of specific antibodies are, respectively, directly and inversely related to the level of the immune stratum in the group. The level of the immune stratum in a given age group supposedly reflects the intensity of the development of the epidemic process at a definite area.

Kornachev, 1990

Epidemiological analysis of hepatitis A morbidity in a city with the population of 500,000 persons in 1960 to 1987 was carried out. Three periods of morbidity rises among children aged 3 to 6 years and 7 to 14 years and living at the same areas (microdistricts) were established. Blood sera from healthy children were tested f or the presence of antibodies to hepatitis A in enzyme immunoassay. The data on the sanitary and bacteriological study of tap water were analyzed. Unsatisfactory results of water analysis in different microdistricts correlated with the presence of antibodies in the population of these microregions and with the average morbidity indices for many years.

Prikazchikov, 1988

Solid-phase enzyme immunoassay was used to study changes in the frequency and levels of antibody to hepatitis A virus (anti-HAV) in 567 children in 20 isolated groups of 5 day-care centers of the town of Kemerovo. The observation period included the seasonal rise in hepatitis A incidence. An increase in the portion of seropositive children occurred in the groups where manifest or asymptomatic infection with hepatitis A existed. The number of seropositive subjects in the groups where the children were given immunoglobulin by epidemiological indications increased by 0-8%, and in those without immunoglobulin by 11-37.5%. The passive antibody received with immunoglobulin were detected in the originally seronegative children and declined to undetectable levels within 2 months. Subsequently, no clinical cases of hepatitis A or asymptomatic seroconversions were observed in these children. Some cases of re-infection showing an increase in anti-HAV levels but without clinical manifestations of hepatitis A were detected.

Prikazchikov, 1987

In order to investigate the shift in the rates and levels of antibody to hepatitis A virus, 567 children in 20 isolated groups of five day-care centers were observed over a period of 8 months during which the seasonal rise in hepatitis A morbidity occurs. Increases in the proportion of seropositive ranging from 5 to 37% were demonstrated in 6 groups, and were always associated with the occurrence of either overt or sub-clinical hepatitis A infection. High rates of seropositivity were also noted in the groups in which cases of hepatitis A had been registered prior to the period of observation. In some children with low and medium antibody levels, antibody titers showed further increases after re-infection. A substantial part of children retained low antibody titers during the entire period of observation, and eight previously seronegative children developed low antibody levels after asymptomatic hepatitis A infections. In one group the spread of hepatitis A infection (clinical and asymptomatic) was prevented by the administration of commercially available immunoglobulin immediately after the discovery of an infected food handler. Passive antibodies were found in previously seronegative children, and these antibodies dropped to undetectable levels two months after administration.

Savinskaia, 1982

Serum specimens collected from 1002 persons in Moscow were tested for the presence of antibodies to hepatitis A virus (anti-HAV antibodies) by solid-phase enzyme immunoassay. The prevalence of these antibodies increased progressively with age from 10% in children aged 5-9 years to over 90% in the age groups of 40-49 years and over, the 50% immunity level being established at the age of 18 years. 79% of infants under 1 year were found to be immune, which was obviously due to the placental transfer of antibodies from mother to child. In a considerable part of seropositive persons over 30 years high or medium antibody titers were detected. These age groups showed a stable proportion of the low, medium and high level of anti-HAV antibodies. The prevalence of such antibodies was not related to sex. The presence of an ample amount of anti-HAV antibodies was determined in all of 18 tested lots of commercial serum immunoglobulin obtained from 3 different manufacturers.

Moisseeva, 2008

Ukraine is a zone of moderate hepatitis A endemicity. The changing epidemiology of the disease because of improved hygiene has shifted the burden of Hepatitis A to older age groups where the disease is more severe. Outbreaks have also become more common as more of the population has become susceptible to hepatitis A virus (HAV). To help guide decisions regarding use of hepatitis A vaccine in Ukraine, we examined the presence of antibody to HAV (anti-HAV) in 1001 persons aged 1 to 85 years, visiting four municipal healthcare centres in the Ukrainian capital, Kiev. Overall, the anti-HAV prevalence was 31.9%. Anti-HAV seropositivity increased with age from 9.2% among children aged 1-5 years to 81.7% among persons over 50 years, but less than 50% of subjects less than 50 years were HAV seropositive. No children under 2 years were seropositive. HAV seropositivity was twice as high in children aged 5-11 years old in the low socio-economic status group (income less than 150 US$ per family member per month) than in the middle/high group (11.1% compared to 6.3%) but this disparity disappeared by adolescence. The prevalence of anti-HAV antibodies in adults was not different with respect to district of residence within the city. Considering the proportion of HAV seronegative subjects in all age groups under 50 years, routine vaccination against HAV of children aged 1-2 years old would appear to be an effective schedule for hepatitis A prophylaxis in Kiev.

EUROPE, WESTERN

(Andorra, Austria, Belgium, Channel Islands, Cyprus, Denmark, Faeroe Islands, Finland, France, Germany, Gibraltar, Greece, Greenland, Holy See, Iceland, Ireland, Isle of Man, Israel, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, Saint Pierre et Miquelon, San Marino, Spain, Sweden, Switzerland, United Kingdom)

Prodinger, 1994

Several European countries report a decreasing prevalence of antibodies to hepatitis A virus (anti-HAV). This trend is most pronounced in the youngest age groups. In 1979, however, 58% of young Austrians aged 20 to 30 years were shown to possess anti-HAV. Here we describe the current epidemiological situation in western Austria. Prevalence of anti-HAV has decreased to 7% in those 18 to 30 years old. This percentage rises to 20% (31 to 40 years of age) and 57% (41 to 50 years of age) and is highest in those older than 50 years (87%). Of 180 cases of clinical hepatitis A occurring from 1985 to 1992 45% were imported by travel to HAV-endemic areas. Seventy-one percent of the cases in children (59/83) occurred in foreign workers' families and were also predominantly acquired abroad. A change in prevention policy should be considered in this respect, as vaccination is available now.

Vranckx, 1999

Health care workers (HCW), especially women (for example, pediatric nurses and day nursery workers), have been shown to be at risk for viral hepatitis A infections. In order to obtain a more precise estimate of the risk in Belgian HCW, a seroprevalence study was undertaken. The data from this study have been compared with the age-specific seroprevalence of anti-HAV in the general population (GP) as recently estimated. During 1996-1997, a sample of 5,068 employees in 22 general hospitals, geographically distributed over the Flemish and Brussels regions of Belgium, was tested for the presence of anti-HAV. Comparison of the anti-HAV prevalences in HCW and GP shows a significantly lower prevalence in HCW for the age groups 25-34, 35-44, and 45-54 years. Within these age-groups, employees performing catering tasks have the highest prevalence. This difference could be explained by socioeconomic parameters: overrepresentation of higher social classes in better educated HCW. The number of unprotected individuals in young and older age groups (25-54 years) is greater than in the general population. In view of the changing HAV epidemiology in western Europe, the number of unprotected persons will rise in the coming years. Considering the more severe course of the disease as age increases, vaccination may become important in the occupational health strategy for HCW.

Beutels, 1998

The purpose of this study was to obtain data on the prevalence of hepatitis A in Flanders, Belgium, in order to analyze any change in the epidemiological pattern of hepatitis A virus (HAV) in the region, and to determine at which age pre-vaccination testing would be useful. To meet these goals, a seroepidemiological survey was conducted: 4058 serum samples were collected from a random sample of the general population in 1993 to 1994. The overall age-standardized prevalence was 51.3%. Among non-Belgians (n=245), the age-standardized anti-HAV prevalence was 66.4%, significantly higher than the 49.6% anti-HAV prevalence found in Belgians (n=3186). Among Belgians, seroprevalence increased with age: from 5.4% in the youngest age group (0-14 years) to over 80% in the two oldest age groups (55-64 years and ≥65 years). Prevalence rates were as high as 31.7% in the 25-34 year old age category, and 60.8% in the 35-44 year old age category. The age-specific prevalence figures among Belgians and non-Belgians reflect two different epidemiological patterns: the epidemiological pattern of a low endemic region for Belgians and the epidemiological profile of an intermediate endemic region for non-

Belgians. The age-specific prevalence figures in Belgians were compared with the 1979 and 1989 anti-HAV prevalence figures in Belgian first-time blood donors. A clear epidemiological shift showing decreasing HAV prevalence in the youngest age groups was found. If we accept that pre-vaccination screening is useful at a 35% prevalence rate, all persons over 35 years of age should be screened before vaccination.

Beutels, 1997

Viral hepatitis is a serious health problem throughout the world. No recent prevalence data on hepatitis A, B and C were available for the population in Flanders, Belgium. For this reason, a seroepidemiological study was undertaken in 1993-1994 in a sample of the general population. The purpose of this study was to obtain a clear picture of the prevalence of hepatitis A, B and C. Between April 1993 and February 1994, 4,058 blood samples were drawn and collected in 10 hospitals in Flanders. The study group was representative for the Flemish population. For hepatitis A a seroprevalence of 55.1% was found. In the non-Belgian residents the HAV prevalence was significantly higher than in Belgians (62% versus 52%; chi2=8.05; p=0.005). For hepatitis B. 9.9% of the study group showed serological evidence of hepatitis B markers: 6.9% of the participants was positive for anti-HBs/anti-HBc, 0.7% appeared to be HBsAg positive and 3.5% was solely anti-HBs positive. The prevalence of HBV markers in Belgians was 6.9%, significantly lower compared to the 13.4% among non-Belgians (chi 2 = 14.05; p = 0.00018). 4055 serum samples were analyzed for hepatitis C serology by second generation anti-HCV tests. Anti-HCV was detected in 0.87% of the serum samples. No statistically significant difference was found in HCV prevalnece between Belgians and non-Belgians. Results of this study should help policy makers in their decisions on the most appropriate hepatitis A and B vaccination strategy and on the most effective prevention strategy for hepatitis C.

Jacques, 1994

To assess the risk for hepatitis A virus (HAV) infection in an occupational group potentially at risk for fecal-oral contact with very young children, a prevalence study of total anti-HAV antibodies (IgG/IgM) was conducted among 591 female employees in day nurseries in Flanders, Belgium, and in a reference group of 560 healthy female blood donors, matched for age. Analysis was also performed on formally exposed persons (n=413) versus blood donors (n=560). The overall prevalence of HAV markers was 48.4% (95% CI: 44.2-52.5) in exposed day nursery personnel, compared with 42.9% (95% CI: 38.7-47.0) in blood donors. The age-specific prevalence rates showed a steeper rise from the age of 30 years among the exposed employees than among the blood donors, with significantly higher prevalences between 35 and 44 years of age. The discrepancies leveled off above 60 years of age. Standardization for parenthood using logistic regression did not affect the odds ratio. These results are in line with recent findings of a higher prevalence of HAV markers among groups of workers professionally exposed to small children. Appropriate measures for the protection of these groups should be taken.

Vranckx, 1993

In childhood HAV infection most often passes sub-clinically. In this study we evaluate the percentages of clinically and sub-clinically developing HAV infections and the age distribution of the prevalence of immunity to HAV. The study population (n=1,008) included newborns, children and teenagers up to 20 years of age from the Brussels area. Sera were randomly collected at a general hospital. Subjects were stratified into six age groups. Among children and teenagers, the overall prevalence of anti-HAV (IgG) was 13.4%; this prevalence increased from 4.8% among children in the first group (1-2-year-olds) to 33.9% in the group of teenagers (16-20-year-olds). Among children and teenagers, 10% HAV infections on average is clinically recognized. For the different age groups, these figures are 3.5%, 18.7%, 12.3% and 5.5%, respectively. It can be concluded that, relative to the overall population of each age group, 0.3%, 1.8%, 1.6%, and 0.3%, respectively, will have a clinically recognized HAV infection as members of that specific age group.

Vranckx, 1990

Epidemiological data from various countries show that the frequency of Hepatitis A virus antibodies (anti-HAV) in different population groups is largely dependent on the geographical and age distribution of the population surveyed. As regards Europe anti-HAV antibodies are generally frequent in all groups in Southern Europe while in Northern Europe these antibodies are common in older people only. The prevalence data collected in 1979 and in 1989 show that the anti-HAV antibodies rate is a function of age, but the rates for all age groups were lower in 1989 compared to 1979. In 1979, at an age between 25 and 30, some 50% of the population was anti-HAV antibody positive. The same results were obtained in another Belgian study conducted in 1979. In 1989 50% positivity was only reached at an age between 35 and 40 years. The present study confirms that anti-HAV antibody prevalence decreases with higher socioeconomic status. The higher rate relative to age is associated with socioeconomic and hygienic living conditions at the time when most infections occur, i.e. before the age of 20. It can be concluded by comparing the 1979 and 1989 results that the number of adults susceptible to HAV infections has increased. This fact drew attention in view of the strongly altered travelling pattern of fairly large sections of the population.

Coester, 1984

In a homosexual communication centre in Antwerp 196 homosexual men were screened for seromarkers of syphilis, hepatitis A (HAV), hepatitis B (HBV) and cytomegalovirus (CMV). A comparison group consisted of 118 heterosexual men attending a venereal disease clinic in Antwerp. Treponemal antibodies were found in 7.1% of homosexual men, of whom half gave no history of past or present infection. Anti HAV was present in 43.3%, HBV seromarkers in 34.4%, and CMV antibodies in 71.2% of homosexual men. Hepatitis B surface antigen (HBsAg) was detected in eight homosexual men, but not in the heterosexual control group. Prevalence rates of infections other than HAV were significantly higher in homosexual men than in heterosexual men. Answers to a questionnaire were used to evaluate risk factors for different diseases, which were: duration of active homosexuality for all infections, promiscuity (greater than or equal to 10 partners in the past six months) for syphilis and hepatitis B, and anal intercourse for hepatitis B. Visiting saunas and travelling for sexual contacts also indicated a higher risk for STD, but were an indirect expression of promiscuity.

Vranckx, 1984

Data from medical histories and seroepidemiological surveys of blood donors offer good grounds for regarding viral hepatitis A in Belgium primarily as a childhood disease. The epidemiology of anti-HA has thoroughly altered over the last few decades, which correlates with radical socioeconomic changes and improved hygienic living conditions. The rate of HLA-antigens shows in general no different patterns in groups with or without a recognized history of HAV infections.

Hadjipanayis, 1999

The prevalence of antibodies to hepatitis A virus was investigated in 385 children and adolescents (52.2% males), aged 6 to 18, in the Larnaca area of Cyprus. This is the first study investigating the prevalence of hepatitis A in Cyprus for this age group. The population was stratified into two groups: 6 to 12 years old and 13 to 18 years old. None of the subjects in the first group were positive. The prevalence of hepatitis A in the age of group 13 tol8 was 1.6%. In conclusion, the low prevalence of anti-HAV demonstrates the susceptibility of young Cypriots to hepatitis A. This is a cause for concern as these unprotected young adults are frequently exposed to potentially infected individuals.

Christensen, 2005

When testing 466 Danish blood donors, of whom 60 reported to be vaccinated against hepatitis A, 55 (11.8%, 95% CI: 9.0-15.1) had detectable levels of anti-hepatitis A virus IgG (> 10 m IU/ml). Among unvaccinated donors, the prevalence rate was 23/376 (6.1%, 95% CI: 3.9-9.0) with age above 50 y and use of private water supply being independently associated with seropositivity.

Linneberg, 2003

Background: Seropositivity to food-borne and orofecal microorganisms (hepatitis A virus, *Helicobacter pylori*, and *Toxoplasma gondii*), which are considered to be markers of poor hygiene, has been reported to be associated with a lower prevalence of atopy. In contrast, colonization of the gut with *Clostridium difficile*, a potential intestinal bacterial pathogen, in early childhood may be associated with a higher prevalence of atopy. Objective: The objective of this study was to investigate the association between atopy and exposure to 2 groups of food-borne and orofecal microorganisms: (1) markers of a poor hygiene and (2) intestinal bacterial pathogens. Methods: A cross-sectional population-based study of 15- to 69-year-olds living in Copenhagen, Denmark, was carried out in 1990 to 1991. Atopy was defined as a positive test result for specific IgE to at least 1 of 6 inhalant allergens. Exposure to microorganisms was assessed as IgG seropositivity to microorganisms. Results: Seropositivity to 2 or 3 markers of poor hygiene (hepatitis A virus, *H pylori*, and *T gondii*) was associated with a lower prevalence of atopy (adjusted odds ratio, 0.5; 95% CI, 0.3 to 0.8). In contrast, seropositivity to 2 or 3 intestinal bacterial pathogens (*C difficile*, *Campylobacter jejuni*, and *Yersinia enterocolitica*) was associated with a higher prevalence of atopy (adjusted odds ratio, 1.7; 95% CI, 1.2 to 2.6). Conclusion: Exposure to markers of poor hygiene was associated with a lower prevalence of atopy, whereas exposure to intestinal bacterial pathogens was associated with a higher prevalence of atopy. These findings raise the hypothesis that different groups of food-borne and orofecal microorganisms may have different effects on the risk of atopy.

Scheutz, 1985

The aim of the study was to investigate the prevalence of previous clinical hepatitis B virus (HBV) infection and the prevalence of HBV markers in Danish oral surgeons, to estimate the annual HBV infection rate, and to assess whether the use of hepatitis B vaccine is to be recommended for this group. The total study population comprised 40 individuals occupied with oral surgery. A questionnaire and a request for a blood sample were sent to all dentists employed at the Danish hospitals and the departments of oral surgery at the 2 dental colleges. 36 (90%) answered a questionnaire, whereas only 27 (67.5%) had a blood sample taken for analysis of hepatitis surface antigen (HBsAg), antibody to HBsAg (anti-HBs), antibody to hepatitis core antigen (anti-HBcAg), antibody to hepatitis A virus (anti-HAV), and serumtransaminases. One had been clinically ill from HBV infection and was positive for anti-HBs. The prevalence rate was thus 3.7% (95% confidence limits: 0.1%-19.0%) and the annual attack rate was 0.3%. The prevalence was not higher than among Danish dentists in general, and they are not considered a high-risk group in Denmark. Even with due statistical consideration to the present small sample, Danish oral surgeons do not seem to belong to a high-risk group like other surgeons in different medical specialties. It is concluded that the use of a hepatitis B vaccine is not recommended at present for this group of dentists.

Skinhøj, 1984

A stratified age matched sample of 564 general hospital nurses, assistant nurses, and porters was studied for antibody to hepatitis A virus (anti-HAV), hepatitis B surface antigen (HBsAg), and antibody to hepatitis B surface antigen (anti-HBs), and these data were compared with serum aspartate aminotransferase (AST) and identified episodes of hepatitis. The overall prevalence of anti-HBs was increased twofold compared with blood donors, while no evidence of increased exposure to hepatitis A virus was found. The serological survey showed porters to have a significantly higher prevalence of hepatitis A virus (52%) as well as hepatitis B virus (10.2%) markers compared with the nurses and assistant nurses (39% and 5.3% respectively). In contrast, the clinical data showed the incidence of hepatitis to be four times higher in nurses than in the two other groups during hospital employment. The serological survey may reflect differences in social background of the groups, while the clinical data identified nurses as having the highest occupational hepatitis risk. A number of episodes of hepatitis in nurses appeared to be due to non-A, non-B agents. AST values, however, did not show any case of liver inflammation not attributable to alcohol. Thus chronic non-A, non-B infections could not be shown in this population group.

Skinhøj, 1982

Two hundred and eighty-five healthy Danish children aged between 7 and 17 years were studied for hepatitis B antigen and antibodies to hepatitis A and B. A positive response to each of these infections was found in 0.7% of them. During a 5-year period 40 children were admitted to hospital with viral hepatitis, 30 of whom had hepatitis A. Eighty-three per cent of these cases of hepatitis A were secondary to adult cases, or had resulted from foreign travel. Hepatitis A is no longer endemic in Danish children, and morbidity from hepatitis B or non-A non-B is negligible.

Mathiesen, 1980

Antibody to hepatitis A virus (anti-HAV) was studied in 225 Danish blood donors. The prevalence was found to be 3% in individuals younger than 30 years but then rising with age to 78% in individuals older than 55 years. The titer of anti-HAV in 51 lots of Danish immune serum globulin (ISG) produced from June 1969 to June 1977 was found to vary between 2300 and 5900 except for 2 with titers of 14000 and 28000. The titers did not change during the period and compared well to 3 lots of ISG produced in the USA and selected by the manufacturer because of a high anti-HAV titer.

Skinhøj, 1980

The persistence of viral hepatitis A (HAV) and hepatitis B (HBV) in the Faroe Islands, a Caucasian, high sanitary standard, isolated area, was studied by means of notified clinical cases of hepatitis and by specific antibody testing of population samples. Large epidemics of hepatitis occurred on the Faroe Islands in 1928-1930 and 1955-1958, although sporadic cases have been continuously recorded. Presence of antibody to HAV (anti-HAV) was confined to age groups exposed to the epidemics, while antibody to HBV surface antigen (anti-HBs) was demonstrated in all age groups, including children. This study provides further evidence for the concept of HAV as a self-limited infection, unable to maintain itself by chronic virus carriers. HBV, by contrast, again is shown to survive even in small populations with high sanitary conditions and to have no recognizable risk factors.

von Hertzen, 2006

Background: Evidence of the influence of pathogen exposure on the development of atopy and atopic disease is not unequivocal. We investigated the association between markers of infections and occurrence of atopy among adults in eastern Finland and western Russia, two adjacent areas with profound differences in living conditions and lifestyles. Methods: Randomly selected adults aged 25-54 years from Finland (n=790) and from Russia (n=387) participated in the study. Skin prick tests were performed to 11 common airborne allergens, and at least one positive prick reaction was considered to indicate atopy. Antibodies to different pathogens including hepatitis A virus (HAV), *Helicobacter pylori*, *Toxoplasma gondii*, herpes simplex virus (HSV), *Chlamydia pneumoniae*, and the periodontal pathogens *Porphyromonas gingivalis* and *Actinobacillus actinomycetemcomitans* were measured. Results: In Finland 34.3% and in Russia 23.3% of the study population was atopic ($p<0.001$). Seroprevalences to all these pathogens were significantly higher among the Russians. In multivariate logistic regression analysis, only H. pylori was inversely associated with atopy in Russia. A further stepwise analysis revealed that H. pylori alone can explain 32% of the difference in atopy between the countries, and *T. gondii, A. actinomycetemcomitans*, HSV, and *C. pneumoniae* had a slightly additive effect, whereas, unexpectedly, seropositivity to HAV and, to a lesser extent, *P. gingivalis* had an opposite effect. The net result of the stepwise analysis showed that 44% of the difference in atopy between the countries could be explained by seropositivity to these seven pathogens. Conclusions: Seropositivity to select pathogens, particularly to *H. pylori*, could explain a substantial part of the difference in atopy prevalence between Finland and Russia. Exposure to HAV was not associated with protection against atopy in this adult population.

Pohjanpelto, 1984

Infectious hepatitis, based on clinical diagnosis, has been reported by practicing doctors in Finland to the National Board of Health since 1943. Two epidemics of infectious hepatitis have been recorded. The first one with more than 16000 cases occurred in 1948 and the second one in 1954-57 with a peak of more than 7000 cases in 1956. After that infectious hepatitis has declined rapidly. In 1966 only 363 cases were reported. Although the figures are incomplete they reflect the changes that have taken place in the frequency of infectious hepatitis in Finland. The statistics are supported by serological studies. 24% of the sera collected in 1970 from 20-24-year-old Finns, born in 1946-50, contained antibodies of the IgG class to hepatitis A while only 0.3% of the sera collected in 1982-83 from the same age group, born in 1958-63, contained these antibodies. Only 3.2% of the sera sent to our laboratory for hepatitis A diagnosis in 1980-82 contained antibodies of the IgM class to hepatitis A, and at least 68% of these infections were connected with travel in foreign countries. This paper shows that the prevalence of hepatitis A is low in Finland and that a rapid decline in its frequency has taken place during the last 25 years.

Denis, 2003

Aim: Age-specific prevalence of hepatitis A virus (HAV) antibodies (IgG and IgM anti HAV). Methods: For eight years between 1994 and 2002, 15329 hospitalized patients were tested. Results: The prevalence of anti HAV according to age group was as follows: 20 to 29: 28.5%; 30 to 39: 47.4%; 40 to 49: 64.8%; 50 to 59: 82.1%; more than 90% after 60 years old and 97% in patients older than 80. This was not a cross sectional seroepidemiological investigation because serum samples were selected by prescription especially among children. Recent HAV infections as shown by IgM positivity (136 patients) was observed among all age groups, particularly before ten years old (28.7%), but was still significant after sixty (19.8%). Conclusion: The age-specific seroprevalence of HAV antibodies compared with previous French prevalence data revealed a good correlation with results obtained in West-Central region and in national investigations in general populations but more elevated than observed in French recruits.

Nalpas, 2000

Objectives: To evaluate the prevalence of serum markers of hepatitis A, B and C viruses in a rural area according to risk factors and alcohol consumption. Methods: Transversal study of unselected subjects living and working in a rural area. Each subject included was asked to fill out an anonymous self-administered questionnaire dealing with his own risk factors, sexual behavior and alcohol consumption. A blood sample was collected for detection of HBsAg, anti-HBc, anti-HBs, anti-HAV, and anti-HCV antibodies. Results: Three hundred three subjects with a mean age of 48 years were included. Main risk factors for viral infection were: blood transfusion (9.4%), intravenous drug addiction (0.73%), acupuncture (17.5%), tattoos (5. 8%), past hospitalizations (71.5%), homosexuality (1.1%), conjugal unfaithfulness (11%), sexual partners >5 (21.3%). Most subjects with at risk sexual behavior had sexual relations without protection. Anti-HAV prevalence was 87.2% (95% confidence interval 83.4-91.0%). None of the subjects was HBsAg positive and 6.0% (confidence interval 4.7-8.7%) had anti-HBV antibodies. HBV prevalence was correlated to homosexuality only. Two subjects (0.67%, confidence interval 0-1.6%) without any identified risk factor had anti-HCV antibodies. There was no correlation between serum viral marker positivity and an excess alcohol consumption (>80 g of ethanol/d) which was present in 46 subjects. However HBV prevalence was 28.6% in the seven subjects who had been treated for alcoholism; these 7 subjects had a highly at risk sexual behavior. Conclusion: In a rural area, infection by HAV is very frequent. The prevalence of HBV and HCV did not greatly differ from that observed in the general and urban population. The frequent failure to use protection in subjects with at risk sexual behavior reinforces the need of prevention programs in rural areas.

Dormart, 1999

To design a vaccination strategy against hepatitis A among hospital employees, we carried out a serological survey of hepatitis A virus (HAV) infection in 10 university hospitals in the Paris area. Subjects under 60 years of age were consecutively enrolled by occupational health services and tested for IgG to HAV by ELISA. Of the 1,516 subjects recruited, 926 were health workers (HW), 322 clerks, and 268 cooks or kitchen employees. Among HW and clerks the HAV seroprevalence was 53.8% (95% CI: 44.0-65.6), increasing with age and being higher among employees of African or Caribbean origin than those from Europe (83.6% vs. 45.6%, p<0.001). Age correlated closely with the duration of hospital work, so only age was taken into account for further analysis. The HAV seroprevalences among HW and clerks originating from Europe were close (46.8% vs. 42.6%) and remained so after adjustment for age. HAV seroprevalences in HW caring for adults and those caring for children were also similar (45.2% vs. 40.1%). Seroprevalence was higher in assistant nurses than in nurses (51.3% vs. 39.8%, p<0.02). Among cooks and kitchen employees, 53.4% were HAV-seropositive. This study shows that hospital employees need not routinely be vaccinated against HAV; the decision should be taken by the occupational physician according to the type of work, but should be routine for cooks and kitchen employees. The need for pre-vaccinal screening for anti-HAV should be assessed in the light of employees' geographical origin and age.

Joussemet, 1999

Objective: An anti-hepatitis A virus seroprevalence survey was performed in 1997 in 1052 French army recruits (mean age: 21.2 years). To describe epidemiological trends, the current pattern was compared to previous results obtained by similar methods in 1985, 1990 and 1993. Results: In 1997, overall anti-hepatitis A virus seroprevalence was 11.5%. The greatest risk factor of hepatitis A infection was related to travel in intermediate or highly endemic areas for hepatitis A virus: 46% of overseas residents (odds ratio = 10.3), 28% of recruits who had travelled in developing countries (odds ratio = 3.7) and 7.65% of French living in industrialized countries are anti-hepatitis A virus antibody positive. Moreover, seroprevalence was higher in subjects with a history of icteria (adjusted odds ratio = 3.5) and families with at least 3 children (adjusted odds ratio = 3). No association was found with drinking water, socioeconomic status such as baccalaureate degree, or parents profession. The seroepidemiological shift of hepatitis A, as assessed in three previous studies, shows a marked decrease of 20% in 12 years from

30.4% in 1985, to 21.3% in 1990, to 16.3% in 1993, and to 11.5% in 1997. The decrease in the prevalence of anti-hepatitis A virus was more marked in young adults who had never travelled in endemic countries (decrease of 20%) than those who had visited or lived in developing countries (decrease of 10%). Conclusion: Although France is not highly endemic for hepatitis A thanks to improved hygiene and housing conditions over the past 20 years, a pattern of intermediate endemicity was seen in French overseas areas in which the risk of outbreaks of hepatitis A was higher. The decrease in anti-hepatitis A virus seroprevalence in French youth can be used to draft a public health policy for hepatitis A control.

Lucht, 1996

Objectives: In industrialized countries with a high level of sanitation, immunity against hepatitis A (HAV) is not acquired during childhood, and infection typically occurs in adults, mainly in travelers returning from developing countries where infection is endemic. However, the introduction of hepatitis A virus among certain population groups, such as intravenous drug users (IVDU) or homosexual men, leads to a significant increase in the disease. We conducted a retrospective analysis of seroprevalence of anti-HAV antibodies. Methods: The study group included 296 patients (174 homosexual men and 122 IVDU) for comparison with 76 control subjects (nurses in pediatric wards and workers in hospital kitchen). Results: We found a significantly higher anti-HAV seroprevalence among less than 35-year old IVDU, HIV positive or negative, in comparison with control subjects but not among homosexual men, whatever their HIV status. Conclusion: Our experience illustrates that HVA is a health risk for IVDU in industrialized nations, and given its morbidity among adults population, IVDU should receive HVA vaccine.

Cadilhac, 1996

Sewers are an ideal environment to be occupationally exposed to viral hepatitis A (HAV) infection, because of high frequency and ability of the virus to remain viable for prolonged periods in sewage. However, data on the occupational risk of HAV infection among sewage workers is not well documented. In a cross sectional study comparing sewage workers (n=155) to those not occupationally exposed to it (n=70), we found a non significant increase in HAV seropositivity among sewage workers of 12.9% (p=0.07). The prevalence of HAV antibody was significantly associated with duration of occupational exposure to sewage (p<0.015), stay in HAV endemic areas (p<0.03), age (p<0.001), and number of siblings (p<0.03). A stepwise logistic regression analysis gave an adjusted odds ratio for HAV seropositivity 2.15 fold greater in sewage workers compared to those not occupationally exposed to it. So, although there was no significant difference in the prevalence of HAV antibody between sewage workers and others, exposure to sewage was an independent risk factor for HAV seropositivity, and this raises the question of whether it is necessary to vaccinate sewage workers against viral hepatitis A.

Djeriri, 1996

Objectives: Evaluate risk of hepatitis A, B, and C infection and anti-HBV vaccination policy in hospital personnel. Methods: A sample of 440 health care workers (7.5% of the personnel at the Clermont-Ferrand University Hospital) representing 74.5% people directly involved in health care and 25.5% other workers were selected at random and stratified by work classification and age. A questionnaire was used to establish personal data on viral hepatitis status and blood samples were drawn for serological tests. Results: Seroprevalence for hepatitis A was 52% with no significant difference between health care and other workers. For hepatitis B, 88.3% of the population had been vaccinated and anti-HBs titre was ≥10 mIU/ml for 91.6% and ≥50 mIU/ml for 86.1%. Seroprevalence for anti-HBc was 7% and none of the subjects were positive for HBs antigen. Anti-hepatic C antibodies were found in 2 health care workers (0.7%). Conclusion: These findings emphasize the need to pursue further preventive actions against hepatitis A, B and C and the requirement for continued efforts in elementary hygiene.

Nguyen-Khac, 1996

Objectives and Methods: The epidemiology of viral hepatitis A has been evolved in the past few years, resulting in an increasing number of people without immunity to this virus. Health care workers are usually considered to be a group at risk of contamination by hepatitis A. A seroepidemiologic study was performed in 525 members of the pediatrics, gastroenterology, Internal medicine, digestive radiology, kitchen and maintenance department staffs in the Amiens University Hospital. The aim of this study was to describe the epidemiology of hepatitis A and to estimate the level of occupational hazard it represents in the hospital. Results: Age, low education level, country of origin in an endemic region and more than 2 siblings or children were significantly associated with the presence of anti-HAV antibodies. The prevalence of 50% was similar to that observed in other hospitals, but lower than that found in the general population. Seroprevalence was not higher in departments exposed to stools (pediatrics, digestive endoscopy, and laboratories) than in others. A higher rate of seroprevalence was observed in kitchen and maintenance staffs than in medical, laboratory, and radiology staffs, in internal medicine than in the gastroenterology department, and in the laboratory than in radiology department. These differences disappeared after adjustment for extraprofessional parameters which appeared to be most important for hepatitis A epidemiology. Conclusions: The hospital occupational hazard for hepatitis A virus did not seem higher than that observed in the general population.

Lagarde, 1995

The prevalence of serologic markers for hepatitis A was investigated in 936 French male military recruits from October 1992 to June 1993. Data were collected in order to assess the evolution of seroprevalence level according to the decline observed for several years and to appreciate the importance of potential risk factors. The overall prevalence of antibody against hepatitis A virus was 16.3%. The prevalence was higher among those with high number of siblings and whose Father's occupation falls into low professional class categories. Multivariate analysis found that high level of seroprevalence was also associated with tap water consumption (odd ratio (OR)=1.56; $p<0.04$), overseas travels (OR=2.26; $p<0.001$) and was higher for recruits reporting an history of clinical jaundice (OR=2.27; $p<0.01$). Together with more anticipated factors, tap water consumption may be of importance in France and this study points out the potential part taken by chlorinated water.

Joussemet, 1992

Hepatitis A antibodies (anti-HAV) were surveyed in 1000 French recruits during 1990. The prevalence of anti-HAV in this group was 21.35%. Compared to a 1985 survey a 9% fall in the anti-HAV prevalence rate was observed. Living in a coastal area, low educational level, stay overseas were the main risk factors, as already noted in 1985.

Germanaud, 1992

(no abstract)

Dubois, 1992

Antibodies to hepatitis A virus were sought for among residents of 6 "départements" of West-Central France during a routine medical check up provided by the national health insurance system to all affiliated persons. Among them 5,641 subjects (aged 6 to 60) were randomly selected to a sample size of 256 ± 15 male or female subjects for each five-year age group. Anti-HAV were detected in 51% of the screened population. The prevalence was less than 5% in the 6-15 age group and increased by successive steps to exceed 90% in the subjects over 50. The highest increase was observed between the 26-30 (39%) and the 31-35 (57%) age groups. This study confirms the influence of socio-economical factors on the anti-HAV prevalence rate. Factors such as profession or scholar education were previously known, but the housing conditions and especially the number of siblings were identified in our present report. In relation to this low prevalence of anti-HAV among young adults, one may fear an increase of overt hepatitis cases which are known to be more frequent in adults than in infants or children. Moreover any break in hygiene may expose the population to an epidemic. Only active immunization with a vaccine against hepatitis A could efficiently prevent these individual and community-related risks.

Joussemet, 1987

The epidemiological study of hepatitis A antibodies prevalence in 1000 French recruits shows a 20% fall in people of 18-20 years old between 1979 and 1985, and identifies variables such as residence in coasting area, stay overseas, study level, as the most important social and geographical risk factors. These results are in agreement with the evolution observed in different other European countries.

Lemaire, 1980

(no abstract)

Ongey, 2004

Objective: The objective of this study was to investigate the associations of seropositivity for *Helicobacter pylori* (HP) and hepatitis A virus infection (HAV) with prevalence of cardiovascular diseases (CVD) and CVD-risk markers in a large population-based sample of patients with diabetes mellitus (DM), who are at high risk of developing CVD. Background: Several studies have suggested that chronic infections are associated with the development of atherosclerosis and coronary heart diseases (CHD). Methods: This analysis is based on the German National Health Interview and Examination Survey which was conducted in 1998. We identified all subjects with prevalent DM aged 40-79 years. *Helicobacter pylori* and HAV status were measured by serum immunoglobulin G antibodies. Prevalence of several CVD events (myocardial infarction, stroke and CHD) was recorded. In addition, serum levels of total triglycerides, total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and lipoprotein (a) were measured. Results: Among the 4285 participants of the German Health Survey aged 40-79 years, we identified 365 patients with DM. Of these, 32.1% had at least one CVD and there was a clear increase of CVD with age. Sero-prevalence of HP or HAV and their combination was not associated with the prevalence of CVD nor with mean levels of blood lipids after multivariate adjustment for covariates. Conclusion: In this large group of 365 patients with diabetes mellitus no association of HP and HAV seroprevalence with presence of CVDs or the level of serum lipids was established. Therefore it seems unlikely that HP and HAV sero-prevalence strongly influence CVD progression in patients with diabetes.

Hafner, 2008

Background: Environmental factors are likely to be involved in the pathogenesis of inflammatory bowel disease (IBD), as the incidence of both Crohn's disease (CD) and ulcerative colitis (UC) increased with improved living standards in Europe after World War II. On the basis of earlier reports suggesting that hygienic standards may also play a role in the pathogenesis of IBD, we investigated the influence of hepatitis A seroprevalence as an indicator for poorer hygienic conditions and worm infestations in IBD. Methods: Hepatitis A seroprevalence was examined in patients with UC and CD. Patients with minor endocrinological disorders served as controls. All patients were questioned about immunizations, parasitic infections (worms), contact with animals, living on a farm, and ever traveling abroad. Patients were excluded for active hepatitis A immunization or recent passive immunization. Results are presented as Mantel-Haenszel odds ratios with 95% confidence interval, adjusted for age group. Results: The sample included 307 patients (73 CD, 48 UC, and 186 controls). Hepatitis A seroprevalence was strongly associated with age older than 50 years. Age adjusted Mantel-Haenszel odds ratios were 0.25 (0.09-0.71) for UC and 0.75 (0.38-1.46) for CD versus controls. For parasitic infections, the odds ratios were 1.15 (0.52-2.53) for UC and 0.34 (0.13-0.89) for CD. Conclusion: We were able to demonstrate a negative association of hepatitis A infection with UC only. In contrast, a novel finding was a strong protective effect of worm infestations for the occurrence of CD, but not UC.

Nübling, 2002

Background: Since transmission routes of hepatitis E virus (HEV) and hepatitis A virus (HAV) are believed to be similar, comparable risk factors and a correlation between the two seroprevalence rates may be assumed. Materials and Methods: Anti-HAV and anti-HEV serology was assessed in 511 German subjects from nursing, pediatric nursing and administration groups, none of whom had been vaccinated against HAV. At the same time a standardized questionnaire on occupational and individual parameters was completed. Results: Overall seroprevalence for anti-HEV was 3.9%, for anti-HAV 28%. Multivariate analysis revealed that anti-HEV seroprevalence was significantly higher in persons working in emergency admission or in surgery, while persons working in children's psychiatry were more likely to be anti-HAV positive. Comparing the two serological resulLts, no contingency difference was found (chi2=0.42 (df=1), p>0.05). Conclusion: Specific departments of health care show higher prevalence of anti-HAV or anti-HEV. In the case of HEV further studies in the exposed working field are needed. Since no connection between the two serological results was found, transmission mechanisms might be (partly) different.

Thierfelder, 2001

The prevalence of serological parameters indicative of infection with hepatitis A, B and C was determined using sera collected from representative population samples in the former East German (new) federal states and the West German (old) federal states during the German National Health and Examination Survey in 1998. Sera were tested for antibodies to hepatitis A virus (HAV), to hepatitis B core antigen (HBc) and to hepatitis B surface antigen (HBsAg), hepatitis C Virus (HCV), as well as for the presence of HBsAg and HCV-RNA. The mean weighted prevalence of anti-HAV was 46.5% (95% CI: 45.3-47.7) and increased markedly with age. The mean weighted prevalence of past infection with hepatitis B was 7.7% (95% CI: 7.0-8.4) in the old federal states and 4.3% (95% CI: 3.2-5.3) in the new federal states, corresponding to an overall prevalence of 7.0% (95% CI: 6.4-7.6). The mean weighted prevalence of HBsAg carriage was 0.6% (95% CI: 0.4-0.8), while the prevalence of HCV antibodies was 0.4% (95% CI: 0.2-0.5).

Thierfelder, 1999

Representative random samples were tested for hepatitis A, hepatitis B and hepatitis C infections within the framework of the German National Health Interview and Examination Survey. The laboratory parameters included determination of anti-HAV, anti-HBc, anti-HBs, HbsAg, anti-HCV and hepatitis C virus RNA. The prevalence rate for anti-HAV was 46.5% with a definite age-dependence. The infection rates for hepatitis B of 7.7% in former West Germany and of 4.3% in former East Germany were obtained. This is equivalent to a total of 7% prevalence rate. The HbsAg carrier rate was 0.6%. Hepatitis C virus antibodies showed a prevalence rate of 0.4%.

Rudi, 1997

Objectives: The purpose of this study was to determine whether different staff groups in an acute care hospital are at increased risk of acquiring *Helicobacter pylori* and hepatitis A virus infection. Methods: We examined staff members of an acute care hospital for serum antibodies to *H. pylori* IgG (n=457) and to hepatitis A virus (n=434). The staff members were assigned to three groups: 1) nonmedical staff (n=110), 2) medical and nursing staff (n=272), and 3) medical and nursing staff working in a gastroenterology and endoscopy unit (n=75). Serum antibodies were measured by validated enzyme immunoassays. A questionnaire inquiring about medical and professional history, history of upper GI pain and ulcer, as well as about the use of non-steroidal anti-inflammatory drugs or medication for GI complaints and smoking habits was completed by each person. Results: The seroprevalence of *H. pylori* was 35.5% in group I, 34.6% in group II, and 24.0% in group III (not significant). The seroprevalence of *H. pylori* antibodies increased with age (p<0.001), and antibodies were present more frequently in women than in men (36.2 vs. 25.4%, p<0.05). After adjustment for age, duration of experience and the number of years working in the gastroenterology or endoscopy unit did not increase *H. pylori* seropositivity. No significant association was found between H. pylori seropositivity and history of upper GI pain, ulcers, use of non-steroidal anti-inflammatory drugs or medication for GI complaints, or tobacco use. The prevalence of hepatitis A antibodies was similar in the three groups (group I, 26.4%; II, 26.5% III, 21.7%; not significant). Cross-tabulation showed that 67 subjects (15.4%) were seropositive for both *H. pylori* and hepatitis A (p<0.001) and that 245 (56.5%) were negative for both. Seventy-seven (17.7.%) and 45 (10.4%) were seropositive for only *H. pylori* and for only hepatitis A, respectively. Conclusion: Occupational exposure to patients in an acute care hospital as well as to patients and to endoscopic procedures of a gastroenterology and endoscopy unit does not increase the rate of infection with *H. pylori*. The significant correlation between the seroprevalences of *H. pylori* and hepatitis A antibodies suggests fecal-oral transmission of H. pylori.

Bölke, 1995

A seroprevalence study of antibodies against the hepatitis A and B virus is described along with the prevalence of the surface antigen of the hepatitis B virus (HBs1 Ag). Two groups are compared: the first comprising young adults born between 1961 and 1968; the second, an older population aged 50 and above. Results show that only 3.9% of the younger population were found to have antibodies against the hepatitis A virus, in sharp contrast to the older generation in whom the prevalence of antibodies was as high as 40.3%. There is a prevalence of 0.4% of HBs Ag in the younger group, while the rate in the older population is 1.5%. Only 7.1% of the younger group were found to have antibody markers for anti-HBc2 and 3.5% for anti-HBs. In the older group the respective figures are 32.5% and 15.8%.

Abb, 1994

We screened 351 employees of a county hospital for the presence of antibodies against hepatitis A virus (anti-HAV). Hospital staff tested was from the department of pediatrics, infectious diseases unit, institute of microbiology, hospital kitchen, and the day-care centre. 292 donors from the hospital blood bank served as a control group. The prevalence of anti-HAV in indigenous hospital staff less than 30 years of age was extremely low, but showed an age-dependent increase to 69 per cent in personnel more than 50 years of age. The anti-HAV prevalence rate of indigenous health-care workers did not show significant differences from that of volunteer blood donors. The high prevalence of anti-HAV in non-indigenous employees with almost total exposure in persons more than 40 years of age most probably reflects the high risk of childhood infection in endemic regions. We conclude that the risk of occupational exposure to HAV in the hospital setting appears to be small. Active immune prophylaxis with hepatitis A vaccine should be restricted to employees with frequent contact with HAV-contaminated feces. Pre-vaccination screening for anti-HAV is cost effective in indigenous hospital staff more than 30 years of age and in all non-indigenous employees.

Bienzle, 1993

(no abstract)

Hofmann, 1992

Few studies have been carried out to evaluate the role of hepatitis A virus (HAV) as an occupational hazard. Our analysis of data on occupational diseases in Germany showed that hepatitis A ranks as third among infectious occupational diseases. Morbidity based on the frequency of compensation (15.2%) was in the same range as that observed for hepatitis B (19.7%). In another study, data were collected on anti-HAV prevalence among 2293 hospital workers in southwest Germany. Anti-HAV prevalence of hospital staff responsible for patient care and that of the general population were comparable, while food-handlers under the age of 30 years had a higher degree of anti-HAV prevalence. When an evaluation of anti-HAV prevalence data was carried out on persons younger than 30 years who comprised subsets of the medical staff, the relative risk was: charwomen 4.2, food-handlers 2.49, and pediatric nurses 1.84, showing that they had higher prevalence rates than nurses 1.25, physicians 1.09 and laboratory assistants 0.93. Vaccinations for the prevention of hepatitis A should therefore reach individuals that have an increased occupational risk: food-handlers, health care workers in infectious diseases and pediatrics, medical staff in laboratories handling stool samples, medical charwomen and, according to previously published work, staff of day care centers and sewerage workers.

Koster, 1990

(no abstract)

Ebell, 1983

198 members of the Institute of Anesthesiology at Munich University were tested using radioimmunoassay for HBsAg, HBeAg, anti-HBs, anti-HBc, anti-HBe, and anti-HAV. It was found that 50 (25%) of the subjects had detectable quantities of anti-HBs in the serum. In 42 cases (21%) anti-HBc was detected, in 17 (5.5%) anti-HBe, and in 63 cases (31.5%) anti-HAV.

Lasius, 1983

The incidence of antibody to hepatitis A (anti-HAV) was studied in two populations living in Berlin (West): German children and children of parents, coming from Mediterranean countries, mainly from Turkey (77%). Sera of 366 German and 280 foreign children aged between 1 and 17 years were tested by a competitive binding radioimmunoassay (HAVAB). In the group of German children only 15 (4.1%) had anti-HAV, but there were 86 (30.7%) among the foreign children. In contrast to the results taken from German children the presence of anti-HAV in foreign children was significantly according to their age. The frequency of anti-HAV rose from 2.6% in children aged between 1 and 2 years to nearly 90% in children older than 10 years.

Frosner, 1980

Sera from 1966 Bavarian blood donors were investigated by radioimmunoassay for serological markers of past hepatitis A and B infections. The prevalence of hepatitis A antibody increased with age and was higher in the urban than in rural populations. More than 80% of persons above 40 years of age had antibody whereas only few young adults showed previous exposure to hepatitis a virus. 20 of 1093 random persons (1.8%) were HBsAg positive at first blood donation. In all age groups anti-HBc was the best marker for previous hepatitis B exposure. There was no correlation between the frequency of hepatitis A and B markers.

Kyrka, 2009

A national cross-sectional seroprevalence survey was conducted in order to evaluate the current seroepidemiology of hepatitis A among 1,383 children, aged 0-14 years, residing in Greece. Stratification of the study population was conducted according to age and area of residence. Sera from study participants were tested for the presence of anti-HAV IgG antibodies. Immigrant children, as well as children residing in rural areas, had lower immunization rates. Among unvaccinated children, the seroprevalence rate of anti-HAV was 17.1%. Nationality was shown to have a marginally significant effect since non-immunized immigrant children had a higher seroprevalence rate (22.4% vs. 15.9%, OR=1.52, p=0.064). Significant differences between geographic areas for both vaccination coverage and natural immunity were observed. The study findings indicate that hepatitis A is prevalent in Greece and therefore universal infant hepatitis A immunization should be implemented.

Michos, 2008

The prevalence and risk factors of hepatitis A, B, and C (HAV, HBV, and HCV) markers were compared in non-Roma and Roma children who lived in a deprived suburb of Athens, Greece. The study included 216 children, 118 Roma and 98 non-Roma of 9 years median age (range 5-15 years). Among Roma children 98.3% had detectable antibodies to HAV, compared with 32.7% among non-Romas (p<0.001). Regarding HBV, 22% Roma children were identified with evidence of past infection (anti-HBc(+)), among whom five (4% of the total) were chronic carriers (HBsAg(+)), whereas no past infection was detected among the non-Romas (p<0.001). Markers of past HBV vaccination (anti-HBs(+), anti-HBc(-)) were detected in only 14% Roma but 96% non-Roma children (P-value < 0.0001). There was some indication for intrafamilial transmission of HAV and HBV in Roma school children. Unfavorable living conditions, frequent residency change, lack of child insurance and primary healthcare delivery were significantly associated with seroprevalence of HBV infection among Romas. No child in either group was found positive for HCV markers. These findings document high socioeconomic differentials with regards to preventable communicable diseases, such as HAV and HBV and underline the need for enhancing health policy action targeting pockets of minority childhood populations. Whereas, uptake of HBV vaccination is rather optimal in this general population, the high seroprevalence of HAV among Romas, also calls for implementing general vaccination for HAV, early in life.

Mazokopakis, 2003

(no abstract)

Mazokopakis, 2000

A seroepidemiological study was conducted to assess the seroprevalence of hepatitis A, B, and C markers in 285 males (mean age: 24.4 ± 4.4 years) aboard a Greek warship. Two hundred and sixty three serum samples were tested. None was found to be positive for HAV antibodies, three persons (1.1%) were positive for HBsAg, four persons (1.5%) were positive for anti-HBc and one person (0.4%) was positive for anti-HCV. Forty-five persons (17.1%) had developed titles anti-HBs > 10 IU/L. The establishment of a vaccination policy against hepatitis A among warship personnel is strongly recommended.

