World Health Organization
Report on Infectious Diseases

Removing Obstacles to Healthy Development
"One out of every two people in low-income countries dies at an early age from an infectious disease. Most of these deaths should have been prevented. How can families, communities and countries reach their dreams with this burden? Healthy development removes these obstacles and helps individuals and countries achieve their full potential. If the world invests in priority strategies to fight infectious diseases, much of this death and suffering could be prevented."

Dr Gro Harlem Brundtland
Director-General
World Health Organization
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Notes:
   • Throughout this report, the term “infectious disease” is used to refer to all communicable diseases, including parasitic and zoonotic diseases, and some forms of respiratory infections and diarrheal diseases.
   • $ refers to US dollars.
   • The term “billion” is used to mean a thousand million.
The biggest killer of the young

An infectious disease crisis of global proportions is today threatening hard-won gains in health and life expectancy. Infectious diseases are now the world's biggest killer of children and young adults. They account for more than 13 million deaths a year – one in two deaths in developing countries.

Over the next hour alone, 1,500 people will die from an infectious disease — over half of them children under five. Of the rest, most will be working-age adults — many of them breadwinners and parents. Both are vital age groups that countries can ill afford to lose.

Most deaths from infectious diseases occur in developing countries — the countries with the least money to spend on health care. In developing countries, about one third of the population — 1.3 billion people — live on incomes of less than $1 a day. Almost one in three children are malnourished. One in five are not fully immunized by their first birthday. And over one third of the world's population lack access to essential drugs. Against this backdrop of poverty and neglect it is little wonder that deadly infectious diseases have been allowed to gain ground. Today some of the poorest countries are paying a heavy price for the world's complacency and neglect.

All this has been made worse by the huge increase in mass population movements over the past decade. In 1996, as many as 50 million people – 1% of the world's population – had been uprooted from their homes. Not only are refugees and displaced people especially vulnerable to infectious disease; their movement can help spread infectious diseases into new areas.

Meanwhile, the growth of densely populated cities with unsafe water, poor sanitation and widespread poverty has created the perfect breeding ground for outbreaks of disease. In deprived inner-city areas children are less likely to be immunized against killer diseases and parents are less likely to be able to pay for health care when they get sick. Under these circumstances, diseases that were once under control can rapidly gain a foothold and re-establish themselves.

In addition, many diseases once thought unrelated to infectious diseases — especially cancers — are now known to be the result of chronic infections. Cervical cancer, for example — one of the most common cancers among women in the developing world — is now known to be associated with human papillomavirus infection.
Leading causes of death

53.9 million from all causes, worldwide, 1998

Infectious diseases 25%
Cardiovascular diseases 31%
Cancers 13%
Injuries 11%
Maternal 5%
Respiratory and digestive 9%
Other 6%

13.3 million

Note: Cancers, cardiovascular and respiratory/digestive deaths can also be caused by infections and raise the percentage of deaths due to infectious diseases even more.

Source: WHO, 1999
Meanwhile, chronic infectious hepatitis B and hepatitis C can both cause liver cancer and it is estimated that over 6% of the world’s population is at risk. And bladder cancer can result from chronic infection with schistosomiasis.

But infectious diseases are not just a developing country problem. Unless checked, the crisis threatens the industrialized countries as well. Old scourges such as tuberculosis and diphtheria have occurred in explosive epidemics in Europe and other industrialized countries. And a 1996 outbreak of polio in Albania, Greece and the Federal Republic of Yugoslavia showed how easily a disease can be reintroduced to countries once free of the disease if immunization coverage is allowed to drop. A rapid increase in air travel has meant that diseases can now be transported from one continent to another in a matter of hours. Even today, no country is safe from the threat of infectious diseases.

This is happening at a time when the arsenal of drugs available to treat infectious diseases is being progressively depleted due to increasing resistance of microbes to antimicrobial drugs.

Because the scale and complexity of the infectious disease crisis is so great, and the causes linked so closely to poverty, there is a tendency for some to be fatalistic about the situation. But the situation is far from hopeless. Efforts to prevent and control those diseases are among the most practical and achievable ways of alleviating poverty and furthering social and economic development.

This report argues that we have a window of opportunity to make dramatic progress against ancient diseases, and to establish an early warning system to protect us from new and
Main causes of death among children
Ages 0 to 4 years
Estimates for 1998, worldwide

- Injuries: 6%
- Noncommunicable conditions: 8%
- Nutritional: 3%
- Perinatal: 20%
- Infectious diseases: 63%

Source: WHO, 1999

Main causes of premature death
Ages 0 to 44 years
Estimates for 1998, worldwide

- Maternal: 3%
- Nutritional: 2%
- Perinatal: 10%
- Noncommunicable conditions: 18%
- Injuries: 19%
- Infectious diseases: 48%

Source: WHO, 1999

unexpected diseases. If we fail, increased drug resistance and the emergence of new bacteria and viruses threaten to make the control of infectious diseases both scientifically and economically unlikely in the future.

The World Health Organization

The World Health Organization (WHO) can help mobilize the partners and develop the policies that will prevent and control infectious diseases. There is still a window of opportunity to make dramatic progress against the diseases that have been with us for thousands of years and to establish an early warning system to protect from new and unexpected diseases. WHO was created in 1948 and today, with over 190 Member States, it is the lead agency in international health. WHO’s goal is to foster the attainment by all peoples – especially the poor and most vulnerable – of the highest possible standards of health. The guiding principles of WHO are:

- “We can’t do it alone, so we work in partnership with others.”
- “We can’t do it all at once so we set priorities. Priority setting helps focus the world’s attention, resources and actions on innovative and cost-effective public health action with specific goals and measurable results.”

WHO is the health conscience of the world.

General WHO information can be accessed at www.who.int
Six diseases cause 90% of infectious disease deaths

Most deaths from infectious diseases — almost 90% — are caused by only a handful of diseases. And most of them have plagued mankind throughout history, often ravaging populations more effectively than wars. In an age of vaccines, antibiotics and dramatic scientific progress, these diseases should have been brought under control. Yet, in developing countries today they continue to kill at an alarming rate. And at times — as in recent outbreaks of influenza — they also kill at an alarming rate in the industrialized countries.

No more than six deadly infectious diseases — pneumonia, tuberculosis, diarrhoeal diseases, malaria, measles and more recently HIV/AIDS — account for half of all premature deaths, killing mostly children and young adults.

Every three seconds a young child dies — in most cases from an infectious disease. In some countries, one in five children die before their fifth birthday. Every day 3,000 people die from malaria — three out of four of them children. Every year 1.5 million people die from tuberculosis and another eight million are newly infected.

Behind each of these deaths lies a human tragedy. Because these diseases affect mainly young children and adult breadwinners, their impact on families can be catastrophic. Children may lose one or both parents to an infectious disease. The AIDS epidemic alone has left over eight million children orphaned. To make matters worse, families risk being driven into debt through lost earnings and high health care costs — trapping them in a vicious circle of poverty and ill-health.

Pneumonia

Acute respiratory infections (ARIs) are responsible for many deaths. Pneumonia, the deadliest ARI, kills more children than any other infectious disease. Most of these deaths (99%) occur in developing countries. Yet in industrialized countries childhood deaths from pneumonia are rare.

Pneumonia often affects children with low birth weight or those whose immune systems are weakened by malnutrition or other diseases. Without treatment, pneumonia kills quickly.

The influenza virus is another cause of pneumonia. There is very little information available on the number of influenza deaths in developing countries. However, in the United States alone, the disease kills 10,000-40,000 people in an average influenza season.
Leading infectious killers

Millions of deaths, worldwide, all ages, 1998

Deaths in millions

- Acute respiratory infections (including pneumonia and influenza)
- AIDS*
- Diarrhoeal diseases
- TB
- Malaria
- Measles

Over age five
Under age five

* HIV-positive people who died with TB have been included among AIDS deaths.

Source: WHO, 1999
**HIV/AIDS**
Over 33 million people are living with HIV/AIDS worldwide. There is still no cure on the horizon. Worst affected is sub-Saharan Africa. In some countries, up to one in four of the adult population are now living with HIV/AIDS. In Zimbabwe, 20%-50% of pregnant women in some areas are infected with HIV and risk infecting their children. An increasing number of maternal deaths are now due to infections contracted by HIV-positive women during delivery. In many countries, life expectancy and child survival rates have plummeted. In Botswana life expectancy at birth has fallen from 70 to around 50 years.

**Tuberculosis (TB)**
Tuberculosis, a disease once thought to be under control, has bounced back with a vengeance to kill 1.5 million people a year – even more when in combination with HIV/AIDS. Nearly two billion people – one-third of the world’s population – have latent TB infection. Together they constitute a huge potential reservoir for the disease. TB kills more adolescents and adults than any other single infection. It is also a leading cause of death among women.

To make matters worse, infection with HIV weakens the immune system and can activate latent TB infection. It is also believed to multiply the risk of initial infection with TB. About one-third of all AIDS deaths today are caused by TB.

**Diarrhoea**
Diarrhoeal diseases claim nearly two million lives a year among children under five. They are so widespread in developing countries that parents often fail to recognize the danger signs. Children die simply because their bodies are weakened often through rapid loss of fluids and undernourished through lack of food.

Diarrhoeal diseases impose a heavy burden on developing countries – accounting for 1.5 billion bouts of illness a year in children under five. The burden is highest in deprived areas where there is poor sanitation, inadequate hygiene and unsafe drinking water.

In certain developing countries, epidemics of diarrhoeal diseases such as cholera and dysentery strike down adults and children alike. Other major diarrhoeal diseases include typhoid fever and rotavirus which is the main cause of severe dehydrating diarrhoea among children.

**Malaria**
Malaria kills over one million people a year – most of them young children. Most malaria deaths occur in sub-Saharan Africa, where malaria accounts for one in five of all childhood deaths. Women are especially vulnerable during pregnancy. They are more likely to die from the disease, suffer miscarriages or give birth to premature, low-weight babies.

Malaria can rapidly overwhelm a young child causing high fever, convulsions and breathing difficulties. With the onset of cerebral malaria – an acute form of the disease – the child lapses into a coma and may die within 24 hours.