Lionis, 1997 (Eur J Epidmiol)

Objective: To determine the prevalence of hepatitis A, B, and C markers in children who were attending junior and senior high schools in a high risk area in rural Crete, Greece. Methods: 334 children who attended the three junior schools and one senior high school in the Agios Vassilios province of Southern Crete were invited to participate in the study. Three hundred and four of them were tested for hepatitis A, B, and C markers. Hepatitis B (HBV) markers (HBsAg and anti-HBc) as well as hepatitis A (anti-HAV) and hepatitis (anti-HCV) antibodies were tested with commercial enzyme-linked immunosorbent assay kits. Results: Six of the 304 children (1.97%) were found to be positive for anti-HAV, 1 (0.33%) to HBsAg, 7 (2.30%) to anti-HBc and none were found positive for anti-HCV. No significant differences were seen between the prevalence of anti-HAV antibodies in males (2%) and females (1.95%), and of anti-HBc antibodies in males (3.33%) and females (1.30%). Conclusions: The very low prevalence of anti-HAV is obviously due to the improved conditions of hygiene and it raises the question of the possible emergence of this disease at an older age and therefore appropriate preventative strategies should be considered. The low endemicity of hepatitis B in Crete in contrast to other areas of Greece also calls for a vaccination policy probably during adolescence. The absence of hepatitis C markers in the children in contrast to the observed higher prevalence of HCV-infected people in the adult population in the same rural area raises questions regarding possible sources of transmission of hepatitis C during the preceding years.

Lionis, 1997 (J Viral Hepat)

A seroepidemiological study was carried out in a geographically well-defined area in rural Crete in order to determine the prevalence of A, B and C hepatitis markers in the local population. Serum samples were obtained from 257 subjects (94 males, 163 females), aged 15 years and over, who visited the primary health care services of the Spili Health Centre between July 1993 and March 1994, and from 164 subjects (83 males, 81 females) randomly selected from households in three neighboring villages of the study area. In samples obtained from the Spili Health Centre, antibodies to hepatitis A virus (anti-HAV) were detected in 234/244 (95.9%) subjects, antibodies to hepatitis B virus core antigen (HBcAb) were detected in 63/257 (24.5%) subjects and antibodies to hepatitis C virus (anti-HCV) were detected in 28/257 (10.9%) subjects. The corresponding figures for those randomly selected from the villages were 135/154 (87.7%), 16/164 (9.8%) and 5/164 (3%) respectively. Hepatitis B surface antigen (HBsAg) was positive in three (1.2%) subjects from the first group, while none of those recruited from the villages were positive for HBsAg. Interestingly, hepatitis markers were closely associated with age. No subjects under the age of 15 years showed evidence of prior hepatitis A infection and approximately 20% of those between 15 and 44 years of age were also negative. By contrast, practically all subjects older than 44 years were anti-HAV positive. Similarly, the majority of all those who were anti-HCV positive were older subjects. Seroepidemiology of hepatitis in this well-defined population seems to be different from other parts of Greece, at least for hepatitis B and C viruses. There is a very low prevalence of HBsAg and a very high incidence of anti-HCV. Low exposure to HAV, as found in other parts of the country, was also found in the younger generation in this rural area of Crete.

Dalekos, 1995

Background: Since 1991, thousands of refugees from southern Albania have entered north-western Greece, an area with low-to-moderate endemicity for infection with hepatitis viruses. We examined the prevalence of several markers of viral infection in this population in order to ascertain the likely impact of its presence on the epidemiology of hepatitis infections in north-western Greece. Design: Consecutive unselected serum samples were obtained from refugees resident in three different reception camps. Setting: A university hospital. Study Population: 1025 refugees (662 males and 363 females, age range 0-81 years) and 1984 healthy controls (1293 males and 691 females, age range 0-80 years). Interventions: None. Results: We found a significantly greater prevalence of markers of infection with hepatitis A virus (prevalence of antibodies to hepatitis A virus 98.2%), hepatitis B virus (HBV; prevalence of HBV s antigen 22.2%, prevalence of HBV c antibody 70.6%, prevalence of HBV s antibody 40.5%, prevalence of HBV e antigen 21.1%, prevalence of HBV e antibody 46.2%), hepatitis C virus (prevalence of antibodies to hepatitis C virus 1.75%), and hepatitis D virus (prevalence of antibodies to hepatis D virus 12.7%) among refugees from southern Albania than in healthy Greek controls. These markers were found with significantly greater frequency among younger refugees (< 30 years of age) than in older members of the same population. Conclusions: We conclude that refugees from southern Albania are a new immigrant population characterized by a high incidence of infection with hepatitis A, B and D viruses. This finding may reflect the low socioeconomic status of the immigrant population and the poor hygienic conditions experienced by its members. The high incidence of HBV and HDV infections in the population from Albania will probably increase the prevalence of infection with these viruses in Ioannina and subsequently in the whole of the Epirus region. We therefore believe that rigorous adherence to general precautions and the initiation of hepatitis B vaccination programs will be necessary in future, both in our area and in Albania.

Kremastinou, 1984

The point prevalence of antibody to hepatitis A virus (anti-HAV) in a sample of 1113 healthy Greek children and adolescents 0-19 years old was estimated by radioimmunoassay. The overall anti-HAV prevalence was 8.7%; it increased from almost zero among children less than four years of age to 16.3% in adolescents 15-19 years. Anti-HAV prevalence was independent of sex; it was lower among children born in Athens than among those born in other parts of the country, and it was higher in children of lower socioeconomic class. Compared with the results of previous surveys, the findings of the present study indicate that the exposure of Greek children to hepatitis A virus is decreasing, probably because of the improvement of socioeconomic conditions of the Greek population.

Papaevangelou, 1980

The major epidemiologic characteristics of hepatitis A virus (NAV) infections in Greece were studied in a sample of 877 Air Force recruits, 19-25 years old coming from every geographic region of Greece. Antibodies to HAV (anti-HAV) were detected by solid phase radioimmunoassay in 83.8% of the recruits. Antibody frequency varied significantly in the various geographic regions of Greece and was inversely related to the size of the community. It was further shown that the prevalence of HAV infection was highly related to the recruit's social class and years of education as well as number of siblings and number of persons per room. These findings in accordance with previous reported data show that hepatitis A is hyperendemic and should be regarded as a childhood infection in Greece. Prevailing socioeconomic, hygienic living and housing conditions should be considered as the main epidemiologic determinants of HAV infections.

Langer, 1997

A descriptive study was performed to evaluate the relative frequencies and molecular epidemiological features of viral hepatitis types A to E among the Inuit population in West Greenland. Serum samples were collected from 503 Inuits (186 males and 317 females; mean age 35 years; range 7-79 years) and were tested for markers of viral hepatitis infection. The hepatitis A prevalence averaged 54%, with a significant rise from 9% to 50% between the second and third decade of life. As for hepatitis B, 42% of the total study population showed serological evidence of current or past hepatitis B virus (HBV) infection and 7% were hepatitis B surface antigen (HBsAg) carriers. Among the carriers, 6% were also positive for hepatitis B e antigen (HBeAg), and HBV DNA could be detected in 49% of carriers by polymerase chain reaction. Typing of the HBV isolates revealed genomic group D in 83% (serotype ayw2) and group A in 17% (serotype adw 2). Less than 1% of the study population had antibodies to the hepatitis C virus. None were positive for HCV RNA. Serological evidence of hepatitis D infection was found in 7% of those with hepatitis B helper virus infection markers and in 40% of the HBsAg carriers. As for hepatitis E, 3% of the Inuits showed reactivity in an enzyme immunoassay that detected hepatitis E virus antibody. HEV RNA could not be detected.

Asbjoernsdottir, 2006

Background: Foodborne or orofecal transmitted infections can have influence on health by direct consequences of the infection and indirectly by modulating the immune system. Objectives: To investigate the prevalence and risk factors for *T. gondii*, *H. pylori*, and HAV infection in the Icelandic population and their influence on atopy, allergy related lung symptoms and lung function. Material and Methods: Blood samples were collected in 1999-2001 from 505 subjects in age group 28-52, randomly selected from the Icelandic population. The presence of *T. gondii*, *H. pylori*, and HAV IgG antibodies was determined by an ELISA method. Allergy related lung symptoms were assessed with questionnaire and IgE sensitization and lung function measured. X^2 test was used to test for trend but unadjusted logistic regression for comparison of IgG prevalence. Multiple logistic regression was used to calculate adjusted odds ratios and 95% confidence intervals for different infections factors. Results: The prevalence of antibodies was 9.8%, for *T. gondii*, 36.3% for *H. pylori*, and 4.9% for HAV. Attending day care before the age of 3 years was a risk factor for having *T. gondii* antibodies. The prevalence of *H. pylori* increased with age and smoking. The infections were not associated with the prevalence of asthma or atopy. Having IgG antibodies against *T. gondii* was, however, associated with an increased risk of having FEV/FVC ratio below 70%. Conclusion: *T. gondii*, *H. pylori*, and H AV infection does not influence the prevalence of atopy or asthma. The data indicated that infection with *T. gondii* might be associated with a diminished lung function.

Briem, 1991

The prevalence of antibodies to hepatitis A virus (anti-HAV) was investigated in 445 outpatients in Iceland in 1987. No difference in anti-HAV prevalence according to sex or residence was found. The prevalence rates were low in persons less than 50 years with a sharp increase in persons greater than or equal to 50 years. The prevalence of anti-HAV was now significantly lower in the age groups of 40-49 years and 50-59 years than in 1979 indicating a cohort effect. These findings correspond to a marked decrease in notified cases of hepatitis (epidemic jaundice) after 1950 in Iceland.

Briem, 1982

The prevalence of antibody to hepatitis A virus (anti-HAV) was investigated in 623 outpatients in Iceland. No difference in anti-HAV prevalence according to sex or rural vs. urban residence was found. The prevalence rates in different age groups were found to be comparable to those in the Scandinavian countries, increasing from 1.6% (1/63) in persons below 20 years of age to 66% (51/77) in persons above 60 years of age. The numbers of notified cases of hepatitis (epidemic jaundice) in Iceland during the 20th century showed a pattern of repeated epidemics up to the early 1950s, after which low rates were noted. The incidence of hepatitis dropped 30-fold during the 20th century. Persons born after the latest epidemic in 1952 were positive for anti-HAV in only 4.7% (7/150).

Rajam, 1998

Aims: To determine the prevalence of immunity to hepatitis A virus (HAV) infection in urban Ireland and to categorize the region into low, intermediate or high HAV endemicity, and to analyze the significance of certain commonly associated risk factors. Methods: Two hundred and thirty three volunteers were recruited from 6 general practices in Dublin, Ireland. There were 44 volunteers in the 10 to 19 yr age group, 40 in the 20 to 29, 42 in the 30 to 39, 43 in the 40 to 49 and 64 in the over 50 age groups. Each participant completed a detailed questionnaire and was tested for anti-HAV total antibody (primarily IgG) using a competitive ELISA assay. Urban Ireland was classified into the appropriate area of HAV endemicity according to the prevalence of immunity by age group. Risk factor differences were analyzed for significance using the chi square test and Fisher's exact test. Results: One hundred and fifty seven (67%) volunteers were immune, of whom 20 (45%) were in the 10 to 19 year age group, 17 (43%)

in the 20 to 29, 30 (71%) in the 30 to 39, 34 (79%) in the 40 to 49, and 59 (92%) in the over 50 age groups. Fifty-five per cent of the individuals studied below the age of 20 years were non-immune. The immune rates over the age of 30 were significantly greater ($p<0.01$) than those in the 10 to 29 age groups. Socioeconomic pattern in the total and 10 to 19 year age group was a significant ($p<0.001$, $p<0.001$ respectively) risk factor for infection. Conclusion: This study concludes that urban Ireland is an area of low HAV endemicity with age and socioeconomic status as the significant influences on seropositivity. This survey provides an insight into the changing epidemiology of HAV infection in Ireland and serves as a guide for immunization of at risk population groups.

Fry, 1993

The authors have studied the sero-conversion levels of Irish international travelers over the past 6 years with regard to Hepatitis A IgG levels. The rate of seroconversion is significantly associated with patient age (x^2=77.8, df=1, $p<0.0001$). There was no significant difference in the antibody levels between males and females. The results show that a large proportion of younger people travelling to developing countries are unprotected against Hepatitis A. Also approximately 30% of travelers over the age of 40 years have not seroconverted from previous exposure and therefore remain at risk. The mortality associated with Hepatitis A is in high risk groups. Therefore vaccination should be considered.

Hasin, 2007

We examined the association between socioeconomic status and the level of serum antibodies to selected fecal-orally transmitted pathogens among Israeli adolescents. Random samples of eighty volunteers aged 12-15 years from high (HSL), medium (MSL) and low (LSL) standard of living towns were included in the study. Serum samples were examined by radioimmunoassay for HAV and by in-house-developed ELISA systems for IgA and IgG antibody levels against *Shigella sonnei*, *S. flexneri*, *E. coli* O157:H7 lipopolysacchride, and *Cryptosporidium parvum* antigens. Seropositivity to HAV was highest (98.8%) in the LSL towns and lowest (25%) in the HSL towns, showing a statistically significant linear trend. Antibody levels to the other enteropathogens had gender variation, with higher titers in females. Significantly lower titers in the HSL towns were found for: IgA anti-*S. sonnei* in females ($p<0.001$); IgG anti-*S. sonnei* in females ($p=0.024$) and males ($p=0.033$); IgG anti-*S. flexneri* in females ($p=0.016$). Inverse linear association with socioeconomic status was found for IgA anti-*C. parvum* in females ($p<0.001$); IgA anti-*E. coli* O157:H7 in females ($p<0.001$) and males ($p=0.024$). A statistically significant association between HAV seropositivity and higher titres of IgA anti-*S. sonnei* and *E. coli* O157:H7 was shown. In conclusion, exposure to enteropathogens transmitted via the fecal-oral route in communities of lower socioeconomic status is reflected in a higher prevalence of lifelong lasting antibodies to HAV, and higher levels of antibodies to bacterial and protozoan enteropathogens. Among females, the levels of specific serum antibodies are higher and more strongly associated with low socioeconomic status.

Samuels, 2005

Background: Viral hepatitis is highly endemic in Israel, with the hepatitis A virus (HAV) responsible for most cases. Improved socioeconomic factors, as well as the universal vaccination of infants (introduced in 1999) has resulted in a decline in infection rates in Israel. This study examines the benefits of routine testing for anti-HAV IgG in high-risk population. Methods: A retrospective examination of the files of teenage and adult patients (aged 16-99 years; mean 33.9) in two primary care clinics found 1,017 patients who had been tested for anti-HAV IgG antibodies for either general healthcare screening or ongoing follow-up for chronic illness. Seropositive patients were then asked regarding recall of past hepatitis (i.e. jaundice, regardless of viral etiology); post-exposure prophylaxis with immune serum immunoglobulin (ISG); and active immunization with inactivated virus. Seronegative patients were subsequently sent for active immunization. Results: Of the 1,017 patient records studied

(503 male, 514 female), a total of 692 were seropositive (354 males, 338 females; P = 0.113). Seropositivity rates increased with age (p < 0.005), and were highest among those born in Middle Eastern countries other than Israel (91.3%) and lowest among immigrants from South America (44.1%; P < 0.005). 456 of the seropositive patients were interviewed, of whom only 91 recalled past illness while 103 remembered receiving post-exposure prophylaxis (ISG) and 8 active vaccination. Those who were unaware of past infection were more likely to have been vaccinated with ISG than those who were aware (26.3% vs. 7.7%; p < 0.005). Conclusion: The relatively high prevalence rate of anti-HAV seropositivity in our study may me due to the fact that the study was conducted in a primary care clinic or that it took place in Jerusalem, a relatively poor and densely populated Israeli city. Most of the seropostive patients had no recollection of prior infection, which can be explained by the fact that most hepatitis A infections occur during childhood and are asymptomatic. Routine testing for anti-HAV IgG in societies endemic for HAV would help prevent seropositive patients from receiving either post-exposure or preventive immunization and target seronegative patients for preventive vaccination.

Chodick, 2003

Hospital and community-clinic workers were tested for hepatitis A virus antibodies (HAV)-IgG to identify variables associated with presence of (HAV-IgG) and to determine whether sociodemographic background may explain all differences in HAV seropositivty among healthcare workers. Logistic regression analysis was used to identify variable associated with HAV-immunity. Multivariate logistic regression analysis revealed that HAV-seroprevalence correlated significantly (P<0.01) with age, siblings, residence in rural areas and origin. Nurse aides had an increased risk for HAV seropositivity (OR=5.04; 95% CI: 1.49-17.08) whereas physicians had a lower risk (OR=0.54: 95% CI: 0.30-0.98). Age and socioeconomic background were independently correlated with HAV immunity but did not explain all difference in HAV-seroprevalence. The higher susceptibility and elevated incidence of hepatitis A amongst physicians, prioritize primary prevention in this group.

Livni, 2002

Background: With improved socioeconomic conditions, adults are more frequently seronegative for hepatitis A virus (HAV) and therefore susceptible to infection. A safe and efficacious active HAV vaccine has been developed and licensed. The general recommendation is to vaccinate populations at increased occupational exposure to HAV. Aim: To determine the seroprevalence of HAV antibodies among children's hospital employees and to correlate seropositivity with demographic and occupational variables as a basis for formulating vaccine recommendations. Methods: The staff of a tertiary pediatric medical center participated by answering a structured questionnaire on demographic and occupational data and by donating venous blood for determining HAV antibodies by an enzyme immunoassay. Univariate and multivariate analyses were conducted to identify variables associated with HAV seropositivity. Results: HAV antibodies were found in 48.3% of the 499 employees studied, being lowest in pediatricians (38.7%), and increased with years of work at the hospital, job percentage and contact with pediatric patients. However, multivariate analysis showed that only the sociodemographic variables (age and crowding during childhood) were independently and significantly associated with seropositivity. Conclusions: HAV seropositivity was associated mainly with sociodemographic variables. Most children's hospital employees, especially pediatricians and other young (<40 years) employees, are seronegative and therefore susceptible to HAV. Vaccination of the high risk groups should be considered.

Gillis, 2002

Seropositivity against hepatitis A was examined among 4806 standing army personnel (4497 males and 309 females) during 1998-1999. Each bi-annual birth cohort examined showed a decline in seropositivity compared to the previous one. When compared with a study performed in 1989, however, for each of the 1961-1962, 1963-1964, 1965-1966, 1967-1968 and 1969-1970 birth cohorts examined, the 1998-1999 study showed 5-15% higher seropositivity. This trend remained after controlling for differences between the two studies in ethnic origin, sibship size and level of education. The overall seroconversion rate is estimated as 1.15% per year and the clinical to subclinical ratio as 1:14. Thus, hepatitis A infection continues to occur in the young adult age group and vaccination of this group should be considered.

Ashkenazi, 2001

Background: The licensing of hepatitis A vaccine in the United States and other countries in the 1990s raised the question of vaccine candidates. The authors undertook a study to evaluate the presence of antibodies against hepatitis A virus, or HAV, in dental workers. Methods: The authors recruited 115 members of the dental staff of Tel Aviv University: 82 dentists, 21 dental assistants, eight dental hygienists and four laboratory technicians. The subjects completed a structured questionnaire regarding demographic information (such as age, sex, number of siblings, number of children) and occupational characteristics. Venous blood was obtained and examined for presence of immunoglobulin G antibodies to HAV by microparticle enzyme immunoassay. Results: Univariant analysis (chi 2 and Student t test) and multivariate stepwise logistic regression analysis were used to identify variables that were associated with seropositivity. Greater number of years of occupation in dentistry were independently and significantly (P = .0004) associated with seropositivity to HAV. The calculated odds ratio showed that each year of work increased the likelihood of being seropositive by 1.06 (6 percent). Subjects tended to have higher seropositive rates if they were older, had a greater number of children, had a greater number of siblings, had worked in hospitals and worked with children (pediatric dentists and orthodontists). Conclusions: This study suggests that HAV can be considered a hazard to dental workers, with risk increasing as the number of years in dentistry increases. More studies with larger sample sizes are needed. CLINICAL IMPLICATIONS: As HAV infection is associated with morbidity and mortality, dentists--especially those working in areas of endemic HAV (such as Africa, Asia and Latin America)--are encouraged to consider receiving the active vaccine to prevent HAV infection.

Katz, 2000

Background: The rise in the standard of living of the Israeli population during recent decades has been accompanied by a significant decline in the prevalence of various viral diseases including hepatitis A (HAV). This trend is not reflected in the seroprevalence of herpes simplex (HSV) infection, which has remained stable during these years. Materials and Methods: The Public Health Branch of the Israel Defense Force (IDF) Medical Corps continuously draws a systematic, representative sample of male and female recruits on their 1st day of service, based on digit combinations of the military identification number. These recruits are asked to give a blood sample and to undergo a short interview. A quantitative determination of anti-HSV-1 and anti-HAV antibodies was performed. Results: In the present study that included 124 male and 98 female 18-year-old army recruits, 51.1% of the anti-HSV-positive subjects was also positive for anti-HAV, compared to 27% among anti-HSV-negative persons. Rate ratio (RR) for anti-HAV seropositivity between anti-HSV-1-positive and negative recruits was 1.86 (95% CI 1.3-2.7). Conclusion: The present study suggests a strong association between the seroprevalence of both viruses.

Almog, 1999

The goal of this study was to assess the susceptibility of the sub-population of over 500,000 immigrants from the former USSR who came to Israel during 1989-94 to HAV infection, and to provide military physicians with estimates of the prevalence of HBV and HCV carriage in this sub-population. 987

males aged 17-49 and 195 females aged 17-19, reporting to military recruitment offices between December 1991 and March 1992 were tested. Anti-HAV, anti-HBV antibodies and hepatitis B surface antigen (HBsAg) were detected by using standard enzyme immunoassay (EIA) tests, and anti-HCV antibodies by a second-generation EIA and confirmed by a third-generation INNO-LIA test. It was found that in the 17-19-year age-group the prevalence of anti-HAV antibodies was 37%, anti-HBV was 12.8%, HBsAg was 3.0% and anti-HCV 1.3%. All markers were higher among males. The prevalence of anti-HAV and anti-HBs antibodies increased with age among males. That of HBsAg and anti-HCV antibodies increased with age overall. In the multiple logistic regression analysis, HAV and HBV seropositivity were significantly associated with the mother's education and republic of origin. It was concluded that the prevalence of anti-HAV antibodies is similar to that among the local population, which should not be considered at a higher risk of infection during military service. On the other hand, the higher prevalence of HBsAg and anti-HCV antibodies in this sub-population should heighten the awareness of the possibility of chronic liver pathology.

Gdalevich, 1998

This study sought to determine whether the decline in prevalence of hepatitis A virus (HAV) antibodies detected in Israel in 1977, 1984, and 1987 has continued. The anti-HAV antibody prevalence of a systematic sample of 578 male and female recruits inducted into the Israel Defence Force in 1996 was 38.4%. The reduction in antibody prevalence from 1977 (64%) was highly significant ($p<0.001$). There was a smaller decrease rate in recruits of European, North American, Australian, and South African origin than from elsewhere. A 'strategy' that uses active immunization against hepatitis A (inactivated vaccine, instead of gamma globulin) should be considered, particularly in high risk groups such as field units during military service.

Schwartz, 1998

Background: Hepatitis A (HA) is the most common vaccine-preventable disease among travelers. The probability of contracting the disease depends on the endemicity in both the destination and country of origin of the traveler. The introduction of the new highly effective but expensive inactivated HA vaccine necessitates a re-evaluation of HA prevention policy. In highly developed countries all travelers require vaccination. In highly endemic areas the entire population is immune. In Israel, HA seroprevalence declined from 94% in the early 1970s to <60% in the mid 1980s. Living in a country in which the HA endemicity is changing, we studied the current situation of HA seroprevalence among travelers and the cost-benefit of screening for HA IgG before vaccination. Methods: Israeli travelers of all ages, (range 22-74 years) expecting to spend a considerable time abroad presented to the travel clinic for pre travel advice and vaccination. A brief medical history was taken, including history of jaundice. Blood for HA IgG testing was drawn. Results: In the present study, 389 Israeli travelers were screened for HA IgG. Overall, 46% were seropositive: 26% in the 21-30 group (n=102); 37% in the 31-40 group (n=145); 62% in the 41-50 group (n=62); and 79% in the >50 group (n=80). Conclusions: In countries where hepatitis A endemicity is changing, an evaluation of seroprevalence and then a cost benefit calculation should be made. In Israel, assuming a current cost of $130 for vaccination and $30 for the IgG test, it is economically valid to screen Israeli travelers >30 years old for HAV IgG before vaccination. A formula is presented for calculating the cost benefit ratio in any country, based on local endemicity according to age group.

Karetnyi, 1995

Israel, located in a region endemic for hepatitis A virus (HAV), recently absorbed a large population of immigrants who came from the former USSR. To assess the risk of high morbidity in this population a serosurvey of HAV antibodies was undertaken. Serum samples were collected from 965 new immigrants, of whom 664 came from the European, non-endemic region, and 301 from the Asian and Caucasian endemic regions of the former Soviet Union. They were compared to 240 Israelis. Each population was divided into six age groups: 1-9, 10-19, 20-29, 30-39, 40-49, and 50 years of age and older. The Asian/Caucasian immigrants and the Israeli population were found to share similar characteristics. In both groups, antibodies to HAV (anti-HAV) were present in the 1-9-year-old age group and reached maximum prevalence (90% and 86.7%, respectively) in the 20-29-year-old age group. In contrast, among the European immigrants anti-HAV was first found in the 10-19-year-olds and peaked (93%) in the age group of 50 years and older. It is concluded that immigrants originating from the European part of the former USSR may require vaccination against hepatitis A.

Green, 1992

In order to examine changes in the epidemiology of hepatitis A virus (HAV) infection in Israel during the past decade, a seroepidemiological study was carried out in 1989 in a random sample of 1153 members of the permanent army, aged 21-30 years. Of the males 59.2%, and 54.3% of the females were anti-HAV antibody positive ($p = 0.22$). At all ages, the highest prevalence was in those of North African origin, followed by those of Asian, native Israeli and Western origin. There was a marked decline in the prevalence of antibodies in later birth cohorts, (from 74.4% in those born in 1959-1960, to 47.8% in those born in 1967-1968). Age, ethnic origin, number of siblings, more than two younger siblings and smoking were independently significantly associated with anti-HAV antibodies. Despite an overall decline in family size in later birth cohorts, ethnic differences remain prominent. These findings suggest that when the new active hepatitis A vaccines become available, their use in small children should dramatically reduce the incidence of diseases in highly endemic areas by limiting intrafamilial spread of the disease.

Kark, 1992-1993

Background: Hepatitis A (HAV) is endemic in Israel. A number of developed countries have reported marked reductions in prevalence of antibodies. The objective of this study was to determine whether change in prior infection took place over a 7-year period and to investigate the sociodemographic characteristics of infection in Israel. Methods: Recruitment into military service in Israel at the age of 18 is compulsory. Representative samples of male recruits were selected in 1977 and 1984. Antibodies to HAV were tested by solid phase radioimmunoassay in the 1977 sample and by an enzyme immunoassay in the 1984 sample. Results: HAV antibody prevalence in 1977 was 69% (95% confidence interval (CI) 65% to 72%) versus 54% (95% CI 49% to 59%) in 1984 ($p<0.001$). The reduction was evident in all ethnic-origin groups comprising the Jewish population. In 1984 the prevalence was 28% for Jewish men of European origin, 60% for Asian origin, and 80% for the North African origin group. A statistically significant independent effect of education was evident. Conclusions: These findings point to a reduction in fecal-oral transmission and hepatitis A virus infection in childhood in Israel, yet reveal considerable continuing ethnic and educational inequalities in prior exposure to infection. A potential for large outbreaks exists during transition from high to low endemicity, particularly in high-risk military populations. These populations are candidates for application of active hepatitis A vaccines now undergoing testing.

Green, 1990

The prevalence and sociodemographic correlates of antibodies against poliovirus and hepatitis A virus (HAV) were compared in a random sample of 457 military recruits in Israel inducted during 1987. Lower socioeconomic status (SES) was associated with a higher prevalence of anti-HAV antibodies (67.3 vs. 32.5 percent), whereas the reverse was true for type 1 poliovirus (78.4 vs. 89.5 percent). While the high prevalence of anti-HAV antibodies observed in the lower SES groups reflects considerable natural exposure to enteroviruses, immunity against poliovirus appears to be determined primarily by compliance with vaccination.

Green, 1989

Marked ethnic differences in the prevalence of anti-hepatitis A antibodies among Jews in Israel are only partly explained by variation in socioeconomic status. In this study, various sociodemographic variables were examined as possible correlates of anti-hepatitis A antibodies in a group of 552 Jewish males aged 25-44 years examined between January and April 1987. Among subjects aged 25-29 years, 41.5% of those of European and American origin had antibodies as compared with 88.5% of those of Asian and North African origin ($p<0.001$), whereas by the age of 40-44 years, this difference had largely disappeared. In further univariate analysis, number of siblings, years of education, and number of children were also significantly associated with the presence of antibodies. When multiple logistic regression was used to control simultaneously for the effects of the other variables, sibship size emerged as the strongest correlate of anti-hepatitis A antibodies ($p<0.001$), and it appears to explain a large part of the ethnic differences in antibody status. These findings provide strong evidence for the role of siblings in the spread of hepatitis A infection.

Fattal, 1987

The presence of antibodies to eight enteroviruses (echovirus types 4, 7, and 9, coxsackievirus types A9, B1, B3, and B4, and hepatitis A virus) and varicella-zoster virus was determined during a two-year period, 1980-1981, in paired blood samples of 777 persons in selected agricultural communities (kibbutzim) in Israel. These communities were divided into several categories on the basis of wastewater utilization for sprinkler irrigation and/or fish ponds. Among the nine viral antibodies studied, there was a consistent and significant excess of antibodies to echovirus type 4 only, particularly in the age group 0-5 years, in kibbutzim that had been exposed to aerosols from sprinkler irrigation with partially treated wastewater from nearby towns. This finding may be attributed to a major national echovirus type 4 epidemic, which had peaked shortly before the collection of the blood samples. The fact that no similar excess of the other viral antibodies studied was found in any of the kibbutz categories suggests that, under non-epidemic conditions, exposure to wastewater aerosols usually does not lead to an excess in enteroviral infection. No excess of clinical cases of echovirus type 4-associated disease (meningitis or encephalitis) was detected in the communities exposed to wastewater aerosol.

Margalith, 1986

Within the framework of a comprehensive study of the correlation between enteric diseases and wastewater utilization in agricultural settlements (kibbutzim) the prevalence of several viral antibodies was examined among kibbutz residents and overseas volunteers. The latter were assumed to be a group highly susceptible to local pathogens. For the purpose of this study the presence of antibodies against eight enteroviruses [Coxsackieviruses (COX) types A9, B1, B3, and B4, echoviruses (ECHO) types 4, 7, and 9, and hepatitis A virus (HAV)] and a nonenterovirus, varicella-zoster virus (VZV), was tested in their sera. The prevalence of these viral antibodies among 342 volunteers (aged 18 to 34 years) upon their arrival at the kibbutzim was compared with that of 176 kibbutz residents of the same age. Seroconversion (i.e., acquisition of viral antibodies) was tested in 115 of the volunteers two months after their arrival at the kibbutz. The prevalence of antibodies against each of the eight enteroviruses studied was found to be significantly higher among the kibbutz residents, but the prevalence of antibodies to VZV was similarly high in both groups (52% for volunteers and 59% for kibbutz residents). The mean antibody prevalence for the seven COX and ECHO viruses was 2.1 antibodies/person in the volunteer group v 4.7 antibodies/person among the kibbutz residents. Fifty-eight percent (58%) of the residents had antibodies to HAV as compared with 14% of the volunteers. No correlation was found between seropositivity (ie, previous exposure) to various enteroviruses and the immune status to HAV or VZV in both kibbutz residents and volunteers.

Kark, 1985

Seroconversion to hepatitis A virus was studied in a sub sample of 802 Israeli military recruits (611 men and 191 women) who were taking part in a randomized controlled trial of pre-exposure immune serum globulin (ISG) for the prevention of viral hepatitis. On intake into the service 35% of the men and 47% of the women were negative to hepatitis. A virus antibody (anti-HAV). After three years 7 of 71 men (9.9%) who had not received pre-exposure ISG had become positive to anti-HAV compared to 2 of 83 (2.4%) who had received it; the statistical significance of this difference was p=0.052. At two years 2 of 30 women (6.7%) who had not received ISG had converted compared to 1 of 43 (2.3%) who had received ISG (p=0.37). Pooling the sexes gave conversion rates of 8.9% in those not immunized and 2.4% in those immunized (p=0.029). The sex adjusted odds ratio was 4.0 (95% confidence limits 1.3-19.0). The morbidity rates for clinical non B hepatitis over the three year period among 12 835 men were 7.2 per 1000 in those not immunized and 3.6 per 1000 in those immunized (p=0.004). Point estimates of the ratio of clinical hepatitis to seroconversion in men ranged from 0.25 to 0.30. It is concluded that pre-exposure administration of ISG effectively prevented clinical expression of viral hepatitis, apparently reduced seroconversion, and did not induce passive-active immunization.

Morag, 1984

A seroepidemiological study was conducted to measure the antibody prevalence for eight different enteric viruses. These include seven "classical" enteroviruses, i.e., Coxsackie virus types A9, B1, B3, B4 and three ECHO virus types 4, 7, and 9, as well as hepatitis A virus (HAV), recently classified as enterovirus 72. Sera samples were obtained from 791 residents living in 29 agricultural settlements (kibbutzim) with a total population of 15,950. The results indicated that the acquisition of antibodies to Coxsackie and ECHO viruses occurred at a significantly earlier age than to HAV. Prevalence of antibodies to Coxsackie and ECHO viruses at two to four years of age was 40%-69%, in contrast to 4% for HAV. At age 5-17 years, 85% had antibodies to five or more of the seven "classical" enteroviruses, as compared with 10% to HAV. The latter steeply increased to 63% for age group 18-24 years and reached a peak of 95% for age group 50 years and older. Prevalence of antibodies to ECHO and Coxsackie viruses were often found to be higher in females than in males, within the age group of 18 years and older, but not in age groups 18 years and younger. Prevalence of antibodies to HAV was observed to be much higher in males than in females 18-24 years of age. No significant difference was found in the prevalence of individuals harboring antibodies to three or more and even up to five or more Coxsackie and ECHO viruses between those HAV-negative versus those HAV positive.

Elkana, 1982

A 3.8% prevalence of antibodies to hepatitis A in 185 urban Israel children aged one to three years is reported. Dependence on age and socio-economic state is found, taking the mother’s years of schooling as an indicator for the latter. The significance of the low prevalence in an endemic area is discussed.

Kark, 1980

Sera drawn from a sample of 1,147 military inductees, representative of the conscript population entering service in the Israel Defense Forces (IDF), in 1977, were examined by radioimmunoassay for hepatitis A virus (HAV) antibody. The prevalence of HAV antibody is considerably higher in males of Eastern origin (84.4%) than of Western origins (39.7%) and in females of Eastern origin (79.9%) as compared with those of Western origin (30.3%). The difference between males and females is not statistically significant when level of education is controlled. An inverse association between years of schooling and HAV antibodies is evident both for males and females, but is stronger in Westerners than Easterners. These findings have implications for HAV prevention in the IDF.

Gentile, 2009

Information regarding the current seroprevalence of hepatitis A virus (HAV) is useful for the control of HAV infections. The objective of our study was to evaluate the prevalence of anti-HAV antibodies among children (1-5 years old) and young adults (15-20 years old) in Tuscany, in central Italy. A total of 565 sera were collected in three years 1992, 1998, and 2004, equally distributed between the two age groups. The overall proportion of those that tested positive for anti-HAV antibodies was 8.3%. The proportion of immune children (1-5 years old) statistically significantly increased over the years. The percentage of immune subjects among 15-20-year-old young adults varied over the years, not showing a significant statistical trend, nevertheless our findings indicate that in a low endemicity area, adolescents and young adults are becoming increasingly susceptible to HAV infection. On-going monitoring of immunity to HAV is necessary for detecting trends over time.

Beggio, 2007

Antibodies against viral hepatitis A, B and C were evaluated in 221 students of graduate courses of the Medical School of Padua University born in countries different from Italy. Data were compared with those measured in 362 students born in Veneto Region and 87 students born in Centre-Southern Italy. The results showed a high, significant prevalence of positive antibodies against hepatitis A in students from Africa (94.7%), Asia (60.9%), Central-Southern America (60.9%), and East Europe (52.7%); in Italy, the prevalence was significant in student from Centre-Southern Italy (19.5%). A high prevalence of hepatitis B antibodies was observed in 33.3% of Africa students (two subjects HBsAg positive), in 22.6% of students from East Europe (five subjects HBsAg positive) and in 12.5% of Asian and Centre-Southern American students (one HBsAg positive). Finally, infection with hepatitis C is sporadic and without a significant geographic distribution (three subjects only).

Ansaldi, 2008

To define the pattern of HAV infection in Italy and to study the differences among geographic areas (northern, central, and southern Italy) and age-classes, we performed HAV antibody testing on sera collected in 1996-1997 from a large sample of the Italian population and compared the results with those of other seroprevalence studies and with incidence data for the period 1985-2005, calculated by a surveillance system specific for acute viral hepatitis based on symptomatic cases. A total of 3,561 sera, collected by hospital-based reference laboratories in 18 out of 20 Italian Regions, were tested; 1,138 (32%, 95% CI: 30.5-33.5) were positive. The age-adjusted prevalence was 60.1% and the age-specific rates were among the highest rates reported in Europe in the 1990s. The age-adjusted seroprevalence showed a significant north-south gradient, increasing from 55% in northern Italy to 68% in southern Italy. Age and area of residence were found to be strong predictors of previous HAV infection: the marked increase in prevalence with increasing age represents a strong cohort effect. In northern Italy, a marked increase with age was observed beginning with the 20- to 29-year age-class, whereas in southern Italy, such an increase was observed beginning with the 12- to 19-year age-class, indicating that northern Italy preceded southern Italy by 10-20 years in terms of improvements in hygiene and sanitation. The incidence of HAV infection shows an evident peak in 1997, when an outbreak occurred in southern Italy, mainly affecting 15- to 24-year-old individuals. In the period from 1998 to 2005, the incidence drastically decreased (average of 3.2/100,000 inhabitants), reaching a minimum of 2/100,000 inhabitants in 2005.

D'Amelio, 2005

(no abstract)

De Silvestri, 2002

Hepatitis A is a common viral infection causing substantial morbidity and mortality. The anti-hepatitis A virus (HAV) vaccination in infants would guarantee control of the infection. However, the immunogenicity of the HAV vaccine in infants could be impaired by the presence of passively acquired maternal HAV antibodies. This study evaluated the prevalence of HAV antibodies in 103 women at delivery and in their babies in the first year of life. Eighteen mothers (17.5%) had anti-HAV serum level >10 mIU ml(-1). In their infants the anti-HAV level was still positive in 11 out of 18 (61.1%) at 12 mo. Two out of 85 infants born to anti-HAV-negative mothers and anti-HAV negative at birth were found to be positive at 5 mo of age. Conclusion: It is proposed that all women be screened at delivery for anti-HAV antibodies. Children born to anti-HAV-negative mothers could be vaccinated early during the first year of life, whereas vaccination could be postponed in children born to anti-HAV-positive mothers, if necessary.

Calabri, 1999

In 1998 sera from 430 18 year old male subjects living in Florentina area have been tested for anti-hepatitis A virus (HAV) antibodies. 27 out of 430, (6.2%), study samples were found to be positive. Our results confirm the low circulation rate of HAV in Florence area.

Matricardi, 2000

Objective: To investigate if markers of exposure to foodborne and orofecal microbes versus airborne viruses are associated with atopy and respiratory allergies. DESIGN: Retrospective case-control study. Participants: 240 atopic cases and 240 non-atopic controls from a population sample of 1659 participants, all Italian male cadets aged 17-24. Setting: Air force school in Caserta, Italy. Main Outcome Measures: Serology for *Toxoplasma gondii*, *Helicobacter pylori*, hepatitis A virus, measles, mumps, rubella, chickenpox, cytomegalovirus, and herpes simplex virus type 1; skin sensitization and IgE antibodies to relevant airborne allergens; total IgE concentration; and diagnosis of allergic asthma or rhinitis. Results: Compared with controls there was a lower prevalence of *T gondii* (26% vs. 18%, p=0.027), hepatitis A virus (30% vs. 16%, p=0.004), and *H pylori* (18% vs. 15%, p=0.325) in atopic participants. Adjusted odds ratios of atopy decreased with a gradient of exposure to *H pylori*, *T gondii*, and hepatitis A virus (none, odds ratio 1; 1, 0. 70; 2 or 3, 0.37; p for trend<0.001) but not with cumulative exposure to the other viruses. Conversely, total IgE concentration was not independently associated with any infection. Allergic asthma was rare (1/245, 0.4%) and allergic rhinitis infrequent (16/245, 7%) among the participants (245/1659) exposed to at least two oral-fecal and foodborne infections (*H pylori*, *T gondii*, hepatitis A virus). Conclusion: Respiratory allergy is less frequent in people heavily exposed to oral-fecal and foodborne microbes. Hygiene and a westernised, semi-sterile diet may facilitate atopy by influencing the overall pattern of commensals and pathogens that stimulate the gut associated lymphoid tissue thus contributing to the epidemic of allergic asthma and rhinitis in developed countries.

Patti, 1999

(no abstract)

Trevisan, 1999

Objectives: The seroprevalence of hepatitis A virus antibodies was investigated in a population of 1051 subjects, of whom 376 were controls and 675 were exposed to different degrees of biological risk. Methods: The exposed group was subdivided into subjects at low (242), intermediate (265), and high (168) biological hazard; all subjects were employed in the biomedical field. Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels were also determined. Results: The seroprevalence of positive hepatitis A antibodies was 44.9% in all subjects but was significantly higher in males (50.6%) than in females (34.2%) and increased according to age (25.9% in subjects aged < or =40 years and 62.2% in subjects aged >40 years). No difference related to exposure to the biological risk was observed. The prevalence of transaminases at levels above normal values (chi2 = 4.079, P<0.05 for AST and chi2 = 4.806, P<0.05 for ALT) and mean values (AST P<0.05; ALT P<0.001) appeared significant in hepatitis A virus-positive subjects. On the other hand, excluding individuals with positive hepatitis C virus antibodies (16) and positive hepatitis B virus surface antigen (12), a prevalence of transaminase alterations was not observed, but mean levels of ALT lasted significantly longer in subjects with positive hepatitis A virus antibodies (p<0.01). Conclusions: The results confirm that hepatitis A virus is not a risk for employees in the biomedical field, but the presence of hepatitis A virus antibodies suggests a possible, though not clinically evident, liver involvement.

Stroffolini, 1998

In 1990, to study regional prevalences and risk factors of Helicobacter pylori infection in healthy young adult males, sera were collected from a nationwide sample of 1659 males (mean age 20.7 years) at introduction into the Air Force School for military students in Caserta, Italy. An enzyme-linked immunosorbent assay was used to detect H. pylori specific immunoglobulin G antibodies. The observed overall seropositivity rate was 17.5% (95% CI 15.7-19.4). Prevalence was higher in southern Italy and in the Italian islands as compared with northern Italy and central Italy (21.3% vs. 9.5%). Multiple logistic regression analysis showed that residence in southern areas and islands was the strongest predictor of the likelihood of H. pylori seropositivity; number of siblings in the household was marginally associated; years of father's schooling was not a significant predictor. H. pylori positive subjects were more likely positive for antibodies to hepatitis A virus infection (anti-HAV) than those H. pylori negative (35.4% vs. 24.9%; Odds Ratio 1.7, 95% CI 1.3-2.2). Adjustment for the confounding effect of sociodemographic variables weakened this association (OR 1.3, 95% CI 1.0-1.7). These findings suggest that differences in environmental conditions rather than in socioeconomic status may have played the major role in the different spread of H. pylori infection across the country.

Moschen, 1997

During the period from January to May 1994, the prevalence of antibodies to hepatitis A virus infection (anti-HAV) was tested by immunoenzyme assay in the serum samples of 620 apparently healthy subjects (81% males, 19% females), from 10 to 29 years old, resident in North-East Italy (Pordenone and surrounding district). The overall prevalence of anti-HAV was 3.7%. There was a significant lower prevalence in the group aged 10-19 than in the one aged 20-29 years (0.7% vs. 6%; p<0.001). Moreover, a significant sex difference was observed for the 20-29 year age group (p<0.001). Among the various risk factors considered, family size and travelling abroad to endemic areas were significantly associated with HAV infection. Since a valid and effective vaccine against HAV infection has recently become available, anti-HAV vaccination campaigns can feasibly be programmed. However, different geographical regions present different epidemiological situations, so its use should be adapted to each region, with special attention to the cost-effectiveness of the immunization program. Our data suggest that in our region such vaccination could initially be proposed to high-risk subjects such as those travelling to endemic areas.

Luzza, 1997

Background AND AimS: Recent studies have shown that the age-specific seroprevalence of H pylori infection parallels hepatitis A (HAV), suggesting similar modes of transmission. The aim of this study was to investigate the seroepidemiology of H pylori and HAV in the same setting. PATIENTS: A sample of 705 resident subjects (273 men, age range 1-87 years, median 50) who attended the outpatient medical centre of the rural town of Cirò, Southern Italy (11,000 inhabitants) for blood testing were recruited. Methods: All subjects completed a structured questionnaire. A serum sample was drawn from each subject and assayed for H pylori IgG by a validated in house enzyme linked immunosorbent assay. Antibodies to HAV were determined in 466 subjects (163 men, age range 1-87 years, median 49). A measure of agreement between H pylori and HAV seropositivity, the kappa statistic, was used. Results: Overall, 446 (63%) subjects were seropositive for H pylori. Of the 466 subjects screened for both H pylori and HAV, 291 (62%) were seropositive for H pylori and 407 (87%) for HAV. Cross-tabulation of these data showed that 275 (59%) were seropositive and 43 (9%) seronegative for both H pylori and HAV, 16 (3%) were seropositive for H pylori, and 132 (28%) were seropositive for HAV (OR = 5.6, CI 3 to 10). There was a parallel, weakly correlated (r = 0.287) rise in the seroprevalence of the two infections with increasing age. However, the agreement between H pylori and HAV seropositivity was little better than chance (kappa = 0.21) and in those aged less than 20 years it was worse than chance (kappa = -0.064). Furthermore, multiple logistic regression analysis did not show any risk factor shared by both infections. Conclusions: The correlation between H pylori and HAV reflects the age-specific seroprevalence of both infections rather than a true association. This study provides evidence against a common mode of transmission of H pylori and HAV.

Matricardi, 1997

Objective: To investigate the working hypothesis that common infections occurring early in life prevent atopy. Design: Cross sectional, retrospective study of young Italian men with results for hepatitis A serology and atopy. Setting: Air force school of military students in Caserta, Italy. Subjects: 1659 male students aged 17-24, most of whom (90%) were from central and southern Italy. Main Outcome Measures: Skin sensitisation and specific IgE antibodies to locally relevant airborne allergens; diagnosis of respiratory allergy (asthma or rhinitis, or both); hepatitis A seropositivity. Results: 443 of the 1659 subjects (26.7%) were positive for hepatitis A virus antibody. Atopy was less common among seropositive than seronegative subjects according to skin sensitization (weal reaction ≥3 mm) to one or more allergens (21.9% (97/443) vs. 30.2% (367/1216), p<0.001); polysensitisation (sensitive to three or more allergens) (2.7% (12/443) vs. 6.4% (78/1216), p<0.01); high specific IgF concentration (9.7% (43/443) vs. 18.4% (224/1216), p<0.001); and lifetime prevalence of allergic rhinitis or asthma, or both (8.4% (37/443) vs. 16.7% (203/1216), p<0.001). Hepatitis A seropositivity remained inversely associated with atopy after adjusting for father's education, the number of older siblings, and the area of residence (based on the number of inhabitants). The prevalence of atopy was constantly low among seropositive subjects, whatever the number of older siblings; by contrast, it increased with a decreasing number of older siblings among seronegative subjects. Conclusion: Indirect but important evidence is added to the working hypothesis as common infections acquired early in life because of the presence of many older siblings (among seronegative subjects) or because of unhygienic living conditions (among seropositive subjects) may have reduced the risk of developing atopy.

Russo, 1997

(no abstract)

Ripabelli, 1997

A study on the seroprevalence of HAV and HEV infections among adolescents in an inland territory of central Italy (Molise region) was carried out. The prevalence of antibodies was respectively 3.3% and 0.4%. The results indicated that (1) anti-HAV prevalence in children is low but HAV infection is always present, and (2) HEV infection could be endemic and not necessarily imported.

Castelli, 1996

Background: Hepatitis A virus (HAV) circulation in the environment is decreasing in most industrialized Western countries. This decrease has lead to low seroprevalence rates in adults. As a consequence, many non-immune unprotected travelers from areas of low prevalence are considered at risk of acquiring HAV infection when traveling to high HAV endemic areas in developing countries. The recent HAV inactivated vaccine has proved safe and effective, and its use in different geographic areas should be guided by local age-specific HAV seroprevalence rates. The aim of this paper is to describe the age-specific sero-epidemiology of HAV infection in travelers from a highly industrialized region in Northern Italy (Lombardy). Methods: Seven hundred and forty-four consecutive travelers aged from 20 to 59 years, subdivided in 10-year age groups, gave blood samples in the collaborative Health Centers in the Lombardy region and sera were tested for HAV IgG antibodies. A questionnaire was given to travelers that investigated alimentary habits and a history of previous travel. Results: Anti-HAV seroprevalence was 18.0%, 58.0%, 75.8%, and 89.5% in the 20-29, 30-39, 40-49, and 50-59 age groups, respectively. Age was the single most important determinant of anti-HAV seroprevalence. The influence of previous travels, eating shellfish, or ingestion of self-cultivated vegetables was ruled out by multivariate analysis. Conclusions: In the Lombardy region (Northern Italy), age specific anti-HAV seroprevalence rates are much higher than those reported in other Western European countries. The cost-benefit analysis suggested that travelers born after 1960 do not need serologic screening before vaccination. Whenever possible, however, HAV serologic screening is advisable for travelers born before 1960. However, the severity of the disease in older subjects, and the proved safety of HAV vaccination in immune subjects, may advise HAV vaccination without prior screening, when serologic investigation is unfeasible because of lack of time or the unavailability of testing facilities.

Romano, 1996

A seroepidemiological survey was carried out among 464 food handlers living in Pescara and its province to assess prevalence of HAV infection. The study showed an overall prevalence of 54.7%, without difference between males and females, but with a progressive increase with age: from 5.3% among subjects aged <20 to 99.1% among over 45. Logistic regression analysis showed a significant association between seroprevalence and age, level of education, duration of employment, and raw food handling. The authors point out the cohort effect due to the remarkable environmental health improvement which lowered the risk of exposure to HAV among subjects born after the 1960s and the occupational risk in food service industry, suggesting the opportunity of immunization for a subgroup of food handlers selected according to the predicted risk factors.

Catania, 1996

The authors evaluated the incidence of infection by hepatitis A virus (HAV) in a pediatric population through a seroepidemiological investigation in a group of 278 children (0-12 years old), apparently healthy. The determination of anti-HAV antibodies was carried out by ELISA-test. Of the 287 examined sera, 27 cases turned out HAV positive antibodies (9.7%), with the following distribution, according to the groups of age: 0-3 months: 2 of 6 children were positive (mother's antibodies); 3 months-2 years: 6 of 112 (5.35%); 2-6 years: 10 of 93 (10.75%); 6-12 years: 11 of 67 (16.41%). With regard to distribution of anti-HAV antibodies by sex, 23 (15.03%) males of 153 resulted positive, whereas 4 (3.2%) females of 125 resulted positive. The decline of HAV infection in the pediatric age involves a possible shift of the risk to the adult age. It's advisable that the vaccination against hepatitis A in first period should be reserved for the subjects at risk and later both for unweaned and children in order to eradicate the infection.

Zanetti, 1994

We have compared the prevalence of antibody to HAV in sera collected from healthy individuals of Milan in 1958, 1977 and 1992 respectively. The results show a dramatic reduction of HAV circulation likely due to the considerable improvement of socioeconomic and hygienic living conditions which have occurred in Italy during the last decades.

Stroffolini, 1993

In 1990, the prevalence of antibodies to hepatitis A virus infection (anti-HAV) was assayed by the ELISA method on a national sample of 1000 recruits aged 18-24 years. The overall prevalence was 29.4% (22.4% in the northern and central regions, 32.2% in the south and islands; $p<0.01$). Compared with a similar study conducted in 1981, the results show a marked reduction in anti-HAV prevalence (from 66.3% to 29.4%; $p<0.01$). These findings reflect the improved sanitation standards in Italy and indicate that the proportion of non-immune adults is increasing, with a higher risk of symptomatic infection in the near future.

Nuti, 1993

(no abstract)

Chiaramonte, 1991

A comparative seroepidemiological study (1979 vs 1989) on HAV infection, was carried out in children and adolescents from North-East Italy. Anti-HAV was tested in 850 subjects 6 to 8 years of age and the results were compared to those observed in 1979, in 462 subjects of the same age range and from the same geographical area. Overall anti-HAV prevalence was 1.9% (ranging from 0.5 to 5.2) in 1989 vs 32.5% (ranging from 7.8 to 70.7) in 1979. This dramatic decline of HAV infection in children and adolescents reflects the improved sanitation standard of our country but, on the other hand, indicates that the number of non-immune adults is increasing, with a higher risk of symptomatic infection in the near future.

Stroffolini, 1991 (Infection)

During the period from May 1987 through November 1989, the prevalence of antibodies to hepatitis A virus infection (anti-HAV) was assayed by the ELISA method in the serum samples of 5,507 (54% males, 46% females) apparently healthy subjects three to 19 years old in Italy. Subjects were selected by a systematic cluster sampling in five different geographical areas of Italy. The overall prevalence of anti-HAV was 9.5%; it increased from 2.3% among children three to five-years-old to 16.3% in teenagers 17 to 19 years old ($p<0.001$). A slight preponderance of females was observed (10% versus 9.1%), but the difference was not statistically significant. The prevalence was significantly higher in Southern Italy than in Northern Italy (27.4% versus 4.8%; $p<0.01$). The prevalence of anti-HAV was inversely related to the fathers' years of schooling (O.R. 3.3; 95% C.I. = 2.5-4.2) and positively related to the family size (O.R. 2.4; 95% C.I. = 1.9-3.1). These findings indicate that, today, exposure to HAV infection at a young age in Italy is very low. However, sociodemographic factors are still important determinants in the spread of this infection.

Stroffolini, 1991 (Microbiologica)

In 1989, the prevalence of antibodies to hepatitis A virus (anti-HAV) in a sample of 1350 Sardinian teenagers aged 14 to 19 years was estimated by Elisa method. The overall anti-HAV prevalence was 20%; it increased from 12.3% among 14-16 year old subjects to 27.4% in subjects aged 17-19 years (P less than 0.01). A slight female preponderance was observed (22.1% versus 17.9) but no statistically significant difference was attained. Compared with the corresponding figure (71.6% of prevalence rate) observed in North Sardinia in 1980, the results of the present study show a dramatic reduction in anti-HAV prevalence among teenagers. A significant association was found with sociodemographic factors: subjects whose fathers had less than six years of schooling, had a 2.1-fold risk (C.I. 95% = 1.5-3.1) and subjects belonging to a household of 6 or more under one roof had a 1.7-fold risk (C.I. 95% = 1.2-2.3) of previous exposure to hepatitis A virus (HAV) infection. These findings indicate that exposure to HAV in Sardinia is decreasing, probably because of improvements in socio-economic conditions during recent years. However, overcrowding and short paternal education appear to be important determinants of infection.

Stroffolini, 1990

In 1988 in Palermo, Italy, the prevalence of antibodies to hepatitis A virus (anti-HAV) in a sample of 490 children 6-13 years old was 10.6%; it increased from 6.3% among children 6-10 years old to 14.7% in children 11-13 years old (P less than 0.01). Compared with findings from a survey conducted in 1978 in the same area, the results of the present study show a significant ($p<0.01$) reduction in the anti-HAV prevalence in both age groups. Anti-HAV prevalence was inversely related to the father's years of education and positively related to the family size. Children of fathers with less than 6 years of schooling had a 3.2-fold risk (C.I. 95% = 1.3-8.1), and children with five or more members in their households had a 2.7-fold risk (C.I. 95% = 1.1-6.4) of previous exposure to hepatitis A virus (HAV) infection. Our findings indicate that exposure of children in Palermo to HAV is decreasing significantly, probably because of improvements in socio-economic conditions during recent years; however socio-demographic factors appear to be important determinants of infection.

Stroffolini, 1989

The prevalence of antibody to hepatitis A virus (anti-HAV) in a sample of 1662 Sardinian children aged 3 to 11 years was estimated by ELISA. The overall anti-HAV prevalence was 3.8%; it increased from zero among children of 3 to 7.2% in children of 11 years. A slight male predominance was observed (4 versus 3.6%). Anti-HAV prevalence was inversely related to the number of years of education received by the father and positively related to the number of households in the sample. Children whose fathers had received less than six years of schooling, had a 6.2-fold risk (95% CI = 2.6-15.3) and children with five or more households under one roof had a 2.6-fold risk (95% CI = 1.4-5.0) of previous exposure to hepatitis A virus (HAV) infection. These findings suggest that exposure of Sardinian children to hepatitis A virus is relatively low, probably because of improvements in socioeconomic conditions in recent years in the island. However, overcrowding and poor education in the father of schooling appear to be important determinants of infection.

D'Argenio, 1989

In May 1988, the hepatitis A antibody (anti-HAV) and hepatitis B virus (HBV) markers were studied by radioimmunoassay in 484 apparently healthy children between the ages of 7 and 12, attending a primary school in Naples, Italy. The overall anti-HAV prevalence was 11.2%, increasing from 5.2% in 7-year-old children to 28.2% in children between the ages of 11 and 12 years old. The overall prevalence of the hepatitis B surface antigen (HBsAg) and of other HBV markers were 0.8 and 6.8 respectively. Compared with a similar previous study conducted in Naples in 1980, the results show a significant reduction in the prevalence of anti-HAV in each of the two age-groups ($p<0.01$), in the prevalence of any HBV marker in the 11 to 12-year-old group, as well as in the total population ($p<0.05$). The findings of the present study indicate that today, children in Naples are less exposed to the hepatitis A virus than in the past, most likely because of improvements in both the socioeconomic conditions and in health education during recent years. These same reasons, as well as decreased family size and a lower prevalence of HBeAg among HBsAg carriers could explain the decline, although to a lesser degree, of exposure to HBV infection.

Masia, 1989

The prevalence of Hepatitis A in South-Sardinia was determined in two samples of students in 1987 and 1988. In this paper we present the results of a seroepidemiologic survey covering a population of workers who were residents of the city of Cagliari or its suburbs. A sample of 299 workers was randomly drawn from a population of workers who went to the public health office to ask for a certificate of good health. A radioimmunoassay test (ABBOTT) was used for detection of anti-HAV. The analysis has been carried out in accordance with the manufacturer's instructions. We also study a sample of 323 students 14-19 years old. The age-specific prevalence was analyzed using an exponential model. The age is denoted by the variable x. The parameter h is the force of infection, the per capita rate at which susceptibles individuals acquire infection. If we take the force of infection as a constant, the fraction y of susceptibles in a population is $y = \exp(-h x)$ The anti-HAV prevalence increase with age: in workers 14-19 years of age 44 percent of the tested individuals were antibody positive. The prevalence was 82.7% in the population 25-29 years old. Finally we found a nearly total exposure to HAV in persons over 30 years of age. The workers 14-19 years of age showed a higher prevalence than the students did; the difference was statistically significant. The prevalence that we have observed in our study population is lower the one observed in the city of Sassari (North-Sardinia) in 1981. The seroepidemiological pattern is similar to that prevailing in Greece and France (1979), in Umbria (1978), in the city of Milan (1973). The prevalence was, on the contrary, higher than that observed in North European Countries (1979) and in Venetia (1987). The data from the study population can be fitted satisfactorily with the exponential model ($r2=0.994$). So we can take the force of infection ($h=-0.118$, $se=0.005$) as a constant. In childhood, on the contrary, the estimated values are too high: the estimated fraction of susceptible persons is more than 100%. So our findings are suggestive for an increasing force of infection with the group of age. This deviation from the exponential form can be explained if we assume: 1) a time-dependent force of infection according to the socioeconomic and hygienic conditions, 2) an age-dependent force of infection according to behavioral factors, and 3) an age- and time-dependent force of infection. Finally the low prevalence observed in the students who attended the last year of high school (the years of schooling are associated with the socioeconomic status) emphasizes the role of social and environmental factors.

Contu, 1989

In the developing countries, where socioeconomic and hygienic conditions are inadequate, hepatitis A is mainly a childhood infection. Improvements in environmental conditions cause a decline in the exposure to hepatitis A virus and a change in the age-distribution of the incidence. In the Sardinian population 3-11 years old a study conducted in 1987 showed that 3.8% of children were anti-HAV positive. In this research work we studied the anti-HAV prevalence in the population 13-20 years old. The study population consisted of all the children who attended the third year of the junior high school (13-16 years old) and the fifth year of the senior high school (17-20 years old) in 7 health districts of South-Sardinia. All schools were identified in each district. Our list consisted of 455 classes of the last year of secondary schools and of 242 classes of the last year of high schools. Our sample consisted of 20 classes of the last year of junior high schools and of 29 classes of the last year of senior high schools. We used a pre-coded questionnaire recording age, sex, number of households and father's years of schooling. Sera from 794 students were collected between May and June 1988 and stored at--20 degrees C. A ELISA test (ABBOTT) was used for detection of anti-HAV. The analysis has been carried out in accordance with the manufacturer's instructions. We determined the prevalence of anti-HAV according to age, sex, and socioeconomic conditions. We calculated odds ratios and their 95% confidence limits. We considered as not exposed the group in the most favorable level of exposure (father's highest educational level, lowest number of households). There is a sharp increase from an anti-HAV prevalence of 16.5% in students 13-16 years of age to 24.8% in students 17-20 years of age. As far as the persons 13-16 years of age are concerned we can recognize a significant difference between females (21.8%) and males (10.3%). In the other group of age, on the contrary, the difference is not significant.

Franco, 1988

In the last 10 years reliable tests for the detection of antibodies against hepatitis A virus (HAV) became available for the seroepidemiological survey of the infection. In Italy, HAV infection is endemic and more than 50% of adults have specific antibodies. Risk factors for the acquisition of infection are close contact with icteric patients, poor hygienic conditions, food contamination, particularly shellfish or drink intended for public use, the inadequate dispoal of sewage, or inadequate protection of water supplies. Since 1984 notifications of acute hepatitis A decreased in the country but, as the majority of cases are asymptomatic, only the serological survey can describe the real diffusion of the virus. These studies showed different prevalences of anti-HAV positive subjects in the northern and southern regions. In the highly endemic southern areas the infection aoccurs generally in children, while in the northern regions the first contact with the virus in the young adult is often responsible for acute disease. A seroepidemiological survey performed in Latium in 1984 showed that in our region in the center of the country the antibody prevalence was low in children aged 1-15 and increased in young adults. In this study anti-HAV in children is evaluated 3 years after in the same region. Sera were obtained from 391 children (200 females and 191 males) aged 1-15 years, living in Rome, controlled in 1987 for reasons unrelated to hepatitis. Antibodies against HAV (anti-HAV) were detected with indirect immunofluorescence. Anti-HAV was detected in 14 out of 391 (3.6%) serum samples. The low prevalence in children shows that in Latium the epidemiological pattern is more and more similar to that seen in the northern regions.

Patti, 1987

We used IIF test for seroepidemiological study on 531 sera divided in age-groups obtained from apparently healthy subjects of Rome. Our results confirm the endemicity of HAV (Hepatitis A virus) infection in Rome with a prevalence of more than 50%. The application of the anti-HAV IIF (Indirect Immunofluorescence) test to a large number of sera demonstrated its usefulness as a quantitative and qualitative test in the epidemiological field.

Leonardi, 1985

The authors have carried out an epidemiologic research about the diffusion of antibody to hepatitis A antigen in the inhabitants of Ginostra, fraction of Stromboli, and Alicudi Islands (Eolie's arcipelago). We have examined by ELISA 86 human sera. We have detected a percentage of positivity about 82% and 70.6% for two populations. A critic examination of the results with parameters auxiliary (sex, age), showed significant differences of positivity about two different sexes and ages.

Pasquini, 1984

Prevalence of hepatitis A antibodies among 5005 naval recruits aged 18-26 from all parts of Italy was almost double in the south and islands (83.3%) as compared to the north and central regions (45.2%). Social-demographic variables such as education and number of siblings are associated with prevalence of anti-HAV. Hepatitis A infection is still an early acquired infection in Italy, particularly in the south where among the 18-26-year-old recruits with education limited to lower middle school or less and eight siblings or more, prevalence of anti-HAV was 95%. Good correlation exists in Italy between prevalence of anti-HAV and incidence of reported cases of hepatitis.

Utili, 1983

An epidemiological study was performed in order to evaluate the diffusion pattern and risk factors in an area of hyperendemicity of viral hepatitis in the Neapolitan hinterland. Eight hundred-fifty seven asymptomatic subjects, aged 10 to 65 years, who consecutively went to the public health office of the city of Afragola to ask for a health certificate, were studied. They were interviewed with an epidemiological questionnaire and tested for a basic liver profile and serological markers of both hepatitis A and B viruses. Ninety-five percent of the studied population, had anti-HAV with a prevalence of 73% in the class 10-14 years, and of 98% in the class 45-65 years; 78% had either HBsAg or antibodies anti-HBV (60% in the class 10-14 years and 96% in the class 45-65 years). Healthy carriers state was found in 11.4% of the population and acute asymptomatic type B hepatitis in 3%. For HBV infection the inter-human contact in the family setting appeared to play a major role in viral diffusion. Other favoring factors appeared to be the ingestion of raw shellfish and parenteral therapies with glass syringes not properly sterilized. The data suggest that strategies of prevention of hepatitis diffusion in the Neapolitan area should be based on both reinforcing hygienic measures and the educational level of population and active prophylaxis addressed to people in the very young age.

Chiaramonte, 1983

The sera of 722 children and adolescents without overt liver disease were tested for hepatitis B surface antigen (HBsAg), antiHBs and anti-hepatitis B core anti-HBc; 658 of the sera were also tested for anti-hepatitis A virus anti-HAV. Except for the "passive" antibody peak observed in babies, the anti-HAV age-specific prevalence was negligible until the age of 3; it then increased, reaching 35% by the age of 15. Serological evidence of HBV was present in 16% of the subjects: this prevalence was almost constant at all ages. The HBsAg carrier rate was highest in children under 5 years of age (7.6%) and decreased with age. However, only one HBsAg carrier was under 1 year of age. Anti-HBs age-specific prevalence increased progressively from 2.7% to 11.4%. Anti-HBc alone was present in 4.1% of the subjects. No significant sex differences were found in the prevalence of HBV serum markers or in the HBsAg carrier rate. Neither HAV nor HBV infection was significantly influenced by place of residence or socioeconomic status. It is concluded that in this area both HAV and HBV are endemic, but while HAV is mainly acquired at school, most of the HBV infections occur within the household. The results suggest that not only perinatal transmission, but also intrafamilial horizontal infection, plays a role in HBV spread among infants.

Pasquini, 1982 (Int J Epidemiol)

A random sample of sera from children admitted over a 23-month period to a large pediatric hospital in Rome for diagnoses believed unrelated to viral hepatitis, was tested for HBsAG, anti-HBs, anti-HBc and anti-HAV. No sex or area of residence differences were found. The prevalence for markers of prior hepatitis B infection in children aged 1-12 years was 6.5%, in agreement with other observations in Italy and European countries. Prevalence of anti-HAV among children age 1-12 admitted for diagnoses believed unrelated to viral hepatitis was 10%. Prevalence of hepatitis markers in Roman women of reproductive age is estimated as 23.5 for B and 68.2 for A.

Meloni, 1982

(no abstract)

Pasquini, 1982 (Ann Sclavo)

During an epidemiological study carried out on 1212 hospital workers to investigate their hepatitis B risk, the presence of the hepatitis A virus (HAV) antibodies was also determined. The results show the large diffusion of HAV infection, the ratio between clinical cases and infection, and the absence of correlation between presence of HAVAB antibodies and several other parameters analyzed confirmed the absence of professional risk of the HAV infection among hospital workers.

Tarsitani, 1981

(no abstract)

Romano, 1981

An epidemiological inquiry was carried out, using radioimmunoassay, into the presence of the antibody HAV in an apparently healthy sample of the population of Sassari (428 males and 242 females). In 82% of the subjects the result was positive. The highest percentage was found in the 30 to 50 year age group and in inhabitants of country and coastal towns as opposed to residence in Sassari. The results have been compared to those found in other studies done in Italy and abroad.

Biglino, 1980

The spread of hepatitis A and B viruses in a limited working environment has been evaluated and the main serum "markers" of this infection (HBsAg, anti-HBs, anti-HBc, anti-HAV) have been researched in 187 subjects (males and females) after being taken on by a large company in Northern Italy. This research, carried out again after 8--10 months from hiring, showed a moderate spread of hepatitis B virus in 6,4% of the subjects observed. This finding is probably due to deficient personal hygiene rather than to environmental factors related to work (these may on the contrary condition the spread of hepatitis A virus which, in the cases observed showed insignificant diffusion).

Vendramini, 1980

In order to ascertain the real frequency of HAV infection in North-East of Italy a seroepidemiologic survey was carried out on the population of Padova and its district. The serum samples obtained from 1812 subjects (approximately the 2% of registered people) subdivided according to sex and age (5 to 5 year groups), were tested for anti-HA by radioimmunoassay. The mean prevalence of anti-HA was 69.2%. Positive subjects' frequency of 50% was reached in 15-20 year-old group, whereas more than 90% of people over 35 years of age were positive. No significant differences were observed between the sexes or between town and country populations, while the increase of the anti-HA prevalence curve was delayed in the higher socioeconomic level group. These findings testify the relevant socioeconomic and public health levels improvement in the last decades, while, on the other hand, point out the increasing risk of adulthood HAV infection.

Merletti, 1980

The prevalence of antibody to hepatitis A virus in healthy Umbrian population selected according to age has been studied using a radioimmunoassay technique. 90 sera from 148 gave positive results (60.8%). The results are briefly discussed.

Fredrico, 1980

In the present work the Authors report the results of the research of HAAb in 383 subjects living in Rome with negative history for hepatitis (divided for age, sex and occupation) and in 64 acute non B hepatitis (HBsAg-). In the latter, the titer of HAAb was determined at the beginning and later during the course of the disease. A fractionation of 13 sera of these patients was done and the type of specific immunoglobulin was determined. Among the subject with negative history for hepatitis, 68.9% was positive during first 6 months of age 6.2% from 6 months to 5 years old, 27.6% from 6 to 12 years old, 45.4% from 12 to 17 years old, 76.8% from 18 to 25 years old, 82.2% from 26 to 45 years old, 90.2% from 46 to 65 years old. There was no statistically significant difference either between males and females, or among various occupations. Among the 64 patients with non B hepatitis, 25 (39%) were hepatitis A (because they showed either a seroconversion for HAAb or a positive HAAb-IgM); 12 (18.7%) were non A-non B hepatitis because HAAb negative or HAAb positive but negative for HAAb-IgM; while 27 (42.2%) were impossible to classify because they showed a positivity for HAAb but not a seroconversion during the disease. The limit of the determination of HAAb and the utility of the research of IgM antibody for the diagnosis of hepatitis A are discussed.

Mossong, 2006

A prospective seroepidemiological survey was carried out in Luxembourg in 2000-2001 to determine the antibody status of the Luxembourg population against hepatitis A virus (HAV) and hepatitis B virus (HBV). One of the objectives of this survey was to assess the impact of the hepatitis B vaccination program, which started in May 1996 and included a catch-up campaign for all adolescents aged 12-15 years. Venous blood from 2679 individuals was screened for the presence of antibodies to HAV antigen and antibodies to hepatitis B surface antigen (anti-HBs) using an enzyme immunoassay. Samples positive for anti-HBs were tested for antibody to hepatitis B core antigen (anti-HBc) using a chemiluminiscent microparticle immunoassay to distinguish between individuals with past exposure to vaccine or natural infection. The estimated age-standardized anti-HAV seroprevalence was 42.0% [95% confidence interval (CI) 39.8-44.1] in the population >4 years of age. Seroprevalence was age-dependent and highest in adult immigrants from Portugal and the former Yugoslavia. The age-standardized prevalence of anti-HBs and anti-HBc was estimated at 19.7% (95% CI 18.1-21.3) and 3.16% (95% CI 2.2-4.1) respectively. Anti-HBs seroprevalence exceeding 50% was found in the cohorts targeted by the routine hepatitis B vaccination programme, which started in 1996. Our study illustrates that most young people in Luxembourg are susceptible to HAV infection and that the hepatitis B vaccination program is having a substantial impact on population immunity in children and teenagers.

Borg, 1999

Twenty-two laundry personnel at St. Luke's Hospital, Malta, were tested for seropositivity to hepatitis A together with 37 nursing aides working in pediatric and infectious disease wards, matched for age, who were used as controls. IgG antibodies were found in 54.5% of laundry workers and 13.5% of nursing aides [odds ratio (OR) = 7.68; 95% confidence interval (CI) = 1.87-33.83]. Furthermore, laundry personnel consistently handling dirty linen prior to washing showed an OR of 16.50 (CI = 1.19-825.57) as compared with colleagues handling only clean items. These results would suggest that the increased exposure of hospital laundry workers to potentially infected linen can constitute a risk of occupational hepatitis A for this group of employees.

Veldhuijzen, 2009

Objectives: The prevalence of viral hepatitis varies worldwide. Although the prevalence of hepatitis A virus (HAV) and hepatitis B virus (HBV) infection is generally low in Western countries, pockets of higher prevalence may exist in areas with large immigrant populations. The aim of this study was to obtain further information on the prevalence of viral hepatitis in a multi-ethnic area in the Netherlands. Methods: We conducted a community-based study in a multi-ethnic neighborhood in the city of Rotterdam, the Netherlands, including both native Dutch and migrant participants, who were tested for serological markers of hepatitis A, hepatitis B, and hepatitis C infection. Results: Markers for hepatitis A infection were present in 68% of participants. The prevalence of hepatitis B core antibodies (anti-HBc), a marker for previous or current infection, was 20% (58/284). Prevalence of hepatitis A and B varied by age group and ethnicity. Two respondents (0.7%) had chronic HBV infection. The prevalence of hepatitis C was 1.1% (3/271). High levels of isolated anti-HBc were found. Conclusions: We found a high prevalence of (previous) viral hepatitis infections. This confirms previous observations in ethnic subgroups from a national general population study and illustrates the high burden of viral hepatitis in areas with large immigrant populations.

Baaten, 2007

In order to enhance screening and preventive strategies, this study investigated the seroprevalence of hepatitis A, B, and C in the general adult urban population and in subgroups. In 2004, sera from 1,364 adult residents of Amsterdam were tested for viral markers. Sociodemographic characteristics were collected using a standardized questionnaire. For hepatitis A, 57.0% was immune. Of first-generation immigrants from Turkey and Morocco, 100% was immune. Of all Western persons and second-generation non-Western immigrants, approximately half was still susceptible. For hepatitis B, 9.9% had antibodies to hepatitis B core antigen (anti-HBc) and 0.4% had hepatitis B surface antigen. Anti-HBc seroprevalences were highest among first-generation immigrants from Surinam, Morocco, and Turkey, and correlated with age at the time of immigration, and among men with a sexual preference for men. Seroprevalence among second-generation immigrants was comparable to Western persons. The seroprevalence of hepatitis C virus antibodies was 0.6%. In conclusion, a country with overall low endemicity for viral hepatitis can show higher endemicity in urban regions, indicating the need for differentiated regional studies and prevention strategies. More prevention efforts in cities like Amsterdam are warranted, particularly for hepatitis A and B among second-generation immigrants, for hepatitis B among men with a sexual preference for men, and for hepatitis C. Active case finding strategies are needed for both hepatitis B and C.

Richardus, 2004

Seasonal fluctuations in hepatitis A have been observed in the Netherlands related to Turkish and Moroccan children after visiting their home countries. This study determined the prevalence and associated factors of hepatitis A virus (HAV) antibodies in Turkish and Moroccan children in Rotterdam. A random sample was taken of children in Rotterdam, aged 5-16 years, of Turkish and Moroccan origin, together with a random sample of native Dutch children aged 5-7 and 14-16 years. Blood was collected by finger prick on filter paper. IgG and IgM anti-HAV was detected by an enzyme-linked immunoassay (EIA). The 319 Turkish, 329 Moroccan, and 248 native Dutch children participated in the study. In Turkish children, IgG anti-HAV increased from 2.2% to 22.2% over the age groups. In Moroccan children, IgG anti-HAV increased from 10.2% to 57.7%. In native Dutch children, 0.8% had IgG anti-HAV in the youngest and 3.1% in the oldest age group. The percentage IgG-positive also having IgM anti-HAV was 21% in Turkish, and 41% in Moroccan children. No IgG-positive native Dutch children had IgM anti-HAV. The prevalence of IgG anti-HAV was associated with increased age, being Moroccan, longer stay in the country of origin before migrating to the Netherlands, and known contact to HAV. The majority of Turkish and Moroccan children aged 4-16 years in Rotterdam are not protected against HAV, but do have a high risk of becoming infected while visiting their native country. Active vaccination against HAV of these children is indicated, with as primary aim their own protection. Prevention of HAV-transmission in the general community should be seen as a secondary benefit. In addition, possible Dutch contacts of nonvaccinated Turkish and Moroccan children, such as day care workers and teachers, should also be vaccinated against HAV.

Termorshuizen, 2000

The prevalence of antibodies to hepatitis A virus was assessed in a Dutch nationwide sample (n=7367). A questionnaire was used to study the association with various sociodemographic characteristics. Overall, 33.8% (95% CI 31.6-36%) of the population had hepatitis A antibodies. The seroprevalence was less than 10% in people under 35; it increased from 25% at 35 years to 85% at 79 years. For those 15-49 years of age, Turks (90.9%) and Moroccans (95.8%) had greater seroprevalence than autochthonous Dutch (20.2%) and other Western people (25%). Low or middle socio-economic status, as indicated by the highest educational level achieved, was associated with greater seroprevalence, independently of age and reported immunization (OR 2.11 and 1.45; 95% CI 1.67-2.67 and 1.11-1.89, respectively). These data suggest autochthonous Dutch and other Westerners born after World War II were exposed to hepatitis A during childhood less frequently than older birth cohorts. Thus, more susceptibility is likely in the coming decades. Since this means a greater risk of outbreaks in future years, and since morbidity and mortality are more frequent in older persons, studying the cost effectiveness of selective and general vaccination might be worthwhile.

Andenaes, 2000

Objectives: The aim of the study was to detect the prevalence of antibodies against hepatitis A, B, C, and E viruses in flying airline personnel, and to determine the necessity of hepatitis A vaccination to prevent such infections related to occupational exposure. Methods: Antibodies against hepatitis A (HAV), B (HBV), C (HVC), and E (HEV) were tested for using standard enzyme immunoassay in airline personnel, 208 flying personnel, 199 ground crew, and 204 employees from companies not involved in travel activities. Results: Prevalence of antibodies against HAV was less than 5% in each group, and there was no significant difference between the three groups. Prevalence of antibodies against HEV was significantly higher in flying personnel (3.4%) than in the control groups. Prevalence of antibodies against HBV and HCV was low in each of the three groups and there were no differences between the three groups. Conclusions: Infection with HAV, HBV and HCV does not seem to represent an occupational hazard to flying personnel. It is possible that flying personnel are exposed to infection with HEV, however, presently no vaccine is available.

Siebke, 1989

The prevalence of viral hepatitis in Norwegian merchant seamen in overseas trade was studied in 523 volunteers during compulsory health control before embarkation from the port of Oslo. The prevalence of hepatitis B markers was 9.4%, which is significantly higher than in the general Norwegian population. The prevalence increased with the number of years of occupation. It was associated with frequent casual sexual contacts in foreign countries, but not significantly increased in participants who had been exposed to tattooing or different types of medical treatment under poor hygienic conditions in foreign areas. The prevalence of antibodies against hepatitis A (HAV) was 36% in seamen born in 1945 or earlier and 5% in younger individuals, an age-dependent pattern which is essentially similar in the general Norwegian population. However, the prevalence of hepatitis A antibodies seemed to increase with years in foreign trade. The incidence of viral hepatitis infections in the occupation was noticeably high, suggesting that vaccination of seamen in certain areas of trade should be considered.

Siebke, 1982

The prevalence of hepatitis A virus antibodies was tested by radioimmunoassay in Norway in healthy blood donors, in patients without clinical signs of liver diseases and in two selected groups of patients. The presence of hepatitis A antibodies was highly age-dependent in 625 normal persons. A major reduction occurred from 50% or more in those born before 1938 to 10% or less among those born after 1943. The decline of hepatitis A antibody prevalence was correlated to the history of infectious hepatitis epidemics in the entire country during World War II. The prevalence was not different from controls in a group of patients with various liver disorders. Hepatitis A antibodies were more prevalent in males than in females in blood donors, patients with chronic liver disorders and their controls. Hepatitis A antibodies were frequently present in prison inmates; their presence was associated with the presence of antibodies against hepatitis B virus and with anamnestic data on drug addiction.

Hurlen, 1980

Exceptions have occurred to the generally reported high prevalence of viral hepatitis in dentists. Thus a recent questionnaire survey indicated a low risk of hepatitis in dental professionals in Norway. The present supplementary study was based on frequencies of serological markers of viral hepatitis and disclosed an exposure rate to hepatitis B insignificantly higher than that of the general population. The frequency of antibody to hepatitis A virus was equal to that of the general population.

Braga, 2004

The prevalence of the hepatitis A virus in a population determines the degree of morbidity associated with this illness, that is, the higher the morbidity, the lower the prevalence. This study aims to obtain the prevalence of total antibody to the hepatitis A virus in children, 5 and 8 years of age, and in adolescents, 14 years of age. The study was based on two samples: the serum of 64 healthy five-year-olds and 76 healthy eight-year-olds living in the proximity of the São Marcos Hospital in Braga and the serum of 311 adolescents, aged 14, from a total population of 536 adolescents attending schools in Braga, North of Portugal. The samples were collected in 1999 for the adolescent group, in 2000 and 2001 for the group of the five-year-olds and in 2002 and 2003 for the group of the eight-year-olds. None of the persons involved had been vaccinated with the hepatitis A virus vaccine. The Enzyme Linked Fluorescent Assay method was used to measure the serum total antibody to the hepatitis A virus. The prevalence of total antibody to the hepatitis A virus was 1.6% at 5 years of age [95% confidence intervals (CI), 0-4.7%], 3.9% at 8 years of age [95% CI, 0-8,4%], and 32.5% at 14 years of age ± 6 months, [95% CI, 27.3-37.7%]. The prevalence of total antibody to the hepatitis A virus in this population revealed lower natural immunity. The results obtained for the five and eight-year-olds were the first Portuguese results of low endemicity to the hepatitis A virus.

Cunha, 2001

Aim: To find the prevalence of antibody to hepatitis A virus in the population of the North of Portugal. Material and Methods: Ten General Practitioners were asked to provide blood samples from patients who would need blood tests for any reason other than acute hepatitis, during January and February 1996. In this way, 381 samples were obtained for assessment of anti hepatitis A virus antibodies using a commercial radioimmunassay ELISA. All subjects gave their informed consent and answered to a protocol regarding age, sex, geographic area, number of people per household and sewage systems. The statistics were performed using SPSS. Results: The 381 subjects were distributed into eight age groups: I (1-4 years)--57; II (5-9 years)--57; III (10-14 years)--26; IV (15-19 years)--41; V (20-29 years)--55; VI (30-39 years)--51; VII (40-49 years)--41; VIII--(equal or more than 50 years)--53. The prevalence of anti HAV antibodies per group-percentage (number), (confidence intervals), were: I--7.0% (4) (3-17%); II--15.8% (9), (9-27%); III--26.9% (7) (14-46%); IV--51.2% (21) (37-66%); V--85.5% (47) (74-

92%); VI--72.5% (37) (59-83%); VII--87.8% (36) (75-95%); VIII--88.7% (47) (80-93%). Conclusion: The comparison with previous data (Lecour et al.) shows improvement in sanitary conditions of population, with associated lower prevalence of anti hepatitis A virus antibody.

Barros, 1999

In the early 1980s, Portugal could be classified as a highly endemic area for hepatitis A. However, marked economic and sanitary improvements took place during the following years. In this study we evaluated the temporal trends in the prevalence of hepatitis A in children and adolescents, to identify risk factors for the infection. The study sample included students aged 6 to 19 years (n=999), attending public and private schools. All randomly selected participants gave information on social, demographic, clinical and behavioral variables, but only 667 (67.4%) agreed to provide a blood sample for the determination of total and immunoglobulin M (IgM) anti-hepatitis A virus (HAV) antibodies. The prevalence of anti-HAV-positive subjects was 27.9%, with a linear age-related increase (r=0.87, p=0.011) from 20.9% at 6-7 years to 37.8% at 18-19 years. The crowding index and the level of maternal education were the only independent predictors of hepatitis A infection. This study showed a clear decrease in hepatitis A prevalence in our population. However, it remains a common infection in Portugal, easily acquired early in life and associated with indicators of poverty.

Macedo, 1998

(no abstract)

Marinho, 1997

Objective: To evaluate the prevalence of anti-hepatitis A virus (HAV) in an urban population, in order to assess the changing epidemiological pattern of hepatitis A. SUBJECTS: We studied 325 health care workers from Santa Maria Hospital and 201 students of the Medical School of Lisbon. Results: The prevalence of anti-HAV was lower in the younger age groups: 29% in the first 3 years of Faculty compared to 46% in the last 3 years, p<0.001. The overall prevalence for students was 35%, whereas in health care workers of less than 30 years it was 65%, p<0.001. These findings show a declining prevalence of anti-HAV, particularly in younger age groups, when compared with the results obtained in 1983, which showed a prevalence of 85%. Conclusion: The epidemiological pattern of hepatitis A in Lisbon, Portugal, is changing in some urban groups, with prevalence rates approaching those of more developed countries.

Lecour, 1984

The prevalence of viral hepatitis markers in apparently healthy individuals of both sexes, born and living in both urban and rural areas of all the Portuguese provinces, was studied by radioimmunoassay. The anti-HAV prevalence was determined in 1770 individuals, 1-84 years old, divided into 8 age groups. The HBsAg prevalence was determined in 1440 individuals, 15-84 years old, divided into 5 age groups, while the anti-HBs prevalence was determined in 1980 individuals, 1-84 years old, divided into 8 age groups. The data were standardized for the Portuguese population. The anti-HAV results were similar for both sexes and showed a general prevalence of 83.9%. No significant differences between urban and rural areas was found. Age-group prevalence rates of anti-HAV were: 1-4 years, 23.9%; 5-9 years, 61.3%; 10-14 years, 76.4%; 15-19 years, 93.4%; and over 30 years, 99%. The HBsAg results showed a general prevalence of 1.25% for persons over 15 years old (2.04% for males and 0.78% for females). The anti-HBs results were similar for both sexes and showed a general prevalence of 24.3%. The northern provinces tended to have a higher anti-HBs prevalence than the southern ones, except for Lisbon province which had the highest figure. Age-group prevalence rates of anti-HBs were: 1-4 years, 7.6%; 5-9 years, 12.6%; 10-14 years, 8.7%; 15-19 years, 23.5%; 20-29 years, 28.4%; and over 30 years, between 30.0% and 34.3%. Only 5.3% of the anti-HAV-positive individuals, 11.2% of the HBsAg carriers, and 9.2% of the anti-HBs-positive individuals had a history of acute hepatitis. These results show that Portugal may be considered an endemic area for viral hepatitis infections.

Matricardi, 1999

(no abstract)

Pretolani, 1997

Objective: To evaluate the role of fecal-oral transmission in the spread of *Helicobacter pylori*. Design: A cross-sectional comparison of the patterns of hepatitis A and H. pylori seropositivity. Methods: At interview, blood samples and questionnaire data were collected from a random sample of 1528 healthy subjects aged 20-85 years from the Republic of San Marino. Serum samples from each subject were then tested for anti-*H. pylori* and anti-hepatitis A antibodies. Results: Overall, 529 of 670 H. pylori-seropositive subjects (78.9%) and 460 of 858 *H. pylori*-seronegative subjects (53.6%) were hepatitis A seropositive (p<0.01; odds ratio=3.2; confidence interval 95%=2.6-4.1). This association remained after adjustment by a multiple logistic regression analysis for the confounding effect of age and length of schooling, as surrogate for socioeconomic status (OR=2.0; CI 95%=1.3-3.3). The age-specific prevalence curves for *H. pylori* and hepatitis A infections showed a parallel increase by age, although to a lesser extent for *H. pylori*. Conclusion: These findings provide evidence that in the community studied *H. pylori* may have spread in a manner similar to that of hepatitis A.

Stroffolini, 1997

In 1990-1991, the prevalence of antibodies to hepatitis A virus infection (anti-HAV) was assayed by the ELISA method among 1528 apparently healthy subjects, 20-85 years old in the Republic of San Marino. Subjects were selected from the list of residents by a random stratified sampling procedure with a proportional allocation by age, sex, and district of residence. The overall anti-HAV prevalence was 64.7%; it increased from 28.6% in subjects 20-30 years old to 97% in those > 60 years (p<0.01). No gender difference was observed. At the multivariate analysis age > 40 years (OR: 39.5; 95% CI: 12.4-126) and lowest level of schooling (OR: 1.8; 95% CI: 1.1-2.9), which is a good indirect indicator of socio-economic status, resulted both independent predictors of anti-HAV seropositivity. These findings reflect the improved sanitation standards in this area and indicate that the proportion of non-immune adults is increasing with a higher risk of symptomatic infection in the near future.

Dominguez, 2007

Background: One of the main uses of seroprevalence studies it to evaluate vaccination programs. In 1998, a program of universal vaccination of preadolescents in schools with the hepatitis A vaccine was begun in Catalonia. The objective of this study was to investigate the prevalence and risk factors of hepatitis A virus infection (HAV) in a sample of the adult population of Catalonia in 2002 and to evaluate the changes with respect to a survey carried out in 1996. Methods: The prevalence of HAV antibodies was determined by a third generation competitive immunometric assay in a representative sample of 1292 people aged >15 years. The association between the prevalence and different sociodemographic variables was determined by multiple logistic regression analysis. Results: The standardized global prevalence of HAV antibodies in 2002 was 68.2%, increased with age (p<0.0001) and was associated with being born outside Catalonia (OR: 1.75; 95% CI 1.11-2.76) and lower social class (OR: 1.14; 95% CI 1.05-1.25). Compared with the last survey carried out in 1996 the standardized global prevalence was lower (68.2% vs. 77.8%; p < 0.0001) as was the prevalence in people under 45 years. Conclusion: The prevalence of the hepatitis A virus is decreasing in the adult population of Catalonia, especially in the younger age groups. The program of vaccination of adolescents begun in 1998 to control the disease can provide indirect protection to the unvaccinated population.

Cilla, 2007

The aim of this study was to determine changes in the epidemiology of hepatitis A virus (HAV) infection in the Basque Country, Spain, and to evaluate their implications for vaccination strategies. A total of 1356 persons were enrolled in a study of the prevalence of anti-HAV in 2004 and compared with two previous studies (1986-1987 and 1992). The selection method and the characteristics of the population were similar in the three studies. A marked decline in the seroprevalence in all age groups ($p<0.001$) and in the incidence of cases/100,000 inhabitants (from 38.0 in 1986-1988 to 2.9 in 2002-2004) were observed. The mean age of patients with hepatitis A increased from 17.7 years in 1986-1992 to 21.2 years in 1993-1998 and 25.3 years in 1999-2004 ($p<0.001$). Between 1997 and 2004, 20% of patients were hospitalized. The changes observed have occurred rapidly causing a change in the epidemiological pattern from middle-high endemicity (1986) to low endemicity (2004).

Gonzalez-Quintela, 2005

Background: An inverse association between allergic sensitization and markers of exposure to food-borne and oral-fecal infections (particularly hepatitis A virus, HAV) has been reported. The prevalence of HAV exposure and allergic sensitization vary widely in different areas, and vary along with age within a given area. Aim: To investigate the association between HAV exposure and allergic sensitization in adults from a mostly rural area of Spain. Methods: An age-stratified random sample of 720 subjects was drawn from the population older than 18 years of A-Estrada, Spain. From 697 eligible subjects, 469 (67.2%, median age 54 years, range: 18-92) participated in the study. Positive skin prick tests to a panel of aeroallergens defined allergic sensitization. Positive serum HAV antibodies (assayed in 465 subjects) defined HAV exposure. Results: The prevalence of HAV exposure was 83.6% (95% CI: 80.7-86.5). The prevalence of allergic sensitization was lower in subjects with HAV exposure than in patients without it (25.0%vs 40.0%, OR 0.44, 95% CI: 0.25-0.77, $P=0.004$), but this association became substantially altered after adjusting for age, which was closely linked to both allergic sensitization and HAV exposure (adjusted OR 1.15, 95% CI: 0.60-2.19, $P=0.66$). Conclusions: In a population with high prevalence of HAV exposure, no significant association between HAV exposure and allergic sensitization is observed after controlling for the confounding effect of age.

Junquera, 2004

Introduction: The aim of this study was to investigate the prevalence and risk factors associated with hepatitis A virus (HAV) infection in a representative population sample to determine who can benefit from vaccination strategies and to investigate the age limit at which previous HAV antibody screening is not required. Methods: From April to September 2002, we studied a total of 557 patients, 90 children and 467 blood donors, aged 1-65 years. Information on demographic variables (age, gender, place of residence and education level) was recorded. Patients with history of hepatitis or other liver diseases were excluded. Anti-HAV antibodies (IgG) were determined with an automated enzyme immunoassay (AxSYM, Abbott Diagnostics). The chi-square and Mantel-Haenszel tests were used for the statistical analysis. Results: The overall prevalence of HAV infection was 41.5%. There was a significant increase in prevalence with age (chi-square TL:205, $P < .0001$), with rates from the youngest to oldest groups of 5.5%, 23.5%, 28.1%, 64.2% and 93.2%, respectively. Apart from age, the only other risk factor independently associated with prevalence was the level of education, with higher prevalence at the lower education levels (OR 5 2.7; chi-square = 32.11, $P < .0001$). Conclusions: The prevalence of anti-HAV antibodies has decreased in recent years in the community of Madrid. Among the population less than

35 years of age, 75% of individuals are susceptible to the infection and could benefit from universal vaccination without previous screening for anti-HAV antibodies.

Domínguez, 2004

The objective of this study was to investigate the prevalence of hepatitis A antibodies (anti-HAV) in schoolchildren in Catalonia and to compare it with the rates found in previous studies. Sera from a representative sample of 1,342 children aged between 6 and 15 years, recruited in 2001, were tested for anti-HAV. The results were related to sociodemographic variables and vaccination history. The overall prevalence of anti-HAV was 51.4%. The prevalence was 5.5% in non-vaccinated children, similar to that found in a 1996 study, and 96.6% in vaccinated children. The prevalence of anti-HAV in non-vaccinated children increased significantly with age, reaching 11.6% in the 13-15 years age group. The prevalence of anti-HAV was higher in children born outside Catalonia than in those born in Catalonia (16.1% vs. 5.0%, p=0.02). The expected continuation in the decline in the prevalence of anti-HAV in non-vaccinated schoolchildren, observed in Catalonia since 1986, was not found in 2001. The rate of anti-HAV in 2001 was slightly higher than in 1996, although the difference was not statistically significant (5.5 and 3.5%, respectively). This could be explained by the increased number of recent immigrant children born outside Catalonia, mainly in countries where hepatitis A is highly endemic.

Soriano, 2004

Background: Determine the hepatitis A seroprevalence in Navarra. Because of the improvement in the hygienic-sanitary conditions, we hope to find a decline of the total prevalence. Methods: Population and random sample of Navarra, obtained by stratified sampling with proportional allocation of sex, age, and area of health care: 1,440 individuals over 15 years of age. Detection of total antibodies by enzyme immunoassay of microparticles. Results: Global seroprevalence: 79.24%. By age: 9.09% (16-19 years), 35.32% (20-29 years), 77.78% (30-39 years), 97.31% (40-49 years), 98.58% (50-59 years), 97.51% (60-69 years), 99.33% (70-79 years) and 100% (>79 years). By gender: 78.76% in men and 79.7% in women. Rural area 82.04% and urban area 75.77%. Areas of health care: Tafalla, 89.06%; Estella, 87.91%; Tudela, 82.88%; northern, 77.22%; Pamplona, 75.05%, and eastern, 70.97%. Conclusions: The global prevalence is 79.24% and increasing progressively with the age. Greater seroprevalence in rural areas and in people in contact with livestock. Characteristics of the persons with seroprevalence for HAV in Navarra: inhabitant of the average area, of rural area, with average age and in contact with livestock.

González-Praetorius, 2001

Background: Spain, together with the other southern European countries, was considered to be an area with a moderate degree of endemicity. This fact has consequences for tourists that visit these areas and for vaccination strategies. A prevalence study was proposed in order to get to know the situation of this infection in the Guadalajara province. Methods: 284 specimens of serum were taken from patients who were classified according to their age, sex and place of residence (with more or less than 10.000 inhabitants). In these specimens the presence of hepatitis A antibodies were studied, using a Microparticule Enzyme Immunoassay (MEIA) (Abbott). Results: An increase in the prevalence was observed in older people, there is a low prevalence population (±5%) in people aged between 0-29 years and a high prevalence population (>80%) in adults aged between 30 and 74 years. No differences were observed related to sex. In the stratified analysis according to age, differences were observed between the groups from rural and urban origins. Conclusions: The low prevalence of hepatitis A was found among the younger population, as seen in other studies carried out on a national level, and this together with a decrease in the frequency, means that Spain is included among the countries with low endemia. This fact has consequences for tourists who visit our country and for vaccination strategies, due to the increase in the number of adults who are susceptible to the infection.

de Juanes, 2001

The aim of the study was to carry out a cost analysis to allow the comparison of the cost of two vaccination strategies against Hepatitis A in health-care personnel. A total of 423 health-care workers were recruited at one General Hospital of Madrid, Spain. Blood specimens were obtained for anti-HAV antibody determination. The prevalence of anti-HAV antibody was 40% (95% CI: 35-45) and it was directly correlated with age. Cost analysis determined that the critical value of prevalence for vaccination with HAV vaccine was 23%. In hospital health-care workers ≤30 years in age, vaccination with HAV vaccine (without screening) would be the less costly strategy. In those >30 years in age, it would be less costly to screen for anti-HAV antibody first and vaccinate those who are antibody-negative.

Santana, 2000

Background: The aim of this study was to assess the seroprevalence and the risk factors of hepatitis A virus (HAV) infection in the population from Gran Canaria (Spain) and to determine at which age pre-vaccination testing would be useful. Methods: A transversal observational study of the presence of HAV antibodies (IgG) on serum samples obtained from a population ranging from 8 months to 63 years old was performed between January 1995 and December 1996. IgG anti-HAV were detected by a commercial immunoenzyme assay. The study included 547 persons resident in Gran Canaria. Epidemiological data (age, sex, number of family members, educational level, urban/rural residence and previous history of hepatitis) were gathered through a personal interview. Confusing variables were excluded by mean a multiple logistic regression analysis. Results: Global prevalence of anti-HAV (IgG) was 36.0% (CI 95% 32.0-40.0). The prevalence of anti-HAV increased significantly with age from 2.3% in children under 4 years until 98.9% in older than 40 years (OR 3956.0; CI 95% 241.7-64,753.5). Only three independent data (age, sex and educational level) were significantly associated with HAV seroprevalence. A previous history of hepatitis A was present only in 4.8% of HAV-positive subjects. Conclusions: The low prevalence of anti-HAV (IgG) in persons under 25 years old suggest that in the adolescent population the implementation of universal vaccination programs is recommended even without previous serologic screening. Otherwise, the results suggest that HAV pre-vaccination screening in our geographical were must be limited to subjects older than 25 years.

Dal-Ré, 2000

A seroepidemiological study was conducted to assess the seroprevalence of hepatitis A (HAV) antibodies in the Spanish general population in 1992-93. A total of 2744 subjects (1337 men and 1437 women) in the 5-59 years age range were stratified by gender and age (5-12, 13-19, 20-29, 30-39, 40-49, 50-59 years). The presence of total anti-HAV antibodies was investigated using a commercial enzyme immunoassay. Fifty-five percent (95% CI: 53.5-57. 2%) of the subjects were positive for anti-HAV antibodies, the age-standardized anti-HAV prevalence being 65.4%. Prevalence of seropositive subjects increased with increasing age (chi2 = 996, 17; p<0.0001), being 11%, 25% and 54% for the 5-12, 13-19 and 20-29 age groups respectively. The results from this study showed a remarkable decline in seroprevalence rates among children, adolescents and young adults. The large number of susceptible subjects in these groups of the population has public health implications in a country with intermediate HAV prevalence.

Gil Miquel, 1999

(no abstract)

de Juanes, 1999

(no abstract)

Bruguera, 1999

Background: The aim of this study was to investigate the prevalence of the risk factors of hepatitis A virus infection (HAV) in a representative sample of a Catalonian population obtained from 1995 to 1996 and the changes in the prevalence of this infection over the period of 1989-1996. Subjects and Methods: The prevalence of anti-HAV was determined by an ELISA test in a randomized sample of 2142 individuals, 884 from 6 to 14 years of age and 1248 over the age of 15 years. The results were related to sociodemographic variables and multiple logistic regression analysis was performed to establish which variables were related to the risk of infection. Results: The global prevalence of HAV infection was 67.8%. The prevalence of HAV infection increased from 3.5% in the group from 5-14 years of age to 99% in that over the age of 64 years ($p<0.001$). A higher prevalence was observed in those born outside of Catalonia (odds ratio [OR] = 3.97; 95% CI, 2.4-6.4) and in those with a lower level of education (OR = 2.60; 95% CI, 1.9-3.5). In the period 1989-1996 the prevalence of the infection has decreased in the population under the age of 45, the differences being statistically significant in the age groups 10-14 ($p<0.0001$) and 25-34 ($p<0.0001$). Conclusions: The prevalence of HAV infection has progressively decreased in Catalonia while it proportionally increases the susceptible population under the age of 45 years. These findings may be important in the design of strategies for the prevention of HAV infection with universal vaccination programs against this disease.