The high incidence of malaria cases – over 275 million a year globally – can impose a huge economic burden on both families and governments through lost productivity, missed education and high health care costs.
The death of a child

Percentage of women aged 15 to 49, married or previously married, who have had at least one child die

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burkina Faso</td>
<td>30%</td>
</tr>
<tr>
<td>Columbia</td>
<td>13%</td>
</tr>
<tr>
<td>Egypt</td>
<td>32%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>26%</td>
</tr>
<tr>
<td>Kenya</td>
<td>49%</td>
</tr>
<tr>
<td>Malawi</td>
<td>52%</td>
</tr>
<tr>
<td>Namibia</td>
<td>26%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>30%</td>
</tr>
<tr>
<td>Peru</td>
<td>25%</td>
</tr>
<tr>
<td>Philippines</td>
<td>19%</td>
</tr>
<tr>
<td>Senegal</td>
<td>45%</td>
</tr>
<tr>
<td>United Republic of Tanzania</td>
<td>40%</td>
</tr>
<tr>
<td>Yemen</td>
<td>42%</td>
</tr>
</tbody>
</table>

Source: Demographic and Health Surveys, 1994

Measles
Measles is the most contagious disease known to man. It is a major childhood killer in developing countries – accounting for about 900,000 deaths a year. The measles virus may ultimately be responsible for more child deaths than any other single microbe – due to complications from pneumonia, diarrhoea and malnutrition.

Combating childhood deaths

Children are among the most vulnerable to infectious diseases, and child infections demand rapid and effective treatment. WHO’s Integrated Management of Childhood Illnesses (IMCI) strategy permits immediate treatment at the very periphery of health care systems. IMCI is disease control through management of the five most common causes of childhood deaths – pneumonia, diarrhoeal diseases, malaria, measles and malnutrition.

The IMCI treatment guidelines have been developed to assist health workers to recognize easily signs of illness and take appropriate action, even if there are co-existing health conditions. IMCI also helps prevent illness through promoting improved nutrition and vaccination.

Research & Development being conducted by the Special Programme for Research and Training in Tropical Diseases (TDR) is developing new drugs and studying drug combinations to make IMCI even more effective.

Information on IMCI can be accessed at www.who.int/chd/
Infectious diseases are also among the biggest disablers

The high death toll from infectious diseases is only part of the story. The scale of individual pain and suffering inflicted by these diseases is immense. At any one time, hundreds of millions of people – mainly in developing countries – are disabled by infectious diseases.

Some infectious diseases can cause sudden repeated bouts of debilitating illness throughout the year – keeping children away from school and preventing adults from working or caring for their children.

Other diseases result in severe deformities – covering the body with gaping sores, mutilating the facial features, causing the loss of fingers and toes and leading to withering or grotesque swellings of the limbs and other body parts. Those affected not only suffer from excruciating pain and severe handicap but are also victims of stigmatization, shame and anguish.

Meanwhile, the economic impact of repeated episodes of illness and long-term disability is a major cause of underdevelopment in many countries today. The economic burden of malaria alone has cost Africa billions of dollars this decade. In addition to the cost of lost working days, the cost of treatment for repeated bouts of malaria can also be a huge burden for the poorest families. In Nigeria, it has been estimated that subsistence farmers spend as much as 13% of total household expenditure on malaria treatment.

Measles can lead to severe disability among children who survive the disease. Measles infection can result in blindness, deafness, brain and lung damage, and stunted growth and development.

Lymphatic filariasis is second only to mental illness as the world’s leading cause of long-term disability. A mosquito-borne disease involving infection with parasitic worms, it can cause grotesque enlargement of the limbs and genitals and damage to internal organs. It affects about 120 million people. At least one billion people are at risk – one in six of the world’s population. Over 40 million people are severely disfigured and disabled by filariasis. In addition, the social and psychological impact can be enormous – often destroying marriages and family relationships.

Another widespread parasitic worm disease, schistosomiasis, causes chronic urinary tract disease and often results in cirrhosis of the liver and bladder cancer. Over 200 million people are
Burden of disease

DALYs (Disability Adjusted Life Years) lost in 1998 due to infectious diseases, millions, all ages

- Acute respiratory infections: 83 million
- Diarrhoeal diseases: 73 million
- HIV/AIDS: 71 million
- Malaria: 39 million
- Measles: 30 million
- TB: 28 million
- Sexually transmitted infections: 17 million
- Pertussis: 13 million
- Tropical diseases*: 11 million

* Tropical diseases include trypanosomiasis, Chagas disease, schistosomiasis, leishmaniasis, lymphatic filariasis and onchocerciasis.

Source: WHO, 1999

Note: One DALY is one lost year of healthy life.
infected worldwide and up to three times as many are at risk. This debilitating disease is spread by water snails and contracted through contact with stagnant water sources. It can spread to new areas through dam-building and irrigation projects. Children and rural workers are most at risk and the disease can cause high absenteeism at school and work. In some of the worst-affected areas over 90% of children can be affected simply as a result of wading through water.

More than 12 million people are infected with leishmaniasis, another insect-borne parasitic disease. The disease can cause internal organ damage, skin lesions and mutilation of the nose and mouth. People disfigured by the disease often have to endure rejection by their families as well. Today there is alarm at the sharp increase in cases of visceral leishmaniasis – a deadly form of the disease – due to emerging co-infections with HIV and an upsurge in epidemics in countries such as India and Sudan.

In addition, millions of people are incapacitated by infectious diseases which cause blindness. An estimated 5.6 million people today have been blinded or visually disabled by trachoma and an additional 154 million are infected – mainly in Africa and Asia. The disease is transmitted through person-to-person contact due to poor hygiene. In addition, over 85 million people in Africa, Latin America, and the Arabian Peninsula are threatened by onchocerciasis (river blindness). This parasitic disease, transmitted by blackflies, causes visual impairment, blindness, unbearable itching and skin lesions. The itching can be so intense that people scratch themselves with knives or stones to stop it. Some have even been driven to suicide.

In sub-Saharan Africa, sleeping sickness threatens 55 million people in 36 countries. A parasitic disease transmitted by the tsetse fly, sleeping sickness causes long-term debilitating illness and mental suffering. Without treatment, the disease is fatal. In the worst-affected countries over half the people in some villages become ill. In some provinces the disease is reported to have claimed more lives than AIDS.

Leprosy – one of the oldest scourges known to humanity – is still a problem in many countries in South-East Asia, Africa, and Latin America. Over half a million cases occur every year. About
two million people are currently disabled by leprosy, which can cause severe mutilation of the face and extremities as well as damage to bones, eyes, nerves, and internal organs. Although the disease is not highly contagious, even today leprosy sufferers can become social outcasts.

**Guinea-worm disease** (dracunculiasis) is a parasitic disease transmitted by a tiny crustacean. During 1998, there were almost 72,000 cases of guinea-worm disease in Africa. The countries worst affected today are Ghana, Nigeria and Sudan. This debilitating disease causes joint pain, fever and vomiting. When the mature guinea-worm slowly emerges through the skin – by then up to a metre long – it causes excruciating pain and frequent infections at the exit point. The disability prevents people from going to work or school.

In Latin America, up to 18 million people are infected with **Chagas disease**, a deadly parasitic disease transmitted by blood-sucking insects. The disease can also be transmitted through blood transfusions and from mother to baby. The chronic stage of the disease can last for years as parasites invade the internal organs – causing irreversible damage to the heart and intestines. The disease is very difficult to treat with existing drugs. In some parts of Latin America it is the leading cause of cardiac death in young adults. One hundred million people are at risk. In Santa Cruz, Bolivia, over 50% of the blood in blood banks was infected with the parasites.

In 1995, four **Sexually transmitted infections (STIs)** – gonorrhoea, chlamydia, syphilis, and trichomonas – accounted for an estimated 333 million new cases of curable STIs. These four infections and their complications are among the top ten causes of disease burden.

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**Rolling back malaria**

Partnerships strengthen advocacy and help unify public health action while making more resources available for the fight against infectious diseases. **Roll Back Malaria** is one of WHO's best examples of how global partnerships help control infectious diseases.

Through a global coalition involving UNDP, UNICEF, WHO and the World Bank, Roll Back Malaria is helping health systems deliver cost-effective interventions including: better health care, insecticide-treated bednets and improved environmental management. At the same time Roll Back Malaria is harnessing the support of both the public and private sector in developing new malaria drugs and vaccines. The Roll Back Malaria partnership is working in all countries where malaria is a health problem, and focusing its greatest efforts in Africa where most malaria deaths occur.

Information on Roll Back Malaria can be accessed at www.who.int/rbm
Avoidable at a low cost

Most of the 13 million deaths a year from infectious diseases can be prevented. Low-cost health interventions already exist to either prevent or cure the infectious diseases which take the greatest toll on human lives. And most of these interventions have been widely available for years.

Unfortunately for a number of reasons they are not being used. Inadequate funding of health care in developing countries is one reason. Government failure to prioritize, lack of cross-sectoral collaboration and the inability of weak health service delivery systems to reach the entire population – particularly the most vulnerable and difficult-to-reach – are contributing factors.

Integrated Management of Childhood Illnesses (IMCI)

This radical, low-cost strategy can dramatically reduce the 70% of deaths from pneumonia, diarrhoea, malaria, measles, malnutrition and other infectious diseases such as meningitis.

 Seriously ill children are often suffering from more than one condition at the same time – making exact diagnosis difficult. For these children combined therapy can be life-saving. Treatment may include oral rehydration salts to treat diarrhoea, low-cost antibiotics to treat pneumonia, antimalarial drugs, and vitamin and mineral supplements. Another key focus is prevention through promoting immunization, breastfeeding and better feeding practices.

Millions of lives could be saved every year through the IMCI approach. Correct management of pneumonia and diarrhoeal diseases alone could prevent up to three million deaths a year.

Childhood vaccinations

More widespread use of low-cost vaccines could prevent 1.6 million deaths a year among children under the age of five. Yet today, one in five children are still not fully immunized against the six major killer diseases: diphtheria, whooping cough, tetanus, polio, measles and TB.

DOTS

Millions of TB deaths could be averted through the use of DOTS (Directly Observed Treatment, Short-course) – an inexpensive strategy for the detection and treatment of TB. This highly-effective health care package involves detection of TB cases through low-cost sputum smear tests, followed by 6-8 months of treatment with a combination of inexpensive drugs. A key component is regular ongoing support to the patient. This includes observation to ensure that patients follow the
Preventable deaths

It is estimated that the majority of deaths from infectious diseases can be prevented with existing, cost-effective strategies.