Gil, 1998

The aim of this cross-sectional study was to assess the seroprevalence of antibodies against varicella zoster (VZV), herpes simplex type 1 (HSV-1) and type 2 (HSV-2), hepatitis B (HBV), and hepatitis A (HAV) viruses in adolescents (14-17 years of age) in Madrid, Spain. At the study visit, demographic data and blood samples were obtained. The enzyme linked immunosorbent assay (ELISA) method was used to assess the presence of anti-VZV, anti-HSV-1, anti-HSV-2, anti-HBc and anti-HAV antibodies. A total of 1191 serum samples were collected. Mean age (SD) and male/female ratio of the study population were 15.3 (1.1) years and 0.9, respectively. Seroprevalences obtained were as follows: anti-VZV (94%), anti-HSV-1 (46%), anti-HSV-2 (5%), anti-HBc (3%) and anti-HAV (5%). These data show that Spanish adolescents should be considered a target group for prevention programs against HSV-2, HBV and HAV infections.

García de Pesquera, 1998

Objective: To find the evolution of the prevalence of the Hepatitis-A antibody in Sevilla. Design: Observational study of a crossover type. Comparison of results in 1995 with those from a similar study in 1981. Setting: Health Area covered by Sevilla's University Hospital Virgen del Rocío. Patients and Other Participants: Aliquots of serum from patients without hepatitis were obtained from the hospital's clinical analysis laboratories. Measurements and Main Results: The sera were analyzed in the Nuclear Medicine laboratory of the HUVR. 37.96% (62.74% in 1981) of the individuals surveyed were HA-positive. Prevalence increased with age: in the over-24s it was over 75% (90% in 1981). The differences between the two sets of results was significant ($p<0.001$). Conclusions: Hepatitis A infection is becoming less common in Andalusia, which can now be considered a low-incidence area.

Suarez, 1997

The aim of this study was to know the prevalence of hepatitis A, B and C markers in an adult population in Gijón, Spain. A randomized, transversal sample according to the census was made in a population between 26 and 65 years of age in Gijón, analyzing demographic, epidemiologic and clinical variables, liver function tests, anti-HAV IgG, anti-HBcore and anti-HCV. Of the 476 individuals included a census error was detected in 26 (5.5%) and 340 (71.4%) were studied. Of these anti-HAV IgG was positive in 210 (61.8%) with prevalences of 17.9% from 26 to 30 years (CI: 95%, 11.1%-27.4%), 54.7%

from 31 to 35 years (CI: 95%, 41.8%-67%), 73.6% from 36 to 40 years (CI: 95%, 59.4%-84.3%) and 93% (CI: 95%, 86.7%-96.5%) above 40 years of age (p < 0.001). No other significant variables were found adjusted by age groups. With regard to HBV, of the 331 unvaccinated cases, 35 (10.6, CI 95%, 7.6%-14.5%) presented immune markers and 4 (1.2% CI: 95%, 0.4%-3.3%) HBsAg positivity, with all having normal ALT and no viral replication. Anti-HCV was positive in 1.7% (CI: 95%, 0.7-3.9%), being significantly related to IVDA or tattoos. Hypertransaminasemias were detected in 18 (5.3%) being attributed to virus C (27.8%), alcoholism (27.8%) or obesity (44.4%). History of clinical manifestations of acute hepatitis was collected in 9.7% of the cases with no memory of the episode in 84.3% of the anti-HAV IgG positive cases, 79.5% of the anti-HBcore positive cases and 83.3% of the anti-HCV positive cases. The current curve of prevalence of anti-HAV IgG in the Gijón population varies in the decade from 30 to 40 years in age ranging from values discarding pre-vaccination screening under the age of 30 to levels of minimum susceptibility to infection above the age of 40. The low prevalence of anti-HBcore underestimates its use as pre-vaccination screening versus HBV in the population of Gijón. The prevalence rates of HBsAg or anti-HCV thereby make this area a zone of intermediate endemicity, with around 3% of the population being chronically infected by one of these viruses.

Benito Ruesca, 1997

(no abstract)

García-Fulgueiras, 1997

The prevalence of hepatitis A antibodies in the adult population of the Murcia Region (southeast of Spain) was estimated using an anonymous unlinked serosurvey in a population-based sample of 2203 adults. The overall anti-HAV prevalence was 76.5%. The prevalence increased with age and was higher in individuals living in towns with less than 10,000 inhabitants.

Gil, 1997

Diluted dried blood drops on filter paper were compared with serum samples as a specimen source for qualitative anti-HAV antibody determination by ELISA. A total of 298 serum samples and dried blood drops were collected from a population of healthy adolescents (15.3 ± 1.2 years old). The prevalence of anti-HAV antibody obtained by testing serum samples was 7.7% (95% CI:4.8 10.1). Compared with serum sampling the sensitivity and specificity of diluted dried blood drops were 91.3% and 99.3%. The positive and negative predictive values were 91.3% and 99.3%, respectively, and the likelihood ratios of positive and negative results were 91 and 0.09. It is proposed that this test represents a reliable procedure for anti-HAV antibody testing.

Garcia Erce, 1996

(no abstract)

Gil Miguel, 1996

(no abstract)

Bayas, 1996

Background: To know current hepatitis B (HBV) and hepatitis A (HAV) infection status among a group of health sciences students during 1990-1993 period. SUBJECTS AND Methods: Subjects: 1734 health sciences students during 1990-1991, 1992-1993 and 1993-1994 academic years. Main outcome measures: demographic variables, vaccination history against HAV and HBV viruses, anti-HBc, and anti-HAV antibody titres (ELISA kits). Results: 1,734 subjects aged 22.5 ± 2.9 years (75% women) were included. Anti-HBc total cumulated prevalence during the three year period was 2.5% (CI 95%, 1.9%-

3.4%). Anti-HAV total cumulated prevalence during the three year period was 13.9% (CI 95%: 11.4%-16.8%). No statistical significant association between antibody prevalence and both age sex was found. Conclusions: Low prevalence, and thus, high susceptibility to HBV and HAV infection was found. We stress the importance of systematic vaccination among health sciences students not previously engaged in universal vaccination programs. We also point out the need for further analysis upon the utility of combined HB/HA vaccine as an alternative to anti-hepatitis B universal vaccination programs among adolescent cohorts.

Montes Martínez, 1996

Objective: The purpose of this study was to determine the prevalence of antibodies against the A, B, C and E hepatitis viruses was studied in the rural child population of Plasencia (Northern area of Extremadura). Material and Methods: A set of 411 serum samples, corresponding to 209 boys and 202 girls, distributed in three age groups (4-5, 9-10 and 13-15 years) were studied. The population was randomly chosen from the entire child population of the Plasencia sanitary area. Enzyme immunoassay was used in all cases to determine the IgG antibodies against the A virus (anti-HAV), the antibodies against the antigen of the B virus core (anti-HBc), and the antibodies against the C virus (anti-HCV). In 95 cases of the 13-15 year old group we also determined the antibodies against the E virus (anti-HEV). Results: The anti-HAV was positive in 104 samples (25.3%), 1 belonging to the 4-5 year old group, 46 to the 9-10 year olds (32.8%) and 57 to the 13-15 year old group (38.2%). The anti-HBc was found to be positive only in three children (0.7%). No serum samples presented anti-HCV. The anti-HEV was positive in 5 cases out of the 95 studied (5.3%). Conclusion: Our results indicate high HAV infection rates in the rural child population and a low prevalence of infection by HBV. No infection by HCV was detected. The recently described HEV is present in our area with a higher prevalence than in other European countries.

Suárez, 1996

Background: The aim of this study was to know the prevalence of previous infection markers for hepatitis A and B viruses in a pediatric-juvenile population from Gijón, Spain. Patients and Methods: A representative (according to the census) transversal randomized sample of a population from 6 to 25 years in age from Gijón, Spain, was included in the study analyzing demographic, epidemiologic and clinical variables, liver tests, anti-HAV IgG and anti-HBc. Results: Of the 630 individuals selected a demographic error was detected in 28 (4.4%) and 453 subjects were studied (71.9%) in whom the anti-HAV IgG was positive in 37 cases (8.75% of prevalence adjusted for age), with 4.4% (12/271) (CI 95% 2.3%-7.6%) for the younger cases and 13.7% (25/182) (CI 95% 9.1%-19.6%) in the group ranging from 18 to 25 years in age ($p < 0.001$). No anti-HAV IgG positive case was detected in the population under the age of 10 years. Among the young adults the prevalence of anti-HAV IgG positive cases was higher in those born in the south of Spain (2/6, 33.3%) (CI 95% 4.3%-77.7%) with respect to those from the northern regions of Spain (9/259, 3.5%) (CI 95% 1.6%-6.4%). ($p = 0.02$). With respect to HBV markers, of the 433 unvaccinated cases, 6 (1.4%) presented markers of past infection and 2 (0.46%) HBsAg positivity. Both had normal serum ALT without viral replication. Six cases of hypertransaminasemia levels (1.3%) were detected all being related with obesity or alcoholism. All the cases with previous acute clinical hepatitis were found to be anti-HAV IgG positive and anti-HBc negative. Conclusions: The current prevalence of anti-HAV IgG in the population from 6 to 25 years from Gijón, Spain is very low and given the high degree of susceptibility (86%) for HAV infection in the young adult population (18-25 years) the implementation of vaccination programs is recommended even without previous serologic screening. The low prevalence of anti-Hbc would also undervalue its use as pre-vaccination screening against HB in this geographical area.

Menéndez, 1996

Objectives. To find the prevalence of markers of rubeola, Toxoplasma, lues, HIV and hepatitis A, B, and C viruses in the pregnant women of a health district; and these markers' correlations with epidemiological and socio-demographic antecedents. Patients. 129 pregnant women from the 5.3 Health District in Asturias with birth predicted for between August 1994 and October 1995. A descriptive study of epidemiological, socio-demographic and serological data; statistical calculation with RSigma. Results. 109 pregnant women (84.5%) were assessed, average age 28.6, including 9 abortions with path. analysis in the first three months. HIV was tested in 15 cases, all negative. Toxoplasma was positive in 46 cases, with no association with other variables. Rubeola was negative in 6 cases, all >25 years old, with overall vaccination coverage of 42.2% and 64.7% for < 26-year-olds. One case of lues was found. The HC test was negative in all the pregnant women, with 4% of HBsAg+, related to being gypsy and to AF of hepatopathy. HA IgG was positive in 52 cases (52%) and more common among gypsies vs. the rest. In the latter group there was increasing prevalence according to age. Conclusions. 1) HIV screening is not common. 2) There is a high percentage of pregnant women with no immunity to Toxoplasma. 3) Low rubeola vaccination coverage among women under 26 was found. 4) There is a higher percentage of HBsAg+ cases in comparison with other areas, but not with the HC virus. 5) A high percentage of cases had no previous contact with the HA virus.

Buti, 1996

Background: Recent seroepidemiologic studies have demonstrated a decrease in the prevalence of hepatitis A virus infection (HAV) in relation with an improvement in hygienic conditions. The prevalence of anti-HAV in a group of health care students was studied and a vaccination program initiated in this collective. Methods: Serum anti-HAV determination was performed by an enzymoimmunoanalysis method. A inactivated hepatitis A vaccine was administered. Results: Only 18.5% of the subjects between 17-23 years-old presented anti-HAV antibodies. The prevalence of anti-HAV was related with age and the number of partners. All of the 129 immunized individuals responded to the HAV vaccine with protector antibody titles. Conclusion: The present study demonstrates the decrease in HAV infection among youths as well as the immunogenicity of the anti-hepatitis A vaccine.

Amela, 1995

Hepatitis A is an infection transmitted by the fecal-oral route. Endemicity within a specific country is directly related to sanitation and hygienic standards, while being inversely related to socioeconomic conditions. We studied how the process of urbanization witnessed in Madrid had influenced the transmission of hepatitis A infection. In the Madrid Autonomous Region, this process first began in the early sixties and was not brought to a close until the late seventies. Catalytic models were used to estimate the annual infection rate, lambda, on the basis of seroprevalence data stratified by age. A cohort effect related to a fall-off in infancy-related hepatitis A virus (HAV) is to be observed in the results for the last few years. The model permits four birth cohort-based groups to be differentiated by lambda: individuals born pre-1960, lambda = 0.082 (95% CI 0.095-0.070); those born in the early sixties, lambda = 0.052 (95% CI 0.060-0.042); whose members were born in the late sixties, lambda = 0.033 (95% CI 0.041-0.025); and those born in the late seventies, lambda = 0.017 (95% CI 0.020-0.013). The first group includes those born before the urbanization process had started. The second and third groups coincide with the development stage of that process, hence exhibiting transitional rates. The fourth group reflects the process in its consolidation stage. This reduction in the transmission of infection has changed the manner of presentation, so that while isolated cases or small outbreaks tend to be more common nowadays, occasionally epidemics may evolve explosively. The average age at presentation has risen and the likelihood of symptomatic infection is higher.

Rodriguez-Iglesias, 1995

(no abstract)

Cilla, 1995

The prevalence of antibody to hepatitis A virus (HAV) in a group of socially and economically disadvantaged Spanish gypsy children was compared to that of a group of non-gypsy middle-class children. The study included 438 children, 73 gypsies (38 girls and 35 boys, mean age 8.5 years, age range 2-16 years) and 365 non-gypsy controls, randomly selected by age. The presence of anti-HAV was investigated using ELISA. Among the gypsy children, 82% had antibodies to HAV compared with 9.3% of the children in the control group. The unfavorable living conditions of the gypsy population (e.g. homes with poor sanitary conditions, overcrowding) may explain the high prevalence of HAV infection. These findings underline the need for specific action which targets disadvantaged populations.

Bolumar, 1995

Between July 1988 and July 1989, sera from 1223 persons resident in the Valencia area of Spain were tested for antibodies against the hepatitis A virus. 65% of serum samples were positive for anti-HAV (95% confidence interval = 62.4-67.6). The prevalence of anti-HAV increased significantly with age (odds ratio > 50 years = 69.8; 95% confidence interval = 26.5-183.4) and previous history of hepatitis A (odds ratio = 2.1; 95% confidence interval = 1.4-3.2). Prevalence decreased with higher educational level (odds ratio, university studies = 0.2; 95% confidence interval = 0.1-0.5). Overall, there has been a reduction of anti-HAV prevalence reflecting the decreasing exposure of the Spanish population to hepatitis A virus in recent years, particularly in the younger generations. The age of infection has increased, increasing the probability of future epidemics in groups previously protected by immunity acquired in early childhood. This new epidemiological pattern has strong public health implications, and universal childhood vaccination together with measures directed to improve sanitation may be the best public health strategy to protect the population.

González, 1994

Background: The aim of the present was to study the rate of exposure to the hepatitis A virus (HAV) in the young adult Spanish population. Methods: A transversal observational study was performed to evaluate the prevalence of anti-HAV antibodies (IgG) in a representative sample of the Spanish population between the ages of 20-40 years. Information on demographic variables (age, place of residence, education, number of children and number of brothers or sisters) and history of hepatitis was collected. A blood sample was also obtained from the umbilical cord or heel of newborns. The level of total anti-HAV antibodies was measured by the ELISA method. Results: A total of 1204 pregnant women the ages of 20-40 years with deliveries in 71 hospitals in 14 autonomic regions were included in the study. A total of 606 positive anti-HAV were reported representing a prevalence of 50.4% (CI 95% = 48-52%). The prevalence was seen to significantly increase in relation to age, from 39% (group from 20-25 years) up to 60% (groups from 31-35 and 36-40 years of age). The factors of education and number of children were not associated to greater risk of previous contact with HAV. A non significant increase in prevalence was observed in relation with number of brothers or sisters of the parturient. 86.3% (CI 95% = 83-93) of the positive anti-HAV subjects reported not having had clinical history of hepatitis. Conclusions: Half of the young Spanish adult population does not show antibodies against the hepatitis A virus, with an increase in morbidity by clinical hepatitis A being foreseen in this age group.

Lasheras Lozano, 1994

Objective. To know the prevalence of antibodies against hepatitis A virus (anti-HAV) in a population of children and teenagers pertaining to three municipalities of the Autonomous Community of Madrid (CAM). Design. Cross-study. SITE. The study was conducted in three public schools centers of the municipalities located in the Southeast of the (CAM). Patients and Other Participants. Students between the ages of 6 and 17 whose parents authorized them to be tested. Measurements and Main Results. The presence of anti-HAV antibodies in the serum of 729 students was investigated. 38 of them presented a positive mark, which indicates a prevalence of 5.34%. In the males, the prevalence was 5.7% and in the females it was 5%. Conclusions. The prevalence of anti-HAV antibodies is low in our population, agreeing with the delay in the age that the infection is acquired according to various publications.

Perez-Trallero, 1994

The prevalence of hepatitis A virus antibodies was studied using a commercial ELISA method. 2,214 subjects were included, 1,211 in 1992 and 1,003 during 1986-87. In 1992 the seroprevalence rates among subjects 1-9, 10-19, 20-29, and 30-39 years old were 2.4%, 21%, 57.6% and 87.5% respectively, as compared with 7.7%, 37.9%, 80.6%, and 98.1% respectively, in a similar group of subjects studied 5 years earlier ($p<0.001$). The reported number viral hepatitis cases declined from 35.0 per 100,000 people in 1984 to 8.9 per 100,000 in 1992. Concurrently, the age when contracting the disease rose. The mean age for patients acquiring hepatitis A was 15.5 in 1986-88 and 20.1 in 1991-92. The decline in incidence and prevalence of HAV infection indicates a progressive and continuous decrease in HAV circulation in this geographical area.

Morales, 1992

Three child population groups from the Madrid area were studied for anti-HAV antibodies. Analysis was carried out with respect to age and socio-environmental factors. The population understudy was composed of 156 children, with ages ranging from 1 to 14 years; they were stratified in three socio-environmental groups (white-family unit, gypsy-family unit and orphanage), and also divided into subgroups according to age. As a whole, an age-related increase in prevalence was found. The overall seroprevalence by socio-environmental groups was: gypsy-family unit 63%, orphanage 46%, and white-family unit 23%. Significant differences between groups appeared from seven years on, being more marked among the eldest subgroups. Among the factors evaluated, hygienic-sanitary conditions and overcrowding influenced the high prevalence rate found in the gypsy-family unit subjects, whereas overcrowding appeared to be responsible for the higher prevalence in orphanage residents, as compared to white-family unit children.

Salleras, 1992

Background: Seroepidemiologic studies carried out in different countries show that the prevalence of markers for infection by hepatitis A (HAV) is progressively decreasing in relation with improvement in the level of health care. The prevalence of anti-HAV in Catalunya and the factors related with infection by HAV were studied in order to obtain bases for designing prevention strategies adequate for the epidemiology of this infection. Methods: Anti-HAV was determined by a method of enzyme immunoassay in a randomized sample of the general population in Catalunya. Investigation of the influence of socio/demographic variables in the prevalence of HAV infection was carried out. Results: The global prevalence of anti-HAV was of 36%. In the population from 6 to 14 years of age it was of 13% and that of those over the age of 15 it was 86%. The prevalence of anti-HAV increases with age and is related with the social level of the families, the level of education and the place of birth. The incidence was higher in children of the lowest social class, in adults with the least education and in those born outside Catalunya. These factors constituted independent risk factors of HAV infection. Conclusions: The present study confirms the association between HAV infection and socio-economic factors and demonstrates that the infection is not commonly found in infancy, an increase in the number of susceptible adults is foreseeable.

Jiménez Rodríguez-Vila, 1992

Aims. To assess the level of immunity in a healthy population to the hepatitis A virus (HAV), according to age groups and in an urban health area. Design. Transversal random prospective study of a sample of the population found by letters. Site. Primary Care Centre covering the population of an urban health area in Valladolid. Patients or Other Participants. Random sample of 726 people with an adjustment as to sex and age according to the area's average, in line with the full census of the above area. The sample was 95% trustworthy, with a 3% margin of error. People with serious illness at the time of the study were excluded. Measurements and Main Findings. We carried out a social-health count. We established the anti-HAV titer after its detection by enzyme immunoanalysis (HAVAB EIA Abbott); the titers were inferred from the absorbances relating then to that of a a "pool" of serums with very high titers. 69.9% (standardized rate) gave positive. The highest titers were presented in people between 31 and 50 (29.7 ± 47.0), with significant differences both for lower (17.0 ± 15.7) and higher (15.7 ± 19.8) age groups ($p=0.001$ for both). Conclusions. The highest anti-HAV titers corresponded to people in the middle age-group, with a subsequent dropping-off. This could suggest a greater susceptibility to HAV infection in the older person.

Dal-Ré, 1991

A seroepidemiological study was carried out in order to determine the prevalence of markers of viral hepatitis infection in employees of five health-care companies and their cohabiting family members. Each participating family unit was required to fill out a questionnaire, in which, among other data, the employee was requested to indicate his or her job category. Markers of hepatitis B infection (anti-HBs, anti-HBc or HBsAg) were observed in 11.7% (58/497) of all subjects. When employees and family members were analysed according to the employee's job category, significant differences were found between "staff" (3%) and "administrative personnel" (13.3%; $p<0.01$) or "factory workers" (16.9%; $p<0.01$). Of 489 individuals tested for the presence of anti-HAV and anti-HCV, 59.1% and 0.6% respectively, were positive. There was a correlation between the prevalence of anti-HAV and age; a large proportion of the subjects under the age of 30 years had no evidence of prior HAV infection.

Gil, 1991

Background: To find out the presence of hepatitis A antibodies (anti-HA) in an urban population of Madrid, age ranging from 6 to 18 years. At the same time, the immunity level is evaluated with respect to measles, rubella and mumps in a sub-group aged between 6 and 13 years old. Methods: The study was carried out in two schools population of the north area of Madrid. Results: Anti-HA prevalence in the whole population under study (707 subjects) was of 6%; a direct correlation was observed between prevalence and age. With respect to the seroprotection study against measles, rubella and mumps, 81% out of the 385 vaccinated subjects is protected against the three viruses. Seroprotection rate is of 79% if this is evaluated with respect to the total 6-13 age group under study (458 subjects). Conclusions: The results of anti-HA prevalence obtained in the eldest groups reveal that a high percentage of the study population aged 17 (92%) and 18 (84%), is anti-HA negative, which means that they might be susceptible to the infection when reaching the adult age. 21% of the school age group studied with respect to measles, rubella and mumps is seronegative to some of the three viruses. Considering the above results, it appears that it could be interesting to evaluate whether the administration of a booster dose to children in school age would enable to reduce the number of unprotected subjects in the referred ages.

Ruiz Moreno, 1988

The aim of this study was to determine the prevalence due to hepatitis A, B and D viruses infection in children. A total of 286 children from Madrid area with ages ranging between 0 and 13 years were included. The sample was randomized with respect to the sex and age referring to the total population of Madrid. The anti-HAV was positive in 15.16% of cases, with an increasing lineal correlation with age. Any marker of HBV infection was found in 6.6% and HBsAg in 1.4%. There was an exponential correlation between the carrier state and the age, with a maximum at the first year and diminishing thereafter with age. The 21% of the cases with positive HBV-markers were HBsAg carriers. A predominant perinatal and intrafamiliar transmission of HBV was detected. Our results indicate a intermediate prevalence of HBV infection in Spain, suggesting the importance of HBsAg detection in pregnant women. None of the HBV-infected cases had anti-HD.

Perez Trallero, 1988

(no abstract)

Carreño García, 1983

The prevalence of anti-HAV is investigated among 340 persons who weren't hospitalized, belonging to different socioeconomic levels in our country. The diffusion of the A virus increases with age and diminishes with the socioeconomic level (low level 82% and medium level 62%, $p<0.025$). The persons with a high risk of suffering hepatitis A are, in our country, younger than twenty years old. Among 296 persons, 114 who were anti-HAV positive were analyzed for the anti-HAV-IgM and none of them was positive. Only the 8% of the persons studied presented previous icterus story, but there wasn't any significant difference, concerned with the diffusion of the A virus, with the persons without any icterus history (88% and 74% respectively). The majority of these persons had a contact with the A virus a long time ago. That means that the contact with the A virus is inapparent. As the incidence of anti-HAV is high in Spain, it should be necessary to make prophylaxis with immunoglobulins, specially among young people visiting Spain, coming from Northern countries.

Grau, 1982

(no abstract)

Bottiger, 1998

The prevalence of hepatitis A, B and C virus markers in the adult Swedish population was investigated according to age, gender, ethnic origin, and demographic stratum. Sera, collected from 3382 persons in 1990-1991, were selected on a statistical basis and considered to be representative of the Swedish adult population (age 18 or higher). In the population subgroup of Scandinavian origin, the prevalence oof hepatitis A antibody positivity had not changed since the 1960s, being 69% among those born at the beginning of the century, declining to 6% among those born in the 1940s, and to only 2% among those born after 1950. Subgroups of non-Scandinavian origin differed markedly in the prevalence of hepatitis A antibody positivity, which was 70% among those from other European countries, irrespective of age, and more than 90% among young adults of Arabic or Asian origin. Thus, it is concluded that the population of Scandinavian origin enjoys low natural exposure to hepatitis A, which has remained unchanged for the past 20 years.

Bottiger, 1997

After a 20-year interval, the prevalence of seroimmunity to Hepatitis A (HA) was again investigated in a statistical sample of the adult Swedish population. Sera from 3382 of the 4800 originally selected persons were tested. The prevalence of antibodies to HA had not changed since the

1960s when only the Scandinavian population was considered. In the oldest population born at the beginning of this century, the presence of antibodies amounted to 69%. It gradually declined to 6% in those born in the 1940s. In the population born after 1950, the percentage of seropositive individuals was only 2%. A slightly higher prevalence was seen in the big cities, compared with the rural areas (13% vs. 9%). Persons of non-Scandinavian origin showed a different pattern. Those from other European countries showed a prevalence of about 70% in all the age-groups investigated. Among the young adults of Arabic or Asiatic origin, the figure was >90%. The conclusion is that the native Swedish population has a low natural exposure to HA, which has not changed during the last 20 years. Prophylaxis before going to countries where the disease is endemic is strongly recommended.

Weiland, 1980

Sera collected in 1968 from persons selected on a statistical basis as being a representative sample of the Swedish population, were tested for antibody against hepatitis A (anti-HAV). The prevalence of anti-HAV increased with age from 4% (3/83) among 15-19 year olds (born between 1948 and 1952) to 87% (68/78) among 60-69 year olds (born between 1898 and 1907), and was furthermore higher in cities than in rural areas for corresponding age groups.

Studer, 1993

To assess the prevalence of antibodies to hepatitis A virus (anti-HAV) in future travelers, all visitors to the Zurich University Vaccination Center in July/August 1990 were invited to participate in a cross-sectional study. A total of 1126 future travelers were recruited to have a blood sample drawn and to complete a brief questionnaire. Among these, 35 refused or were excluded, thus 1091 were evaluated. The overall prevalence of anti-HAV was 16.5%. This rate was 5.9% in future travelers born in or after 1961, 11.8% in those born 1951-60, 21.4% in those born 1941-50 and exceeded 49% in all decades born in or before 1940. Risk factors for significantly elevated anti-HAV rates were place of birth or a stay exceeding one year in tropical, subtropical or Southern European countries and travel for occupational reasons. Compared with findings from earlier surveys conducted mainly among blood donors in Switzerland and elsewhere in Europe, the results of the present study show lower anti-HAV prevalence rates. In conclusion, it seems unnecessary to test future travelers for anti-HAV except if they are born before 1944, or have a history of jaundice or of prolonged stay in the tropics, subtropics or in Southern Europe.

Holdener, 1982

Sera of 1126 flying personnel of an airline were tested for signs of ongoing or past infections with hepatitis B virus (HBV) or with hepatitis A virus (HAV). The prevalence of anti-HA antibodies was similar in all professional categories of flying personnel and the same or slightly lower than in Swiss blood donors. The frequency of immune markers identifying HBV immunity was similar in pilots, flight-engineers, and female flight attendants compared to Swiss blood donors. However, HBV immunity was clearly more prevalent in male flight attendants. Within 1 year, 13 of 2624 flying personnel had acute hepatitis. This higher-than-average incidence of hepatitis amongst flying personnel compared to the Swiss population was mainly due to a high incidence of hepatitis B amongst male flight attendants. Their special life-styles might be responsible for the high prevalence of HBV immunity and for the high incidence of hepatitis B.

Stadelmann, 1980

In a study on the prevalence of hepatitis A virus (HAV) exposure among the Basel population in 1978/79, 763 sera matched for age were tested for HAV antibodies by radioimmunassay (HAVAB). Sera of patients with a recent history of liver disease were not included. The results show that the prevalence of HAV antibodies increases with age, a situation similar to that in poliomyelitis before vaccination. The prevalence of HAV antibodies rises from 15% in the 11-20 year age group to 90% in the over-71 age group. The fall in HAV exposure with decreasing age is attributed to a decline in infections due to improvements in hygienic standards during this century, and especially since World War II. The average prevalence of HAV antibodies found in this study is 52%. The results are partly influenced by the high proportion of subjects originating from foreign countries among the population investigated.

Dalton, 2008

The incidence of hepatitis A is falling. In contrast, autochthonous hepatitis E is an emerging infection in developed countries. The objective of this study was to compare both laboratory-confirmed cases of hepatitis A and autochthonous hepatitis E over a 2-year period in Cornwall and Devon and anti-hepatitis A virus (HAV) IgG and anti-hepatitis E virus (HEV) IgG seroprevalence in blood donors. The databases of microbiology laboratories in Cornwall and Devon were searched for the number of diagnostic HEV and HAV assays performed during 2005-2006 and the number of confirmed cases of acute hepatitis A and hepatitis E detected. Patients were followed up until recovery or death. Sera from 500 blood donors from the regional centre were tested for HEV and HAV IgG. In total, 28 cases of autochthonous hepatitis E were identified from 838 assays, and 20 cases of hepatitis A were identified from 4503 assays. Compared to hepatitis A cases, patients with hepatitis E were older (mean age 61 vs. 45 years, p=0.003), less likely to present in winter (P = 0.028) and had more complications (five vs. one). The IgG seroprevalence rates in blood donors were 45% for HAV and 16% for HEV. There was no relationship between HAV and HEV IgG seropositivity. Autochthonous hepatitis E may be more common than hepatitis A, affects older patients, is less likely to occur in winter and may be associated with more complications. Patients with acute hepatitis, whatever their age or travel history, should be tested for HEV.

Jarvis, 2004

Background: A negative association of oral-fecally spread infection with serological markers of sensitization and allergic disease has been reported. Methods: Previous infection with hepatitis A and *Helicobacter pylori* was assessed in a community-based sample of young British adults and associations with serum-specific IgE to environmental allergens, asthma-like symptoms and hay fever were examined. Results: There was no association of previous infection with hepatitis A or *H. pylori* with wheeze or hay fever. There was no evidence of an association of infection with either agent and sensitization except for the isolated finding of a lower prevalence of sensitization to grass in those with IgG antibodies to *H. pylori* (OR 0.65, 95% CI 0.43-0.99). This association did not explain the negative association of family size with sensitization to grass. Conclusion: In this population, there was no evidence that infection with hepatitis A or H. pylori was associated with lower levels of IgE sensitization, asthma or hay fever except for an isolated finding of a negative association of *H. pylori* infection with sensitization to grass.

Morris-Cunnington, 2004 (Commun Dis Public Health)

Seroprevalence data among ethnic minority groups within England and Wales are rare. An opportunistic approach was taken to test residual oral fluid, collected from pre-adolescent school children from an ethnically diverse region of northwest England, for anti-hepatitis A virus (HAV) IgG. Individual data on ethnicity and country of birth were also available. Of the 257 children who consented to participate, 62% were of South Asian ethnic origin. The overall seroprevalence was 18.8%, higher than 13.1% reported from a recent population-based survey in England and Wales among a mainly Caucasian population of the same age. The only factor significantly associated with HAV seropositivity in a multivariable logistic regression model was birth of the child abroad. Association with the place of birth of the child, but not that of the parent indicates that infection within this group occurs mainly abroad. Larger studies among ethnic minority groups are needed to investigate this claim further.

Morris-Cunnington, 2004 (Am J Epidemiol)

Population-based seroprevalence studies provide important data on susceptible groups and the potential for future outbreaks. However, the invasive nature of serum collection has limited studies. This paper describes the first postal population-based survey using noninvasive oral fluid technology to collect antibody prevalence data in conjunction with extensive risk factor data to assess the distribution of immunity to common viral infections in England and Wales. These results pertain to hepatitis A virus (HAV). Approximately 5,500 oral fluid samples were collected between August 2001 and May 2002, as well as individual risk factor data through a questionnaire, from persons aged less than 45 years randomly sampled from general practices countrywide. Samples were tested for immunoglobulin G-specific antibody marking a past infection or immunity to HAV using an antibody-capture enzyme-linked immunosorbent assay. The age-specific HAV seroprevalences indicated a low incidence of infection (overall seroprevalence of 18.9% (95% confidence interval: 17.0, 20.9) and of 9.2% (95% CI: 7.1, 11.3) after the exclusion of vaccinees). Vaccination proved the most important determinant of seropositivity. Ethnic minority groups were underrepresented, and adjustment increased the overall prevalence to 20.1% and to 12.1% in unvaccinated individuals. The availability of comprehensive risk factor data allowed the description of two risk profiles related to natural infection and vaccination.

Ross, 2002

Objectives: To compare the seroprevalence of hepatitis A in homosexual and heterosexual men to determine their susceptibility to infection and provide guidance for a policy on vaccination. Methods: A case-control study design was utilized to compare the risk factors associated with hepatitis A in homosexual and heterosexual men attending a city centre genitourinary medicine clinic. Demographic and sexual behavioral characteristics were included in univariate and multivariate models. Results: The overall seropositivity rate was 29% with no significant difference between homosexual and heterosexual men. Ethnicity and age were strongly associated with hepatitis A seropositivity in both homosexuals and heterosexuals. A history of sex in a sauna in homosexual men, and being born outside the United Kingdom for heterosexual men, was associated with hepatitis A seropositivity. Conclusions: Targeted hepatitis A screening and vaccination of homosexual men attending UK genitourinary medicine clinics is not supported by the results of this study.

Morris, 2002

Sera from an age-stratified sample of 4188 individuals, submitted for diagnostic purposes to 15 public health laboratories in England and Wales in 1996, were tested for hepatitis A antibody. The serological profiles were consistent with declining incidence in the past. This hypothesis was tested by comparing the serological profiles of Ashford, Leeds and Preston public health laboratories with those from sera collected during a previous study in the same laboratories in 1986-1987. A comparison of equivalent 10 year birth cohorts revealed that significant hepatitis A seroconversion had only continued in Ashford. However, it is probable that most seroconversions are due to vaccination and immigration rather than continuing viral transmission. Further population-based surveys collecting more in-depth social and demographic data are needed to confirm the main factors influencing hepatitis A seroprevalence and to explain the regional differences.

Bernal, 1996

The seroprevalence of antibodies to hepatitis E virus (HEV) and hepatitis A virus (HAV) was determined in a community-based sample in innercity London where socioeconomic conditions were expected to result in a high prevalence of antibodies to HAV, and in which the presence of immigrants from the developing world pose a risk of imported infection of both HAV and HEV. The seroprevalence of anti-HAV was 45.1% in UK born subjects and 69.7% in non-UK born subjects and each group showed differing patterns of age-specific seroprevalence. The seroprevalence rates of anti-HEV was 3.9% in UK born subjects and 8.8% in non-UK born subjects. The age-specific seroprevalence of the UK born group is suggestive of a cohort effect. The data suggest a low circulation of HEV in inner-city London, remaining uncommon relative to HAV.

Zuckerman, 1994

The seroprevalence of hepatitis A antibodies in travelers attending London Travel Clinics increases with age and screening may eliminate the need for vaccination at present for approximately 40% of adults. The duration of protection by current hepatitis A vaccine(s) is still to be established.

Nandwani, 1994

Objective: To determine the seroprevalence of hepatitis A antibodies in homosexual and heterosexual males attending a genitourinary medicine (GUM) clinic. Design: Prospective study of male patients recruited from a GUM clinic during a 10 week period in 1993. Setting: Central London outpatient GUM department at Chelsea and Westminster Hospital. Subjects: 255 patients were recruited, comprising 185 homosexual and 70 heterosexual males. 92 men were known to be HIV-positive, of whom 89 were homosexual. Main Outcome Measures: Serum samples were screened for both IgM and IgG antibodies to hepatitis A by enzyme linked immunoassay. Results were matched to an anonymously completed questionnaire. Results: 81 of the 255 subjects (31.8%) had been exposed to hepatitis A, two of whom were IgM positive. There were similar hepatitis A seroprevalence rates in homosexual (32.4%) and heterosexual men (30.0%). Although 48.1% of the homosexual men were known to be HIV-positive, compared with 4.3% of the heterosexuals. Hepatitis A seroprevalence remained comparable in both groups after patients with known HIV infection were excluded from the analysis. 11.4% of the heterosexual men admitted to oral-anal sexual contact compared with 62.2% of the homosexual men. This sexual practice was not associated with antibodies or a past history of hepatitis A exposure. Conclusions: There was no detectable difference in hepatitis A seroprevalence between male homosexual and heterosexual GUM clinic attenders, despite a much higher level of oral-anal sexual activity among the homosexual population.

Gay, 1994

Sera from an age-stratified sample of 7196 individuals, submitted for diagnostic purposes to four public health laboratories in England in 1986-1987, were tested for hepatitis A antibody. The serological profiles, which showed marked regional differences, were consistent with declining incidence in the past. The decline in the incidence of hepatitis A has resulted in an increase in susceptibility in adults. This has three main consequences: an increase in the average age of infection may be leading to an increase in morbidity; normal immunoglobulin may become less protective against hepatitis A; the risk of transmission through blood products contaminated by viremic blood donors may rise. Current average annual incidence in 5-14-year olds was estimated to vary between regions from 0.5-1.9%. This supports the view that, in the absence of a vaccination program, hepatitis A will remain endemic unless there are further improvements in living conditions and standards of hygiene. A vaccine giving long-lasting protection could eliminate hepatitis A transmission with modest coverage at a young age. Targeting childhood vaccination on economically deprived areas or using vaccine to control outbreaks might be more effective policies.

Cumberland, 1994

Between 1989 and 1992, 92% of a sample of 2790 Service recruits aged between 17 and 35 years (mean age 19 years 7 months) were found not to be immune to infection by hepatitis A virus. The proportion of males with immunity was consistently greater than that for females. There was a significantly increased probability of immunity if individuals originated from Northern England, the Midlands and Scotland, in particular the suburbs. Among male recruits there were significantly increased probabilities of immunity associated with travel to Southern and Eastern Europe or to the Tropics, and for females with travel to North West Europe or to Southern and Eastern Europe.

Masterton, 1991

Travel histories were taken from 1111 British travelers. Serological testing showed that increasing age and a past history of jaundice were associated with a greater likelihood of travelers being immune to hepatitis A. Neither travel to nor the duration of stay in areas of increased hepatitis A endemicity influenced the level of hepatitis A immunity. It is concluded that travel histories from British citizens normally resident in the U.K. cannot be used to identify those travelers in whom serological prescreening would be of value prior to immunoglobulin prophylaxis.

Scott, 1989

A total of 1786 blood donors were screened for the presence of anti-hepatitis A antibody (anti HAV). 64.5% of the donors were found to be positive. The prevalence of the antibody was found to be age-related, 55% at 18 years and 75% at 65 years. No relationship was noted between the presence of antibody, foreign travel or a specific destination. Assay of antibody levels in selected seropositive individuals gave a mean level of 5.0 IU/ml. The prevalence of infection in this selected population is important in the context of passive immunization with normal human immunoglobulin and for defining a policy of immunization with hepatitis A vaccines, which are currently undergoing clinical trials.

LATIN AMERICA, ANDEAN
(Bolivia, Ecuador, Peru)

Gandolfo, 2003

Background and Objectives: The epidemiology of hepatitis A, E, B and C was analyzed in 1393 children living in Santa Cruz de la Sierra, Bolivia. They were distributed in two groups according to the social condition. Materials and Method: 1393 children were selected from two different schools: one attended by children belonging to a high social class of the town (group A), and the other school attended by children belonging to the poorest social class (group B). Blood samples were drawn by a team of physicians from Rome University La Sapienza. Serum antibodies against hepatitis A, B, C and E virus, and the hepatitis B surface antigen were evaluated by immunometric methods. The significance was evaluated using the chi^2 test. Results: Antibodies against hepatitis A virus were detected in 82% of examined children, with a significant difference between the two groups (56.3% vs 94.8%). The incidence of anti-HBc antibodies increased with age, so the infection is acquired prevalently in adolescence with a significant difference between both groups (1.1% vs 3.8%). The same phenomenon was observed with anti-HCV antibodies (4.7% positivity only in group B). Serum antibodies against hepatitis E virus were observed in 1.7% cases. Conclusions: In Bolivia, as in other developing countries, viral hepatitis represents a serious burden for public health. Spreading of viral hepatitis can be controlled upon improving hygienic conditions and customs. Moreover, a vaccination plan against hepatitis A and B virus is necessary for the population living in endemic areas.

Bartoloni, 1999

We conducted a cross-sectional study to determine the seroprevalence of antibodies against hepatitis A and hepatitis E viruses (HAV and HEV) in the population of two rural areas, Camiri and Villa Montes, of the Chaco region, south-eastern Bolivia. HAV antibodies were detected in 461 (94.1%) of 490 serum samples tested, not differing significantly between sexes and study areas. The HAV seropositivity rate (64.7%) was high even in the youngest age group (1-5 years). The prevalence of HEV was 7.3%, with no significant differences between sexes. The prevalence of HEV antibodies in the population of the Camiri area (10.4%) was significantly higher than in the Villa Montes area (4.4%), possibly due to the better quality of drinking water in the Villa Montes area. In the population ≤30 years of age, the HEV seropositivity rate (4.4%) was significantly lower than in the ≥31 year-old group. This is consistent with findings in other countries. This is the first report of the prevalence of HEV infection in Bolivia.

Bartoloni, 1989

Several epidemiological studies have shown the worldwide distribution of hepatitis A with the highest prevalence of anti-HAV antibodies in developing countries (Papaevangelou 1984). There is no information about the epidemiology of hepatitis A in Bolivia. The goal of this study was to evaluate the anti-HAV antibody prevalence in the Santa Cruz region, southeastern Bolivia.

Vildósola, 2000

The prevalence of Hepatitis A Virus (HAV) in a country largely reflects its standards of hygiene and socio-economic conditions. In the 1980s, it was reported 98% positive anti-HAV in adults and 82% in children; the rate increased with age, from 30% in those aged 1 year old to 100% in those of 8 years old. From October to December 1999, we performed a sero-epidemiologic survey to evaluate the presence of Hepatitis A antibody (anti-HAV) in 859 subjects (518 were children and 341 adults), aged from 1 to 39 years old, divided in two groups according to their socio-economic status (high and very high, low and very low). Adults older than 20 years old had 84% positives (288/341). Children (between 1 to 14 years old) had 46.3% positives (163/352): 35.6% (57/160) from socio-economic group AB and 55.2% (106/192) in level CD. We concluded that in the last 15 years was performed as significant decrease in the prevalence of Hepatitis A virus infection in children and adolescent population of Lima-Peru, forming an intermediate endemicity as epidemiological pattern.

Cabezas, 1994

Huanta is an Andean valley of Peru, located at 2400 meters above sea level with a population of 45,000 inhabitants. Viral hepatitis is widely known in the area due to its severe clinical symptoms and high morbidity and mortality. Methods: A study on the prevalence of hepatitis A, B and D markers among 143 clinically healthy school students was carried out. The students were selected randomly from 4 schools in the city. The subjects provided epidemiological data regarding viral hepatitis and a venous blood sample to determine HBsAg, anti HBc antibody, anti-HBc IgM, anti HAV and anti HDV by the ELISA technique (Abbott Lab.). Results: A total of 93 males and 50 females participated in the study. The mean age was 13.2 years (7-20 y.). Anti HAV was detected in 140 of them (98%). Prior infection by HBV was detected in 117 (82%) and an active infection in 4 of them (2.7%). The rate of HBsAg carriers was 16.0% (23). HDV infection was found in 21 of 117 (17.9%) individuals infected by the HBV. HBV infection and the previous use of injections represented a significant association (OR:3.7 IC 1.3-11, $p < 0.012$). No differences in sex were noted. Conclusion: A high prevalence of HAV, HBV, and HDV was found among school students in Huanta and this was the first report of hepatitis delta in the area. The association of HBV infection and the use of injections was meaningful. The high prevalence of HBV and HDV suggests the existence of a relationship to the morbidity and mortality by hepatitis in Huanta, thus the need for control programs by means of immunization against HBV.

Méndez, 1989

A review was undertaken of 7521 serum samples that had been tested to detect or confirm the presence of different hepatitis A, B, and delta serologic markers. The sources of the samples included a national reference laboratory, several outbreaks of viral hepatitis in civilian and military populations, and a serologic survey. They were examined using the enzyme-linked immunosorbent assay (ELISA). The prevalence of antibody to hepatitis A virus was very high (means = 92.2%), and it was uniform. Prevalence of hepatitis B markers was more variable and inconsistent; it was high in samples from the jungle region of Peru, where the average prevalence of hepatitis B surface antigen (HBsAg) was 4.9%. Antibodies to delta hepatitis were present in 28.6% of the carriers of HBsAg identified in the outbreaks. All the outbreaks had similarities, including a high, cyclic case-fatality rate associated with the delta virus. Hepatitis A is highly endemic in Peru, while hepatitis B has average endemicity. It will be necessary to do more etiologic diagnosis of cases and conduct more research in order to better understand the epidemiology of viral hepatitis in this country.

Kilpatrick, 1986

A serologic survey in 1983-1984 evaluated the presence of hepatitis A antibody (anti-HAV) and hepatitis A immunoglobulin M antibody (anti-HAV IgM) in 3251 adults and 811 children in the jungle and coastal areas of Peru. All subjects were asymptomatic. Adults had a 98% positive anti-HAV rate except for naval cadets, who had a 76% rate. Children had an 82% positive anti-HAV rate, increasing from 30% at one year of age to 100% at eight years of age. Anti-HAV IgM was present in 27% of children one to four years of age who had antibody and was not present in those older than 12. The vast majority of Peruvian adults are immune to hepatitis A, and children with asymptomatic infection play a significant role in the transmission of this disease.

LATIN AMERICA, CENTRAL

(Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Venezuela)

Ljunggren, 1985

The prevalences of hepatitis B virus (HBV), hepatitis delta virus and hepatitis A virus infections were studied in two regions of Colombia. In Bogota, 10 of 53 patients with acute hepatitis were HBsAg positive and three of these were hepatitis D antigen positive. Hepatitis A virus was the major cause of acute hepatitis in this group. In 366 healthy controls from Bogota, 1.6% were HBsAg positive and 7.1% had at least one marker of HBV infection. In northern Colombia, individuals from three villages with outbreaks of the fulminant "hepatitis of the Sierra Nevada de Santa Marta" were tested. The prevalences of HBsAg (1.8 to 23%) and HBV infection (35 to 93%) were generally high and varied from village to village; 60% of the HBsAg carriers in one village were positive for antibody to hepatitis D antigen, and two individuals in the outbreak area had circulating hepatitis D antigen. The findings suggest that HBV and the associated hepatitis delta virus are etiologic factors in the "hepatitis of the Sierra Nevada de Santa Marta."

Villarejos, 1982

The behavior of hepatitis A virus (HAV) infection among 980 members of 230 families in two rural districts of Costa Rica was studied prospectively from the recognition of the index case. The initial prevalence of detectable antibody (anti-HAV) ranged from 26.2% in children to 71.4% in adults. The ratio of index to household-associated infections was significantly higher among children than among adolescents and adults, indicating that children were most often responsible for the HAV introduction. The rates of household-associated cases among susceptible contacts were 70-83%; the final prevalences of anti-HAV were 90-95%. Neither index showed significant differences related to age. The ratio of clinical to silent infections in household-associated cases was uniformly 1.8:1 among children and adolescents; among adults, almost all associated infections were silent. Beginning with the 5-9-year age group, however, an immunoglobulin M response was absent in a progressively larger proportion of inapparent infections, strongly suggesting re-stimulation of specific immunoglobulin G antibodies by re-infection.

Steinberg, 2004

Water and sanitation interventions in developing countries have historically been difficult to evaluate. We conducted a seroepidemiologic study with the following goals: 1) to determine the feasibility of using antibody markers as indicators of waterborne pathogen infection in the evaluation of water and sanitation intervention projects; 2) to characterize the epidemiology of waterborne diarrheal infections in rural Guatemala, and 3) to measure the age-specific prevalence of antibodies to waterborne pathogens. Between September and December 1999, all children 6-36 months of age in 10 study villages were invited to participate. We collected sufficient serum from 522 of 590 eligible children, and divided them into six-month age groups for analysis (6-12, 13-18, 19-24, 25-30, and 31-36 months). The prevalence of antibodies was lowest in children 6-12 months old compared with the four older age groups for the following pathogens: enterotoxigenic *Escherichia coli* (48%, 81%, 80%, 77%, and 83%), Norwalk virus (27%, 61%, 83%, 94%, and 94%), and *Cryptosporidium parvum* (27%, 53%, 70%, 67%, and 73%). The prevalence of total antibody to hepatitis A virus increased steadily in the three oldest age groups (40%, 28%, 46%, 60%, and 76%). In contrast, the prevalence of antibody to *Helicobacter pylori* was relatively constant in all five age groups (20%, 19%, 21%, 25%, and 25%).

Serology appears to be an efficient and feasible approach for determining the prevalence of infection with selected waterborne pathogens in very young children. Such an approach may provide a suitable, sensitive, and economical alternative to the cumbersome stool collection methods that have previously been used for evaluation of water and sanitation projects.

García-Juárez, 2008

Introduction: Twenty years ago, prevalence of Hepatitis A in Mexican children was 90%. Objective: To describe a shift in the prevalence of Hepatitis A virus (HAV) infection and to demonstrate an increment in the age at the first contact with HAV, in a sample of Mexican children. Material and Methods: Reports of antiviral serologic studies collected from 1991 to 2005 from patients attending a pediatric hospital, were reviewed, and those with IgM anti-HAV positive in serum were selected. Age at the moment of acute infection was analyzed. Additionally, a serological survey searching IgG anti-HAV was made in a group of HAV unvaccinated children. Results: From 1708 determinations of IgM, 221 were positive (13%). According to the year of report, five groups were constituted. Mean age by group was: 1991-1993 of 6.4 years, 1994-1996 of 8.0, 1997-1999 of 8.4, 2000-2002 of 8.0 and from 2003-2005 of 10.1 years. In a cohort of 259 unvaccinated children (mean of age 8.59 years), IgG antibodies were detected in 51%. Conclusion: In the infantile population studied a Hepatitis A epidemiology shift is suggested.

Tanaka, 2000

In the past, Latin America was considered to be an area of high endemicity for hepatitis A virus (HAV) infection, with most people infected in early childhood. A seroepidemiological study was recently undertaken in six countries to determine whether this pattern has changed. The highest seroprevalence of antibodies to HAV (anti-HAV) was found in Mexico and the Dominican Republic. Analysis of the different age groups showed that at age 6-10 years, 30% of children in Chile and 54-55% in Brazil, Venezuela and Argentina had been infected, compared with almost 70% in Mexico and 80% in the Dominican Republic. At age 11-15 years, nearly 90% in Mexico and 91% in the Dominican Republic had been infected, compared with 54% in Argentina, 62% in Venezuela, 60% in Brazil and 70% in Chile. By age 31-40 years, over 80% of the populations in all six countries had been exposed to HAV. In all of the countries except Brazil and Venezuela, the seroprevalence of anti-HAV was significantly higher in females than in males. In Mexico, Argentina and Brazil, anti-HAV seroprevalence was significantly higher in the low socioeconomic groups than in the middle/high socioeconomic groups. The results show that there has been a shift from high to medium endemicity of HAV infection throughout Latin America, which may result in more clinical cases in adolescents and adults and a greater potential for outbreaks. The vaccination strategy for hepatitis A should thus be reviewed.

Tapia-Conyer, 1990

In a multicenter study, hepatitis A virus (HAV) seroprevalence was surveyed in six countries in Latin America in which in 12,000 subjects were stratified for age. The highest rates of seroprevalence were recorded in the Dominican Republic (89.0%) and Mexico (81.0%), with lower rates in Brazil (64.7%), Chile (58.1%), Venezuela (55.7%), and Argentina (55.0%). The seroprevalence of HAV in children between 1 and 5 years of age was less than 50%, except in the Dominican Republic. In the 5-10-year-old age group, seroprevalence rates have also decreased compared with previous reports. This suggests that the epidemiology is shifting from high to intermediate endemicity, with the population susceptible to HAV infection shifting from children to adolescents and adults. Furthermore, data from Brazil, Argentina, and Mexico show that HAV seroprevalence is significantly lower in people living in medium and high socioeconomic conditions. This study suggests the need for appropriate vaccination programs to be implemented targeting children, adolescents, and adults, particularly in higher socioeconomic groups.

Redlinger, 1998

Two seroprevalence studies of viral hepatitis A and hepatitis E were conducted in El Paso, Texas, and Ciudad Juárez, Mexico. Subjects were randomly selected, low-income pregnant women. Blood from 557 women in El Paso and 307 women in Ciudad Juárez, obtained from routine prenatal testing, was analyzed for antibodies to hepatitis A and hepatitis E. Women from both cities showed high seroprevalence rates of hepatitis A (75.8% in El Paso and 96.1% in Ciudad Juárez). Rates increased significantly by age, with 100% of women in Ciudad Juárez older than 28 years testing positive. Nationality and ethnicity were significantly associated with hepatitis A seroprevalence: Mexican nationals, 96.1%; U.S. Hispanics, 78.8%; and U.S. Caucasians, 36.4% ($P < .001$). With respect to hepatitis E, 0.4% of women in El Paso and 1.6% of women in Ciudad Juárez tested positive for anti-HEV. The rate of hepatitis A seroprevalence was higher for women with lower educational levels and for women residing in crowded households, but these findings were not statistically significant.

Ramirez Mayans, 1997

We studied by ELISA test 450 healthy children looking for IgG and IgM antibodies against virus A hepatitis. 376/450 (86.3%) showed IgG antibodies. 50% of children under one year were positive. At 3 years of age 80% of children from this study were with antibodies IgG and 96% of children at 10 years of age were positive. Only 9 children showed antibodies IgM.

Ortiz-Ibarra, 1996

Objective: To determine the seroprevalence of hepatitis A, B, C and D virus infection among pregnant women attending a perinatal care hospital. Material and Methods: A prospective study was carried out to determine the seroprevalence of hepatitis A virus IgG antibodies (anti-HAV), hepatitis B virus markers (anti-HBcAg and HBsAg) and hepatitis C virus antibodies (anti-HCV) in pregnant women. In HBsAg positive cases. HBeAg and hepatitis D virus antibodies (anti-HDV) were investigated. All analyses were performed with the ELISA technique. Results: Of the 1500 pregnant women studied. 93.3% were positive for anti-HAV IgG. The HBsAg seroprevalence was 0.26% and anti-HCV seroprevalence was 0.53%. There were no patients with HBeAg or anti-HDV. Conclusions: A higher seroprevalence of HBsAg was found in this study than in other studies of pregnant Mexican women. We propose that HBsAg screening become a routine prenatal test.

Bustamante-Calvillo, 1986

We investigated the epidemiology of hepatitis A in the Guatemalan and Mexican population at the southern border of Mexico. We studied 1127 serum samples to analyze immunoenzymes, looking at total antibodies to hepatitis A virus, specifically IgM, in children less than 5 years old. Of the 764 Guatemalan samples, 756 (98.9%) were positive for hepatitis A and 362 (99%) of the 363 Mexican samples. We found a 100% positivity rate in almost all age groups, with a small percent decline for the group of 1-2 year olds in Guatemalans (87.8%) and Mexicans (93.8%). The median percentage of immunity varied from 90 to 100% in seropositive individuals in both populations. In 47 (25%) of the 186 Guatemalan and Mexican children less than 5 years old, we found anti-HAV IgM. The obtained results indicate that HAV infection is hyperendemic in the study zone, that children acquire infection in the first three years of life, and that the epidemiology of hepatitis A in Mexicans did not change with the arrival of Guatemalan refugees.

Ruiz-Gomez, 1985

The prevalence of antibodies against hepatitis A virus (anti-HAV) was evaluated in sera from 275 asymptomatic infants and children under the age of five years and in 46 maternal-cord serum pairs, followed by sera obtained thereafter each month from the first to the fifth month of life in 29, 17, 9, 9 and 7 infants (a total of 163 serum samples). Anti-HAV was found in all cord blood sera, but its prevalence declined progressively to 0% among 19 infants aged eight months. Four (25%) of 16 children aged one year had positive anti-HAV and the antibody prevalence was 89% in children five years old. Recent hepatitis A infection shown by circulating anti-HAV immunoglobulin M was detected in five infants under the age of two months and with frequencies ranging from 19-67% in one- and five-year-old children. It was concluded that in children living in Mexico City, hepatitis A infections occur at an earlier age and at higher rates than in children in other cities, especially those in developed countries.

Bustamante-Calvillo, 1983

We investigated the prevalence of antibodies to hepatitis A virus and immunoglobulin M en blood samples from children less than 5 years old. All of those less than one month had total antibodies and 23.5% had IgM specifically. The proportion of positive sera diminished gradually: at 8 months all were negative. After that the percentage of children with antibodies rose rapidly: by 5 years of age 89.9% sampled had total protective antibodies and 66.6% had anti-HAV IgM specifically.

Kumate, 1982

(no abstract)

Pérez, 1996

A cross-sectional survey of the seroprevalence of hepatitis A virus (HAV), B (HBV), C (HCV), and E (HEV) antibodies in a healthy population in Leon, Nicaragua was conducted and associated with demographic data. The overall prevalence of antibodies to HAV was 94.6%, to HBV 6.5% and to HEV between 4.6% and 8.0%, whereas none of 399 tested subjects showed confirmed seropositivity to HCV. A high HAV seropositivity rate (72.7%) was observed even in the lowest age groups tested (2-4 years of age). In contrast, HBV and HEV seropositivity was observed mainly in adults, the seroprevalence in > 40-year-old individuals being 15.4% and 17.6%, respectively. The overall mean hepatitis B surface antigen carrier rate was estimated to be 0.9%, and in individuals more than 20 years of age, 2.0%. The prevalence of anti-HAV as well as anti-HEV was significantly higher in people having their water supply outside rather than inside the house. Furthermore anti-HAV seroprevalence correlated with lack of access to a flush toilet. Hepatitis B virus seropositivity was more frequent in people living in a crowded environment than in those living with few household members. These findings indicate that hepatitis A is a childhood infection in Nicaragua and that the spread of the infection is facilitated by poor socioeconomic conditions. In contrast, HBV infection is relatively infrequent in the country and HCV seems to be very uncommon. Hepatitis E virus infection may occur in all age groups and is apparently associated with water-borne transmission.

Albornoz Monque, 1995

In order to find out the variations in the Prevalence of HAV ab and identify the persons who should be vaccinated against Hepatitis A virus, we assessed HAV ab to 200 patients without any occupational risk. They were classified by their socioeconomic status; in the following categoris: High (level I n = 0); Medium-High (level II n = 50); Medium-Low (level III, n = 50); Low (level IV, n = 50); and Very Low (level V, n = 50). The percentage of positivity ofr serum HAV ab was: Level II: 12%, Level III: 18%, Level IV: 38% and Level V: 40%. The difference between levels II and III and between levels IV and V was no significant ($p > 0.05$), but after making a comparation between levels II and III as a group and levels IV V as another one, we found a statistical significant difference ($p < 0.005$). We concluded: There is a bimodal behavior for the prevalence of serum HAV ab in our study: one group with high prevalence (78%) and another one with low prevalence (30%). The massive Vaccination government programs and the vaccionation in particular cases in the daily medical practice should be done after assessing the personal Socioeconomic status in order to improve the use of this tool and achieve a progressive reduction in the morbiditi and high endemicity of HAV in our city.

Pujol, 1994

Viral hepatitis serological markers were analyzed in two groups of pregnant women residing in Caracas from: 1) a maternity unit at the moment of delivery (106 sera, low income population), and 2) a private clinic during the third trimester of pregnancy (105 sera, medium-high economic class population). A higher percent positivity was observed in the maternity unit compared to the private clinic for hepatitis A virus (HAV) as measured by anti-HAV activity (96% vs 48%; $p < 0.01\%$), for hepatitis B virus (HBV) as measured by anti-HBc activity (13% vs 2%; $p < 0.01\%$), but not for HBV carriage, as measured by HBsAg (3.8% vs 0%; $p = 0.06$ %). These differences appear to correlate with the socio-economic level. All the HBsAg positive sera were HBeAg negative and negative for the presence of DNA by PCR, confirming the low rate of perinatal transmission observed in Venezuela. Two out of 106 sera (1.9%) were positive for HCV antibodies in the maternity unit and 0/105 in the private clinic, although these differences were non significant (N.S.). Two out of 106 sera (1.9%) were positive for HEV antibodies in the maternity unit and 1/80 (1.3%) in the private clinic (N.S.). The anti-HEV seropositivity probably reflects a past infection. The importance of testing these viral markers during pregnancy is discussed.

Amesty-Valbuena, 1989

With the purpose of determining the incidence of Hepatitis A virus infection, we determined the presence of antibodies against this virus (anti-VHA) with the ELISA technique in 209 children from Maracaibo city of different socioeconomic levels, ages ranging from 6 months to 12 years. At the same time, we investigated the incidence of a recent infection through IgM antibodies for Hepatitis A (anti-VHA IgM) using the same ELISA technique. We found a global positive incidence of 46.4% for all ages. Individual ages studied showed 31% seropositivity in children less than one year old and a higher seropositivity in children between 9 and 11 years old (50-76.4%). There were noticeable differences in seropositivity in relation to social economic condition observing a higher percentage in children of low social economic level. A recent infection was demonstrated after the second year of life (60%) and a variable percentage through all pediatric ages studied. There was no recent infection detected in children under one year of age which suggests that antibodies anti-VHA obtained transplacentally can last at least for the first year of life as it does with other virus.

LATIN AMERICA, SOUTHERN

(Argentina, Chile, Falkland Islands (Malvinas), Uruguay)

Soria, 2006

The goal of this population-based clinical, biochemical and ultrasonographic study was to assess the prevalence of liver diseases in Lara, a small rural community isolated in the mountain heights of Tucumán, a Province of Argentina with the highest reported rates of HAV infection in children. Inhabitants of Lara lack electricity, potable water and a sewer system. The study included 102 individuals representing 41% of the total population. Anti-HBc and anti-HCV were negative in all cases. No children showed clinical, biochemical or ecographic abnormalities. Among adults, 41% referred alcohol consumption and 12% blood transfusions. Only 3 adults (6%) had mildly elevated ALT. Ultrasound showed steatosis in 8 individuals (16%), gallstones in 7 (14%), parenchymal micro-calcifications in 5 (10%) and parasitic cysts in 4 (8%). Prevalence of HAV infection in Lara was 89% in adults and 35% in children, being significantly lower than that of children of medium/high (53%, p = 0.05) and low (74%, p = 0.0006) socioeconomic level from the city of Tucumán (control groups). These differences were more marked in children aged < 5 years (anti-HAV in 0%, 53% and 75% respectively). Serologic tests for echinoccocal disease were positive in 3/4 individuals with parasitic cysts, 2/5 with micro-calcifications and 17/85 (20%) with normal ultrasound, thus suggesting a high rate of false-positive results of the Elisa test utilized. This study showed that in Lara there is a high prevalence of steatosis, gallstones and equinoccocal disease in adults, absence of HBVand HCV infection and low exposure to HAV in children especially in those aged < 5 years.

Foussal, 2002

The objectives of this study were to analyze the seroepidemiologic prevalence of Hepatitis A Virus (HAV) in children of the city of Resistencia by means of specific antibody detection, relate these data with the socio-sanitary conditions, and discuss vaccine strategies. Two hundred and eighty eight children between 2 and 14 years of age, with a mean of 6.6 years, of both sexes and with no patent liver disease were studied. Blood samples were taken, and the presence of total anti-HAV antibodies was determined. A prevalence of 83.3% was found with no significant differences between sexes. When age groups were compared, antibodies were found in 57.3% of children between 2 and 4 years of age, 90.8% in the 5 to 9 group, and 96.6% in the 10 to 14 group. It was seen that the precarious system of excreta elimination, the lack of potable water in the dwellings, and the absence of sanitary devices, were statistically associated with the high prevalence of HAV infection. In view of the high endemicity found in the first years of life, and considering this disease as a marker of other pathologies with a similar pattern of dissemination, these data may represent the tip of an iceberg holding a broad base of accompanying infections with a high impact in the health of the population. A simultaneous approach towards anti HAV vaccination in young children, and the political decision of improving socio-sanitary conditions and decreasing poverty indexes, should be promptly implemented.

López, 2000

Objective: This study evaluated the seroprevalence of hepatitis A virus (HAV) antibodies in 360 middle-class subjects from Buenos Aires City and its outskirts. Methods: The study population included 360 individuals between 10 and 89 years of age, from the socioeconomic middle class in Buenos Aires City and some suburban areas of Buenos Aires province. Antibodies to hepatitis A virus were determined by enzyme immunoassay test kits. Results: The overall prevalence of HAV antibodies was 42.2%. The highest percentage of seronegativity was found in the subgroup of younger people without a history of symptomatic hepatitis and living in houses with more than one bathroom (86.9%). In the subgroup aged 21 to 60 years, the highest rates of seronegativity were found in individuals with higher level of education living in houses with tap water (66.6%). In both groups, seronegativity may be correlated with a higher socioeconomic status. Conclusions: In the middle-class community studied, more than 50% of people under 30 years of age were unprotected against HAV. Thus, the use of a vaccine against hepatitis A has to be considered for the prevention of symptomatic hepatitis, especially in adults at risk of infection, such as those who travel to areas with poor sanitation, taking into consideration that the severity of the disease increases with age.

Tanaka, 2000

In the past, Latin America was considered to be an area of high endemicity for hepatitis A virus (HAV) infection, with most people infected in early childhood. A seroepidemiological study was recently undertaken in six countries to determine whether this pattern has changed. The highest seroprevalence of antibodies to HAV (anti-HAV) was found in Mexico and the Dominican Republic. Analysis of the different age groups showed that at age 6-10 years, 30% of children in Chile and 54-55% in Brazil, Venezuela and Argentina had been infected, compared with almost 70% in Mexico and 80% in the Dominican Republic. At age 11-15 years, nearly 90% in Mexico and 91% in the Dominican Republic had been infected, compared with 54% in Argentina, 62% in Venezuela, 60% in Brazil and 70% in Chile. By age 31-40 years, over 80% of the populations in all six countries had been exposed to HAV. In all of the countries except Brazil and Venezuela, the seroprevalence of anti-HAV was significantly higher in females than in males. In Mexico, Argentina and Brazil, anti-HAV seroprevalence was significantly higher in the low socioeconomic groups than in the middle/high socioeconomic groups. The results show that there has been a shift from high to medium endemicity of HAV infection throughout Latin America, which may result in more clinical cases in adolescents and adults and a greater potential for outbreaks. The vaccination strategy for hepatitis A should thus be reviewed.

Tapia-Conyer, 1999

In a multicenter study, hepatitis A virus (HAV) seroprevalence was surveyed in six countries in Latin America in which in 12,000 subjects were stratified for age. The highest rates of seroprevalence were recorded in the Dominican Republic (89.0%) and Mexico (81.0%), with lower rates in Brazil (64.7%), Chile (58.1%), Venezuela (55.7%), and Argentina (55.0%). The seroprevalence of HAV in children between 1 and 5 years of age was less than 50%, except in the Dominican Republic. In the 5-10-year-old age group, seroprevalence rates have also decreased compared with previous reports. This suggests that the epidemiology is shifting from high to intermediate endemicity, with the population susceptible to HAV infection shifting from children to adolescents and adults. Furthermore, data from Brazil, Argentina, and Mexico show that HAV seroprevalence is significantly lower in people living in medium and high socioeconomic conditions. This study suggests the need for appropriate vaccination programs to be implemented targeting children, adolescents, and adults, particularly in higher socioeconomic groups.

Gonzalez, 1997

The severity and/or the prognostic of infections with the hepatitis A virus (HAV) is related to the age at which the infection occurs. Since transmission of the virus occurs by the fecal-oral route, the prevalence and age-relate incidence of infection is determined by the adequacy of sanitation hygienic measures and the socio economic level of exposed populations. Thus, the disease is having an increasing impact in developing countries with improving sanitary standards whereas inhabitants of industrialized countries are particularly at risk while visiting under-developed countries. We have established a cooperative group for the serologic study of children range between six months to ten years old, without symptoms of acute hepatitis. The patients live in Buenos Aires, San Justo, Trelew, Rosario and

Tucumán cities. We studied 3699 children. The specific Ab-antiHAV IgG were measured by enzyme immunoassay with commercial available kits (Organon and-or Abbott). The variable of study were age, sex and water quality. RESULTS: 45.19% were of San Justo, 26.15% of Rosario, 13% of Buenos Aires, 8.37% of Trelew and 7.29% of Tucumán. We observed the highest of possibility percentage (%POS) in Tucumán (81.4%), followed by San Justo (57.8%), Rosario (46.5%), Trelew (41.99%) and Buenos Aires (29.4%). In all the cities the lowest %POS was found in children under three years old. Between three and six years old the results were variable and an increase in %POS was observed related to the growth. The global %POS was 51.56%. CONCLUSIONS: This study confirms Argentina as a high endemic country for HAV infection. A global vaccination program is the only strategy that has the potential to prevent recurrent epidemics of hepatitis A and its eradication.

Ibarra, 2006

Background: The seroprevalence of antibodies against hepatitis A virus (HAV) is decreasing in many Latin American countries, along with improvements in sanitary standards. However, there is no information available about low socioeconomic status (LSE) populations. Aim: To assess the evolution of hepatitis A and E virus antibodies in a cohort of LSE Chilean children. Material and Methods: One hundred sixty eight children aged four years, 97 males, coming from public primary care clinics, were studied. Two blood samples were obtained with an interval of one year. Anti-HAV and anti-hepatitis E virus (HEV) antibodies, were detected by ELISA using Abbott kits. Results: Anti-HAV was positive in 19 children (11.3%). After one year of follow-up, only 10 children had sustained reactivity (52.6%). Fourteen children, initially negative, became positive during the follow up (9.4%). Antibody titers to HAV were significantly higher in samples that remained positive, compared with those that lost reactivity. Anti-HEV was found positive in two children (1.2%). One remained positive and the other became negative. Conclusions: In this cohort of LSE Chilean children, the prevalence to antibodies against HAV and HEV is low. Follow-up detected loss of reactivity to HAV in nearly one half of the children, probably related to lower antibody levels.

Fix, 2002

Transition from high to lower endemicity of hepatitis A virus (HAV) infection may portend increased public health burden with the shift of infection to older ages and increasing morbidity and mortality. This report describes age-specific prevalence of antibodies to HAV (anti-HAV) among children and young adults in Santiago, Chile, compared with previous prevalence data and assesses factors predictive for anti-HAV. In 1998, a serosurvey was performed in Metropolitan Santiago, designed to enroll a representative, age-stratified population on the basis of area of residence. A total of 784 individuals (age range, 1-24 years) were enrolled. Anti-HAV prevalence by year of life was as follows: ages 1 to 4, 12.5%; 5 to 9, 26.2%; 10 to 14, 43.4%; 15 to 19, 57.4%; 20 to 24, 73.9%. Adjusting for age, factors associated (inversely) with anti-HAV included residential areas of higher socioeconomic status (SES), parental education, and household characteristics of potable water, municipal sewage system, and the presence of a toilet or refrigerator in the house. In logistic regression analysis, only maternal years of education and residence in areas of higher SES remained independently associated with anti-HAV. Excluding those from higher SES areas, comparison of the age-specific anti-HAV prevalence data from previous studies of similar methodology in areas of lower SES revealed consistent decreases across all age groups; the age-standardized prevalence for this age range (1-24 years) dropped from 53.7% in 1990 to 40.6% in 1998. In light of the growing pool of susceptible individuals at older ages, with HAV continuing to circulate in the communities, evaluation of the feasibility of vaccination programs would be judicious.

Ibarra, 1999

Background: As sanitary and economic conditions improve, the prevalence of antibodies to hepatitis A is now significantly lower. AIM: To evaluate the prevalence of hepatitis A virus antibodies in healthy Chilean adults. Material and Methods: Antibodies to hepatitis A virus were measured, using a commercial ELISA assay, in 215 voluntary blood donors (163 male, aged 19 to 30 years old) and 295 medical students and health personnel (156 male, aged 19 to 39 years old), residing in Valdivia, Chile. Results: Antibodies against hepatitis A virus were found in 68.2% of the total sample (351/510). Ninety percent of blood donors and 54% of health personnel and students were positive ($p<0.01$). Age specific prevalence in blood donors 19 to 22, 23 to 29 and 27 to 30 years old was 81.0%, 95.2% and 95.6% respectively. Among the same age groups in medical students, the prevalence was 47.9%, 53.2% and 61.9% respectively ($p<0.01$). Conclusions: This study indicates a reduction in the prevalence of hepatitis A virus antibodies among adults in Valdivia (Chile). Differences detected between individuals are probably related to different socioeconomic levels. Medical students have an increased risk for hepatitis A infections than the general population.

Lagos, 1999

Background: The epidemiology of hepatitis A virus (HAV) infection is closely associated to the level of hygiene and sanitation of the population. Newly industrializing areas experience a transition from high to intermediate endemicity, which is characterized by a shift in the exposure age to HAV, from early childhood to school ages or adolescence. Aim: To measure the prevalence of HAV antibodies in subjects living in urban Santiago. Subjects and Methods: A HAV antibody survey in five medium and low socioeconomic level urban districts of northern Santiago, was conducted in 1996. Healthy subjects aged 1 to 39 years old were recruited from randomly selected households. Results: Five hundred three subjects were studied. Anti HAV antibodies were found in 13.2, 29.5, 59.6, 78.1, 95.6 and 98.2% of individuals aged 1 to 4, 5 to 9, 10 to 14, 15 to 19, 20 to 29 and 30 to 39 years old, respectively. Conclusions: The profile of positive antibodies is compatible with an intermediate pattern of transmission of HAV. The current data supports the idea that infection is shifting towards older ages. A progressive increase in the number of susceptible school age children and teenagers is propitious for the occurrence of common source hepatitis A outbreaks.

Riedemann, 1998

Background: As sanitary conditions of a population improve, hepatitis A virus infection occurs at higher ages, thus decreasing the prevalence of antibodies against the virus. In the eighties, the prevalence of antibodies among children was 97% and depended on the socioeconomic level. Aim: To assess the prevalence of antibodies against hepatitis A virus in school age children living in Valdivia. Subjects and Methods: Two thousand three hundred thirty three school age children were studied. Total antibodies against hepatitis A virus were detected using an ELISA kit from Abbott. Children were stratified in age groups and school were classified as private, subsidized, municipal or foster homes. Results: Antibodies were positive in 65% of children (59% in children aged 6 to 8 years old, 66% in children aged 9 to 11 years and 69% in children aged 12 to 15 years. In private schools, the prevalence was 26%, in subsidized schools the figure was 54%, in municipal schools 73% and in foster homes 91%. Conclusions: The general prevalence of antibodies against hepatitis A virus is higher in low socioeconomic level children. There is a global decrease in the prevalence of these antibodies in the last years.

Ibarra, 1988

The prevalence of hepatitis A was analyzed in 154 healthy children of pre-mountain range areas of Chile. A socio-sanitary survey was done and the total anti-HAV serum was determined in Pucón and

Chaitén. Socio-sanitary conditions are similar but ruralism is extreme in Chaitén. Positive anti-HAV titers were found in 69.5% of 82 children in Pucón and 47.2% of the 72 children in Chaitén. Prevalence in the age groups 1-4, 5-9, and 10-15 years old was 37.5%, 77.2%, and 86.1% in Pucón as compared to 10.5%, 38.5%, and 81.5% in Chaitén, respectively ($p<0.05$). Multivariate analysis suggests that the prevalence of anti-HAV increased in relation to age, location, and family or school history of hepatitis. The lower prevalence of anti-HAV found in Chaitén may be explained by the high ruralism of that location, with lower contact among children within their families and at school.

Riedemann, 1987

In view of the high prevalence of viral hepatitis in Chile, some epidemiological factors were analyzed in a rural population. Total anti-HAV, total anti-HBc, and HBsAg were determined using the ELISA test (Abbott Laboratories). A total of 227 young and adult "mapuch" Indians who live in Huapi Island (Renco Lake, X Region) were examined. From these, 215 (95%) were found to be anti-HAV reactors. Among adults 99% were anti-HBc negative and the only positive case was HBsAg negative. The highest prevalence of anti-HAV was found in the age groups composed of individuals older than 16 years (99%) and in those between 10 and 15 years of age (98%). There were no differences in relation to sex in any group. The high prevalence of anti-HAV could be related to factors such as rural residence, deficient hygienic and socioeconomic conditions, characteristics of the family, and housing. The prevalence of anti-HAV in this rural area is higher than in other similar urban groups yet without clinical cases or epidemic outbreaks. Hepatitis B virus markers do not play an important role in this group.

Riedemann, 1984

A seroepidemiological study was done for hepatitis A and B in the population of Valdivia, Chile. A total of 95 sera from healthy adults (mean age 37.2 years) picked at random were examined. The group comprised of different housing areas with all socioeconomic levels represented. The following parameters were examined: anti-HAV, anti-HBc, and-HBs, HBsAg, and HBeAg. Elisa kits were used. Anti-HAV was found in 96.9% of the group. Anti-HBs and anti-HBc were found in two sera; two other sera contained anti-HBc and HBeAg, respectively. The high incidence of hepatitis A coincides with previous reports on infectious enterohepatic disease in Chile. Hepatitis B does not seem to be a major problem.

Zacarias, 1981

We determined anti hepatitis A antibodies (anti-HAV) in 524 healthy children from different socio-economic groups and in 73 children with acute viral hepatitis. In the low socio-economic group, 70% of 2-year-olds and 97% of 10-year-olds had a positive anti-HAV titer. This was significantly different from the high socio-economic group, where the corresponding figures were 7% and 41%. The hepatitis A virus was confirmed as the etiologic agent in 91% of the children with hepatitis, the remaining cases being negative for anti-HB and therefore presumed to be due to a non-A, non-B virus.

Cruells, 1997

The hepatitis A and E virus (HAV and HEV) share the fecal-oral mechanism. Hepatitis A is an endemo-epidemic disease in Uruguay but no data on the epidemiologic pattern of the HEV is available. The aims of this study were to update the epidemiologic behavior of the HAV in Montevideo and demonstrate the circulation of the HEV in Uruguay. Two hundred fourteen patients who consulted in the Policlínica de Nutrición y Digestivo were studied, 185 (86%) of whom were anti HAV (HAVAB, Abbot) positive. 81.8% (117/143) of those residents in Montevideo and 95.7% (68/71) of those who were from the inland were anti-HAV positive. From the Montevideo population 55.8% cases under the age of 40 years were anti-HAV positive and occurred in 97.6% of those older ($p < 0.001$). Considering the health care conditions of the positive patients in Montevideo, 95.6% (43/45) had septic chambers and 75.5%

(74/98) disposed of toilet facilities ($p < 0.001$). It is concluded that although the global prevalence has been maintained since 1982, there is a change in the epidemiologic pattern with greater risk of infection in patients under the age of 40 years proceeding from areas without toilet facilities. The prevalence of total antibodies for HEV (EIA, Abbot) was 2.8% in this population. An association was observed with HAV in 2.2% (4/185). Moreover, a sample of 252 blood donors from the National Blood Service was analyzed with 5 being found to be anti HEV positive, with only 3 (1.2%) being confirmed in the Center for Disease Control in the United States. Although no definitive conclusions may be drawn from the present study, from an epidemiologic point of view, it has been shown that there is evidence of the circulation of HEV in Uruguay, in both the out patient and in blood donor populations.

LATIN AMERICA, TROPICAL
(Brazil, Paraguay)

Matos, 2009

This study was conducted to estimate the prevalence and molecular epidemiological features of viral hepatitis A, B and C in the Kalunga population, which represents the largest Afro-Brazilian isolated community. Among 878 individuals studied, the overall prevalence of anti-hepatitis A virus antibodies was 80.9%, with a significant rise from 44.8% to near 100% between the first and fourth decade of life. Rates for hepatitis B surface antigen (HBsAg) and antibody to hepatitis B core antigen (anti-HBc) of 1.8% and 35.4%, respectively, were found. Increasing age, male gender, illiteracy and history of multiple sexual partners were associated with hepatitis B virus (HBV) infection. An occult HBV infection rate of 1.7% (5/295) was found among anti-HBc-positive individuals. HBV genotype A (subtype Aa) was dominant in this community. Only 5/878 individuals (0.6%) were positive for anti-hepatitis C virus (HCV). HCV RNA was detected in three of them, who were infected with genotype 1 (subtype 1a). These findings point out high, intermediate and low endemicity for hepatitis A, B and C, respectively, in the Kalunga community in Brazil. Circulation of HBV genotype A (subtype Aa) in this Afro-Brazilian isolated community indicates the introduction of this virus during the slave trade from Africa to Brazil.

de Alencar Ximenes, 2008

Background: The objectives were to estimate the prevalence of hepatitis A among children and adolescents from the Northeast and Midwest regions and the Federal District of Brazil and to identify individual-, household- and area-levels factors associated with hepatitis A infection. Methods: This population-based survey was conducted in 2004-2005 and covered individuals aged between 5 and 19 years. A stratified multistage cluster sampling technique with probability proportional to size was used to select 1937 individuals aged between 5 and 19 years living in the Federal capital and in the State capitals of 12 states in the study regions. The sample was stratified according to age (5-9 and 10- to 19-years-old) and capital within each region. Individual- and household-level data were collected by interview at the home of the individual. Variables related to the area were retrieved from census tract data. The outcome was total antibodies to hepatitis A virus detected using commercial EIA. The age distribution of the susceptible population was estimated using a simple catalytic model. The associations between HAV infection and independent variables were assessed using the odds ratio and corrected for the random design effect and sampling weight. Multilevel analysis was performed by GLLAMM using Stata 9.2. Results: The prevalence of hepatitis A infection in the 5-9 and 10-19 age-group was 41.5 and 57.4%, respectively for the Northeast, 32.3 and 56.0%, respectively for the Midwest and 33.8 and 65.1% for the Federal District. A trend for the prevalence of HAV infection to increase according to age was detected in all sites. By the age of 5, 31.5% of the children had already been infected with HAV in the Northeast region compared with 20.0% in the other sites. By the age of 19 years, seropositivity was approximately 70% in all areas. The curves of susceptible populations differed from one area to another. Multilevel modeling showed that variables relating to different levels of education were associated with HAV infection in all sites. Conclusion: The study sites were classified as areas with intermediate endemicity area for hepatitis A infection. Differences in age trends of infection were detected among settings. This multilevel model allowed for quantification of contextual predictors of hepatitis A infection in urban areas.

de Souza, 2007

Background: Human herpesvirus type 8 (HHV-8) is hyperendemic in Amerindian populations, but its modes of transmission are unknown. Methods: Antibodies against either HHV-8 lytic antigen or HHV-8 latency-associated nuclear antigen (LANA) were detected, by immunofluorescence assays, in 339 Amerindians and 181 non-Amerindians from the Brazilian Amazon. Serological markers of oro-fecal (hepatitis A), parenteral (hepatitis B and C), and sexual (herpes simplex virus type 2 and syphilis) transmission were measured by specific ELISAs. Salivary HHV-8 DNA was detected by use of a nested polymerase chain reaction assay and was sequenced. Results: Antibodies against either lytic antigen or LANA were detected in 79.1% of Amerindians and in 6.1% of non-Amerindians (adjusted seroprevalence ratio [SR], 12.63 [95% confidence interval {CI}, 7.1-22.4]; p<0.001). HHV-8 seroprevalence increased with age among Amerindians (p(trend)<0.001) and already had high prevalence in childhood but was not sex specific in either population. The 2 populations did not differ in seroprevalence of oro-fecal or parenteral markers, but seroprevalence of markers of sexual transmission was lower among Amerindians. HHV-8 DNA in saliva was detected in 47 (23.7%) of 198 HHV-8 seropositive Amerindians. Detection of HHV-8 DNA decreased with age (p(trend)<0.04) and was more common in men (SR, 2.14 [95% CI, 1.3-3.5]; p=0.003). A total of 36 (76.6%) of the 47 saliva HHV-8 DNA samples were sequenced, and all clustered as subtype E. Conclusion: The data support the hypothesis of early acquisition and horizontal transmission, via saliva, of HHV-8 subtype E in Amerindian populations.

Lafer, 2007

A seroprevalence study to detect total antibodies against Hepatitis A Virus was done with 220 samples from 589 Native Indians from Xingu National Park, Brazil, in five Kaiabi and Kuikuro villages, the most populous ethnic groups. Using a commercial immunoassay kit we detected 97.7% positive samples (95% Confidence Interval: 95%-99%). We noticed a precocious seroconversion, before the age of six years, when the disease is usually asymptomatic. These results are similar to those found in the literature in non-Indian population studies of the Northern, Northeastern and West Central regions of Brazil. They suggest that it is not necessary to introduce vaccination against Hepatitis A in these highly endemic populations.

Kozlowski, 2007

To investigate hepatitis A virus (HAV) infection rates among isolated African-descendant communities in Central Brazil, 947 subjects were interviewed about demographic characteristics in all 12 isolated Afro-descendant communities existing in the state of Mato Grosso do Sul, Central Brazil, between March 2002 and November 2003. Blood samples were collected and sera were tested for HAV antibodies (total and IgM anti-HAV) by enzyme-linked immunosorbent assay. The overall prevalence of HAV infection was 75.6% (95% CI: 72.7-78.3), ranging from 55.4 to 97.3%, depending on the communities studied. The prevalence of anti-HAV increased significantly with age, from 13.8% in the age 0-5 age group to 96.6% in those older than 40 years. The findings point out an intermediate endemicity of HAV infection in some Afro-Brazilian isolated communities in Central Brazil. In addition, the high proportion of susceptible young subjects could be target of future HAV vaccination programs.

Almeida, 2006

In the village of Cavunge, located in a dry tropical, semiarid rural region of the state of Bahia, Brazil, a sentinel study on viral hepatitis is underway. We report on the first part of the study. The objective of this study was to determine the prevalence of serological markers for hepatitis A, B and C in the village. Cross sectional study. Blood samples were tested for serological markers of hepatitis A (HAV), B (HBV) and C (HCV) through ELISA-III assay. In HBsAg and anti-HCV carriers, HCV-RNA and HBV-DNA were checked by PCR. The prevalence of anti-HAV IgG was 83.3% (1,210/1,452), being higher among residents from the village (87.4%) than in residents from the rural area (79.5%); it also higher among individuals older than 10 years of age. The prevalence of HBsAg was 2.6% (38/1,476), 9.3% anti-HBc (137/1,476) and 10.5% (155/1,476) anti-HBs of. In more than half (58.1%; 90/155) of anti-HBs carriers, this was the only serological marker found. In 3.7% of the population, (55/1,476), anti-HBc was the only serological marker found. All HBV carriers were infected by genotype A. Only 0.4% (6/1,536) presented anti-HCV antibodies and only one of them was viremic, being infected with genotype 1. The prevalence of patients with antibodies against hepatitis A virus in the village of Cavunge was high, but the prevalence of B virus was moderate, with only genotype A among HBV carriers. The prevalence of C virus was very low, contrasting with the situation in large Brazilian urban centers.

Morais, 2006

A cross-sectional study was conducted in order to identify hepatitis A virus (HAV) serological markers in 418 individuals (mean age, 16.4 years; range, 1 month-80 years) at a public child care center in Rio de Janeiro, Brazil, as well as to analyze risk factors and determine circulating genotypes. Serum samples were tested using an enzyme immunoassay. Reverse transcription polymerase chain reaction (RT-PCR) was used to detect and characterize HAV RNA, and sequencing was performed. Anti-HAV antibodies and IgM anti-HAV antibodies were detected, respectively, in 89.5% (374/418) and 10.5% (44/418) of the individuals tested. Acute HAV infection in children was independently correlated with crawling ($p < 0.05$). In 56.8% (25/44) of the IgM anti-HAV-positive individuals and in 33.3% (5/15) of the IgM anti-HAV-negative individuals presenting clinical symptoms, HAV RNA was detected. Phylogenetic analysis revealed co-circulation of subgenotypes IA and IB in 93.3% (28/30) of the amplified samples. In present study, we verify that 79% (30/38) of children IgM anti-HAV-positive were asymptomatic. In child care centers, this asymptomatic spread is a more serious problem, promoting the infection of young children, who rarely show signs of infection. Therefore, vaccinating children below the age of two might prevent the asymptomatic spread of hepatitis A.

Bortoliero, 2006

A cross-sectional study was carried out among 996 volunteer blood donors enrolled from May 1999 to December 1999 to determine the seroprevalence of hepatitis E virus (HEV) infection among volunteer blood donors of the Regional Blood Bank of Londrina, State of Paraná, Brazil, and to evaluate whether the rate of seroprevalence of IgG anti-HEV antibodies is associated with sociodemographic variables and with seropositivity for hepatitis A virus (HAV) infection. All participants answered the questionnaire regarding the sociodemographic characteristics. Serum samples were tested for IgG antibodies to HEV (anti-HEV) by an enzyme linked immunoassay (ELISA). All serum samples positive for anti-HEV IgG and 237 serum samples negative for anti-HEV were also assayed for IgG anti-HAV antibodies by ELISA. Anti-HEV IgG was confirmed in 23/996 samples, resulting in a seroprevalence of 2.3% for HEV infection, similar to previous results obtained in developed countries. No significant association was found between the presence of anti-HEV IgG antibodies and the sociodemographic variables including gender, age, educational level, rural or urban areas, source of water, and sewer system ($p>0.05$). Also, no association with seropositivity for anti-HAV IgG antibodies was observed ($p>0.05$). Although this study revealed a low seroprevalence of HEV infection in the population evaluated, the results showed that this virus is circulating among the population from Londrina, South Brazil, and point out the need of further studies to define the clinical and epidemiological importance of HEV infection and to identify additional risk factors involved in the epidemiology and pathogenesis of this infection in this population.

Dinelli, 2006

The prevalence of hepatitis A virus (HAV) antibodies was assessed in adolescents (age ranging from 10.4 to 19.9 years) at an Adolescent Outpatient Clinic in São Paulo, Brazil. Anti-HAV was detected in 137 (54.2%) out of 253 individuals. When separated into two age groups, anti-HAV frequency was higher in the 15 to 19 year-old group (64%) in comparison to the 10 to 14 year-old group (46%) (Chi-square test: p = 0.004). These results suggest that adolescents in São Paulo are at risk of hepatitis A infection and are probably contracting HAV infection during this age period.

Almeida, 2006

In Cavunge community, a rural village of the dry tropic in Bahia State, Brazil, a sentinel study on viral hepatitis was developed to characterize the seroprevalence of hepatitis A. The presence of IgG anti-HAV was analyzed in 891 citizens and 85.9% were positive. The prevalence was similar between genders and increased with age.

Zago-Gomes, 2005

This report describes the prevalence of anti-HAV antibodies in children from elementary school in the Municipality of Vila Velha, ES, Brazil. Anti-HAV antibodies were investigated by ELISA method in the serum of 606 children (four to fourteen years old) from three elementary schools, located in neighborhoods with varying household monthly income levels: São José School, 200 children, household income higher than US$700; São Torquato School, 273 children, US$200 to 300; and Cobi School, 133 children, less than US$200. From each children data on age, gender, skin color, sanitary conditions, frequency of contact with sea or river water and family history of hepatitis were recorded. Anti-HAV antibodies were present in 38.6% of all children, 9% in São José School, 49.1% in São Torquato School and 61.7% in Cobi School. Logistic regression analysis demonstrated a positive correlation of positive anti-HAV test with age, non white color of the skin, absence of sewage treatment and domestic water filter, and a past history of hepatitis. The prevalence of anti-HAV antibodies in school children in Vila Velha, ES, was lower than that observed in the same age group in North and Northeast Brazil and was significantly higher in children from families with low socioeconomic status. In addition the results indicate a changing epidemiologic pattern of hepatitis A in our country, with an increasing number of children and adolescents with high risk for HAV infection, mainly in high socioeconomic class. A consideration must be given to the feasibility of vaccination programs for children and adolescents in our country.

Moreira, 2005

Aim: To investigate whether *Helicobacter pylori* (*H. pylori*) infection is associated with hepatitis A virus (HAV) infection, presence of enteroparasites, and other surrogates of fecal exposure. Methods: We conducted a cross-sectional study in 121 children consecutively admitted at a pediatric hospital in Salvador, Brazil. *H. pylori* and HAV infection were identified by the presence of serum antibodies. Stool specimens were examined for the presence of ova and parasites. A structured questionnaire inquiring about sanitary conditions and life style was applied to each subject. Results: Fifty-one of the 121 children (42.1%) were found to be seropositive for *H. pylori*, and 45 (37.2%) for HAV. The seroprevalence of *H. pylori* and HAV both increased significantly with age. Cross-tabulation of data showed that 26 (21.5%) were seropositive and 51 (42.1%) were negative for both *H. pylori* and HAV antibodies (chi(2) = 7.18, OR = 2.8, CI 1.30-5.97). The age adjusted OR for an HAV-infected child being H pylori positive was 2.3 (CI 1.02-5.03). The agreement between *H. pylori* and HAV seropositivity was fair (kappa = 0.24). After controlling for possible confounding, the variables remaining independently associated with seropositivity to *H. pylori* were age, presence of Giardia lamblia in feces (OR = 3.2, 95%CI, 1.1-9.5) and poor garbage disposal quality (OR = 2.4, 95%CI, 1.1-5.1). Conclusion: Our data suggest that *H. pylori* infection is associated with surrogate markers of fecal exposure. Thus, we conclude that the fecal-oral route is relevant in the transmission of HP among children in an urban setting of a developing country. The association observed between *G. lamblia* and *H. pylori* infection may have several explanations. Further studies to investigate this relationship are warranted.

Luiz, 2003

Objectives: The objective of this study was to analyze the relation between residence water access (water taps) and hepatitis A virus (HAV) antibodies, associated with socio-economic, environmental and demographic factors. Methods: A logistic regression model was used for estimating the relation between residential water access (presence of water taps inside the house) and HAV antibodies, related to confounding effects of selected variables. The odds ratios estimated by the model were used as incidence density ratios (IDR) for the analysis of the water access-antibody association. Data were obtained from a cross-sectional study on the seroprevalence of hepatitis A in 3779 volunteers from Duque de Caxias city, greater Rio de Janeiro, Brazil. Participants were selected according to an age-specified random sampling survey. Results: Besides water access (main variable of interest), age, monthly family income, housewife schooling, persons per room, proximity to open sewage channels and consumption water treatment were statistically associated to hepatitis A seroprevalences. An interaction between water access and proximity to open sewage channels was detected. Persons living in residences distant from an open sewage channel had a water access-antibody IDR of 2.5 (95% CI [1.4; 4.3]), in contrast to 1.1 for those living close to such channels. Conclusions: Although indirectly measured through the proxy variable water access, personal hygiene, in conjunction with the absence of open sewage channels in the proximity of the residence, was an important factor for low HAV seroprevalence study population.

de Almeida, 2002

The objective of this work was to assess the intensity of transmission of hepatitis A in Rio de Janeiro, Brazil. We also used the estimation of the parameters of a deterministic model to study the effects of risk factors. Age-specific seroprevalence of antibodies against hepatitis A virus (HAV) was obtained from a survey screening in a city of the metropolitan area of Rio de Janeiro, in 1997. From the seroprevalence data, we estimated the age-dependent force of infection (lambda) and the average age of first infection (A), using a deterministic model. To evaluate the influence of the environmental risk factors, we estimated the same parameters stratifying the sample for the selected socio-environmental risk factors: the number of years of schooling of the female responsible for the house, crowding within the bedroom, number of water taps and fittings, and the presence of sewage in front of the house. For the whole sample, the maximum force of infection estimated was 0.12/year and the average age of infection was 10.1 years. This last parameter decreased as the number of persons per bedroom increased, and also when the number of water taps and the number of years of schooling of the woman responsible for the house decreased. The proposed environmental interventions may lead to a decrease in the intensity of transmission of HAV and an increase in the average age of first infection in the next few years. This may have public health implications, since hepatitis A is more severe in adults. In this context, specific vaccination programs may be necessary, as in developed countries.

Ferreira, 2002

The high incidence of hepatitis A and B in institutionalized patients with Down Syndrome (DS) is not fully understood. Under poor hygienic conditions, immunological alterations might predispose individuals to these infections. Sixty three DS children between 1 and 12 years old living at home with their families were examined for anti-HAV and compared to age-matched controls (64 healthy children). This cross-sectional study was carried out from May 1999 to April 2000 at the Hospital de Clínicas of

Porto Alegre, southern Brazil. Groups were compared in terms of age, sex, skin color, and family income (>R$500 and <R$ 500/month) by the chi-square test, with Yates' correction and for the prevalence of anti-HAV (Fisher's exact test). In the DS group (n=63), the mean age was 4.4 ± 3.3 years, 94% of the patients were white and 51% were female. Family income was ≤R$500/month in 40 cases (63%). In the control group (n=64), the mean age was 4.8 ± 2.7 years, 81% of the patients were white and 56% were female. Family income was ≤R$500 in 20 patients (31%). DS children's families had a significantly lower income (p<0.001). In the DS group there were 6 positive (9.5%) anti-HAV cases, and all came from low-income families (less than R$500/ month). In the control group, 3 cases (4.7%) were positive for anti-HAV (two were from a low-income family and one was from a higher income family). These differences were not significant. Our data indicate that Hepatitis A is not a special risk for mentally retarded DS outpatients, even in a developing country like Brazil.

Gaze, 2002

Total HAV and HBc seroprevalence rates in two socioeconomic groups in Macaé, Rio de Janeiro State, Brazil, were estimated in 1,100 surplus serum samples from routine laboratory tests identified by sex, age, neighborhood, and category of medical care, i.e., the public health system or National Unified Health System (SUS) as compared to private health services (NSUS). Seroprevalence rates by age, 95% confidence intervals, and statistical significance tests for differences between SUS and NSUS are presented. Distribution of seroprevalence rates for total HAV (88.8%; 95% CI = 86.8-90.6) and total HBc (15.3%; 13.2-17.6) by age showed an ascending curve. Prevalence rates in the SUS group were significantly higher that in the NSUS group, for both HAV (chi2 = 31.15; p<0.001) and HBV (chi2 = 15.41; p<0.001). The high prevalence rates reflect the epidemiological pattern of HAV infection in developing countries and the relevance of the social and environmental context. The proportion of susceptible individuals in the <5 and >20 year groups highlights the need to vaccinate for hepatitis A and the potential increase in severe cases. High HVB prevalence among adolescents underscores the importance of vaccinating this group. The results serve as a reminder to health professionals concerning biosafety norms.

Santos, 2002

We investigated the seroprevalence of hepatitis A virus (HAV) and hepatitis E virus (HEV) infection in subjects living in the community of Manguinhos, Rio de Janeiro, Brazil, and assisted at the Health Unit of Escola Nacional de Saúde Pública, Fundação Oswaldo Cruz. After formal consent, individuals were submitted to an interview using a standardized questionnaire. Anti-HAV and anti-HEV antibodies were detected by ELISA. Statistical analysis was carried out using the Epi-Info 6.04b software, to investigate possible associations between serological markers and risk factors. Results were regarded as significant when p<0.05. Although a high prevalence of anti-HAV was observed (87%), almost 50% of subjects under the age of 10 were susceptible to HAV infection, an unexpected rate in endemic areas. This fact could be attributed to improvements in environmental sanitation, occurring in this area in the last years. The increasing proportion of susceptible people may result in outbreaks of HAV infection, since the virus still circulates in this area, as verified by the detection of anti-HAV IgM in some individuals. No statistical association was met between HAV infection and the risk factors here assessed. The anti-HEV IgG prevalence found in this population was 2.4%, consistent with the one found in non-endemic areas.

Lewis-Ximenez, 2002

A seroprevalence study was carried out among a group of women in Rio de Janeiro to determine the prevalence of different markers for viral hepatitis given the limited data among healthy populations. Blood samples collected and tested from 874 women before or after delivery in a public county maternity hospital demonstrated age to be directly related to markers for hepatitis A virus and hepatitis B virus (HBV) infection. The prevalence of HBV and hepatitis C virus infection were lower than that observed in the blood donor population and might be explained by the younger age group and gender.

Assis, 2002

The prevalence of antibodies to hepatitis A anti-HAV total and E viruses anti-HEV IgG was assessed in 487 children ranging from 2 to 9 years old who were students of nurseries and public schools in a county of the Amazonian region, in Mato Grosso State, Brazil. The anti-HAV and anti-HEV prevalence were 86.4% (CI95% 83.0-89.3) and 4.5% (CI95% 2.9-6.9), respectively. The anti-HAV prevalence was high in all ages, suggesting that this is an area of high endemicity for HAV infection. There was no association between the anti-HAV markers and gender, socioeconomic level, parental educational level, hygienic conditions, number or density of residents per room or schools in which they studied. Anti-HEV prevalence was low and similar to that found among adults in other Brazilian regions.

de Paula, 2001

The western region of the Brazilian Amazon Basin has long been shown to be a highly endemic area for hepatitis B and hepatitis D viruses. Data concerning the prevalence of hepatitis C and E viruses in this region are still scarce. In this study we investigated the presence of hepatitis A, B, C, D and E viruses infection in communities that live along the Purus and Acre rivers in the states of Acre and Amazonas within the Amazon Basin. A total of 349 blood samples were collected and tested for hepatitis A-E serological markers (antibodies and/or antigens) using commercial enzyme linked immunosorbent assays. Anti-HCV positive sera were further assayed by an immunoblot. HBsAg positive sera were subtyped by immunodiffusion. The overall prevalence for hepatitis A, B, C, and E were 93.7%, 66.1%, 1.7%, and 4%, respectively. A very high prevalence of delta hepatitis (66.6%) was found among HBsAg positive subjects. Hepatitis A, B and D viruses were shown to be largely disseminated in this population, while hepatitis C and E viruses infection presented low prevalence rates in this region. The analysis of risk factors for HBV infection demonstrated that transmission was closely associated with sexual activity.