**Childhood vaccinations** have proven extremely effective in reducing deaths from **measles** and other preventable diseases.

**Bednets** and other prevention and treatment strategies can prevent 50% of all **malaria** deaths.

**DOTS** (Directly Observed Treatment, Short-course) can prevent 60% of all **tuberculosis** deaths.

**IMCI** (Integrated Management of Childhood Illnesses) can prevent most childhood deaths from pneumonia, diarrhoea, malaria and measles. An important part of IMCI is oral rehydration therapy, which can prevent up to 90% of deaths from **diarrhoeal diseases**.

**Antibiotics** used in timely and correct doses, combined with other strategies such as IMCI, are highly effective in preventing deaths from **pneumonia**.

**HIV prevention strategies** such as condom promotion, sex education and treatment of STIs have been proven to reduce the spread of **HIV/AIDS**.

Source: WHO
## Affordable health services for developing countries

<table>
<thead>
<tr>
<th>Disease</th>
<th>Intervention</th>
<th>Prevention or treatment costs</th>
<th>Annual cost per capita (1990)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS</td>
<td>Treatment of STIs</td>
<td>$14 for a year's supply of condoms</td>
<td>$0.20</td>
</tr>
<tr>
<td></td>
<td>Prevention programmes</td>
<td></td>
<td>$1.70</td>
</tr>
<tr>
<td>TB</td>
<td>DOTS strategy</td>
<td>$20 for 6 months of medicines</td>
<td>$0.60</td>
</tr>
<tr>
<td>Malaria</td>
<td>Prevention</td>
<td>$10 for a bednet treated with insecticide</td>
<td>Being determined</td>
</tr>
<tr>
<td>Measles</td>
<td>Immunization</td>
<td>$0.26 to administer one dose of measles vaccine</td>
<td>$0.50</td>
</tr>
<tr>
<td>Diarrhoeal diseases</td>
<td>Integrated Management of Childhood Illness</td>
<td>$0.33 for oral rehydration salts</td>
<td>$1.60</td>
</tr>
<tr>
<td>ARI</td>
<td>Treatment of pneumonia</td>
<td>$0.27 for 5 days of antibiotics</td>
<td>Being determined</td>
</tr>
</tbody>
</table>


Treatment correctly and follow-up sputum tests to determine whether it has been successful. The strategy can detect and cure disease in up to 95% of infectious patients, even in the poorest countries.

### Impregnated bednets

One in four child deaths from malaria could be prevented if children at risk slept under bednets at night to avoid mosquito bites. Bednets dipped in an insecticide cost about $10 each and $0.50 to $1 a year for a supply of insecticide to re-treat the net. Dip-it-yourself kits are now available for re-treating the nets at home. The cost of a net and one year’s supply of insecticide is less than one hour’s parking in New York, Paris or Tokyo.

### Availability of essential drugs

Millions of people in developing countries are dying needlessly from diseases that could be easily treated with safe, inexpensive drugs. More than one-third of the world’s population lack regular access to essential life-saving drugs. Drugs may be too expensive for those on the lowest incomes, or they may not be available.

In Africa, where many of the poorest countries have no more than $1 per capita each year to spend on drugs, fewer than half have access to the basic drugs they need.

User-friendly packaging of drugs is a low-cost way of increasing compliance with antimalarial drug therapy. Studies in Ghana show that over 80% of patients given a course of antimalarial
drugs packaged in a numbered blister pack finished the course of treatment. Of those receiving loose, unpackaged drugs – the way they are usually dispensed in developing countries – only 65% completed the treatment.

A simple packet of fast-acting drugs made widely available to parents – together with training to recognize malaria symptoms – could save the lives of many children with severe malaria.

**Prevention strategies for HIV/AIDS**

While expensive antiretroviral drug therapy for HIV/AIDS is still way beyond the means of most developing countries, well-targeted, low-cost HIV prevention and care strategies can have a major impact on the spread of HIV.

Millions of new infections could be prevented through low-cost interventions including:

■ access to cheap condoms and, where necessary, safe drug injecting equipment
■ use of essential drugs to treat other sexually transmitted infections (which amplify the risk of subsequent infection with HIV)
■ HIV testing and counselling (which can lead to safer sex)
■ counselling and support for HIV-positive mothers along with antiretroviral drugs and counselling on safe alternatives to breastfeeding
■ promotion of safe injection practices
■ sex education at school and beyond.

**Other important strategies**

Inexpensive vitamin and mineral supplements can also save lives. As many as one in four child deaths from infectious diseases – mainly from measles and diarrhoea – could be prevented by giving children vitamin A supplements. Malaria deaths among children could be reduced through the use of iron supplements to treat anaemia. Yet these inexpensive remedies are not always available where they are needed most.

Effective health education can also save countless lives – by promoting safe sex, good nutrition and hygiene, immunization and ensuring parents know what to do when a child is sick.