Almeida, 2001

A serological study of hepatitis A was carried out in low-income areas scheduled for a major sanitation program in Rio de Janeiro, Brazil. Blood spots were collected by finger puncture and transported on filter paper, and total antibodies to hepatitis A virus were detected by ELISA. Households were also interviewed to collect information on their environmental conditions and socio-economic status. A generalized linear model using a complementary log-log function was fitted to the data, using the logarithm of age as an explanatory variable to derive adjusted rate ratios (RR). The risk of infection was greater among households with 2-3 members per room (RR = 1.4; 95% CI = 1.04-1.8) or more than three per room (RR = 1.5; 95% CI = 1.2-2.0). People living on hilltops (RR = 1.5; 95% CI = 1.02-2.2), near to open sewers (RR = 1.2; 95% CI = 1.03-1.5) or lacking a kitchen (RR = 1.4; 95% CI = 1.08-1.9) were also at greater risk than others. The number of taps and water-using fittings in the house was associated with a protective effect (RR = 0.9 for each tap; 95% CI = 0.9-0.98). A significant protective association was found with maternal education but not with gender or household income. The results do not suggest a strong association with water quality. Ownership of a ceramic water filter was associated with a protective effect on the margin of significance, but the practice of boiling drinking-water was not, nor was the type of water source used. The results suggest that that the risk of infection with hepatitis A is determined by environmental variables in the domestic and public domains.

Niel, 2001

TT virus (TTV) is an unenveloped virus with a single-stranded, circular DNA genome of 3,818-3,853 nucleotides (nt) that infects humans and non-human primates. Recently, the existence of a novel human virus, TTV-like mini virus (TLMV), that shows a genetic organization similar to that of TTV, but with smaller virion particle and genome, was proposed [Takahashi et al. (2000) Archives of Virology 145:979-993]. To date, no information is available with respect to the prevalence and pathogenicity of TLMV. A sensitive PCR assay was developed by using two oligonucleotide primers (LS2 and LA2) designed from the conserved non-coding region of the TLMV genome. One hundred thirty-seven sera from volunteer Brazilian blood donors were tested and 99 (72%) were TLMV DNA positive. No significant differences were observed between the groups of TLMV positive and negative subjects in relation to sex ratio, seroprevalence of TTV DNA, prevalence of anti-hepatitis A virus antibodies, area of residence, occurrence of daily contact with animals, family income, education level, and level of alanine aminotransferase. The specificity of the PCR assay was demonstrated after cloning of amplification products and determination of the nucleotide sequences (200-228 nt) of clones derived from 23 individuals. When DNAs extracted from TLMV/TTV-coinfected sera were submitted to PCR with LS2 and LA2 primers, the amplification products were derived exclusively from the TLMV genome. A markedly wide range of sequence divergence, even higher than that existent among TTV strains, was noted among TLMV isolates, with a maximum evolutionary distance of 0.80.

Trinta, 2001

A retrospective study on the prevalence of hepatitis E virus (HEV) infection was conducted in selected populations in Rio de Janeiro, Brazil. A total of 1115 subjects were tested including 146 patients with acute Non-A Non-B Non-C (NANBNC) viral hepatitis, 65 hemodialysis patients, 93 blood donors, 102 intravenous drug users (IVDUs), 304 pregnant women, 145 individuals living in the rural area and 260 individuals living in the urban area. In order to characterize a favorable epidemiological set for enterically transmitted infection in the studied populations we also evaluated the prevalence of anti-HAV IgG (hepatitis A virus) antibodies. Specific antibodies to HEV (anti-HEV IgG) were detected by a commercial EIA and specific antibodies to HAV (anti-HAV IgG) were detected using a competitive "in house" EIA. We found a high prevalence of anti-HAV IgG in these populations, that could indicate some risk for infections transmitted via the fecal-oral route. The anti-HEV IgG prevalence among the different groups were: 2.1% in patients with acute NANBNC viral hepatitis, 6.2% in hemodialysis patients, 4.3% in blood donors, 11.8% in IVDUs, 1% in pregnant women, and 2.1% in individuals form the rural area. Among individuals living in the urban area we did not find a single positive serum sample. Our results demonstrated the presence of anti-HEV IgG in almost all studied populations; however, further studies are necessary to establish the real situation of HEV epidemiology in Rio de Janeiro, Brazil.

Saback, 2001

The prevalence of antibodies directed against the enterically transmitted hepatitis A virus (HAV) was measured in 2 groups of people living in Rio de Janeiro, Brazil. Of 1056 health care workers (HCWs), 778 (73.7%) were anti-HAV positive. A high prevalence of anti-HAV antibodies (85.7%) was also found among 274 voluntary blood donors (BDs). TT virus (TTV) is a DNA virus that has been found in the sera of patients with post-transfusion hepatitis of unknown etiology. Occurrence of virus shedding suggests that the fecal-oral route may be an important mode of TTV transmission, particularly in the developing world. The presence of TTV DNA was analyzed by PCR in the sera of 191 HCWs and 151 BDs. TTV was detected in 65.4% of HCWs and 79.5% of BDs. In both groups, a family income of < US$400 per month and a level of education of < 11 y of schooling were found to be risk factors for HAV infection. Furthermore, a low family income was associated with TTV viremia in the HCW group. However, the presence of TTV DNA was associated with neither low level of education nor anti-HAV positivity.

Clemens, 2000

The prevalence of antibodies to hepatitis A and B virus was assessed in 3,653 subjects across four regions of Brazil. The anti-HAV and anti-HBc seroprevalence were 64.7% and 7.9%, respectively. The highest anti-HAV (92.8%) and anti-HBc (21.4%) rates were seen in the Northern region. In other regions, anti-HAV seroprevalence over 90% was only reached in the more elderly, indicating an intermediate endemicity and a significantly higher anti-HAV prevalence was seen in the low socioeconomic group between 1-30 years. With respect to anti-HBc seroprevalence an increase was seen in adolescents and there was a significantly higher anti-HBc prevalence in the lower socioeconomic group between 1-20 years. A 3.1% anti-HBc prevalence was seen in one-year-old infants, suggesting a vertical transmission. The major findings of this study indicate that the pre-adolescent and adolescent populations in some Brazilian cities are at greatest risk from both hepatitis A and B infection, but for different reasons.

Tanaka, 2000

In the past, Latin America was considered to be an area of high endemicity for hepatitis A virus (HAV) infection, with most people infected in early childhood. A seroepidemiological study was recently undertaken in six countries to determine whether this pattern has changed. The highest seroprevalence of antibodies to HAV (anti-HAV) was found in Mexico and the Dominican Republic. Analysis of the different age groups showed that at age 6-10 years, 30% of children in Chile and 54-55% in Brazil, Venezuela and Argentina had been infected, compared with almost 70% in Mexico and 80% in the Dominican Republic. At age 11-15 years, nearly 90% in Mexico and 91% in the Dominican Republic had been infected, compared with 54% in Argentina, 62% in Venezuela, 60% in Brazil and 70% in Chile. By age 31-40 years, over 80% of the populations in all six countries had been exposed to HAV. In all of the countries except Brazil and Venezuela, the seroprevalence of anti-HAV was significantly higher in females than in males. In Mexico, Argentina and Brazil, anti-HAV seroprevalence was significantly higher in the low socioeconomic groups than in the middle/high socioeconomic groups. The results show that there has been a shift from high to medium endemicity of HAV infection throughout Latin America, which may result in more clinical cases in adolescents and adults and a greater potential for outbreaks. The vaccination strategy for hepatitis A should thus be reviewed.

Tapia-Conyer, 1990

In a multicenter study, hepatitis A virus (HAV) seroprevalence was surveyed in six countries in Latin America in which in 12,000 subjects were stratified for age. The highest rates of seroprevalence were recorded in the Dominican Republic (89.0%) and Mexico (81.0%), with lower rates in Brazil (64.7%), Chile (58.1%), Venezuela (55.7%), and Argentina (55.0%). The seroprevalence of HAV in children between 1 and 5 years of age was less than 50%, except in the Dominican Republic. In the 5-10-year-old age group, seroprevalence rates have also decreased compared with previous reports. This suggests that the epidemiology is shifting from high to intermediate endemicity, with the population susceptible to HAV infection shifting from children to adolescents and adults. Furthermore, data from Brazil, Argentina, and Mexico show that HAV seroprevalence is significantly lower in people living in medium and high socioeconomic conditions. This study suggests the need for appropriate vaccination programs to be implemented targeting children, adolescents, and adults, particularly in higher socioeconomic groups.

Saback, 1999

TT virus (TTV) is an unenveloped, single-stranded DNA virus that was discovered recently in the sera of Japanese patients with post-transfusion hepatitis of unknown etiology. A high prevalence of TTV infection in blood donors of several countries, including Brazil, has been demonstrated. To study the variation in TTV prevalence between different age groups, sera from 223 individuals without liver disease, aged 0-80 years, were tested by the polymerase chain reaction for the presence of TTV DNA. All subjects were inhabitants of the city of Rio de Janeiro, Brazil. The prevalence increased continuously with age (P <.001), from 17% among children under the age of 11 years, to 57% in people older than 50 years. To assess vertical transmission, sera from 105 unselected, consecutive parturient women attending a public maternity hospital were paired with cord bloods and examined for the presence of TTV DNA. Thirty-seven (35%) mothers were found to be TTV infected. Seven cord bloods were also positive, suggesting the possible transplacental transmission of the virus. Furthermore, a direct correlation between TTV viremia and presence of antibodies to the enterically transmissible hepatitis A virus (HAV) was observed in this group of women, with a relative risk of TTV infection of 5.09 (95% confidence interval 0.76-34.03) for women with anti-HAV, compared with women without. This finding suggested that the fecal-oral route might be an important route of TTV transmission.

Struchiner, 1999

Background: To assess the impact of water sanitation and sewage disposal, part of a major environmental control program in Rio de Janeiro, we carried out sero-prevalence studies for hepatitis A virus (HAV) in three micro-regions in Rio de Janeiro. Each region varied with regard to level of sanitation. We are interested in assessing the discriminating power of age-specific prevalence curves for HAV as a proxy for improvement in sanitation. These curves will serve as baseline information to future planned surveys as the sanitation program progresses. Methods: Incidence rate curves from prevalence data are estimated parametrically via a Weibull-like survival function, and non-parametrically via maximum likelihood and monotonic splines. Sera collected from children and adults in the three areas are used to detect antibodies against HAV through ELISA. Results: We compare baseline incidence curves at the three sites estimated by the three methods. We observe a strong negative correlation between level of sanitation and incidence rates for HAV infection. Incidence estimates yielded by the parametric and non-parametric approaches tend to agree at early ages in the micro-region showing the best level of sanitation and to increasingly disagree in the other two. Conclusion: Our results support the choice of HAV as a sentinel disease that is associated with level of sanitation. We also introduce monotonic splines as a novel non-parametric approach to estimate incidence from prevalence data. This approach outperforms current estimating procedures.

Pinho, 1998

To evaluate the prevalence of antibodies against hepatitis A in two socioeconomically distinct populations, 101 and 82 serum samples from high and low socioeconomic groups, respectively, were analysed for the presence of IgG anti-HAV using a commercial ELISA. The prevalence in low socioeconomic level subjects was 95.0%, whereas in high socioeconomic subjects was only 19.6% (p<0.001). These data show a duality in Brazil: anti-HAV prevalence in low socioeconomic subjects is similar to that of developing countries, while in high socioeconomic subjects, a pattern typical of developed countries is found. The control of this infection in our country is primarily related to the improvement of sanitation, but especially for high socioeconomic level populations, the use of vaccination against hepatitis A is strongly advisable to avoid the occasional appearance of this disease in adults.

Vitral, 1998

The age-specific prevalence of antibodies to hepatitis A virus (anti-HAV) was determined in two different population groups with low socio-economic status from Rio de Janeiro city, Brazil, whose serum samples were collected 17 years apart (Population 1, 1978; Population 2, 1995). In Population 2, analysis of the anti-HAV prevalence was also carried out with respect to environmental factors. Population 1 was composed of 520 stored sera collected from the umbilical cord of term neonates and children aged 1 month to 6 years. In population 2, 720 serum samples were collected from children and adolescents with ages ranging from 1 to 23 years. The overall prevalence rate of anti-HAV in Population 1 and Population 2 was 65.6% and 32.1%, respectively. In Population 1, the anti-HAV prevalence reached 88% at the age of 3, while in Population 2, it increased from 4.5% in children under the age of 3 to 66% in the group of adolescents over the age of 14. The low exposure to HAV infection in younger children from Population 2 could be a result of improved environmental hygiene and sanitation, as demonstrated by the presence of piped water, waste and sewage disposal systems in most houses from this population group. These findings indicate a possible change in the prevalence of hepatitis A in Rio de Janeiro.

Black, 1986

Antibody to hepatitis A in an Amerindian tribe was found in everyone over 50 years old but in no one younger. We suggest that the tribe had become infected with hepatitis A virus during the period, about 50 years earlier, when they engaged in raids on Luso-Brasilian settlers, that the virus failed to persist in the tribe when they withdrew into isolation, and that those who had been infected maintained antibody titers without boosting since that time.

Sutmoller, 1982

An excess of hepatitis cases, in the research center of Petrobrás located in the Fundão Island, within the city of Rio de Janeiro, was notified during the second half of March 1980. In recent years this center has had an average of four cases per year, but between March 5 and April 25, sixteen cases were reported. The cause and probable sources of infection were investigated. A serologic diagnosis of hepatitis A was made by showing IgM antibodies against this virus in patients. No subclinical cases among a group of 60 healthy employees could be identified. A questionnaire was circulated to investigate a possible common source of infection. Evaluation of the water supply system indicated that it had recently been contaminated. Information obtained from other medical services in the island failed to reveal that the episode was part of a larger outbreak.

Ferreira, 1998

(no abstract)

Quieróz, 1995

A seroepidemiologic survey about hepatitis A virus (HAV) infection was carried out in a group comprising 310 children, ranging in age from 3 months to 9 years, from day-care centers, in Goiania, a middle sized city in the central region of Brazil. The biomarkers employed in the investigation of previous infection include total IgG and IgM anti-HAV antibodies, and for the detection of more recent infection, IgM anti-HAV antibodies were analyzed. The study was performed in 1991 and 1992. According to the results, 69.7% of the children presented total IgG/IgM anti-HAV antibodies, with 60% of the group in the age range of 1 to 3 years. Among 10 day-care centers analyzed, the prevalence of the biomarker IgM anti-HAV was 3.2%, with an uniform distribution of the cases in the group of children ranging in age from 1 to 4 years. Multivariate analysis was performed to investigate the socio-demographic factors that could influence the results. It was verified that the risk for the infection increased with the length of the attendance in the day-care centers, i.e., the risk for children with attendance of one year or more was 4.7 times higher, when compared with children with one month attendance (CI 95% 2.3-9.9). According to the results, hepatitis A is an endemic infection in day-care centers in the study area. The length of attendance in the day-care settings was demonstrated to be a risk factor for the HAV infection. Such findings suggest that if hepatitis A vaccination becomes available as a routine policy in our region, the target group should be children under one year. Moreover, those children should receive the vaccine before they start to attend the day-care centers.

Abuzwaida, 1987

Hepatitis B markers were determined in 397 individuals from Niterói and 680 from Nova Iguaçú and prevalences of 9.1% (1.0% of HBsAg and 8.1% of anti-HBs) and 11.1% (1.8% of HBsAg and 9.3% of anti-HBs) were found, respectively. The comparative prevalence of both markers in relation to age showed a higher prevalence of HBsAg in the group 21-50 years old. Considering the anit-HBs antibody, it was demonstrated a gradual increase with age, reaching 14.9% in Niterói and 29.1% in Nova Iguaçú in individuals over 51 years old. For hepatitis A, in 259 samples from Niterói, equally distributed by age groups, an overall prevalence of 74.5% of anti-HAV antibodies were found. This prevalence increases gradually reaching 90.5% of antibodies at age over thirty. In 254 samples from Nova Iguaçú analyzed, a prevalence of 90.5% of antibodies was encountered when the same criteria of distribution were used. This level of prevalence reached 90.0% already in the age over ten years old. The tests were performed by enzyme immunoassay with reagents prepared by our laboratory.

NORTH AFRICA / MIDDLE EAST

(Algeria, Bahrain, Egypt, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Morocco, Occupied Palestinian Territory, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, Turkey, United Arab Emirates, Western Sahara, Yemen)

Hamdi-Cherif, 1986

The results show that infection occurs very early in life and that as of 10 years of age all the population is immunized against this virus. The results of this study exclude intervention of the HAV agent in viral hepatitis of waterborne origin in adults.

Khalfa, 1984

Viral hepatitis is endemoepidemic in Algeria. Recent serologic and epidemiological surveys have specified the importance of A, B and non A non B viruses respectively and brought out some details. -- Hepatitis A is very common: 96% of individuals have anti-HAV antibodies. Patients come into contact with the virus before the age of 10. No symptoms are found in 95% of cases. Icteric hepatitis occurs in infants. Hepatitis B infection includes 40 to 50% of icteric hepatitis in adults. Clinical and biological symptoms are similar to those described in the literature. The prevalence of HBs Ag carriers is within the range of 1.8 to 2.8%, but reach high level in Eastern and Saharan Regions of Algeria. It increases with age and low socio-economic status. In hospital environment, laboratory technicians and room servants is the most frequently contaminated personnel. Non-A non-B hepatitis is so far the least known in Algeria. In 1981, an epidemic of water-borne non-A non-B hepatitis was reported.

Al-Aziz, 2008

We determined the seroprevalence of hepatitis A virus antibodies (HAV Ab) among 296 Egyptian children aged 2.5-18 years of different social classes to ascertain whether to give HAV vaccine early in life or to leave children to acquire natural immunity. Overall 61.4% were seropositive for HAV Ab. There was a significant increase in the seroprevalence of HAV Ab with higher age and lower social class; in children aged < 6 years, 72.7% of high and 19.0% of low social class were seronegative for HAV Ab. A national vaccination program for HAV is not a priority. We recommend vaccination against hepatitis A for high social class children at the preschool period without testing for HAV. Vaccination for middle social class children can be done, but only after testing for HAV.

Salama, 2007

To determine seroprevalence of anti-hepatitis A virus (HAV) antibodies and potential risk factors for and age of contracting symptomatic hepatitis A infection among children of different socioeconomic status (SES) in Cairo, we carried out a cross-sectional study on 426 children aged 3-18 years from low SES areas and 142 from high SES areas. Seroprevalence was significantly higher with age. Seropositivity to anti-HAV antibodies was significantly higher among children of low and very low SES, 90%, compared to children of high SES, 50%. Water supply and sewage disposal were the most significant risk factors for HAV seropositivity in children of low SES. Children of high SES were more likely to be vulnerable to infection in adolescence than those of low SES.

Omar, 2000

Hepatitis A virus (HAV) immunity in a group of socially and economically deficient preschool children in Alexandria has been investigated. A total of 228 randomly selected children were enrolled. Saliva was collected from every child using a cotton wool swab. Anti-HAV was investigated in the collected saliva by a competitive ELISA technique utilizing a commercially available kit. The results revealed that among the investigated children 60 (26.3%) were anti-HAV positive. The mean age of anti-HAV positive children was 4.43 years ± 0.21 years. Ten (33.3%) couples were siblings, 2 (3.3%) children gave a positive history of jaundice. As regards housing conditions; 34 (56.7%) of anti-HAV positive children had indoor sources of water supply and 26 (43.3%) had outdoor ones. The mean crowding index was 3.35 ± 1.72. Positive anti-HAV was significantly more prevalent among older ($P < 0.05$) and among female children ($p<0.02$). In conclusion, the routine administration of hepatitis A vaccine, combined with improvements in sanitation should reduce the incidence of acute illness and complications associated with the disease thereby decreasing the spread of HAV in developing countries.

Darwish, 2001

Residents of Egypt's Nile river delta have among the world's highest seroprevalence of hepatitis C virus (HCV) infection. To assess the impact of HCV on chronic liver disease, we studied the association between HCV, other hepatitis viruses, and cirrhotic liver disease in a cross-sectional, community-based survey of 801 persons aged ≥10 years living in a semi-urban, Nile delta village. Residents were systematically sampled using questionnaires, physical examination, abdominal ultrasonography and serologically for antibodies to HCV (confirmed by a third-generation immunoblot assay) and to hepatitis A virus (HAV), hepatitis B virus (HBV), and hepatitis E virus (HEV). The seroprevalence of HCV increased with age from 19% in persons 10-19 years old to about 60% in persons 30 years and older. Although no practices that might facilitate HCV transmission were discovered, the seroprevalence of HCV was significantly associated with remote (>1 year) histories of schistosomiasis. Sonographic evidence of cirrhosis was present in 3% (95% CI: 1%-4%) of the population (0.7% of persons under 30 years of age and in 5% of older persons), and was significantly associated with HCV seroreactivity. Our findings are consistent with the hypothesis that past mass parenteral chemotherapy campaigns for schistosomiasis facilitated HCV transmission, and that HCV may be a major cause of the high prevalence of liver cirrhosis in this Nile village.

Darwish, 1996

Hepatitis C virus (HCV) infection is hyperendemic in Egypt, with seroprevalence rates of 10-20% among volunteer blood donors, and even higher rates reported among segments of the general population. We attempted to confirm the high seroprevalence of HCV and to compare it with the age-specific seroprevalence rates for hepatitis A, hepatitis B, and hepatitis E among 155 non-randomly selected residents of a semiurban village in the Nile River delta. Of the two orally transmitted viruses (HAV and HEV), all 1-3-year-old children had been infected by HAV and the seroprevalence rate of 100% persisted until age 67. In contrast, HEV infections were not detected until children were 4-9-years old, and the 57% seroprevalence rate in this age group did not increase appreciably in older age groups. Of the two parenterally transmitted viruses, HBV was first detected in 1-3-year-olds, whereas HCV was first detected later, in 10-19-year-olds. The seroprevalence rates of both viruses increased progressively with age, peaking in the 40-67-year-old group at 66% for HBV and at 51% for HCV. The number of persons who had only one infection, or no infection at all, was too small to allow meaningful statistical analysis of serologically pure groups infected only by HBV, HCV, or HEV. The results of this pilot study revealed extraordinarily high seroprevalence rates of HBV, HCV, and HEV in this village, and distinctive age-specific seroprevalence rates suggesting different patterns of transmission.

Kamel, 1995

The seroendemicity of hepatitis E virus (HEV) in an entire village population located in the Egyptain Nile Delta is described. Serum specimens were obtained from 68% of the total population of

1,850 villagers. The lack of serum specimen was greatest in the youngest age group (< 5). Commercially available enzyme immunoassays (EIA) for antibody to hepatitis A virus (anti-HAV), to hepatitis B virus core antigen (anti-HBc), to second-generation hepatitis C virus (anti-HCV) core and nonstructural antigen, and to hepatitis E virus (HEV) were used. Only repeated reactive sera were coded as positive. Stool specimens were examined for *Schistosoma mansoni* by the Kato method and standard methods for the examination of the liver and spleen by ultrasonography were used. Unadjusted for non-response, the seroprevalence of anti-HEV was 17.2% (SE +/- 1.1). Anti-HEV seroprevalence increased by age and was not associated statistically with any of the other viral markers including HCV. Anti-HAV seroprevalence was consistently > 95%, even in the youngest age group (< 5). The overall sero-endemicity of HEV was higher than reported elsewhere and appears not to have been introduced into the village population recently.

Ataei, 2008

Introduction: Hepatitis A infection is caused by the hepatitis A virus (HAV). Improved sanitary conditions have resulted in a significant decline in the incidence of hepatitis A. There is inadequate data about the epidemiology of this infection in Iran. Therefore, this study was carried out to evaluate the anti-HAV seroprevalence in Isfahan Province in Iran in 2006. Methods: In a cross-sectional study, 816 subjects over 6 years from urban and rural areas of the Isfahan Province in 2006 using the multi-stage cluster sampling method were selected. Demographic data and blood samples were collected and anti-HAV antibodies were measured by ELISA. Chi-square, odds ratio and logistic regression tests were used for statistical analysis and a p value<0.05 was considered significant. Results: The subjects of this study included 428 female and 388 male subjects. The overall anti-HAV seroprevalence rate was 8.33%. There were statistical differences between HAV seropositivity in districts of Isfahan province; the highest seropositivity was seen in Borkhar and Meimeh (28.6%) (p<0.001). There was no significant difference in HAV seropositivity between the subjects grouped according to demographic factors. Conclusoin: HAV seroprevalence in Isfahan province is not high that can caused by improved sanitary conditions. More studeis in other parts of Iran are needed to set new strategy for post exposure prophylaxis and hepatitis A vaccination.

Nassrolahei, 2004

(no abstract)

Mehr, 2004

Background: Hepatitis A is an enterically transmitted disease that still remains endemic in many developing countries. In some countries improvements in living conditions have recently led to changing in epidemiology of hepatitis A virus (HAV) infection. In our country there are very few reports on prevalence of HAV infection. Objective: To determine the seroprevalence of anti-HAV IgG among children visited in pediatric hospitals of Tehran, Iran. Methods: The study group included 1018 children who were 6 months-14.9 years of age. These children were visited in four major pediatric hospitals of Tehran. The children were separated to three age groups: Group 1 (6 months-4.9 years; n=469), Group 2 (5.0-9.9 years; n=290), and Group 3 (10.0-14.9 years; n=259). Serum anti-HAV IgG was tested with commercial ELISA kits. The data were tested for statistical significance with chi2 test. Results: In all subjects, seroprevalence of hepatitis A was 22.3% (95% CI: 19.7, 24.9). There was no significant difference between genders (22.2% vs. 22.5% in males and females, respectively) and among age groups (Group I was 22.1% and Group 3 was 25.9; p>0.05). Conclusions: In summary, it seems that HAV infection is not highly endemic at least in some urban areas of Iran. On the basis of this epidemiologic data, post exposure prophylaxis would be necessary for children and young adults, and hepatitis A vaccination strategy should be revised.

Farzadegan, 1980

Our studies revealed that the incidence of viral hepatitis in Iran is more common than in the western countries. Although the incidence of hepatitis type A in the region is not thoroughly investigated, our first report on this disease in our region reveals an almost complete immunity among adults after 30 years of age. The incidence of HBsAg among our voluntary blood donors is 3.5%. If it is assumed that the incidence rate in the whole country is also 3.5%, then it is possible that there are one million HBsAg carriers among 35 million Iranians. These carriers constitute a major health problem in Iran. There is a good possibility that the HBsAg incidence rate in the other countries of the region is similarly high. Therefore it is highly recommended that control and preventive measures such as third generation HB testing of donated blood and blood products become mandatory. All HBsAg positive donors should be interviewed and informed that their blood contains an infectious agent and this must be carefully considered at the times of bleeding. Other high risk groups such as hemodialysis patients and staff and hemophiliacs also should be investigated as possible candidates for HB vaccination.

Chironna, 2003

Background: Since little is known about the burden of viral hepatitis in Kurds, the prevalence of infection with hepatitis A virus (HAV), hepatitis E virus (HEV), hepatitis B virus (HBV), and hepatitis C virus (HCV) was investigated in a sample of refugee Kurds from Iraq and Turkey. Patients and Methods: A cross-sectional study was carried out. Serological markers to hepatitis viruses were determined for 1,005 subjects from all age-groups of which 36.6% were from Turkey and 63.4% from Iraq. Results: Overall seroprevalence for anti-HAV was 94.4% and 14.8% for anti-HEV. A significantly higher prevalence for anti-HEV was found among Iraqis (17.5%) compared to Turkish immigrants (10.0%). The prevalence of hepatitis B surface antigen (HBsAg) and total anti-HBc (core) was 6.8% and 35.6% in Turkish Kurds and 2.2% and 12.7% in Iraqis, respectively. Only 10% of children aged up to 10 years and 2.8% of subjects aged 11-20 years had been vaccinated against HBV, the majority of them coming from Iraq. One subject was confirmed as positive for anti-HCV (0.1%) and HCV-RNA and analysis showed a 4c/4d genotype. Conclusion: This survey shows a high prevalence of enterically transmitted viral hepatitis in Kurds. HBV infection is moderately endemic, while the prevalence of HCV infection is low. There is a need for a universal immunization strategy for HBV in the Kurd population.

Toukan, 1988

Healthy residents of three remote villages and urban areas of Jordan, as well as patients presenting with acute hepatitis, were assessed for seroprevalence of hepatitis A virus (HAV) infection. HAV infection increased with age, and almost full saturation of the population by anti-HAV was attained in the first five years of life. 13% of acute hepatitis cases were due to hepatitis A, and most of these cases were children. Hepatitis A infection is, therefore, predominantly a disease of younger people in Jordan.

Alkhalidi, 2009

Aim: To find the current seroepidemiology of hepatitis A virus (HAV) in Kuwait. Methods: A total of 2851 Kuwaitis applying for new jobs were screened. Results: HAV-positive cases were 28.8%; 59% were males and 41% were females. The highest prevalence was in the Ahmadi area. High prevalence was among the group of non-educated rather than educated parents. This is the first study in Kuwait demonstrating the shifting epidemiology of HAV. Conclusion: This study reflects the need of the Kuwaiti population for an HAV vaccine.

Bizri, 2006

Background: The epidemiologic association between Helicobacter pylori and hepatitis A virus (HAV) has been evaluated by various different groups with conflicting conclusions. The aim of the present study was to determine the prevalence of HAV and *H. pylori* infection among adolescents attending high schools in Lebanon, and to identify the sociodemographic factors associated with their prevalence, individually and concurrently. Methods: Nine hundred and two school students 14-18 years of age were selected randomly from 30 schools scattered all over Lebanon and tested for IgG antibodies against hepatitis A and *H. pylori*. Each student received a copy of a self-administered questionnaire to be completed by his/her parents inquiring about demographics, history of immunization, and prior viral hepatitis illness in the student. Bivariate analysis examined the association between different sociodemographic variables and prior HAV or *H. pylori* infection, and multivariate regression analysis was done to determine the factors independently associated with prior infection. Results: Using ELISA the seroprevalence of antibodies against HAV was 71.3% as compared to 61.6% for anti-*H. pylori*. A total of 9.1% of those tested were negative for both agents. A multinomial regression analysis revealed that place of residence in relation to district or urban versus rural areas, in addition to mothers' education, were important determinants for the incidence of both agents. Conclusion: The low number of subjects negative for both *H. pylori* and HAV antibodies in Lebanon is indicative of their high prevalence in the country. It is possible that this high prevalence reflects an age-specific prevalence rather than a true association.

Sacy, 2005

In this multicenter study in Lebanon, hepatitis A virus (HAV) seroprevalence rates were surveyed by age, gender, and socioeconomic factors. Blood samples collected from 606 subjects aged 1 to 30 years were analyzed for anti-HAV IgG. Age was the most important factor influencing HAV seroprevalence. HAV seroprevalence rates in the current study were about 78% in the ≥21 years age group, 28% in the 6-10 years age group, and 11% in the 1-5 years age group as compared with 97.7% in adults, 85% in children aged 6-12 years, and 40% in children aged 1 to 5 years in previous studies, demonstrating a shift in HAV seroprevalence from the younger to the higher age groups. In light of the severity of the disease in adults and availability of safe and effective vaccines against HAV infection, introduction of HAV vaccination into the national immunization schedule of Lebanon should be considered.

Shamma’a, 1982

A comparative seroepidemiologic survey was performed on the prevalence of antibody to HAV (anti-HAV) in 772 subjects in Lebanon. The results show that 97.7% of the adult Lebanese carry anti-HAV in their sera irrespective of geographic or socioeconomic factors, as compared to 38.8% of the adult foreign population. In the pediatric group, the highest prevalence of anti-HAV was encountered at the age of 1-120 days indicating placental transfer of maternal anti-HAV. In the 1-5 year age group there is a sharp drop of anti-HAV to 40%. The anti-HAV of this age group indicates a response to actual infection with HAV. At 12 years the prevalence of anti-HAV is 85%, approaching that of adults. This survey indicates that Lebanon is an endemic area for HAV infection. The age of onset of this infection may be as early as five months, is commonest in the 1-6 year age group and becomes rare again after the age of 12. Finally, fractionation of immunoglobulins of test sera demonstrated that all subjects had their anti-HAV activity in the IgG class, denoting either maternal transfer or old infection and acquired immunity.

Nejmi, 1984

(no abstract)

Yassin, 2001

In Palestine, there has been an increase in the reported incidence of acute hepatitis A virus (HAV) infection since 1995. Since overt clinical disease occurs only among adults, questions were raised whether or not a shift in the epidemiology of HAV has occurred. This is generally characterized by a decrease in the overall incidence rate and a shifting in the mean age of infection towards adolescence and early adulthood. The need for a vaccination program is being discussed. To resolve this issue, we examined the prevalence of anti-HAV in a representative sample of 396 school children in the Gaza Strip. The prevalence of anti-HAV was 93.7% (95% CI: 91.3, 96.1%). Stratifying the prevalence by age showed that 87.8% (95% CI: 78.6, 97%) were HAV antibody positive by the age of 6. By the age of 14, almost 98% (95% CI: 92.7, 100%) were HAV antibody positive. This means that the majority of HAV infection is still taking place in early childhood, when it is usually asymptomatic and of little clinical significance. The results refuted the shifting epidemiology theory and we recommend that a vaccination program against HAV infection is not yet needed. Alternative explanations for the increase in reported cases are discussed.

Al Faleh, 2008

Aim: To determine the seroprevalence of Hepatitis A (HAV) amongst Saudi children and compare it with previously reported prevalence data from the same population. Methods: A total of 1357 students were randomly selected between the ages of 16 and 18 years (689 males and 668 females) from three different regions of Saudi Arabia (Madinah, Al-Qaseem, and Aseer) and tested for anti-HAV-IgG. Results: The overall prevalence of anti-HAV-IgG among the study population was 18.6%. There was no difference between males and females but there was a significant difference in the seroprevalence ($p<0.001$) between the three different regions, with Madinah region showing the highest prevalence (27.4%). When classified according to socioeconomic status, lower class students had a prevalence of 36.6%, lower middle class 16.6%, upper middle class 9.6%, and upper class 5.9% ($p<0.001$). Comparing the current study results with those of previous studies in 1989 and 1997 involving the same population, there was a marked reduction in the overall prevalence of HAV from 52% in 1989, to 25% in 1997, to 18.6% in 2008 ($p<0.001$). Conclusions: Over the last 18 years, there has been a marked decline in the prevalence of HAV in Saudi children and adolescents. The current low prevalence rates call for strict adherence to vaccination policies in high-risk patients and raises the question of a universal HAV vaccination program.

Almuneef, 2006 (ICHE)

Objective: To determine the prevalence of the vaccine-preventable diseases caused by varicella, measles, rubella, and hepatitis A and B viruses in a multinational healthcare workforce. Design: Prospective cohort study. Setting: A 750-bed tertiary care center located in Riyadh, Saudi Arabia. Methods: In compliance with hospital policy, newly recruited healthcare workers (HCWs) were enrolled in the study from September 2001 to March 2005. Serum samples were collected from all HCWs during the initial hiring process and tested for IgG antibodies against each of the 5 viral agents. Non-immune HCWs were subsequently vaccinated at the earliest opportunity. Results: A total of 4,006 newly hired (international and local) employees were included in the study. All underwent serologic testing for IgG antibodies against varicella, measles, rubella, hepatitis A, and hepatitis B viruses. Of the total, 63% were female and 37% were male. Middle Eastern employees comprised 47% of the total, followed by employees from the Far East (35%), the West (10%), and Africa (8%). 42% were nurses, 27% were in administration, 18% were medical technicians, and 13% were physicians. Among the 4,006 newly hired HCWs, 14% had negative IgG antibody test results for varicella virus, 13% for measles virus, 10% for rubella virus, 33% for hepatitis A virus, and 43% for hepatitis B virus. More women than men were susceptible to hepatitis A (40% vs. 24%; $P<.001$), whereas more men were susceptible to hepatitis B

(55% vs. 35%; p<0.001). Varicella susceptibility was more common among HCWs from the Far East (19%), whereas susceptibility to measles, rubella, hepatitis A, and hepatitis B was highest among HCWs from the Middle East. Both relative youth and male sex were associated with lack of antibodies against hepatitis B virus and rubella virus. In contrast, female sex and younger age were associated with lack of antibodies against hepatitis A virus (P<.001). Conclusion: Seroprevalence surveys of vaccine-preventable diseases among HCWs, although labor intensive, are invaluable in caring for a multinational workforce.

Jaber, 2006

Objective: To determine the seroprevalence of antibodies to hepatitis B virus (HBV) and hepatitis A virus (HAV) among children in Jeddah, Kingdom of Saudi Arabia (KSA) and to evaluate the need of anti-HAV mass vaccination. Methods: This study was carried out on random samples of schools located at different regions in Jeddah, KSA during the year 2004. A total of 527 sera, (285 males and 242 females), collected from children aged (4-14 years) were tested for anti-hepatitis B surface (antigen) (HBsAb) and anti-HAV viruses antibodies by enzyme linked immunosorbent assay technique. Results: Approximately 98% of children received HBV while 49% of received HAV vaccine. For HBV the overall seropositivity was 75% while HAV was 28.7%, whereas seronegativity was 14% for HBV and 70.5% for HAV. Percentage of seropositivity against HBV was elevated in vaccinated versus non-vaccinated children (p<0.001). In vaccinated children against HBV, percentage of seropositivity was elevated in children attending public versus those attending private and no schools (p<0.001) and in Saudi versus non-Saudi children (p<0.05). In vaccinated and non-vaccinated children against HAV, percentage of seropositivity was elevated in children attending public versus those attending private schools (p<0.001) and no schools (p<0.000) and in males (p<0.05) versus females (p<0.01). In vaccinated children, percentage of seropositivity for HBV obtained by age range from 4-6 years was 78.7%, for 7-11 years 74.4% and for 12-14 years 72.6%, whereas for HAV virus, seropositivity was 14.8% for 4-6 years, 38.3% for 7-11 years and 28.6% for 12-14 years. Conclusion: Despite successful coverage of mass vaccination against HBV among school aged children, in Jeddah, KSA, there are high prevalence levels of seronegative with increasing age suggesting outbreak of disease among adolescent. Low prevalence of protective antibodies against HAV in vaccinated and non-vaccinated children may suggest application of mass vaccination program.

Almuneef, 2006 (Vaccine)

This study aims to determine the seroprevalence of Hepatitis A among a selected group of Saudi children and thus, identify the best immunization strategy. A school-based seroprevalence study in children 4-18 years of age attending the National Guard schools was done. Of the 25,531 children attending the National Guard schools, 2399 (10%) were randomly selected through a stratified one-stage cluster survey. The overall prevalence of HAV-IgG was 28.9%. The prevalence was almost the same in male and female (28.2% versus 29.5%, respectively). There was a gradual increase in the HAV-IgG with 7% in children (< 8 years), 14% (8-11 years), 30% (12-15 years), and 52% (> 16 years) of age. Since a substantial proportion of this pediatric population confirms a continuing decrease in anti-HAV seroconversion rates, we recommend including Hepatitis A in the schedule of routine childhood vaccinations.

Fathalla, 2000

Objective: To record and update the sero-epidemiological status of hepatitis A virus in Eastern Saudi Arabia. To investigate the main viral etiology of clinical hepatitis in children and discuss the possibility of introducing a hepatitis A virus vaccine in this Province. Methods: Examining serum specimens by Enzyme Linkage Immuno-Sorbet Assay technique for these parameters: Immunoglobulin M anti-hepatitis A virus, total immunoglobulin anti-hepatitis A virus, and in selected cases we checked for hepatitis B surface antigen and anti-hepatitis C virus. The study was carried out in the Virology Diagnostic Labs, of Dammam Regional Laboratories & Blood Bank, Dammam. A total of 12,357 serum samples were collected from 5876 healthy children, 5798 healthy adults, and 683 from clinically diagnosed hepatitis in children. The period of study was 12 years from February 1987 to January 1999. Results: Hepatitis A virus prevalence showed 3% for pre-school age, 80% in older children and 93% in adults, while total prevalence was 86%. Breaking down the prevalence among children showed 3% in the <6 years age group, 62% in the 6 to <8 years age group, 71% in the 8 to <10 years age group, 83% in the 10 to <12 years age group and 93% in the 12 to <18 years age group. While the grand total among children was 78%. The prevalence of hepatitis viruses causing clinical hepatitis in children showed: 65% for hepatis A virus, 21% for hepatitis B virus, 7% for hepatitis C virus, 2% for double infection of hepatitis B virus + hepatitis C virus and 5% for non A, non B, non C. Conclusion: Hepatitis A virus infection starts dramatically high in school-age children, and then rises gradually with an increase in age. This reflects that our region is of pattern I class. There is no difference in the prevalence due to seasons of year, climate or sex. Hepatitis A virus is the leading cause of clinical hepatitis in children, followed by hepatitis B virus and hepatitis C virus. There is a possibility of starting to introduce hepatitis A virus vaccine among pre-school age children, as well as among hepatitis A virus negative adults that live in a higher socioeconomic environment within the country, which can be considered as islands of pattern II among pattern I areas.

Memish, 2001

A seroprevalence study of hepatitis A virus (HAV), hepatitis B virus (HBV), and varicella-zoster virus (VZV) was carried out among Saudi Arabian National Guard soldiers with the objective of determining the cost-saving potential of prevaccination antibody tests when implementing an immunization program for the soldiers. A systematic sampling of 450 blood samples from 1,350 soldiers who donated blood at our hospital was carried out. Antibody tests were performed using the enzyme-linked immunosorbent assay method. The seropositivity rates for antibodies to HAV, HBV, and VZV were 97.5, 17.8, and 88.5%, respectively. Comparing the cost of pre-vaccine screening with that of universal vaccination, it was estimated that savings of 76 and 32% could be effected for HAV and VZV. Conversely, screening for HBV before immunization could increase the cost of vaccinating against the disease by 49%. A seroprevalence study could be a useful cost-saving approach to a mass immunization program against endemic, natural immunity-conferring diseases.

Khalil, 1998

The prevalence of anti-HAV antibody in children was tested in subjects presenting at clinics in Riyadh, Saudi Arabia. A blood sample was taken to test for the presence of IgG (indicating past infection) and a questionnaire concerning personal and epidemiological data relating to hepatitis A was completed. In total, 592 children aged 6 months to 15 years were suitable for the analysis. There were 179 subjects who were positive for HAV (30.2%). The proportions of subjects positive for HAV varied significantly with age ($p=0.001$); 32%-49% in the 7-15 age range were positive compared with 13-20% aged 6 and below. There was a significant association between a positive HAV test and social level ($p=0.044$), with a higher proportion positive in the low social level. Children with jaundice, personal history of jaundice or travel abroad were significantly more likely to be HAV positive ($p=0.001$, $p=0.006$, $p=0.021$, respectively). There was also a significant association with nationality ($p=0.022$), where the lowest proportion of HAV positive children were Saudi Arabian (28%). Compared to previous studies, there is a significant decrease in the HAV exposure in Saudi children with shift from high to intermediate pattern. National strategy for prevention should be evaluated.

Al Rashed, 1997

HAV is endemic in Saudi Arabia, with about 90% of the adult population having positive anti-HAV. A population-based survey of hepatitis B virus markers provided an opportunity to determine the age-related prevalence of anti-HAV among Saudi children and examine some of the factors that influence its transmission in the community. The overall prevalence of anti-HAV is 52.4% of 4375 children tested. There was no significant difference in HAV prevalence between males and females (51.3% vs. 53.5%). The age-specific rates, which were similar in both sexes, indicated the lowest rate in infants with a steady increase in the older age group. There was a marked regional variation in anti-HAV prevalence, the Eastern region showing the lowest prevalence (38.4%), while the Northwestern region showed the highest prevalence (67%). In nearly all the regions, rural inhabitants had a higher prevalence than urban residents. Socioeconomic factors had a significant correlation with the prevalence of anti-HAV, with the level of education of parents having the strongest influence on HAV prevalence. The high overall HAV prevalence in children confirms that Saudi Arabia is endemic for HAV infection, despite the recent improvement in the socioeconomic standards of its population. The pattern of HAV may be changing in Saudi Arabia as the prevalence has dropped in the Central province compared to previous reports. The need for the introduction of hepatitis A vaccination will be determined in the future definition of HAV epidemiology in Saudi Arabia.

Arif, 1996

Rates of exposure to two, enterically transmitted viruses, hepatitis E virus (HEV) and hepatitis A virus (HAV), were investigated among the populations of two areas of Saudi Arabia: Gizan (a rural area) and Riyadh (an urban area, with relatively good sanitation). In Riyadh, 24.7% and 1.2% of children were seropositive for HAV and HEV, respectively, by the age of 12 years. There was a sharp increase in exposure to HAV between 13 and 20 years of age (to 63.5%) and most (80.0%) of the subjects aged 50 years had apparently been exposed to HAV. Although seropositivity to HEV also increased with subject age, it only reached 18.8% (in subjects aged > 50 years). The age-specific patterns of exposure to HAV and HEV in Gizan were similar to those in Riyadh but the rates of exposure were generally higher; mean rates of exposure to HAV and HEV were 76.3% and 14.9% in Gizan and 61.3% and 8.37% in Riyadh, respectively. That rates of exposure to HEV in Gizan were almost twice those in Riyadh emphasizes the importance of sanitation as an effective measure in controlling the spread of HEV in developing countries.

El-Hamzi, 1989

Hepatitis caused by hepatitis A virus (HAV) occurs at a variable prevalence in different countries, and the exposure to HAV is as high as 100% in some areas. There appears to be a close association between the prevalence of anti-HAV and socioeconomic status and age. In this paper, we report the prevalence of antibody to HAV (anti-HAV) in five regions covering different parts of Saudi Arabia. The results of this study show that the overall prevalence of anti-HAV is 96% and 95.1% in the total male and female population respectively. In different age groups the prevalence varies from 78-100% with a concomitant increase with age. These results show that the rate of exposure to HAV is high in Saudi Arabia and predominant exposure occurs in early childhood.

Ashraf, 1986

(no abstract)

Ramia, 1986

The age-specific rate of exposure to hepatitis A virus (HAV) was studied in 1015 native Saudi Arabians (504 males, 511 females) from the Riyadh area. The relatively high prevalence of antibody to

HAV (anti-HAV) (38.6%) in children between 1 and 4 years of age indicates that infection is acquired early in life in the Saudi Arabian population. The prevalence of anti-HAV was found to increase steadily so that by the age of 30 years 91.0% of Saudi Arabians have anti-HAV. The prevalence in adult Saudi Arabians was compared with that in expatriates from various parts of the world working in Saudi Arabia. It was lowest among Swedish (10.7-12.3%) and highest among Yemeni (94.5%) blood donors while British blood donors were intermediate same among Saudi Arabian, Yemeni, Egyptian and Filipino blood donors (91.0-94.5%). All the donors tested were of the same age group (20-35 years).

Talukder, 1983

(no abstract)

Antaki, 2000

Hepatitis A is a benign infection, which in the developing world affects mainly children; the majority of adults are immune by the age of 30. In the last decade or so, a shift in the prevalence pattern of hepatitis A virus (HAV) infection from a low- to a high-age group has appeared in the developed countries. This shift has been attributed to an improvement in the socio-economic and hygienic conditions. In the present study, 849 Syrians of all age groups and both sexes were tested by enzyme-linked immunosorbent assay technique for the seroprevalence of hepatitis A IgG antibody (anti-HAV IgG). It was observed that anti-HAV IgG was present in 89% Syrian population; with 50% in the 1-5 year age group and 95% in the 11-15 year age group. These results demonstrate that HAV infection in Syria is mostly acquired during childhood. As yet there is no serological evidence of a shift in HAV infection from a younger to a higher age group.

Rezig, 2008

Objective: Viral hepatitis A (HAV) and E (HEV) infections are still frequent in many regions of the world, particularly in developing countries where sanitary conditions and socioeconomic level are frequently low. In this work, we have studied seroprevalences of these two infections in Tunisian children, teenagers and young adults. Material and Methods: The studied population included 3357 individuals from different regions of Tunisia and distributed in three groups 1 (n=1145), 2 (n=707) and 3 (n=1505) with a mean of age of 6.94, 12.84 and 20.71 years, respectively. Results: Rates of HAV infection prevalence of 84.0, 90.5 and 91.7% were found within groups 1, 2 and 3, respectively. These rates are lower than those previously found in the country; thus, primary infection with HAV in Tunisia is progressively shifting to older ages, which is probably due to the improvement of sanitary conditions. Lower anti-HAV prevalences were found in costal regions as compared to the rest of the country. This difference may be due to the higher socioeconomic level of the population living in costal regions. Antibodies against HEV were assessed in individuals of group 3. A seroprevalence of 4.3% was found which indicates that, despite the absence of epidemics, the virus is circulating among the Tunisian population as sporadic cases. Conclusion: The present work contributes to a better knowledge of HAV and HEV infections in Tunisia and highlights the need of the establishment of a national program for virological surveillance of hepatitis cases and of further studies to monitor changes in the epidemiology of these infections.

Letaief, 2005

Hepatitis A virus (HAV) has different epidemiologic and clinical patterns, depending on the level of endemicity in a given geographic area. Tunisia is considered a region of high endemicity for hepatitis. Improvement of socioeconomic conditions in this country has made a determination of the seroprevalence of this disease advisable. We assessed the seroprevalence of HAV in Sousse in central Tunisia. A total of 2,400 school children 5-20 years of age (mean +/- SD age = 11.7 +/- 3.5 years) were selected by two-stage cluster sampling and tested serologically for IgG antibody to HAV by using an enzyme-linked immunosorbent assay. The overall seroprevalence among this population was 60% (44%, in children < 10 years old, 58% in those 10-15 years of age, and 83% in those > 15 years of age. Seroprevalence also varied according to area of residence. At the age of 10, 21.3% of school children living in the urban areas and 87.7% of those living in rural areas had antibodies to HAV. Other factors that increased seroprevalence included non-potable water, crowding, and a low education level of parents with odds ratios of 4.37, 2.96, and 2.62, respectively. This study has shown an increase of seroprevalence with age, suggesting that transmission among younger children has decreased, particularly in urban areas. Programs to prevent hepatitis A may need to be modified based upon the changing age distribution of the disease and mass vaccination program could be indicated if additional incidence and prevalence data confirm the intermediate endemicity of HAV.

Ceyhan, 2008

Hepatitis A is a worldwide vaccine-preventable infection. Recommendation of vaccination depends on the endemicity of the disease. The World Health Organization recommends universal hepatitis A vaccination in intermediate areas; however, there is no need of mass vaccination in high and low endemicity regions. Therefore, most of the countries are using a vaccination policy according to the endemicity characteristic representing the whole of the country. The endemicity of this infection varies due to sanitary and hygiene conditions and socioeconomic differences among the countries and in various regions of the same country. A sample of 1173 persons between the age of 0 and 91 years from nine randomly selected medical centers from five different geographical centers of Turkey were tested for the level of anti-hepatitis A virus (anti-HAV) immunoglobulin-G antibodies using an enzyme-linked immunosorbent assay. The overall prevalence of anti-HAV antibodies was 64.4% (1142/1173). While the rate of sero-positivity was over 80% in the 5-9 age group and more than 90% after 14 years of age in south-eastern and eastern regions, it was lower than 50% at the age of 5-9 years in central and western regions and remains under 80% in those areas. We conclude that the differences observed in HAV sero-positivity among various geographical regions in Turkey support a universal HAV immunization policy for children currently living in regions of intermediate endemicity.