**Stopping TB**

The **STOP TB Initiative** is mounting a political and social movement against TB throughout the world by promoting the use of cost-effective Directly Observed Treatment, Short-course (DOTS). Despite the DOTS policy, there are obstacles to countries adopting its use. These include lack of political will and commitment to support TB control programmes, inadequate financing and human resources, poor organization of and management capacity for programmes, and interrupted supplies of high-quality anti-TB drugs.

STOP TB, based at WHO, is a partnership of countries with serious TB problems, UN and other international organizations, bilateral donors, scientific and public health institutions and NGOs. The partnership is:

■ ending social apathy towards TB
■ expanding the global coalition of partners involved in TB control
■ pushing TB issues higher on both international and national health agendas
■ increasing investment in DOTS.
■ check out www.stoptb.org
Controllable in any country

Wherever a low-cost strategy is available to prevent or treat infectious diseases, individual countries — even low-income countries — can make dramatic progress in getting them under control. But few countries have succeeded without strong political commitment at the highest level, a health care system that can deliver services to the entire population, and public demand for action.

During the 1980s the success of mass campaigns against polio in the Americas showed what could be achieved against all the odds with strong political commitment. The WHO Regional Office for the Americas and its partner organizations worked with governments and civil society throughout the Americas to carry out a massive social mobilization campaign. Parents were educated about the need for immunization and millions of health workers and volunteers were mobilized.

In war-torn countries, negotiators worked with the warring factions to ensure that children’s health would not become another casualty of the war. And the ceasefire for immunization worked. It worked in the poorest countries, in a densely populated country like Brazil, and even in countries where armed conflict was terrorizing populations and reducing health centres to rubble. Within six years a disease had been eliminated from the Americas. It could be done.

In Viet Nam, a four-year onslaught on malaria between 1992 and 1996 succeeded in reducing malaria deaths by over 90% and malaria cases by 40%. A decade earlier the situation was dire. An economic recession had dealt a body blow to health services, donations of insecticide had been stopped, resistance to antimalarial drugs was rising fast and migrant workers were carrying malaria into areas where it had once been eliminated. In 1991 alone, there were 144 epidemics of malaria.

Through government commitment, increased funding, and the widespread use of locally produced low-cost tools, health workers have today succeeded in turning the situation around. Locally produced high-quality drugs are now being used to treat cases of severe and multidrug-resistant malaria. Throughout Viet Nam, about 12 million people are protected by house spraying and insecticide-impregnated bednets. In areas where malaria is endemic, insecticide impregnation is provided as a public service – free of charge. The success of the programme has attracted international funding –
Success stories

ORT reduces diarrhoeal deaths among children in Mexico

Sex education reduces HIV prevalence in Uganda

20-24 year olds in Nsambya

Condom promotion reduces STIs among sex workers in India

Free treatment reduces malaria deaths in Viet Nam

Source: Gutiérrez et al., 1998

Source: UNAIDS

Source: WHO Global Programme on AIDS

Source: Turning Malaria Around, WHO/TDR

19
allowing the government to give greater attention to the control of other diseases such as dengue.

In West Africa, a small low-income country – Guinea – has shown what can be done to control TB through government commitment to use the DOTS treatment strategy. Within four years of launching its TB control programme, the case detection rate had doubled and almost 80% of patients were being cured. The number of patients who failed to complete the treatment was halved as home visits were used to motivate patients to complete the course.

With three out of four people living in rural areas, the TB programme operates through primary health care clinics. It has grown from small beginnings, steadily increasing its reach every year. Today every prefecture is covered. Guinea has also established a network of laboratories for diagnosis and research. When the TB programme was launched in 1990 there were only 15 laboratories. Today there are 67.

In Mexico the success of efforts to reduce child deaths from diarrhoeal diseases has served as a model for other national programmes. Strong political commitment and leadership were key factors in achieving a 60% reduction in death rates within a decade.

Even more impressive, the dramatic reduction
in death rates was achieved in the face of a nationwide epidemic of cholera during 1990-92. The strategy involved efforts to ensure correct home case management and the availability and use of oral rehydration solutions at home and in health centres.

Meanwhile in Senegal, a rapid broad-based response to the HIV/AIDS epidemic has succeeded in holding the spread of HIV at much lower levels than in many other African countries. The government acted swiftly – putting sex education on the timetable in primary and secondary schools, providing treatment for sexually transmitted infections, and actively promoting the use of condoms.

The results so far have been impressive. As HIV infection rates have risen steadily in other urban centres, the rate in the capital city, Dakar, has stayed below 2%. Over 60% of men and 40% of women aged 15-24 are now reported to be routinely using condoms with casual partners.

And, as a result of active condom promotion in Senegal, the condom distribution rate has soared – from 800 000 a year in 1987 to over seven million by 1998.

Towards a polio-free world

Polio has proven to be controllable in any country. Ceasefires in war-torn countries and strong partnerships are now overcoming natural and man-made obstacles along the road to freeing the world from polio.

Through its Polio Eradication Initiative, WHO is spearheading a global partnership to eradicate polio by the year 2000. In just ten years the number of cases worldwide has fallen by almost 90% to 5 000 today. The Americas have been declared polio-free and polio has disappeared from Europe and China. Transmission is now restricted to a band of sub-Saharan Africa and the Indian subcontinent. As well as creating a polio-free world, polio eradication activities are strengthening our capacity to tackle other preventable diseases.

Information on the Polio Eradication Initiative can be accessed at www.who.int/gpv
The end of the line for some infectious diseases?

Throughout history only one infectious disease – smallpox – has ever been eradicated. Today, two more diseases – polio and guinea-worm disease – are on the verge of eradication. Several more are gradually being brought under control or reduced to a level manageable within the existing health system.

But progress is not always straightforward. Environmental change, internal conflict, mass population movements and the collapse of basic health services can rapidly overwhelm efforts to control infectious diseases. And, in the final stages when a disease becomes less visible, progress is often hampered by complacency. Success can never be taken for granted.

Today efforts are being stepped up to ensure that polio is eradicated by the year 2000. Prospects are good. Over the past decade the number of reported cases fell from 35,000 cases to about 5,000. The disease has been eradicated throughout the Americas and transmission now appears to have been halted in the Western Pacific Region, including China.

Mass immunization campaigns which reach hundreds of millions of children in a few days have had a dramatic impact on the disease. Children have been reached in some of the remotest corners of the world. Health workers have used camels, horses, dug-out canoes, boats and motor-bikes to get the vaccines through. In many countries polio immunization campaigns have been used to deliver vitamin A supplements as well, increasing the impact of immunization on child health. These efforts to reach neglected groups were made possible with the support of partners such as Rotary International and the Centers for Disease Control and Prevention (CDC).

But problems remain. Polio is still widespread in a few heavily populated countries. Worst affected are Afghanistan, Democratic Republic of Congo, India, Nigeria and Pakistan. Many polio cases still go undetected due to poor reporting systems. Conflict is another frequent constraint, hampering vital mass immunization campaigns in war-torn countries and triggering a polio outbreak in Angola in early 1999.

There is concern at the shortfall in funding needed to carry out the final mass immunization campaigns. Once polio has been eradicated, savings on vaccination costs worldwide will amount to $1.5 billion a year. The United States alone will save around $250 million a year – the amount it now spends on polio immunization.
Nearly eradicated or eliminated

Polio
Annual reported cases 1988-1998, worldwide

Guinea worm
Reported prevalence, worldwide

Neonatal tetanus
Annual reported cases, worldwide

Leprosy
Reported prevalence, worldwide
every year to prevent the re-importation of a disease it has already eradicated.

**Guinea-worm disease** is also on the way out. Over the past decade the number of cases has been reduced by 90%. The strategy used involves health education, case containment and provision of safe drinking water. Guinea-worm disease is now restricted to 14 countries in Africa.

Principal partners in guinea-worm eradication are UNICEF, the Carter Foundation and CDC, all working together to intensify eradication efforts. Over 100 countries have been freed of the disease, but stumbling blocks remain. War and social upheaval have frequently hampered efforts to eradicate guinea-worm disease. In one country the number of cases actually increased between 1996 and 1998.

Today there are fears that lack of resources could lead to a resurgence of both polio and guinea-worm disease in areas that are now almost free of these diseases – reversing hard-won gains. Success can breed complacency. A disease can rapidly become yesterday’s story once it has low visibility and limited impact.

Efforts are also under way to control or eliminate a range of other diseases. **Neonatal tetanus** has been eliminated in over 100 countries but the disease continues to kill almost 300 000 newborn babies every year, and tetanus kills about 40 000 mothers as well. The disease could be eliminated through immunizing women with tetanus toxoid during pregnancy and ensuring they have access to a safe delivery. But in 1997, only 64% of pregnant women were immunized and, of the almost 50 countries where the disease is still a public health problem, only 17 had national plans to eliminate the disease.

Almost ten million people have been cured of **leprosy** over the past 15 years in an effort to eliminate the disease by the year 2000. Today virtually every registered patient is receiving multi-drug therapy. The number of countries where the disease is a public health problem has been reduced from 122 in 1985 to only 28. But leprosy remains a serious problem in 16 countries which together account for over 90% of all cases.

Today the efforts of WHO and its principal partners – the International Federation of Antileprosy Associations and the Nippon Foundation – are being stepped up to reach neglected groups in remote areas. About half a million new cases are reported every year. While global targets may be met by the year 2000, in some countries intensified efforts will have to continue for some time.

Global efforts to control **measles** are being hampered by continuing low immunization coverage rates in some countries. In Africa, fewer than two in three children today are immunized against measles. And in ten countries fewer than half of all children are protected.

Mass vaccination campaigns are now being carried out in the highest-risk areas in some regions – especially densely populated deprived urban areas. In the Americas, where the disease is targeted for elimination by the year 2000, over 90% of children are now immunized against measles.

Efforts are also under way to eliminate **lymphatic filariasis** as a global public health problem. The elimination initiative has been made possible by greatly improved diagnostic techniques and dramatic advances in treatment
Lymphatic filariasis in China

Number of counties with infections

Source: National Technical Steering Group for Filariasis Control and Research, MOPH, in Chinese Journal of Parasitology and Parasitic Diseases, 1999

methods – both for controlling the spread of the disease and for alleviating the suffering involved. In addition, partnerships with pharmaceutical manufacturers SmithKline Beecham and Merck are ensuring that drugs are available wherever they are needed.