Coskun, 2008

(no abstract)

Kaya, 2008

Aim Hepatitis A and E are enteric viral diseases that are characteristically found in developing countries. Sero-epidemiological data about both infections showed higher prevalence rates soon after the 1999 earthquakes in Duzce, Turkey. The aim of the present study was to evaluate the data 4 years after the earthquakes. Methods: The study group included 589 children (72.3% boys) who were between the ages of 6 months and 17 years (mean age 11.5 years). The children were separated into three groups: Group 1 (ages 6 months to 5.9 years), Group 2 (ages 6.0-12.9 years) and Group 3 (ages 13.0-17.0 years). Serum anti-hepatitis A virus IgG and anti-hepatitis E virus IgG were determined using commercial enzyme-linked immunosorbent assay kits. The data were tested for statistical significance with the chi(2)-test. Results: The sero-prevalence rates of hepatitis A and E were 63.8% and 0.3%, respectively. The sero-prevalence rates of both hepatitis A and E increased with age, and there was no significant difference between the genders. Hepatitis A infection was associated with socio-economic condition, crowded living environment, and education level of the family (p<0.01). Conclusions: Hepatitis A infection is still common, whereas hepatitis E infection appears to be relatively rare in paediatric age groups in Duzce, Turkey.

Kaya, 2007

Hepatitis A infections are influenced by environmental and socioeconomic factors. Epidemiologic studies regarding hepatitis A virus (HAV) infection in Turkey have not previously examined these factors. We investigated HAV seroprevalence and its association with socio-demographic factors among children of various ages in the Eastern Mediterranean region of Turkey. The study included 1142 children (603 male and 539 female) between ages of 6 months and 18 years. Seropositivity in the whole group was 57.2%. HAV prevalence rates according to age groups were as follows: 35.5% in 6-23 months group, 19.2% in 2-5 years group, 74.3% in 6-10 years group, 83.0% in 11-14 years group, 92.8% in 15-18 years group. Risk factors that influenced seropositivity were; dense population, over-crowded families, excessive number of siblings, low socioeconomic status and low education of the mother. As HAV seroprevalence in children older than 6 years of age is high, we recommend hepatitis A vaccination in this region after the first year of life.

Soysal, 2007

Introduction: This randomized, observer-blind clinical trial conducted in Turkey evaluated the immunogenicity, safety and interchangeability of three pediatric inactivated hepatitis A vaccines in 424 seronegative children between 1 and 15 years of age. Methods: Potential subjects were screened for anti-hepatitis A virus (HAV) antibodies prior to receiving a first dose of Avaxim 80, Havrix 720 or Vaqta 25, followed by a second dose of either the same vaccine or Avaxim 6 months later. Anti-HAV antibody concentrations were measured 2 weeks after the first injection, at 24 weeks (before the second dose) and at 28 weeks for the evaluation of the immune response. Results: Nearly 80% of the children between 1 and 5 years of age and half of those between the ages of 6 and 10 in the population from which the subjects were recruited were seronegative for HAV antibodies. Two weeks after the first dose, 98.2% of all subjects had anti-HAV antibody concentrations equal to or higher than 20 mIU/mL, believed to be seroprotective, and all subjects were seroprotected before and after the second dose. Anti-HAV geometric mean concentrations (GMCs) 2 weeks after the first dose and before the second were similar in children who received Avaxim and Vaqta ($P = 0.2$), but both were higher than Havrix ($P < 0.01$). There were no significant differences in the anti-HAV GMCs between the study groups that received two doses of the same vaccine compared with two doses of different vaccines. There were no significant differences in the frequency of any local or systemic adverse events among the study groups following either of the two doses. Conclusion: All three vaccines are safe and highly immunogenic in healthy children aged 1 to 15 years. Avaxim 80 may also be given as the second dose when Havrix 720 or Vaqta 25 are given as the first dose. The pattern of seroprevalence seen here is similar to that reported in a number of recent evaluations in Turkey, and are supportive of the routine hepatitis A vaccination of young children.

Egemen, 2006

Previous research about coexistence of *Helicobacter pylori* (HP) and hepatitis A virus (HAV) infections and the factors that increase their prevalence has suggested that the route of transmission of HP infection includes oral-oral and water-foods as well as the fecal-oral route. The aim of this study was to evaluate the routes of transmission of HP by comparing the seroprevalences of HP and HAV in children. One hundred and two children aged 1-18 years living in rural and urban regions of Izmir were included in this study. Anti-HP IgG and anti-HAV IgG antibodies were measured via enzyme immunoassay method. Seropositivities for HP and HAV were 56.8% and 51.9%, respectively. Seroprevalence for both infections increased with increasing age. However, a significant difference could not be detected between rural and urban areas. Sex did not have a significant effect. There was no infection in 22.1% of children, while 30.8% had both of the infections. 21.1% were positive only for HAV while 26% were positive only for HP. No significant correlation between seroprevalences of HP and HAV was detected. This study suggests the existence of various other routes of transmission of HP apart from the fecal-oral route.

Vancelik, 2006

Background: It has been reported that there are great deal of changes in the epidemiology of hepatitis A at the present. The epidemiologic studies regarding to hepatitis A virus (HAV) infection are not sufficient both in the country and study region. Objective: To investigate HAV seroprevalence and association with socio-demographic variables. Design: Cross-sectional and community based study. Setting: Erzurum Province, Eastern Turkey between April and June 1998. Subjects: Four hundred and fifty persons under the age of 30 years. Results: The rate of the study involvement was 87.1% (392 persons) and ratio for seropositivity 84.2%. Although seropositivity is elevated by age, it has been high within the younger age group. Epidemiological changes could not be interpreted, since the study results were first for the group of people aged under 30 years. Statistical significance was found between hepatitis A seroprevalence and age, the number of households and localization of toilet within the house. There was no correlation between hepatitis A and sex, jaundice history, family type, tap water availability in the residential area. Conclusion: The frequency of hepatitis A infection appearance in the region was found out to be high as compared to other regions of Turkey.

Derya, 2005

Selective immunization of at-risk groups may reduce the incidence of hepatitis A infection, but only the inclusion of hepatitis A vaccine in a routine universal childhood immunization schedule would guarantee control of the infection. But the interference by maternally derived hepatitis A antibodies (anti-HAV) with the immunogenicity of inactivated hepatitis A vaccine is still important in the determination of the optimal age for hepatitis A vaccination. The hepatitis A vaccines have not been assessed widely in children under the age of 2 years and are not currently licensed for this age group in many countries. A prospective trial was performed to detect seroprevalence of maternal hepatitis A antibodies during the first 2 years of life among young infants born to hepatitis A antibody positive mothers in Turkey. We measured at-birth anti-HAV in 147 infants born in our hospital and in their mothers and then from the offspring at months 3, 6, 9, 12, 15, 18, 21, and 24. The prevalence of seropositivity among the mothers at birth were found similarly high (93.9%) to the studies previously done among the adults in our area. The prevalence of anti-HAV among children aged 0, 9, 12, 15, 18, and 21 months were 93.9%, 62.6%, 36.1%, 13.6%, 6.1%, and 0.7%, respectively. Although a proportion of infants still had measurable antibodies at 9 and 12 month of age, two thirds of the infants over the age of 12 months were at high risk of acquiring hepatitis A infection, as living in a endemic region.

Oncu, 2005

Objective: Health science students are commonly exposed to some infectious agents, including hepatitis A virus (HAV) and hepatitis B virus (HBV), which may cause substantial morbidity and even deaths. The identification of prevalence and risk factors is essential for implementing efficacious preventive measures. A serological survey was performed among medical students of Adnan Menderes University Medical Faculty to determine the prevalence of antibodies against HAV and HBV, and, as a secondary objective, to determine risk factors for acquisition of these infections. Methods: Nearly all students were included in the study. All participants completed a structured questionnaire that assessed demographic and socio-economic characteristics. Anti-HAV IgG, anti-HBc IgG, HbsAg and anti-HBs were tested using commercially available Elisa kits. Results: A total of 247 students, 146 (59.1%) male and 101 (40.9%) female, were included in the study. The prevalence of anti-HAV IgG was detected as 64%. Number of siblings and place of residence were detected as independent factors affecting the anti-HAV seropositivity. The prevalence of anti-HBc IgG was detected as 7.3%. Among the students positive for anti-HBc IgG, 5 (2%) students were HBsAg positive and the other 13 (5.3%) were anti-HBs positive. HBV infection in household members, risky sexual behavior and vaccination were independent factors affecting the prevalence of anti-HBc IgG positivity. Conclusions: The high susceptibility of medical students and their increased risk of clinical HAV and HBV infection identify a need for primary prevention through the administration of vaccination in this group in western Turkey.

Tosun, 2004

Background: Hepatitis A virus (HAV), being an enteric transmitting virus wide world, occurs mostly in children of developing countries. However, the virus has recently been seen in adolescents and young adults worldwide. The aim of the present study was to evaluate the seroprevalence of the HAV infection in children and adolescents in Manisa, Turkey, and to verify whether the increased incidence of HAV infection in other parts of the world and Turkey generally is also true for the area of Manisa. Methods: The authors studied blood samples of 1395 adolescents and children aged between 6 months and 17 years from the Manisa area in order to evaluate the existence of anti-HAV antibodies using micro-ELISA test. Results: Total seropositivity was 44.6% while age related values were as followed: 6-23 months, 47.8%; 2-6 years, 23.7%; 7-10 years, 43.4%; 11-14 years, 52.4%; and 15-17 years, 76.6%. These results suggest that the seropositivity increases significantly among children at school age and also increases parallel to age. Conclusions: According to these results, the authors concluded that there has been a shift of seropositivity from children to adolescents especially in families with an average or high socio-economical level.

Sencan, 2004

The aim of the study was to investigate the prevalance of enterically transmitted hepatitis among children living in post-earthquake camps, and to assess the efficacy of the measurements during and after the disaster in Düzce and Golyaka. In the second half of 1999, North-western Turkey, was struck by two massive earthquakes in less than 3 months. The first, on 17 August 1999, involving Golyaka, was struck, measuring between 7.4 and 7.8 on the Richter scale. Irregularity about providing clean water and necessary sanitary facilities were observed after the first earthquake because of confusion. The second quake, on 12 November 1999, which rated 7.2 on the Richter scale, shook Düzce. Necessary precautions were applied rapidly at the second quake about shelter, clean drinking water, food and control of distribution of the aids by government and civil aid organizations. Anti-HEV(IgG) and anti-HAV(IgG) antibodies were determined in 476 sera of the children who was living in six camps. HAV prevalence of the children who were living in Düzce and Golyaka temporary houses was 44.4 and 68.8% respectively, OR: 0.37, CI 95%: 0.22-0.61, p = 0.0005. HEV prevalence of the children was 4.7 and 17.2% respectively, OR: 0.24, CI 95%: 0.11-0.51, p = 0.0007. In conclusion, HAV and HEV prevalence of children were lower than that in endemic areas but higher than that in developed countries. This study has pointed out the importance of providing urgent need of the sufficient sanitary facilities after disasters for preventing or reducing the incidence of enterically transmitted hepatitis, especially in the regions which were at risk for various disasters. Essential precautions such as providing clean water and food supply must be taken and an emergency action plan for preventing the infectious disease must be prepared before disasters such as earthquakes.

Erdoğan, 2004

Turkey is a middle endemic area with respect to Hepatitis A virus (HAV) infection. However, the frequency of this infection varies due to socio-economic differences in various regions. The aim of this study was to detect the most likely age of exposure to HAV and factors affecting infection rates among children living in Edirne. A sample of 645 children between the ages of 0-19 living in Edirne were tested for total anti-HAV levels using ELISA method. A questionnaire on socio-economic status (SES), possible risk factors, and place of residence was completed for each child. Anti-HAV seropositivity was found to be 4.4, 25, 37.3 and 43.2%, in 2-5, 6-10, 11-14 and 15-19 age groups, respectively. Seropositivity was found to be increasing with age ($p<0.05$). According to logistic regression analysis results; mother's education, SES of family, history of hepatitis in primary family members and the number of brothers or sisters were determined as factors increasing the seropositivity of HAV. Furthermore, HAV infection risk was found to be a decreasing function of income that is higher the income less likely the infection. These results showed that HAV infection rate in Edirne is in middle endemicity and the most likely way of exposure is transmission from family members. Although it requires further cost-effectiveness studies, our results indicate that applying the HAV vaccination in early childhood would be beneficial to decrease the prevalence of the infection and prevent HAV epidemics.

Atabek, 2004

Objective: To determine the prevalence of antibodies to hepatitis A (HAV) and E (HEV) viruses in the different areas of Konya. Methods: Anti-HAV and anti-HEV antibodies were investigated in 210 healthy children randomly selected (100 from rural areas and 110 from urban areas of Konya). None gave a history of previous icterus nor other signs of hepatitis, had received blood transfusion and HAV vaccine, or had been on hemodialysis. Results: Evidence of HAV infection occurred in children under the age of 6 years. The seroprevalence rate was 67.8% in rural areas and 25.8% in urban areas. This increased rapidly with age and became universal after 11 years of age in both areas. In contrast, HEV infections were not detected until children were 6-11 year olds, and the 5.2% seroprevalence rate in urban areas and 8.5% seroprevalence rate in rural areas in this age group did not significantly increase in older age group. The prevalence of anti-HAV as well as anti-HEV was significantly higher in children with poor socio-economic conditions in both areas. Conclusions: These results suggest that HAV infection in rural areas of Konya is widespread and that environmental and socio-economic factors play a major role in its transmission. In contrast, hepatitis E is not a public health problem in Konya.

Tosun, 2003

Background: Acquisition of Helicobacter pylori (H. pylori) occurs mainly in childhood. However, little is known about the mode of transmission. In such developing countries as Turkey, where the hygienic situation facilitates the transmission of hepatitis A virus (HAV), infection with HAV is mainly transmitted via the enteral route. Therefore, it seemed advisable to evaluate the role of fecal-oral transmission in the spread of *H. pylori*. Material/Methods: Blood samples taken from healthy children (n= 90) 2-16 years old were studied for anti-*H. pylori* and anti-hepatitis A antibodies by enzyme immunoassay. Results: Of the 90 children, 33.3% were seropositive for both *H. pylori* and HAV, 33.3% were seronegative for both, 8.9 % were seropositive for *H. pylori* only, and 24.4% were seropositive for HAV only. The percentage of seropositive children increased with age for H. pylori and HAV. There was no significant relationship in seroprevalence between *H. pylori* and HAV when analyzed by logistic regression analysis ($p=0.178$). Conclusions: This study suggests that the seropositivity rates of *H. pylori* and HAV increase with age, while the fecal-oral route may not be an important mode of transmission for *H. pylori* in children living in western Anatolia, in the Manisa region.

Cesur, 2002

In this study, between the period of September 2000 to July 2001, hepatitis A virus (HAV) IgG antibodies and hepatitis E virus (HEV) total (IgG + IgM) antibodies have been searched by using commercially provided enzyme immunoassay kits (Axsym, Abbott USA), in 1046 adults aged between 15-75 years old (mean age: 32.3 years), who were admitted to the outpatient clinics of Internal Medicine and Infectious Diseases Department of Ankara University Medical School, with no acute hepatitis signs and symptoms. As a result, anti-HAV and anti-HEV seropositivities were detected in 914

(87.4%) and 40 (3.8%) subjects, respectively. The seropositivity rate for anti-HAV was 72.7% at the ages of 15-30 years, while anti-HEV was negative in this age group. Anti-HAV and anti-HEV seropositivity rates were found to be the highest between the ages of 30-60 years.

Yapicioglu, 2002

The present study was aimed at determining the seroprevalence of anti-HAV in children and adolescents in the city of Adana, Turkey. The overall prevalence of anti-HAV was 44.4% (316/711). The prevalence increased with advancing age i.e. 28.8% (2.1-6 yr), 49.8% (6.1-12 yr), and 68% (12.1-16.5 yr) ($P < 0.0001$). Seroprevalence was significantly lower in children less than 6 years and belonging to higher socioeconomic status.

Kanra, 2002

This study was conducted to determine the hepatitis A virus (HAV) seroprevalence in nine provinces representative of Turkey as a whole. These provinces are representative of the country's geographical location, and demographic, economic and social characteristics. In each province, sample sizes were determined using published data on HAV seroprevalence, and sample sizes for each province and for the cluster were calculated for each group of subjects under the age of 30 for seroprevalence estimates within a 95% confidence interval. The samples were selected by a cluster method, and the planned recruitment was a total of 4800 subjects, including 600 subjects each from five large provinces (Istanbul, Ankara, Izmir, Adana, Diyarbakir) and 450 subjects from each of the remaining four provinces (Samsun, Erzurum, Trabzon, Edirne). These numbers were distributed in accordance with the percentages for age groups in five-year increments starting from age five for the population under the age of 30 living in the rural and urban areas in each province. This study of 4,462 subjects under the age of 30 in nine provinces of Turkey identified an overall HAV seroprevalence rate of 71.3%. The distribution of HAV seroprevalences by age showed a steady increase from one year of age from 42.7% to 91.1% at 25-29 years of age. HAV seroprevalence was slightly higher in female subjects (73%) than in male subjects (69.3%). By educational status, seroprevalences were comparable except in young children under age six. Seroprevalence was notably higher in large families with six and more members (80.1%) than in small families with five or fewer members (66.7%). According to our study results, 50% of Turkish children are seropositive for HAV by the age of 10 years. We believe the date support the need for a routine primary immunization policy in Turkey and the development of effective prophylactic programs after possible exposure. Consequently, an immunization policy can be developed for each region according to its epidemiological conditions.

Ungan, 2002 (Eur J Gast Hep)

(no abstract)

Ungan, 2002 (J Trop Ped)

The prevalence of antibodies to hepatitis A virus (HAV) was investigated in 114 children (59.7 per cent males) aged 4-6 years, in the campus area of Middle East Technical University, Ankara, Turkey. The prevalence of hepatitis A antibody in this age group was 11.4 per cent (13/114). The rate of immunized children against hepatitis A was 3.65 per cent (5/137). In conclusion the prevalence of anti-HAV demonstrates the susceptibility of other preschool children to hepatitis A. This may be a cause for considering hepatitis A vaccination before preschool attendance in Turkey.

Colak, 2002

Hepatitis A and hepatitis E are enteric transmitted viral diseases occurring in epidemic and sporadic forms especially in developing countries. Previous studies in Turkey showed that most residents are infected with HAV by the second decade of life. Since HEV is generally transmitted by the same route as HAV we conducted a community-based seroprevalence study for HAV and HEV infection in Ahatli area in Antalya, Turkey where socioeconomic conditions are low. Anti-HAV total immunoglobulin was tested by using a microparticle EIA (Axsym-Abbott Lab). Anti-HEV IgG was assayed by a micro ELISA method (Genelabs-Singapore). Of the 338 sera tested, 112 (33.1%) were positive for anti-HAV total antibody. Anti-HEV IgG was detected in three (0.89%) of the serum samples. Seropositivity rates of HAV in preschool and school children were 19.9% and 43.9% respectively ($p < 0.001$). No antibody to HEV was detected in preschool children, while the prevalence of anti-HEV IgG was 1.6% in children attending school. Our data showed that seroprevalence of anti-HAV is high among children samples but HEV infection appears to be relatively rare in pediatric age groups.

Sidal, 2001

This study was performed for evaluation of seroprevalence of hepatitis A, B, and E among children in Istanbul, Turkey. The study group included 909 children who were 6 months-15 years of age. The children were separated to three age groups: Group 1 (6 months-4.9 years; n=321), Group 2 (5.0-9.9 years; n=318), and Group 3 (10.0-15.0 years; n=270). Group I was divided to two subgroups for evaluation of the maternal antibody sera (6 months-2 years and over 2 years). Serum IgG anti-HAV, anti-HBc, and anti-HEV were tested by commercial ELISA kits. The data were studied by multivariant analysis. In all subjects, seroprevalence of hepatitis A, B, and E were determined as 29, 15.9, and 2.1% respectively. The prevalence of hepatitis A increased with age ($p < 0.05$; Group 1 15.1% and Group 3 49.6%). Anti-HBc IgG level did not significantly change with age (Group 1 18.6% and Group 3 15.4%; $p > 0.05$). The seroprevalence of hepatitis E virus infection was higher in Group 1 (3.7%) than Group 3 (0.3%; $p < 0.05$). In Group 1 first subgroup, between 6 month and 2 year, antibody levels were 12.2, 17.3, and 4.8% respectively, for anti-HAV IgG, anti-HBc IgG and anti-HEV IgG. Hepatitis A and B infection is a community health problem, but hepatitis E infection is low in children in Istanbul, Turkey. The high positive rate in Group I for IgG anti-HEV may be due to maternal antibodies.

Ersoy, 1998

(no abstract)

Baki, 1993

(no abstract)

Doǵanci, 1992

(no abstract)

Sharar, 2008

The seroprevalence of hepatitis A in Emirati children less than 12 years was 20.1% (95% CI 16.4-24.6%) in 2004.

Scott, 1990

During February 1988 a seroepidemiological survey of hepatitis A, B and D was performed in the Yemen Arab Republic. 879 sera were collected from 4 different areas; Sanaa, Hajja, Hodeidah, and Taiz. The prevalence of hepatitis B surface antigen (HBsAg) was 12.7% (112/879) and some marker of hepatitis B infection was found in 45.5% (399/879) of study subjects. Only 2 (1.8%) of the 112 HBsAg positives were positive for antibody to delta hepatitis, and 9.7% (9/93) were positive for hepatitis B e antigen (HBeAg). Univariate analysis showed age, sex, qat chewing, blood transfusion, surgery and a past history of jaundice to be associated with hepatitis B infection. Using multivariate logistic regression analysis only, age (odds ratios 1.37 for HBsAg carriers and 1.51 for seropositives), a past history of jaundice (odds ratio 1.42), and combined history of blood transfusion and surgery (odds ratio 2.76) were independent predictors of infection. Hepatitis B appears to be a major health concern in the Yemen Arab Republic.

NORTH AMERICA, HIGH INCOME
(Canada, United States of America)

Ochnio, 2005

Background: The risk of hepatitis A virus (HAV) infection during childhood is difficult to estimate without population serosurveys because HAV-related symptoms are often mild at this age. Few serosurveys have been conducted in Canada. The present study surveyed teenagers in two nonurban regions of British Columbia where the historical rate of reported HAV either exceeded (region A) or was less than (region B) the historical provincial rate. Methods: A point prevalence survey of salivary HAV-specific immunoglobulin G was conducted in high schools among grade 9 students in regions A and B. A questionnaire was used to gather sociodemographic data. The survey was extended to grade 1 and grade 5 students in community 1 of region B. Associations between risk factors and prior infection were evaluated by logistic regression. Results: 811 grade 9 students were tested. Antibody to HAV was detected in 4.7% of students in region A (95% CI 2.9% to 7.2%) and 9.6% of students in region B (95% CI 6.9% to 12.9%). The region B figure reflected HAV antibody prevalence rates of 19.5% in community 1 and 2.5% in the remainder of the region. Younger students in community 1 had low HAV antibody to HAV prevalence rates (3.9% for grade 1 and 3.1% for grade 5), and positive tests in this community were associated with a particular school, foreign travel and brief residence. The risk factors for HAV infection in grade 9 students were not determined. Conclusions: Children in nonurban areas of British Columbia are generally at low risk of HAV infection during the first decade of life regardless of the reported population rates, thereby permitting the consideration of school-based HAV immunization programs.

Ochnio, 2007

Background: The risk of hepatitis A virus (HAV) infection during childhood is difficult to estimate without population serosurveys because HAV-related symptoms are often mild at this age. Few serosurveys have been conducted in Canada. The present study surveyed teenagers in two nonurban regions of British Columbia where the historical rate of reported HAV either exceeded (region A) or was less than (region B) the historical provincial rate. Methods: A point prevalence survey of salivary HAV-specific immunoglobulin G was conducted in high schools among grade 9 students in regions A and B. A questionnaire was used to gather sociodemographic data. The survey was extended to grade 1 and grade 5 students in community 1 of region B. Associations between risk factors and prior infection were evaluated by logistic regression. Results: Eight hundred eleven grade 9 students were tested. Antibody to HAV was detected in 4.7% of students in region A (95% CI 2.9% to 7.2%) and 9.6% of students in region B (95% CI 6.9% to 12.9%). The region B figure reflected HAV antibody prevalence rates of 19.5% in community 1 and 2.5% in the remainder of the region. Younger students in community 1 had low HAV antibody to HAV prevalence rates (3.9% for grade 1 and 3.1% for grade 5), and positive tests in this community were associated with a particular school, foreign travel and brief residence. The risk factors for HAV infection in grade 9 students were not determined. Conclusions: Children in nonurban areas of British Columbia are generally at low risk of HAV infection during the first decade of life regardless of the reported population rates, thereby permitting the consideration of school-based HAV immunization programs.

Duval, 2005

Background: Hepatitis A vaccines provide consistent, long-lasting protection and have been available for almost 10 years in Canada, but their use remains limited. It is difficult to assess their optimal utilization given that our knowledge of hepatitis A epidemiology in Canada is fragmentary.

Unlike the United States, no nationwide study of hepatitis A prevalence has ever been done in Canada. Consequently we do not know the incidence of infection in children and what would be the most appropriate age for hepatitis A vaccination. Objective: To estimate the proportion of 8- to 13-year-old children who have been infected with hepatitis A virus (HAV) and the risk factors for this infection on a nationwide scale. Methods: Children were sampled in 10 Canadian provinces, comprising 5 regions, using random digit dialing methodology with regional stratification. Demographic data and information about risk factors for hepatitis A were collected by the telephone interviewers. Oral fluid samples were self-collected and mailed to the laboratory, where they were tested for anti-HAV IgG. Results: Of 6740 contacted families with a child of required age, 1688 (25%) agreed to participate and answered the questionnaire. From these, 1074 oral fluid samples were received, and 1057 could be analyzed. Anti-HAV IgG was detected in 2.7% of subjects, with variation by region from 0.8 to 3.4%. The parents of 54 subjects (5.1%) reported that their child had previously been vaccinated against HAV. Anti-HAV IgG was present in 2.0% of unvaccinated subjects, among whom antibody prevalence was 19.4% in children born in HAV-endemic countries, 6.1% in Native children and 4.2% in travelers to endemic countries. In multivariate analysis of all subjects, the presence of anti-HAV IgG was significantly associated with birth in an endemic country, travel to an endemic country, Native status (American Indian and Inuit population), female gender and vaccination against HAV. In nonvaccinated, non-Native children born in Canada who did not travel to endemic countries, anti-HAV prevalence was 1.1%. Conclusions: The risk for hepatitis A during childhood is low in Canada. Almost all teenagers (>97%) would be at risk for infection in case of contact with HAV. Changes in immunization policy against hepatitis A should be considered.

Minuk, 2003

Serological markers for hepatitis A (HAV), B (HBV) and C (HCV) were documented in 315 inhabitants (27%) of a central Manitoba First Nations community. Serologic evidence of HAV infection (anti-HAV positive) was almost universal (92%) by the age of 20 years. HBV infection (antibody to hepatitis B core antigen positive) had occurred in only 2.3% of the study population and no chronic carriers were identified. Serological evidence of HCV infection (anti-HCV positive) was documented in 2.2% of the population but ongoing viremia (HCV-RNA positive by polymerase chain reaction) was absent. The results of this study highlight the importance of universal HAV vaccination; likely reflect the efficacy of existing prenatal screening and immunoprophylaxis programs for HBV; and raise the possibility that First Nations peoples have an enhanced ability to spontaneously clear HCV.

Roy, 2002

Objective: To estimate the prevalence of hepatitis A virus (HAV) antibodies among Montreal street youth. Method: Anti-HAV antibody testing was performed on blood samples from a hepatitis B and C study conducted among street youth in 1995-96. Results: Among the 427 youth aged 14 to 25 years, prevalence of HAV antibodies was 4.7% (95% confidence interval [CI]: 2.9%-7.2%). A multivariate logistic regression analysis showed that birth in a country with a high anti-HAV prevalence (Adjusted odds ratio [AOR]: 200.7; 95% CI: 38.1-1058.4), having had sexual partner(s) with history of unspecified hepatitis (AOR: 13.8; 95% CI: 4.2-45.2), and insertive anal penetration (AOR: 5.1; 95% CI: 1.6-16.7) were independently associated with infection. Conclusion: Based on the relatively low HAV prevalence, the high prevalence of risk factors for infection, and the substantial hepatitis B and C prevalence, vaccination against hepatitis A is now actively promoted among Montreal street youth.

Ochnio, 2001

Background: In Canada, inactivated hepatitis A vaccines are targeted selectively at those at increased risk for infection or its complications. In order to evaluate the need for routine hepatitis A vaccination programs in Vancouver for street youth, injection drug users (IDUs) and men who have sex with men (MSM), we determined the prevalence of antibodies against hepatitis A virus (HAV) and risk factors for HAV in these groups. Methods: The frequency of past HAV infection was measured in a sample of Vancouver street youth, IDUs and MSM attending outreach and STD clinics and needle exchange facilities by testing their saliva for anti-HAV immunoglobulin G. A self-administered, structured questionnaire was used to gather sociodemographic data. Stepwise logistic regression was used to evaluate the association between presumed risk factors and groups and past HAV infection. Results: Of 494 study participants, 235 self-reported injection drug use, 51 were self-identified as MSM and 111 met street youth criteria. Positive test results for anti-HAV were found in 6.3% of street youth (95% confidence interval [CI] 2.6%-12.6%), 42.6% (95% CI 36.2%-48.9%) of IDUs and 14.7% (95% CI 10.4%-19.1%) of individuals who denied injection drug use. Among men who denied injection drug use, the prevalence was 26.3% (10/38) for MSM and 12% (21/175) for heterosexuals. Logistic regression showed that past HAV infection was associated with increased age and birth in a country with high rates of hepatitis infection. Injection drug use among young adults (25-34 years old) was a significant risk factor for a positive anti-HAV test ($p = 0.009$). MSM were also at higher risk for past HAV infection, although this association was nominally significant ($p = 0.07$). Interpretation: Low rates of past HAV infection among Vancouver street youth indicate a low rate of virus circulation in this population, which is vulnerable to hepatitis A outbreaks. An increased risk for HAV infection in IDUs and MSM supports the need to develop routine vaccination programs for these groups also.

Levy, 2001

(no abstract)

Ochnio, 1997

To determine the prevalence of hepatitis A virus (HAV) infections in children in a large urban center, a point prevalence survey was conducted using a novel, ultrasensitive assay for HAV-specific IgG in saliva. A structured sample of 224 grade-six students (5.8% of grade registrants) was obtained from 23 schools throughout Vancouver. All students provided saliva samples adequate for testing. The anti-HAV prevalence rate was 7.1% (95% confidence interval, 4.1%-11.3%). Among 167 Canadian-born students, only 5 (3%) were positive, whereas among 57 students born elsewhere, 11 (19.3%) were positive ($P < .001$), with circumstances in the latter group supporting infection prior to emigration. No clustering of positive persons was evident. The cumulative risk of HAV infection in Canadian-born children was low through age 11-12 years even in less affluent parts of the city, speaking against a need for routine use of HAV vaccine in this setting.

Kocuipchyk, 1995

(no abstract)

Embil, 1989

Sera were collected from 3958 Canadian Forces personnel, including recruits, personnel posted to bases in Canada and on rotation with United Nations Peacekeeping forces, and the crew of a Canadian destroyer. All sera were tested for the presence of anti-hepatitis A antibodies by a competitive radioimmunoassay. The overall prevalence of anti-hepatitis A antibodies was found to be 23.5% (3.2% to 40.0%). The incidence of viral hepatitis A, as measured by seroconversion in paired sera, was found to be 0.17% (0.01% to 1.42%). The study results support the existence of a direct relationship between increasing age and an increased prevalence of anti-hepatitis A antibodies.

Crewe, 1983

Blood samples from 304 children aged 6 months to 16 years were tested by radioimmunoassay for antibodies to hepatitis A virus (anti-HAV). Of several factors examined for a possible association with the prevalence of anti-HAV - age, sex, race, geographic location and presence of malignant disease - only age showed a positive correlation with the prevalence of these antibodies.

Minuk, 1982 (Can Med Assoc J)

To determine the prevalence of hepatitis A in a Canadian Inuit population, serum from 85% of the 850 inhabitants of Baker Lake, Northwest Territories, was tested by radioimmunoassay for antibody to the hepatitis A virus (anti-HAV). The overall prevalence of anti-HAV in the community was 71%. Exposure to the virus occurred early in life, such that by the age of 6 years 53% of the children had anti-HAV in their serum. The rate approached 100% by the age of 50 years. These findings document the ubiquitous nature of the hepatitis A virus in this northern Inuit settlement and suggest that immunoprophylaxis be considered for individuals taking short-term employment in such places.

Minuk, 1982 (J Med Virol)

The epidemiology of Hepatitis A virus (HAV) and hepatitis B virus (HBV) infection was studied in a northern Canadian Inuit (Eskimo) settlement. Sera from 720 of the 850 inhabitants of Baker Lake, Canada, were tested for markers of HAV and HBV infection. Anti-HAV was present in 71% of the residents and its prevalence increased with age. Serologic evidence of HBV infections was found in 27% of residents. The prevalence increased with age, being uncommon under the age of 20 (6%) and almost universal over the age of 60 (93%). Among the 29 hepatitis B surface antigen (HBsAg) carriers identified, all were adults, all had low levels of HBsAg, and all were negative for hepatitis B e antigen (HBeAg) and DNA polymerase but positive for antibody to HBeAg. These data demonstrate a high prevalence of HAV and HBV infection in this population. Further, they suggest that a dramatic decrease in the transmission of HBV infection has occurred over the past 20-30 years.

McFarlane, 1980

Samples of serum from 970 people in Nova Scotia, Canada, were tested by radioimmunoassay for determination of the prevalence of antibodies to hepatitis A antigen (anti-HA). Volunteer blood donors aged 16--26 years or 51 years old or older provided 575 samples. Other samples were obtained from 152 students accepted for nursing training at the Victoria General Hospital, Halifax, Nova Scotia, and from 243 patients of the Special Urology (sexually transmitted diseases) clinic of the hospital. Percentages of samples positive for anti-HA were determined according to classification of the donors by age, rural vs. urban location, sex, and attendance at the clinic. Samples were positive for 43.4% of the male patients and 45.8% of the female patients at the clinic, 13.8% of the student nurses, 12.6% of the young blood donors, and 69.1% of the older blood donors. A higher prevalence of anti-HA in donors was associated with increased age, urban environment, and attendance at a clinic for treatment of sexually transmitted diseases.

Nevin, 2007

Background: The U.S. military immunizes new recruits against hepatitis A. Since 2001, immunization with the hepatitis A vaccine has been recommended for civilian adolescents in higher risk areas. Recently, the Armed Forces Epidemiological Board recommended serologic screening where feasible to reduce redundant recruit immunizations. OBJECTIVES: The purpose of this study was to determine hepatitis A seroprevalence in recruit populations to inform screening policy. Methods: Banked serum from a sample of military recruits (n = 2,592) in 2004 was tested for total antibody to hepatitis A (anti-hepatitis A virus (HAV)). Results: The overall anti-HAV seroprevalence was 12.0% (95%

confidence interval, 10.8%-13.3%). Adjusted to the age distribution of the 18- to 34-year-old population, the seroprevalence was 11.9% (10.5%-13.4%). The lowest seroprevalence was noted in the 1984 birth cohort, with significantly higher seroprevalence among younger recruits. Conclusions: Rising hepatitis A immunity among successive birth cohorts suggests increasing compliance with immunization recommendations. In anticipation of rising population immunity, universal screening of military recruits for anti-HAV is recommended.

Bell, 2005

To determine the prevalence of hepatitis A virus (HAV) infection in the general U.S. population, sera from participants in the Third National Health and Nutrition Examination Survey (NHANES III) conducted in 1988-1994 were tested for antibody to HAV (anti-HAV). Among 21,260 participants aged > or = 6 years tested, the overall prevalence of infection was 31.3%, and increased markedly with age. The age-adjusted prevalence was significantly higher among foreign- compared to U.S.-born participants, and was highest among Mexican-Americans and lowest among non-Hispanic whites. Among U.S.-born children, only Mexican-American ethnicity and income below the poverty level were associated with HAV infection in a multivariate model. During this period before hepatitis A vaccination, age, ethnicity and birthplace were the most important determinants of HAV infection in the United States.

Kruszon-Moran, 2005

Objective: To provide seroprevalence estimates for six selected infectious agents by various sociodemographic and risk behavior variables stratified by race/ethnicity for adults age 20 years or more. Methods: Seroprevalence estimates for hepatitis A, B, and C, *Toxoplasma gondii*, *Helicobacter pylori*, and Herpes simplex-2 were calculated from data in the third National Health and Nutrition Examination Survey, 1988-94 utilizing weights to account for differential oversampling by race/ethnicity and nonresponse to the interview and examination. Standard errors and 95% confidence intervals were calculated taking into account the complex sample design. Results: Age-adjusted prevalence estimates and 95% confidence intervals are presented for three enteric infectious diseases hepatitis A, *Toxoplasma gondii*, *Helicobacter pylori*, as well as three blood-borne/sexually transmitted diseases, hepatitis B, hepatitis C, and Herpes simplex-2 stratified by race/ethnicity and by various demographic factors including gender, poverty index, population size of area of residence, country of birth, household crowding, and years of education. In addition, estimates are presented for the three blood-borne/sexually transmitted diseases by various risk behaviors that include marital status, age at first sexual intercourse, number of lifetime sexual partners, cocaine use, and marijuana use.

McQuaillan, 2004

Objectives: We examined racial/ethnic differences in the seroprevalence of selected infectious agents in analyses stratified according to risk categories to identify patterns and to determine whether demographic, socioeconomic, and behavioral characteristics explain these differences. Methods: We analyzed data from the third National Health and Nutrition Examination Survey, comparing differences among groups in regard to the prevalence of infection with hepatitis A, B, and C viruses, *Toxoplasma gondii*, *Helicobacter pylori*, and herpes simplex virus type 2. Results: Racial/ethnic differences were greater among those in the low-risk category. In the case of most infectious agents, odds associated with race/ethnicity were almost 2 times greater in that category than in the high-risk category. Conclusions: Stratification and adjustment for socioeconomic factors reduced or eliminated racial/ethnic differences in the prevalence of infection in the high-risk but not the low-risk group, wherein race/ethnicity remained significant and might have been a surrogate for unmeasured risk factors.

Hirota, 2002

The U.S. Army administers the hepatitis A virus (HAV) vaccination for prophylaxis against HAV infection. There is little comparative data as to whether prescreening for previous HAV infection before immunization is less costly than universal vaccination. We designed a study to determine the prevalence of previous HAV infection in U.S. Army recruits and then perform a cost analysis. The cost analysis compared selective vaccination versus universal vaccination. Basic demographic information, including age, gender, geographic origin, and ethnicity, were collected after which patients were tested for HAV antibodies. A total of 1332 individuals was prospectively enrolled with 183 individuals (13.7%) having evidence of previous HAV infection. Minority recruits were found to have a higher prevalence than Caucasian recruits (p=0.0451. The cost analysis demonstrates that vaccination without prescreening was the least costly of two vaccination strategies for this cohort. To achieve current vaccination goals, all U.S. military recruits should be vaccinated without evaluation for previous HAV immunity.

Peach, 2002

The dynamics of population-based immunity were examined by using serologic surveys of 7 villages in rural Alaska between 2 epidemics of hepatitis A virus (HAV) and after the second epidemic (1988-1990). Among persons aged 2-30 years, the overall age-adjusted prevalence of antibody to HAV (anti-HAV) was 51% in 1983 and 49% in 1993 (P=.506). In children aged <5 years, prevalence rates were 0% and 11% in 1983 and 1993, respectively. The prevalence of HAV infection increased with age in both surveys. When examined by 5-year birth cohorts, anti-HAV prevalence increased in children born between 1979 and 1983 (P<.001). Between the 2 survey periods, 43 clinical cases of HAV infection were reported in these villages; all occurred from 1988 to 1990. Despite high overall prevalence of immunity, transmission during epidemics was facilitated by children aged <15 years susceptible to HAV. Little transmission occurred between epidemics. Vaccination of children against HAV should prevent future epidemics.

Matricardi, 2002

Background: The hygiene hypothesis proposes that declining exposure to infections is implicated in the rising trend of allergy and asthma. Objective: We sought to test this hypothesis by examining the relationship of hay fever, asthma, and atopic sensitization with markers of infection in a large general population sample of the United States. Methods: We analyzed the data of 33,994 US residents recorded in a public database of a nationally representative cross-sectional survey (Third National Health and Nutrition Examination Survey, 1988-1994). The variables examined were sociodemographic information, lifetime diagnosis and age at first diagnosis of hay fever or asthma, current skin sensitization to 9 airborne allergens and peanut, and current serology for *Toxoplasma gondii*, herpes simplex viruses type 1 and 2, and hepatitis A, B, and C viruses. Results: Hay fever (adjusted odds ratio, 0.27; 95% CI, 0.18-0.41; P <.001) and asthma (adjusted odds ratio, 0.45; 95% CI, 0.31-0.66; P <.001) were less frequent in subjects seropositive for hepatitis A virus (HAV), *T gondii*, and herpes simplex virus 1 versus seronegative subjects after adjusting for age, sex, race, urban residence, census region, family size, income, and education. Skin sensitization to peanut and to all the airborne allergens examined, except for cockroach, was less frequent among HAV-seropositive versus HAV-seronegative subjects younger than 40 years of age. The prevalence of hay fever and asthma diagnosed at or before 18 years of age in HAV-seronegative subjects increased progressively from 2.7% (95% CI, 0.7%-4.7%) and 0.4% (95% CI, 0.1%-1.6%), respectively, in cohorts born before 1920 to 8.5% (95% CI, 7.3%-9.7%) and 5.8% (95% CI, 4.8%-6.8%), respectively, in cohorts born in the 1960s, whereas they remained constant at around 2% in all cohorts of HAV-seropositive subjects. Conclusion: In the United States serologic evidence of acquisition of certain infections, mainly food-borne and oral-fecal infection, is associated with a lower probability of having hay fever and asthma. Third National Health and Nutrition

Examination Survey data support the hypothesis that hygiene is a major factor contributing to the increase in hay fever, asthma, and atopic sensitization in westernized countries.

Fishbain, 2002

Background: Older individuals and those born overseas are thought at increased risk of prior exposure and thus have naturally acquired immunity to hepatitis A. Whether these individuals or other groups of international travelers should be screened for acquired immunity or empirically immunized is not clear. Hepatitis A serology and risk factor data was obtained prospectively in patients presenting for hepatitis A immunization and used to develop a cost-effective strategy for the use of serologic screening and empiric immunization in our traveler population. Method: Candidates for hepatitis A immunization were routinely screened for total hepatitis A serum antibody. Risk factor data including country of birth, travel history, and history of jaundice was collected. Cost-effectiveness was assessed by comparing the cost of serology to screen all patients plus cost to immunize those found to be seronegative with, the cost of empirically immunizing all patients. Results: Analyses were conducted comparing age, travel history, country of birth, and history of jaundice for significance in predicting seropositivity in a group of 115 subjects. Country of birth was statistically a significant predictor of positive results with 80.0% of foreign-born patients positive for total antibody against hepatitis A compared with 35.6% of patients born in the United States. Living outside of the United States (defined as greater than 30 days) was also correlated with a higher prevalence of hepatitis A positive serology. Age was not predictive for the group as a whole. A lower prevalence (24.3%) was noted in the group of US born individuals aged 30 to 60. Travel and prior history of jaundice failed to demonstrate significance. Conclusions: Employing a simple cost-effectiveness equation using cost of serological testing, cost of vaccine, and prevalence of acquired immunity in the community, a strategy was developed. In our population it was cost-effective to screen all foreign-born individuals and those who had lived outside the United States.

Alagappan, 2001

Hepatitis A is a self-limited, virally mediated infection of the liver. The usual mode of transmission is by the fecal-oral route. Employees of food-service establishments who are infected with the hepititus A virus can transmit the disease when handling food products. The Centers for Disease Control and Prevention recommends the use of the hepatitis A vaccine among dietary workers who may be at risk for contracting and spreading the disease. Because hepatitis A infection can often be a subclinical disease, the incidence of cases reported is not indicative of its true prevalence. The objective of this study was to document the seroprevalence of hepatitis A among hospital dietary workers. Dietary workers at a suburban hospital were interviewed to determine if they had been exposed to hepatitis A and if they had a history of hepatitis A infection. Serum was obtained from each subject and tested for the presence of hepatitis A antibodies. The Abbott HAVAB EIA kit was used for the detection of immunoglobulin G (IgG) and IgM hepatitis A antibodies. Of 119 subjects, 56 (47%) were women, and 63 (53%) were men; the subjects had a mean age of 42 years (range, 20-66). Fifty-one subjects (43%) were born in the United States, and 68 subjects (57%) were born outside of the United States. Of the 119 subjects, only 2 (2%) had a known history of hepatitis A infection, yet 67 (56%) had hepatitis A titers; 52 (44%) were susceptible to the disease. One subject had received the hepatitis A vaccine. Fifty-five of 68 foreign-born subjects (81%; 95% confidence interval, 71-91%) had hepatitis A antibodies versus 12 of 51 US-born subjects (24%; 95% confidence interval, 12-36%). The foreign-born subjects had a mean age of 28 years at the time of their arrival in the United States. In conclusion, a large number of foreign-born hospital dietary workers have hepatitis A antibodies without a history of disease. Immunization of this group of dietary workers may not have any beneficial effects, nor is it cost-effective.

Dentinger, 2001

Background: The Advisory Committee on Immunization Practices recommends routine hepatitis A vaccination of children living in communities with high rates of hepatitis A. Rates among children living in migrant farm worker families are unknown. Methods: Participants recruited from the 1243 migrant children aged 2 to 18 years in Okeechobee County, Florida, were administered a questionnaire. A blood sample was taken for testing for antibodies to hepatitis A virus (anti-HAV), and hepatitis A vaccine was administered. Results: Of 244 (20%) participating children, 125 (51%) were anti-HAV-positive. Seropositivity increased with age from 34% (2- to 5-year-olds) to 81% (≥14-year-olds) ($p<0.0001$). In multivariate analysis, age (odds ratio = 1.2/year; 95% CI = 1.1 to 1.3), having a Mexican-born father (OR=12.2; 95%CI: 2.2 to 227.9), and age on moving to the United States (OR = 1.3/year; 95% CI: 1.0 to 1.6) were independently associated with anti-HAV positivity. Among US-born children aged 2 to 5 years who had never left the United States, 33% were anti-HAV-positive. Conclusions: Anti-HAV prevalence among migrant children in Okeechobee County, including the youngest US-born children, is high, indicating ongoing transmission of HAV. Children in this and other US migrant communities may benefit from hepatitis A vaccination.

Weldon, 2000

To determine if wastewater workers had a higher prevalence of antibody to hepatitis A virus (anti-HAV) than drinking water workers, a convenience sample of Texas wastewater and drinking water workers was evaluated for risk factors by questionnaire and tested for anti-HAV. A total of 359 wastewater and 89 drinking water workers participated. Anti-HAV positivity was 28.4% for wastewater and 23.6% for drinking water workers. After adjustment for age, educational attainment, and Hispanic ethnicity, the odds ratio for the association between anti-HAV positivity and wastewater industry employment was 2.0 (95% confidence interval, 1.0 to 3.8). Among wastewater workers, never eating in a lunchroom, > or = 8 years in the wastewater industry, never wearing face protection, and skin contact with sewage at least once per day were all significantly associated with anti-HAV positivity in a model that adjusted for age and educational attainment. Wastewater workers in this study had a higher prevalence of anti-HAV than drinking water workers, which suggested that wastewater workers may have been at increased risk of occupationally acquired hepatitis A. Work practices that expose workers to wastewater may increase their risk.

Chien, 1999

Objectives: To assess the prevalence of current or previous infection with viral hepatitis agents in an older nursing home population. Design: A prospective cohort study. Setting: Three nursing homes in the greater St. Louis area affiliated with Saint Louis University. Subjects: Older residents admitted to these facilities. Measurements: Residents were interviewed and examined for evidence of hepatitis or liver disease. Serum samples were tested for hepatitis B surface antigen (HBsAg), antibody to hepatitis B core and surface antigens (anti-HBc and anti-HBs), antibody to hepatitis A virus (anti-HAV), antibody to hepatitis C virus (anti-HCV), and hepatitis G virus RNA (HGV RNA). Results: Of 329 residents queried, 199 gave consent and were able to participate. The seroprevalence of hepatitis was: HBsAg 0%, anti-HBc 24.1%, anti-HBs 19.5%, anti-HAV 79.9%, anti-HCV 4.5%, and HGV-RNA 10.6%. Frequency of HAV infection increased significantly with age whereas HBV infection correlated with ethnic status and former occupation as a manual worker. A history of blood transfusion was associated with a higher rate of anti-HCV. End stage renal disease, present in 17 patients, was associated with anti-HBc, anti-HCV, and HGV RNA positivity but not with anti-HBs or anti-HAV positivity Conclusions: The seroprevalence of anti-HCV was surprisingly high in this population residing in skilled nursing facilities, and we recommend that all new patients admitted to this type of institution be screened for anti-HCV. The prevalence of HGV

RNA was higher than in the general US blood donor population, but the significance of this finding remains uncertain.

Leach, 1999

An initial retrospective study of 194 children demonstrated a high prevalence of hepatitis A but not hepatitis B or C infection among children living along the Texas-Mexico border. A larger prospective study of hepatitis A was conducted with 285 children (aged 6 months to 13 years) living in 3 sociodemographically dissimilar areas of South Texas. Children living in colonías along the border had a significantly higher prevalence of hepatitis A virus infection (37%) than children living in urban border communities (17%) or in a large metropolitan area (San Antonio [6%]). Independent risk factors for hepatitis A infection included increased age, colonía residence, and history of residence in a developing country. Use of bottled water (vs. municipal or spring/well water) and years of maternal secondary education were protective. Improved sanitation or routine hepatitis A vaccination in early childhood may reduce the prevalence of hepatitis A in these areas.

Adair, 1999

Background: Despite increasing numbers of African immigrants to the United States, there is a lack of detailed information about their health problems. Methods: Data on communicable diseases were obtained from the charts of all 102 patients who had emigrated from Africa in the last 5 years and were seen at an urban clinic in Minneapolis, Minn, during the last 7 months of 1997. Results: Eight patients had active tuberculosis, 10 had hepatitis B, 7 trichuriasis, 2 amebiasis, 1 schistosomiasis, 1 ascariasis, 2 human immunodeficiency virus infection, and 1 malaria. All patients tested had antibodies to hepatitis A, 55% to hepatitis B, and 3% to hepatitis C. Characteristics of these patients are described. Conclusions: Communicable diseases are common in African immigrants, often despite a healthy appearance and prolonged residence in the United States. Careful screening is warranted.

Redlinger, 1998

Two seroprevalence studies of viral hepatitis A and hepatitis E were conducted in El Paso, Texas, and Ciudad Juárez, Mexico. Subjects were randomly selected, low-income pregnant women. Blood from 557 women in El Paso and 307 women in Ciudad Juárez, obtained from routine prenatal testing, was analyzed for antibodies to hepatitis A and hepatitis E. Women from both cities showed high seroprevalence rates of hepatitis A (75.8% in El Paso and 96.1% in Ciudad Juárez). Rates increased significantly by age, with 100% of women in Ciudad Juárez older than 28 years testing positive. Nationality and ethnicity were significantly associated with hepatitis A seroprevalence: Mexican nationals, 96.1%; U.S. Hispanics, 78.8%; and U.S. Caucasians, 36.4% ($P < .001$). With respect to hepatitis E, 0.4% of women in El Paso and 1.6% of women in Ciudad Juárez tested positive for anti-HEV. The rate of hepatitis A seroprevalence was higher for women with lower educational levels and for women residing in crowded households, but these findings were not statistically significant.

Redlinger, 1997

Objectives: A cross-sectional study investigated the association of hepatitis A seropositivity with environmental and personal risk factors among children in a United States-Mexico border community. Methods: Hepatitis A serological markers and a questionnaire identifying risk factors were evaluated for 523 primary school children. Results: Of the children studied, 16.9% tested positive for total anti-hepatitis A virus. Risk factors included being in the first grade, low maternal educational attainment, living in Mexico for more than 6 months, household crowding, and inadequate excreta disposal systems. Conclusions: To decrease enteric disease, improvements in excreta disposal infrastructures and educational programs are needed. Hepatitis A vaccine should be administered before school age.

Thomas, 1997

If the occurrence of hepatitis E virus antibody (anti-HEV) in regions where the disease is not endemic represents infection, rates may be greater in high-risk populations and behavioral correlates may reflect recognized transmission modes. Serum samples from 300 homosexual males, 300 injection drug users (IDUs), and 300 blood donors from Baltimore, Md., were tested for anti-HEV by enzyme immunoassay. Anti-HEV was found in an unexpectedly high percentage of homosexual men (15.9%) and IDUs (23.0%). However, anti-HEV was present in a similar proportion of blood donors (21.3%) ($P > 0.05$), while hepatitis A, B, and C virus antibodies were more prevalent in the high-risk groups ($P < 0.001$). Among homosexual men, anti-HEV was not significantly correlated with a history of hepatitis, high-risk sexual practices, or sexually transmitted infections, in contrast to hepatitis A and B antibodies. Among IDUs, anti-HEV was not significantly associated with a history of hepatitis or high-risk drug-using practices, as was found with hepatitis C antibodies. In a setting without endemic hepatitis E disease, there was no evidence that anti-HEV reflected subclinical infection. Until the basis for HEV seroreactivity in such areas is elucidated, anti-HEV results should be interpreted with caution.

Ansdell, 1996

Background: Hepatitis A is the most frequent vaccine-preventable infection in travelers to developing countries. Hepatitis A vaccine and immune serum globulin (IG) offer safe, effective protection against hepatitis A. Some travelers are already immune, however, and it is useful to try to identify subgroups with an anticipated high prevalence of antibody to hepatitis A (anti-HAV). Screening for antibody in these groups would often be a cost-effective alternative to routine use of hepatitis A vaccine or IG prior to travel. Methods: Prospective travelers to developing countries from Hawaii (n = 476) were tested for anti-HAV. Total antibody was measured by an enzyme immunoassay. Age, sex, birthplace, previous travel experience, and past history of hepatitis or jaundice were recorded for each traveler. Results: Overall prevalence of anti-HAV was 35.3%. Antibody prevalence increased progressively with age and varied significantly with birthplace and travel experience. Antibody prevalence was particularly high in travelers with a history of hepatitis or jaundice. Conclusions: Screening for preexisting immunity to hepatitis A is often worthwhile in extended stay or repeat travelers. This study suggests that screening may also be a cost-effective alternative to routine use of hepatitis A vaccine or IG in those travelers (i) born in the United States (including Hawaii) before 1930; (ii) born in Europe, Australasia, or Japan before 1950, (iii) born in developing countries; (iv) with increased travel experience; and (v) with a history of hepatitis or jaundice.

Bulkow, 1993

To assess the epidemiologic characteristics of the population susceptible to hepatitis A virus (HAV) infection and determine the natural history of infection, a retrospective survey was done using banked serum specimens. A random sample of 4030 Alaska Natives statewide was selected, stratified by year of birth and community of residence. Overall, 1988 serum samples (49.3%) tested positive for antibody to HAV (anti-HAV). Past HAV infection was strongly age-related, increasing from 7% in persons born since 1975 to 85% among persons born before 1945. Prevalence of infection also varied between regions. In small communities, a clear demarcation typically existed between previously infected older persons and younger anti-HAV-negative persons. This indicated that village-wide outbreaks of HAV infection have been the norm and appear to be dependent on the presence of a young susceptible population. Widespread vaccination with hepatitis A vaccine to maintain a high proportion of young anti-HAV-positive persons may be successful in preventing future epidemics.

Hyams, 1992

One thousand five hundred thirty-eight U.S. Navy and Marine Corps enlisted recruits were tested for hepatitis A, B, and C serologic markers. The recruit population (mean age, 19 years) was 91% male, 69% white, 17% black, 9% Hispanic, 2% Filipino, and 2% "other" racial/ethnic group. Anti-HAV was found in 129 (8.4%) recruits, anti-HBc in 35 (2.3%), HBsAg in 5 (0.3%), and anti-HCV in 4 (0.3%). For recruits born in the U.S., the prevalence of anti-HAV and anti-HBc was 5.5% and 1.3%, respectively; for the 7% of recruits born outside the U.S., the prevalence was 44.9% and 14.0%, respectively. By logistic regression analysis, seropositivity for hepatitis A and B was independently associated with age, nonwhite racial/ethnic groups, and birth outside of the U.S. This study indicates that there is a relatively low risk of hepatitis A, B, and C infection among Navy and Marine Corps recruits.

Hawkins, 1992

A prevalence study of 2072 male US shipboard military personnel scheduled for deployment to South America/West Africa and the Mediterranean was conducted to determine whether serologic evidence of prior hepatitis A, B, or C infection is associated with exposure in foreign countries. There were 210 subjects (10.1%) who had antibodies to hepatitis A virus (anti-HAV), 76 (3.7%) to hepatitis B core antigen (anti-HBc), and 9 (0.4%) to hepatitis C virus (anti-HCV). By multivariate analysis, anti-HAV seropositivity was independently associated with age, non-white racial/ethnic groups, birth outside of the United States, and prior Caribbean deployment for less than 1 year. Anti-HBc seropositivity was independently associated with black and Filipino race/ethnicity, foreign birth, a history of a sexually transmitted disease, South Pacific/Indian Ocean deployment (less than 12 months), and South Pacific or Mediterranean duty for (greater than 1 year). No geographic risk factors were associated with anti-HCV positivity. These data indicate that military personnel deployed outside the United States are at increased risk of viral hepatitis infection and should be considered for vaccination.

Levine, 1991

The risks of viral transmission from trauma patients is a continuing concern to those involved in their care. However, the prevalence of hepatitis (HPT) in trauma patients is poorly described. The purpose of this study is to evaluate the prevalence of HPT in trauma patients admitted to an urban trauma center. Two hundred sixty-four consecutive admissions to an urban Level I trauma center underwent serologic screening for HPT. Risk factors were assessed by direct patient questioning. Serologic evidence of HPT B was found in 19.7 per cent of patients. Intravenous (IV) drug abusers represented eight per cent of the study population; this group had a 67 per cent rate of seropositivity. Hepatitis A was not found in any patient. Antigenemia was found in 1.9 per cent of patients. It is concluded that HPT B seropositivity is common in trauma patients. IV drug abusers have particularly high prevalence of HPT. This high prevalence rate of HPT B serology poses a significant risk to those involved with the care of trauma patients. The authors suggest that specific protocols to avoid the transmission of viral disease should be mandatory in urban trauma centers.

Shaw, 1990

Hepatitis A continues to occur in cyclical community-wide epidemics on the Indian reservations of South Dakota. In June 1985 a population-based serosurvey for viral hepatitis involving 120 households was conducted at the Pine Ridge and Rosebud Sioux Indian reservations in South Dakota. The serosurvey was performed shortly after a large hepatitis A epidemic on the Pine Ridge reservation in 1983-84, and immediately before a large hepatitis A epidemic on the Rosebud reservation in 1985-86. The overall seroprevalence for antibodies to hepatitis A virus (anti-HAV) was 76.2% (Pine Ridge reservation 80.5%, Rosebud reservation 72.0%, relative risk = 1.12, 95% confidence interval = 1.01, 1.24). For age groups 0 to 4 years, 54.2% and 36.1% of children were seropositive at Pine Ridge and Rosebud, respectively.

Seropositivity rose rapidly with age; by age 40, more than 90% of persons at both Pine Ridge and Rosebud were anti-HAV positive. Only 1.1% of persons tested were positive for hepatitis B markers. Anti-HAV seroprevalence rates in both communities are similar to rates observed in developing countries. The surprisingly high anti-HAV seroprevalence among young children at Rosebud, where clinical hepatitis A had been virtually absent in the previous seven years, indicates that high-grade silent transmission was taking place during the interepidemic period.

Hooper, 1988

(no abstract)

Pepe, 1986

Houston has large groups of people known to be at high risk for hepatitis B virus (HBV) infection. Emergency medical services (EMS) personnel are continuously exposed to blood from these high-risk individuals. We sought to determine the prevalence of HBV infection in the city's EMS personnel. Of the 350 Houston firefighters assigned to EMS, 344 were surveyed by questionnaire and a blood specimen was obtained. Each sample was assayed by radio-immunoassay or enzyme-linked immunoassay for hepatitis A antibody (anti-HAV), hepatitis B surface antigen (HBsAg), and antibodies to HBsAg (anti-HBs) and hepatitis B core antigen (anti-HBc). A history of hepatitis was reported by 19 persons, 17 of whom had serologic evidence of infection with HAV (56%), HBV (26%), or both diseases (11%). The anti-HAV prevalence was 16% (12% in whites and 35% in nonwhites; P less than .001). No correlation was observed with years of occupational exposure. Of the 338 personnel evaluated for HBV seromarkers (six HBsAg-vaccinated subjects were excluded), 13% were positive; 0.6% had an active infection as determined by the presence of both HBsAg and anti-HBc; 6.8% were both anti-HBs and anti-HBc positive; 0.9% were positive for anti-HBc alone; and 4.7% of the sera contained only anti-HBs (all with geometric mean antibody levels of less than or equal to 13 mlU/mL). The 28 individuals (8.3%) whose sera contained anti-HBc were classified as cases of previous or concurrent HBV infection. A strong correlation (P less than .004) was observed between HBV infection and years of work exposure in EMS regardless of job description (paramedic versus emergency medical technician).

Williams, 1986

Previous studies of the prevalence of immunity to hepatitis A (anti-HAV) in the United States have used urban settings or institutions for the mentally handicapped. In a rural setting among normal children, a serologic investigation of prevalence of anti-HAV was conducted in a boarding school adjacent to the Navajo reservation. The results show rates of anti-HAV that are the highest reported at the ages tested in any subpopulation in the United States, comparable only with those in developing countries.

Siebke, 1986

During two expeditions to four remote Eskimo villages of Alaska in 1982-1983, serum samples from practically the entire population over 5 years of age were collected for the study of serologic evidence of hepatitis A and B. An average of 41% of the population showed serological evidence of hepatitis A with only minor differences from village to village. Antibodies were found among all age groups and undoubtedly reflect repeated minor hepatitis A epidemics in the various villages over a long period of time.

James, 1981

(no abstract)

OCEANIA

(American Samoa, Cook Islands, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Pitcairn, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Wallis and Fortuna Islands)

Withers, 1985

Current US military recruit vaccination policy presumes that recruits have had a complete childhood immunization series. This assumption may not be appropriate for recruits from Micronesia, who may have had limited access to modern health care, including immunization programs. During 1988 and 1990, a cross-sectional serosurvey was conducted among 66 US military recruits, 56 from the Federated States of Micronesia and 10 from the Republic of the Marshall Islands, collectively referred to as Micronesia. Antibody seronegativity levels for 12 vaccine-preventable (or potentially so) diseases were: measles (52%), mumps (14%), rubella (21%), varicella (38%), diphtheria (39%) tetanus (0%), polio type 1 (4%), polio type 2 (0%), polio type 3 (14%), hepatitis A (9%), hepatitis B (17%), and hepatitis C (98%). Compared with Army recruits in general, Micronesian recruits were significantly more likely to be seronegative for measles and varicella and seropositive for hepatitis types A and B. Personal histories of disease were felt to be inadequate in predicting antibody status.

Duval, 2008

(no abstract)

Hawkes, 1981

Sera from 988 subjects in four ecologic zones of the Sepik district and 219 subjects from four widely spaced altitudes of the Bismarck range in Papua New Guinea were tested for antibody to the hepatitis A virus (anti-HAV) by radioimmunoassay. The Sepik district subjects, mostly children between three months and six years of age when first sampled in 1963, were re-bled on four occasions over the ensuing nine years. The Bismarck range population was sampled only in 1964. In the Sepik district, anti-HAV was detected infrequently before the age of three years and showed maximum increase in prevalence rates between 7-10 years, with little increase thereafter. Antibody acquisition rates also indicated peak transmission in this age group, with fewer conversions between three months and six years of age and in adulthood. There was a consistent, though unexplained tendency for HAV infections to occur more frequently in proximity to the Sepik river than in areas farther away, and in the lower altitudes of the Bismarck range. As determined by serial samples, anti-HAV detected in 1963-1964 was still present in 1972 in 118 out of 119 subjects.

SUB-SAHARAN AFRICA, CENTRAL

(Angola, Central African Republic, Congo,
Democratic Republic of the Congo, Equatorial Guinea, Gabon)

Werner, 1985

In a seroepidemiological study of the population of a rural area in northern Zaire, markers of hepatitis A and B were determined. Examinations of serum specimens (n = 142) showed that hepatitis A is acquired early in childhood; virtually all persons beyond 20 years of age are immune. Capillary blood dried on filter discs (n = 352) gave accurate results only in childhood; in older individuals a high percentage of positive results was missed (approximately 20%), presumably due to lower anti-HAV titers in older persons. The dried-blood method showed similar limitations regarding the detection of hepatitis B markers. In the 5-7 year age group there was already a high prevalence of anti-HBc (59%) as determined by the dried blood method. In the 10-19 year age group the prevalence was 94% as determined by examination of serum specimens. In all age groups the percentage of HBsAg positive persons was 20.7%, as demonstrated in capillary blood specimens and 31.7% in serum specimens.

Werner, 1984

In a sero-epidemiological study, clinically healthy persons from a rural area of Zaire were tested for antibodies against hepatitis A, B and yellow fever. There was a high prevalence of antibodies to hepatitis A-virus in early life: 90% of all children at the age of ten had antibodies in their sera. Similarly up to the age of 19 years almost 90% of all persons investigated were positive for hepatitis B (anti-HBc). The incidence of the hepatitis B-surface antigen in all ages was high. According to the method used, it totaled to 21% (capillary blood) or 32% (serum specimens). All these persons were asymptomatic HBsAg carriers. A carrier-rate of 20-30% is extremely high; it has been reported only in a few studies in tropical countries. 138 serum specimens from all age groups were tested for antibodies to yellow fever virus; 59 of them (43,4%) were positive. None of these persons reported a history of yellow fever; evidently they had undergone subclinical infections. Our findings show that yellow fever still is endemic in Central Africa. It may be concluded that all persons visiting Central Africa should be vaccinated against hepatitis A (passive prophylaxis), yellow fever and, if possible, against hepatitis B.

SUB-SAHARAN AFRICA, EAST

(Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, Sudan, Uganda, United Republic of Tanzania, Zambia)

Aubry, 1997

The seroprevalence of hepatitis E virus (HEV) was measured through use of data from a 1992-93 case-control study of patients with chronic liver diseases conducted at Kamenge University Hospital in Bujumbura, Burundi. 97.7% of subjects were anti-hepatitis A virus (HAV)-positive. In contrast, the seroprevalence of anti-HEV IgG was only 14%. Hepatitis B virus (HBV) markers were as follows: HBV surface antigen, 4.7%; antibody to HBV surface antigen, 55.8%; and antibody to HBV core antigen, 65.1%. The prevalence for all 3 HBV markers combined was 77.6%. No seropositivity was found for anti-hepatitis D virus among subjects positive for HBV surface antigen (4.7%) or for antibody to HBV core antigen (17.1%). 27.1% were anti-hepatitis C virus-positive. The prevalence of HIV was 30.2%. The presence of serologic markers of hepatitis A, B, and C virus was not associated with that of antibody to hepatitis E or HIV. Previous studies have found high rates of HEV in areas that have experienced high rainfall and flooding. The relatively low rate of HEV recorded in this study may reflect the fact that most Bujumbura residents use drinking water pumped from the middle of Lake Tanganyika and piped to taps near homes.

Fox, 1988

A serosurvey involving 656 individuals revealed that hepatitis A infection was virtually universal in Djibouti in 1987, and more than half of the people investigated had serum markers of hepatitis B infection. The rate of chronic HBsAg carriers was 7.3% and was higher for males than for females. Both HBsAg and anti-HBs positivity rates were directly related to increasing age. No uniform mechanism could be found to account for transmission of the hepatitis B virus, and no correlation was noted between HBV-marker status and sexual promiscuity or the classic blood exposure risks. However, a significant association existed between the abuse of khat and the chronic HBsAg carrier state.

Scrivener, 2001

Background: Why asthma is rare in rural subsistence societies is not clear. We tested the hypotheses that the risk of asthma is reduced by intestinal parasites or hepatitis A infection, and increased by exposure to dust-mite allergen or organophosphorus insecticides in urban and rural areas of Jimma, Ethiopia. Methods: From 12,876 individuals who took part in a study of asthma and atopy in urban and rural Jimma in 1996, we identified all who reported wheeze in the previous 12 months, and a random subsample of controls. In 1999, we assessed parasites in fecal samples, Der p 1 levels in bedding, hepatitis A antibodies, serum cholinesterase (a marker of organophosphorus exposure), total and specific serum IgE, and skin sensitization to *Dermatophagoides pteronyssinus* in 205 cases and 399 controls aged over 16 years. The effects of parasitosis, Der p 1 level, hepatitis A seropositivity, and cholinesterase concentration on risk of wheeze, and the role of IgE and skin sensitization in these associations, were analyzed by multiple logistic regression. Findings: The risk of wheeze was independently reduced by hookworm infection by an odds ratio of 0.48 (95% CI 0.24-0.93, p=0.03), increased in relation to Der p 1 level (odds ratio per quartile 1.26 [1.00-1.59], p=0.05), and was unrelated to hepatitis A seropositivity or cholinesterase concentration. In the urban population, *D pteronyssinus* skin sensitization was more strongly related to wheeze (9.45 [5.03-17.75]) than in the rural areas (1.95 [0.58-6.61], p for interaction=0.017), where *D pteronyssinus* sensitization was common, but unrelated to wheeze in the presence of high-intensity parasite infection. Interpretation: High degrees of parasite infection might prevent asthma symptoms in atopic individuals.

Tsega, 1990

Three groups of individuals in Ethiopia, with different socioeconomic status, were studied demographically and serologically to determine the age-specific prevalence of antibody to hepatitis A virus (anti-HAV). A total of 959 subjects, 89% of whom were children under 15 years of age, were tested for anti-HAV by radioimmunoassay. Evidence of infection started early, found in 50% of the population before 5 years of age, increased rapidly with age and became universal after 15 years of age. A comparison of anti-HAV prevalences between 2 socioeconomic groups (children of health professionals versus children of lower income group) revealed a significant difference (p less than 0.01). These data show that HAV infection in Ethiopia is widespread and that environmental and socioeconomic factors play a major role in its transmission. The widespread prevalence of anti-HAV and anti-HBs also suggest that non-A, non-B virus(es) may be a major cause of the commonly observed sporadic cases of acute viral hepatitis in adult Ethiopians.

Tsega, 1986

A total of 500 individuals from five different regions of Ethiopia were studied. Demographic and clinical data were recorded and serologic tests were carried out to detect antigen and antibody markers of hepatitis B virus, hepatitis A virus, and the delta agent. Data on the economic status, number of rooms per household, number of persons per household, type of water supply, and mode of excreta disposal revealed that the majority of the population surveyed lived with economic hardship, overcrowding and poor hygiene. Only 36 persons gave a past history of jaundice. The mean carrier rate of hepatitis B surface antigen (HBsAg) was 6.2%, the mean overall hepatitis B virus marker prevalence was 42%, and in those over 14 years of age it was 76%. Among those who were positive for HBsAg, there was a tendency for hepatitis B e antigen (HBeAg) to decrease and the corresponding antibody (anti-HBe) to increase with advancing age. No woman more than 15 years of age had demonstrable hepatitis B e antigen in serum. Antibody to hepatitis A virus was detected in 84%. Three positive individuals were found to have antibody to the delta agent.

Gebreselassie, 1983

There have been few reports from Africa, and none from Ethiopia, pertaining to sero-epidemiological investigation of viral hepatitis A and B. In this study, 396 serum samples, from male and female Ethiopian subjects aged between 3 and 60 years, were tested for specific markers of hepatitis A and B. Antibodies to hepatitis A virus were detected in 99% of the study population. There was an overall prevalence of hepatitis B surface antigen (HBsAg) of 9%, with a peak value of 15% in the age groups 21-30 years and ≥41 years. The pattern of age prevalence of HBsAg was similar to that found in China (province of Taiwan), Senegal and Thailand. The distribution of the subtypes of HBsAg was in line with that generally found in east Africa, northern Europe, and central America, where subtype ad predominates. HBsAg was found in 3 times more men than women (10.5% and 3.5%, respectively). Antibodies to hepatitis B surface antigen were found in 67% of the population, and were evenly distributed between males and females. In general, the results indicated that hepatitis B virus is more endemic in rural, rather than urban, areas, while hepatitis A virus is endemic throughout the country.

Siekmann, 2003

Background: Undernutrition is widely perceived to affect the development of an effective immune system. Objective: We used a mini-analysis system to quantitate antibody titers and evaluate the sera of 200 Kenyan schoolchildren for antibodies to Helicobacter pylori [isotypes of immunoglobulins A (IgA), G (IgG), and M (IgM)], hepatitis A virus, rotavirus, tetanus toxoid (IgG), and a panel of recombinant malarial antigens (MSP1(19), MSP2, Ag512, MSP4, and MSP5). Design: Children participated in a school-based feeding intervention with meat, milk, or nonanimal-source foods or in a nonintervention control group. Microvolumes (200 mL) of sera were analyzed at baseline and after 1 y. Results: Nearly all children had elevated titers of antibody to *H. pylori*, hepatitis A virus, rotavirus, and malaria at the outset, despite a high prevalence of apparent biochemical micronutrient deficiencies and stunting, but many had titers of tetanus toxoid IgG antibodies below the protective concentration. Children with low hemoglobin had a greater proportion of elevated *H. pylori* IgM antibody titers at baseline, which suggests that current infection with H. pylori may be associated with anemia. Compared with the control subjects, only the group eating meat had a significant increase in *H. pylori* IgM antibodies during the intervention (P = 0.019). No other group comparisons with the control subjects were statistically significant. The additional finding that the sera of some children showed inadequate tetanus-protective antibodies, despite immunization, suggests that the vaccination program was suboptimal. Conclusions: A large battery of immune assays can be performed on microvolumes of sera. Furthermore, despite evidence of malnutrition, children do develop significant antibody-mediated responses to common pathogens.

Raharimanga, 2008

Background: Hepatitis A virus (HAV) is an enteric, viral, infectious disease endemic in many developing countries such as Madagascar. Infection is often subclinical or asymptomatic in children; however, symptomatic acute infections become more common with increasing age. In some developing countries, improvements in living conditions have led to changes in the epidemiological pattern of HAV infection. There are very few reports on the prevalence of HAV in Madagascar. This study was to determine the seroprevalence of hepatitis A virus antibodies in relation to age in the city of Antananarivo, Madagascar. Methods: Serum samples collected in 2004 during a cross-sectional survey of individuals aged between two and 24 years from Antananarivo were tested for anti-HAV antibody using a commercial enzyme immunoassay kit. Subjects were investigated using a standardized social and medical history questionnaire. Results: 926 subjects were enrolled including 406 males and 520 females. There were 251 children under 10 years old and 675 subjects between 10 and 24 years old. Of the 926 serum samples tested, 854 (92.2%) were positive for anti-HAV antibodies. The number of seropositive samples was similar for males and females. The overall seroprevalence was 83.7% (210/251) for children under 10 years old and 95.5% (644/675) for subjects aged between 10 and 24 years ($p < 0.001$). Conclusion: Despite improvements in sanitary conditions and hygiene over the last few years, the prevalence of HAV in Antananarivo is high. Only children under five years old remain susceptible to HAV infection. Immunization against HAV is not needed at the present time in the Madagascan population, but should be recommended for travelers.

Morvan, 1994

The first serological survey of hepatitis A, B and C virus infection was carried out in Madagascar during 1993 in two rural villages (653 sera) of the middle-west. This study shows a high frequency of positivity of hepatitis A virus markers (94.9%). Hepatitis A is acquired in early childhood. The data show the high frequency of positivity of hepatitis B (HBV) markers: in the two villages 72.5% and 89.8% have one marker, and seroprevalence of HBs antigene is 18.9% and 30.5%. Hepatitis B also is acquired in early childhood. The data show that not only hepatitis A and B but also hepatitis C is highly prevalent (2.2% and 5.8%). There was an increase in HCV antibody prevalence with age.

Bile, 1992

The prevalence of serologic markers for hepatitis A, B, and C was investigated in children from two residential institutions in Somalia. Among 596 individuals at one residence (Shebeli), the prevalences were 96% for antibody to hepatitis A virus (anti-HAV), 75% for total hepatitis B virus (HBV) markers, 16% for hepatitis B surface antigen (HBsAg), and 1.5% for antibody to hepatitis C virus (anti-HCV). Corresponding figures for the 76 individuals at a smaller residence (Societe Organisation Sociale, SOS) were 59%, 20%, 3.9%, and 0%, respectively. At Shebeli, the HBsAg carrier rates in the 1-10-year-old age group was 28% for boys and 16% for girls. These rates were significantly higher than in the older children (16% and 7.4% for boys and girls, respectively). 58% of the HBsAg carriers were positive for hepatitis B e antigen. Total HBV markers were significantly more frequent in girls from Shebeli, when their duration of residence was longer than five years (89% versus 63%). The duration of stay did not influence the prevalences of HBsAg, HAV, or HCV antibodies. A followup study of children initially seronegative for HBV markers was carried out after two years. For children at Shebeli 1-10 years old, the annual seroconversion rates to HBV markers (95% confidence interval) was 60.5% (42.7-77.0%). The corresponding rate for children at SOS was 10.2% (5.2-17.5%). The differences between the two institutions in the prevalence of serologic markers for hepatitis A and B, and in the annual seroconversion rate to HBV markers reflected different rates of horizontal transmission. This was presumed to be due to differences in socioeconomic conditions and size between the two institutions, and the disparity in the number of infectious HBV carriers.

Mohamud, 1992

We report the results of a study carried out to evaluate the extent of hepatitis A virus (HAV) and hepatitis B virus (HBV) circulation in Somalia. Serum samples were collected from 593 subjects (age range 0-83 years) and tested for anti-hepatitis A (HAV) and anti-HAV IgM. Serum samples taken from 1272 individuals (age range 0-83 years) were tested for HBsAg, anti-HBsAg, anti-HBcAg, HBeAg and anti-HBeAg. We confirmed a very high rate of HAV exposure (about 90% of the subjects tested had circulating anti-HAV) as is typical of fecal-orally transmitted infectious agents. The age-specific anti-HAV IgM prevalence suggests that HAV infection is acquired very early in life. Our data also indicate a high rate of HBsAg carriers (range: 10.5%-27.4%) in the Somalian population. When all markers are considered, 60% of the adult population showed evidence of HBV exposure. HBV spreads very subtly: in fact, it is generally transmitted via non-overtly percutaneous routes. In Somalia, hepatitis A virus infection is highly endemic and occurs very early in life. Hepatitis B virus infection is also widespread in this country.

Bile, 1986

In developing countries, HAV seems to be responsible for a widespread, inapparent and protective infection during early childhood. This report emphasizes early infection and its relationship to protection by passive immunity from maternal antibody in a highly endemic area such as Somalia. Our result show that HAV infection in Somalia primarily occurs during the first 4 years of life (4 months to 4 years). Cases are infrequent in the first 3 months due to passive immunity secondary to maternal antibody (cord-blood and colostrum anti-HAV). As the level of protection declines, the rate of acute infection rises as determined by the presence of IgM-specific anti-HAV.

Mayama, 1998

We studied the seroprevalence and transmission of Kaposi's sarcoma-associated herpesvirus (KSHV/HHV8), among 215 Ugandan children, adolescents and young adults. We measured antibodies to a latent nuclear antigen (LANA) and a lytic cycle protein encoded by open reading frame (orf) 65. Infection with KSHV/HHV8 occurred during early childhood and reached adult levels (approx. 50%)

before the age of puberty. In children younger than 12 years of age, antibodies to LANA and the orf65 protein were independently associated with hepatitis B infection ($p < 0.005$). KSHV/HHV8 infection was not associated with antibodies to hepatitis A virus and hepatitis C virus, nor with the quality of the water supply, household size, previous blood transfusions, number of boy/girl friends or marital status. Antibodies to the orf65 protein, but not LANA, were weakly associated with a history of i.v. injections. Our results show that, in contrast to its sexual mode of transmission among homo/bisexual men and sexually transmitted diseases clinic attendees of Northern Europe and the US, transmission of KSHV in Uganda occurs largely before puberty. Among Ugandan children, KSHV transmission follows a horizontal pattern similar to other herpesviruses, in particular the related gamma herpesvirus, Epstein-Barr virus. Transmission of KSHV may be facilitated by living conditions that also promote infection with hepatitis B virus.

Miller, 1998

In a cross-sectional study in Dar es Salaam, Tanzania, we determined the seroprevalence of markers for hepatitis A, B, C and E viruses and examined associated risk markers. Among 403 healthy adults, the seroprevalence of antibodies to hepatitis A virus was 99.0% (95% confidence interval: 97.5-99.7). Prior exposure to hepatitis C and E viruses was rare (hepatitis C: 0.7% (0.2-2.1); hepatitis E: 0.2% (< 0.1-1.4)). The prevalence of all markers of hepatitis B was 70.7% (66.0-75.1). Hepatitis B surface antigen was identified in 6.0% (3.9-8.7) of subjects. Independent predictors of hepatitis B infection identified by logistic regression included older age, male gender, Muslim religion and type of abode. Given the high prevalence of hepatitis B and the low prevalence of hepatitis C, the majority of chronic viral hepatitis is likely to be associated with hepatitis B. Control efforts should focus primarily on hepatitis B.

SUB-SAHARAN AFRICA, SOUTH

(Botswana, Lesotho, Namibia, South Africa, Swaziland, Zimbabwe)

Steele, 1995

A community based sero-epidemiological study was undertaken to determine the age specific prevalence rates of hepatitis A virus (HAV) and hepatitis B virus (HBV) infection in a band of Bushmen in the West Caprivi, Namibia. All children tested and all but two of the adults tested showed the presence of anti-HAV antibodies. Nineteen individuals (18%) were positive for HBsAg and 65 (61%) individuals had serologic evidence of past exposure to HBV infection.

Joubert, 1985

A survey of the frequency of hepatitis B markers in 258 subjects from Kavango, northern South West Africa/Namibia, was undertaken during February to May 1983. The hepatitis B surface antigen and hepatitis B e antigen carrier rates were 13.6% and 2.7% respectively. Only 1.9% of the subjects were negative for all the markers tested, indicating that infection had been present at some stage in 98.1% of the sample. No known transmission method of the virus seems to fit this high exposure rate. The possibility that arthropod transmission of the virus may play a role in the epidemiology of the disease in Kavango is being investigated. All subjects tested for antibodies to hepatitis A virus were found to give a positive result. Of the arboviruses tested for, West Nile virus was usually predominant and was probably responsible for most of the arbovirus infections. Antibodies to the Sindbis, Chikungunya, Germiston, and Rift Valley fever viruses were also found.

Vardas, 2002

The prevalence of hepatitis A, B and C antibodies was measured in a group of healthcare workers (HCWs) at increased risk of occupational acquisition of blood-borne viruses (n=402) from a large, urban referral hospital in South Africa. The aims of this study were to determine the immunity of HCWs to these agents and to recommend policy for the protection of HCWs against occupational exposure to viral hepatitis in this country. Race, sex and age were shown to be important factors influencing the presence of hepatitis A (HAV) antibodies. Most black HCWs (96.2%) are protected from HAV infection. Females have significantly higher HAV antibodies compared with males and antibodies increase with increasing age. Hepatitis B antibodies (anti-HBs) were found in 30.6% of HCWs. Anti-HBs levels were significantly associated with a past history of HBV vaccination. However, only a small proportion of HCWs (21.2%) could remember ever being immunized against HBV. For those individuals that did receive HBV vaccination (n=83), the mean number of years since their last vaccine was 6.2 years (SD +/- 3.5). HCV antibodies were found in 1.8% of HCWs at increased risk of occupational exposure. It was not possible to define whether these infections were occupationally acquired but genotyping of the HCV (in two of seven cases) showed genotype 5, the predominant South African genotype. New recommendations for the prevention of viral hepatitis in HCWs in South Africa are made, including pre-employment screening for HAV based on self-selection criteria, universal anti-HBs screening with HBV booster vaccination. HCV recommendations are based on appropriate education of HCWs about this infection and its prevention and a standardized post-exposure testing protocol.

Waner, 1997

(no abstract)

Taylor, 1995

Certain health risks have been associated with recreational exposure to fecally polluted water. Canoeing in certain South African waters is considered to be a high risk activity with regard to schistosomiasis, gastroenteritis and possibly hepatitis. In a cross-sectional study, a serosurvey was conducted amongst canoeists to ascertain whether or not they had a higher seroprevalence to hepatitis A virus, Norwalk virus and *Schistosoma* spp. than non-canoeists. In comparisons between the two groups, a significant association could not be demonstrated between canoeing and antibody response to hepatitis A and Norwalk viruses (p-values for age-adjusted chi^2 were 0.083 and 0.219 respectively), but a significant association could be demonstrated between canoeing and the antibody response to *Schistosoma* spp. ($p<0.001$; age-adjusted).

Sathar, 1994

The age- and race-specific seroprevalence of hepatitis A virus (HAV) infection was determined by radioimmunoassay (RIA) in 786 subjects between the ages of 6 months to 60 years. More than 50% of African children were seropositive by the age of 5 years. In blood donors (17-60 years), 50% (93/187) of Whites, 67% (110/163) of Indians, 85% (117/137) of Coloureds, and 91% (115/127) of Africans were seropositive. There was a significant difference in the seroprevalence of HAV infection between White blood donors and blood donors from the other three racial groups [Coloureds ($p<0.0001$), Africans ($p<0.0001$), and Indians ($p<0.001$)] and between Indians and Coloureds ($p<0.0001$) and Indians and Africans ($p<0.0001$). There was no significance difference in HAV infection between Coloureds and Africans ($p<0.200$). Eighty-seven per cent (32/37) of rural Africans had previous infection. In the African population HAV infection is acquired in childhood. There are significant racial differences in the seroprevalence of HAV infection. The surveillance of HAV infection may be used as a valuable yardstick to monitor the changing standards of hygiene and socioeconomic conditions of a community in transition in South Africa and to make rational public health decisions regarding a hepatitis A vaccination policy.

Martin, 1994

Testing stored sera from various categories of individuals has shown that among the black population hepatitis A virus (HAV) infection is universal and most adult black subjects are immune. Infection probably occurs early in life, consistent with the epidemiological pattern seen in the developing world. By contrast, seroprevalence of HAV infection in adult White subjects increases with age, reflecting an epidemiological pattern seen in the developed world. White subjects working in a virological laboratory and White medical students had comparatively low seroprevalences of HAV infection and could therefore represent groups at risk. Hepatitis A vaccine is likely to be available in South Africa in the near future and could be offered to these groups. Pre-vaccination immunity screening would be a cost-effective strategy.

Song, 1994

The age-specific prevalence of antibody to hepatitis A virus (anti-HAV) was determined in 949 Chinese people residing in South Africa in 1983 to 1985. This small community is comprised of original settlers from the mainland China province of Guandong, where hepatitis A virus infection is endemic, and their South African-born descendants. The overall anti-HAV prevalence (by radioimmunoassay) in South African Chinese people was 57.8%, was lowest in children aged 0-9 and 10-19 years (10.0% and 12.8%, respectively), and rose progressively with increasing age to a peak level of 96.6% in the sixth decade of life. A sharp rise in antibody prevalence to 82.9% was observed in the 30-39 year age group, suggesting a high level of childhood exposure at a time of socioeconomic development in South Africa. The age-specific prevalences of anti-HAV among young South African Chinese people are appreciably lower than those of mainland Chinese children, the majority of whom are infected by age 19 or 20 years. Their rates of infection are also much lower than those for Black South African children living under adverse sanitary conditions. This study indicates that a large proportion of South African Chinese children and adolescents are susceptible to HAV infection and should be included in a broader national vaccination program.

Botha, 1994

The prevalence of hepatitis A virus infection, in a population as well as the age at which it is usually acquired reflect the prevailing socio-economic conditions and standards of public hygiene. Infection occurs equally in both the sexes. Black Africans are known to have a high prevalence of hepatitis A virus infection and do acquire the infection early in life. This study documents the age-specific prevalence in Owambo children and confirms an equal sex distribution.

Abdool Karim, 1993

A community-based sero-epidemiological survey was undertaken to determine the age-specific prevalence rates of hepatitis A virus (HAV) infection in a representative sample of 782 urban black children aged from newborn to 13 years. Among children aged 0-5 months, the prevalence of anti-HAV was 68.8% (95% confidence interval (CI) 60.6-77.0%); this fell to a low of 2.5% (CI 0.1-4.9%) in those aged 6-11 months, implying the presence of maternal antibody in the first few months of life. By the age of 2 years, 51.2% (CI 45.7-56.7%) had anti-HAV, by age 4 the prevalence had risen to 81.4% (CI 75.5-87.3%) and by age 6, the prevalence of anti-HAV was almost 100% (CI 90.5-96.7%), reflecting the poor socio-economic and environmental conditions these children live in. The lowest prevalence of HAV infection among urban black South African children was during infancy, before the age at which the incidence rate rose sharply; e.g. 1 out of 5 children was already infected with HAV by their 2nd birthday. Vaccination in infancy will therefore have the biggest impact on the spread of HAV. However, before HAV vaccination in infancy is advocated, vaccine immunogenicity in infancy and the possible detrimental effect of maternal antibodies on the immunogenicity of the vaccine need clarification.

Dibisceglie, 1986

Roughly 15% of black children in rural areas of southern Africa are carriers of the hepatitis B virus. The purpose of the present study was to determine the prevalence of chronic hepatitis B virus infection among urban black children born and growing up in Soweto. A total of 2364 children were studied, ranging in age from 3 to 19 years, and of these, 1319 (56%) were girls. The children were drawn from the highest and the lowest socioeconomic classes. Serum samples were tested for all hepatitis B virus markers as well as IgG antibody against hepatitis A virus. HBsAg was detected in 23 (0.97%) of the children, anti-HBc and anti-HBs together in 155 (6.6%), anti-HBc alone in 17 (0.7%), and anti-HBs alone in 72 (3%). Of the 2364 children, 2097 (88.5%) were negative for all hepatitis B virus markers. IgG antibody to hepatitis A virus was present in 175 (97%) of a sample of 179 children. There was no difference in prevalence of hepatitis B virus markers between children from the upper and lower socioeconomic classes. HBsAg was more common in boys (16 out of 1043 (1.5%)) than girls (seven out of 1321 (0.57%)), and the prevalence of all hepatitis B virus markers increased with age. The youngest carrier of hepatitis B virus was 7 years old. The remarkable difference in the hepatitis B virus carrier rate between urban and rural black children offers a unique opportunity to investigate the favorable influences operating in an urban environment to limit the prevalence of hepatitis B virus infection.

SUB-SAHARAN AFRICA, WEST

(Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Saint Helena, São Tomé and Príncipe, Senegal, Sierra Leone, Togo)

Skalsky, 1995

In a prospective study, 102 hospital patients with liver disease were evaluated in West Cameroon, Africa. Blood donors, pregnant women and patients without liver disease served as controls. A total of 757 individuals were tested for markers of hepatitis A, B, C and D and for immunological markers (autoantibodies, procollagen III, alpha-fetoprotein, CA50 antigen, alpha-1-antitrypsin and antibodies to human immunodeficiency virus types 1 and 2). One-third of the liver disease patients had focal lesions on ultrasound examination. Histologically, 20 cases of cirrhosis, 14 cases of chronic hepatitis, 15 hepatocellular carcinomas and 17 cases of acute hepatitis were detected. All hepatic patients and virtually all controls had had a previous hepatitis A virus infection. Over 85% of adult patients and controls had at least one marker of hepatitis B virus infection. Over 30% of patients with liver disease had markers of possible hepatitis B virus replication. Antihepatitis C virus antibody was present in 18% of hepatic patients and in 6% of controls. Hepatitis C virus infection seems to play an important role in the development of chronic liver pathology; 40% of cirrhotic patients had a combined hepatitis B and C virus infection. Serum autoantibodies were frequently found and were not correlated with the presence of autoimmune liver disease.

Ndumbe, 1994

Since some hepatitis viruses and the human immunodeficiency viruses share common modes of transmission, such as the sexual route, we undertook to investigate the prevalence of antibodies to these and other pathogens among 384 rural pregnant women. Our study was intended to form the basis of infection management policies in pregnancy. Antibodies and other markers of the hepatitis A, B, C, and D viruses (HAV, HBV, HCV, HDV), the human immunodeficiency virus type 1 (HIV-1) and *Treponema pallidum* were sought. We tested for antibodies to the viruses using the appropriate enzyme-linked immunosorbent assays. HCV and HIV-1 infection were confirmed using standard immunoblotting techniques. Regarding HBV, we tested for the surface antigen (HBsAg), antibody to the surface antigen (anti-HBs) and antibody to the core antigen (anti-HBc). A non-specific test, the rapid plasma reagin test (RPR), was used for estimating *Treponema pallidum* (syphilis) infection. We found an overall prevalence of antibodies to HAV of 91.4%, to HCV of 6.8%, to HDV of 0%, and to HIV-1 of 3.5%. We found no IgM antibodies to HAV. The incidence of HBV markers was as follows: 5.4% for HBsAg, 61.3% for anti-HBs, and 84.6% for anti-HBc. RPR reactivity was found in 15.8% of the women. These results will be used to establish appropriate management and preventative policies for women attending the antenatal clinic. Prevention and appropriate early treatment of infections in these women will be considered.

Stroffolini, 1991

In January 1989, the prevalence of antibodies to hepatitis A virus (anti-HAV) was determined by ELISA in 702 apparently healthy children 5-14 years old in Kumba City, Cameroon. Children were recruited from those attending six different primary schools, representative of the socio-demographic characteristics of the inhabitants, using a systematic random sampling. The overall IgG anti-HAV prevalence was 96.9%, reaching 100% by the age of 11 years. In primary school beginners the prevalence was very high, 94.0%, contrary to what has been observed in developed countries. The anti-HAV prevalence was not associated with family size, but was related to parent's occupation, children from the lower class having a 5.9 fold risk (C.I. = 1.9-18.3) of past exposure to HAV. These results suggest a persistently high prevalence of anti-HAV in children despite improving hygienic conditions. The spread of HAV in this population may be the result of domestic water and/or food contamination.

Ndumbe, 1989

Hepatitis A and B virus infections are common in the tropics. There is, however, no information concerning hepatitis A virus (HAV) infection in Cameroon, while data on the hepatitis B virus (HBV) infection are incomplete. Sera from 272 subjects attending the Central Hospital, Yaoundé, for blood donations or mild ailments were tested by an ELISA technique for the presence of anti-HAV total antibody; antibody was found in 217 (79.8%). When 188 subjects (randomly chosen from the 272) were further tested for the presence of the hepatitis B surface antigen (HBsAg), 18 (9.6%) were positive; these included 9 of 127 males (7.1%) and 9 of 61 females (14.8%). Antibody to the HBsAg (anti-HBs) was present in 15 of 43 persons (34.9%) who were HBsAg-seronegative, while antibody to the hepatitis B core antigen was detected in 76 of 97 subjects (78.4%) who had been seronegative to the HBsAg and had not been tested for anti-HBs. Thus, 60% of our subjects (including 45% of subjects under five years of age) had at least one marker indicative of previous infection with the hepatitis B virus.

Sixl, 1987

General screening investigations with various antigens were carried out with a view to further specific investigations being carried out on the Cape Verde Islands concerning infectious diseases. Serological positive reactions were found in mumps, adeno, PLT, cytomegaly, herpes, Para-influenza 1, 2, 3, Influenza A and B, mycoplasmosis, RS-Virus, gonorrhea, hepatitis A and B, *R. conori*, malaria, syphilis, *Brucella abortus*, *Brucella melitensis*, varicella, legionella, picornavirus, measles, German measles, listeriosis, toxoplasmosis, and amoebic dysentery.

Ivanov, 1990

The results of examinations of sera from apparently normal urban and rural residents of the Guinea Republic (GR) for markers of viral hepatitis A (anti-HAV) and B (HBsAg) are presented. The number of HBsAg-positive subjects was 16 +/- 1% (1199 serum specimens were examined by direct enzyme immunoassay, EIA, and HI test), the rate of HBsAg findings in sera from children (<16 years) and adults (greater than or equal to 16) did not differ significantly (p<0.05). The rate of a HBsAg carrier state did not depend on sex and residence of the subjects under study (p<0.05). The detection rate of total (IgM + IgG) anti-HAV antibody was 67 +/- 2% (812 serum specimens were examined by a variant of EIA block). The detection rate and titres of anti-HAV in children were higher than in adults, and in urban residents higher than in rural subjects (p<0.05). The results of detection of HBsAg and total anti-HAV antibody in the sera of GR residents are close to those obtained in examinations of sera from the populations of countries bordering GR in Western Africa (Senegal, Mali, Liberia) and are typical of Africa as a whole.

Prince, 1985

To provide background for future hepatitis A vaccine trials, sera were collected from 0- to 4-year-old Liberian infants and their mothers on two occasions an average of 14.75 months apart and tested for antibody to hepatitis A virus (anti-HAV). The prevalence of anti-HAV rose from 2.5% in infants 0-6 months of age to 70% in children 3-4 years of age and did not differ between male and female infants. The annual incidence of new infections was slightly lower in the first year of life (35%) than in the subsequent 3 years, when it averaged 45%. The presence of HBV infection did not affect the incidence of HAV seroconversion. No clinical hepatitis was recognized in the subjects who seroconverted. Dual hepatitis A and B virus infection were observed; these were all clinically inapparent.

The extraordinary incidence of HAV infection documented in the present study offers an opportunity for vaccine efficacy trials requiring minimal numbers of subjects.

Ayoola, 1982

Two hundred and fifty Nigerians (175 male and 75 female), whose ages ranged from 5 to 70 years, were surveyed for the presence of antibody to hepatitis A virus (anti-HAV). The prevalence was determined to be 82%. The rates were highest in blood donors (90%) and hospital workers (91.4%) and lowest in children under the age of 10 (25%). The seroprevalence rates were not related to socioeconomic groups, previous exposure, jaundice, or sex. The study confirms that HAV infection is endemic in Nigeria and that most infections are subclinical and occur early in life. Acute hepatitis in Nigerian adults may therefore not be due to HAV.

Baylet, 1981

The sero-epidemiological study carried out in Senegal consisting of 10 main points taken from two very different geographical areas--Senegal river and Lower Casamance, based on the evidence of anticorps against the hepatitis A virus (anti-HAV) showed that: 1) the speed of infection in very young children; 2) the large spread of this virus in rural African communities, accounted for by the living and hygiene conditions favors the spread to large numbers of people by way of mouth of the original enteric virus i.e. that of the hepatitis A.

Barin, 1980

A prevalence survey of antibody to hepatitis A (anti-HAV) was carried out by radioimmunoassay in 413 children under 13 years old living in a rural area of Senegal. After one-year-old, the prevalence of anti-HAV increased quickly and reached 100 per cent at 4 years. In this study, the prevalence of anti-HAV was very similar to that observed for antibody to poliovirus in the same area prior to the introduction of immunization campaigns.

Hodges, 1998

The prevalence of hepatitis markers (Hepatitis A, B, C and E) in primary school children in Freetown, Sierra Leone was investigated in a government school, representative of the urban middle class. The children were aged between 6-12 years old. A sub-sample (n = 120) of the 450 pupils were invited to participate. Of the 66 volunteers (mean 8.32 years) 12 were positive for HBsAg (males 9, females 3) and 11 were confirmed. Six of these were HBeAg positive, anti-HBe negative, (male 5, female 1). Whilst 6 were HBeAg negative, anti-HBe positive (male 4, female 2). HBcAb was present in 47 children (71%). Hepatitis A, C and E antibodies were detected in 64 (97%), 1 (2%) and 5 (8%) of children respectively.

The World Health Organization has provided technical support to its Member States in the field of vaccine-preventable diseases since 1975. The office carrying out this function at WHO headquarters is the Department of Immunization, Vaccines and Biologicals (IVB).

IVB's mission is the achievement of a world in which all people at risk are protected against vaccine-preventable diseases. The Department covers a range of activities including research and development, standard-setting, vaccine regulation and quality, vaccine supply and immunization financing, and immunization system strengthening.

These activities are carried out by three technical units: the Initiative for Vaccine Research; the Quality, Safety and Standards team; and the Expanded Programme on Immunization.

The Initiative for Vaccine Research guides, facilitates and provides a vision for worldwide vaccine and immunization technology research and development efforts. It focuses on current and emerging diseases of global public health importance, including pandemic influenza. Its main activities cover: i) research and development of key candidate vaccines; ii) implementation research to promote evidence-based decision-making on the early introduction of new vaccines; and iii) promotion of the development, evaluation and future availability of HIV, tuberculosis and malaria vaccines.

The Quality, Safety and Standards team focuses on supporting the use of vaccines, other biological products and immunization-related equipment that meet current international norms and standards of quality and safety. Activities cover: i) setting norms and standards and establishing reference preparation materials; ii) ensuring the use of quality vaccines and immunization equipment through prequalification activities and strengthening national regulatory authorities; and iii) monitoring, assessing and responding to immunization safety issues of global concern.

The Expanded Programme on Immunization focuses on maximizing access to high quality immunization services, accelerating disease control and linking to other health interventions that can be delivered during immunization contacts. Activities cover: i) immunization systems strengthening, including expansion of immunization services beyond the infant age group; ii) accelerated control of measles and maternal and neonatal tetanus; iii) introduction of new and underutilized vaccines; iv) vaccine supply and immunization financing; and v) disease surveillance and immunization coverage monitoring for tracking global progress.

The Director's Office directs the work of these units through oversight of immunization programme policy, planning, coordination and management. It also mobilizes resources and carries out communication, advocacy and media-related work.

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