In Latin America, countries have made a political commitment to eliminate Chagas disease. The first initiative was launched in 1991 by Argentina, Brazil, Bolivia, Chile, Paraguay and Uruguay. So far Uruguay has been successful. The strategy used involves screening blood donations and vector control.

More recently, the Andean and Central American group of countries have launched similar elimination efforts. One of the key tools being used is a low-cost colourless latex-based insecticide paint developed within this region.

Onchocerciasis (river blindness) has been virtually eliminated in 11 countries in West Africa through a 20-year programme initially involving vector spraying and now providing once-yearly community-based treatment with the drug ivermectin – supplied free by the manufacturer Merck. In 1994, with partners including the World Bank, the African Programme for Onchocerciasis Control was established to ensure that the disease is eliminated in the remaining 19 African countries where it is a serious health problem.

Partnerships for long-term goals

Seven infectious diseases – filariasis, leprosy, guinea-worm disease, tetanus, Chagas disease, measles and polio – have been targeted by WHO for eradication/elimination. WHO’s immediate aim is to lower their prevalence so that they are more easily managed by health systems.

Effective public/private sector partnerships are exemplified in WHO’s Eradication and Elimination Programmes against these seven diseases. Like polio, the eradication of guinea-worm disease is in its final phase with a stubborn, but disappearing incidence in only 14 of the initial 20 countries where the disease was rampant at the beginning of the campaign.

Diseases such as leprosy and lymphatic filariasis, Chagas and measles are being eliminated, with the disease burden decreasing dramatically. Partnerships include public and private organizations and institutions, NGOs and the pharmaceutical industry.

Information on Eradication and Elimination Programmes is found at www.who.int/ctd and www.who.int/lep and www.filariasis.org/index
Investing in healthy development

Effective medicines and control strategies are available to reduce dramatically the deaths and suffering caused by infectious diseases. Yet many governments are failing to ensure that these strategies receive enough funding to succeed. In some cases, this is because health budgets are unrealistically small. In other cases, it is because health spending is poorly prioritized to address the most urgent health threats.

Some of the poorest countries have no more than $7 a head to spend on health care annually – making it difficult to ensure that even the most basic health needs are met. On average, health expenditures in 1994 in low-income countries were $16 per capita. Comparatively, average health expenditures in high-income countries were more than $1,800 per capita.

Low-income countries spend 4% of GDP per capita on health, half the amount spent by wealthier countries. In many poor countries, spending is even lower. In Cameroon, Indonesia, Nigeria and Sri Lanka, for example, it is less than 2% of their GDP.

Donor assistance has helped supplement underfunded health initiatives. However, resources available for such support are relatively small. Health, nutrition and population projects receive less than 5% of donor support, which is a fifth of the amount provided to energy, transportation and communications projects.

Infectious diseases are a neglected concern within this neglected sector. In 1990, bilateral, multilateral, foundation and NGO partners provided just over $800 million to help developing countries control infectious diseases. This represents less than 2% of total donor funds. This sum is considerably stretched since 50% of deaths in low-income countries are caused by infectious diseases.

With these disparities, it is not surprising that a child born in a developing country today runs a 1,000-fold greater chance of dying from measles than a child born in an industrialized country. Or that children born in Singapore are likely to live 40 years longer than children born in Sierra Leone.

However, more money is not the solution when provided to governments that fail to make cost-effective use of resources. In some developing countries, 60% or more of government health expenditures are devoted to meeting the operating costs of urban hospitals and expensive equipment. For the cost of a few expensive operations in such institutions, thousands of lives could be spared from infectious diseases.

One of the most important roles of the World Health Organization is to assist countries in
Limited funding

Total donor assistance worldwide

Health assistance
- 1.5% Infectious diseases
- 7.3% Other areas of health, nutrition and population

Total GDP worldwide

Health expenditures
- 2.6% Public sector
- 2.6% Private sector

Source: Global Comparative Assessments in the Health Sector

Source: WHO, 1999
making optimum use of scarce health resources. With a budget representing only $0.01 out of every $30 spent on health worldwide, WHO provides technical and policy guidance that helps increase the impact of larger public and private health budgets.

WHO priorities for the control of infectious diseases in developing countries include childhood immunization, integrated management of childhood illnesses, use of the DOTS strategy to control TB, a package of interventions to control malaria, a package of interventions to prevent HIV/AIDS, access to essential drugs, and the overall strengthening of surveillance and health service delivery systems. Funds are urgently needed for implementing these and other cost-effective interventions to prevent further deaths and suffering.

It is in the best interest of all countries to support global initiatives to control infectious diseases. Any segment of society that ignores the spread of infections among its neighbours does so at its own peril. When a country becomes a weak link in the chain of global surveillance and disease control, everyone is affected. And we must effectively use the tools we have today while there is still a window of opportunity.

Smallpox provides a very striking example. If smallpox had

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GLOBAL WARMING is creating more ecosystems that are hospitable for deadly diseases such as malaria and dengue. The optimum temperature for mosquitoes is between 25 and 27°C. Increases in average temperature of just a few degrees centigrade can transform a mosquito "no fly zone" into a malaria breeding area.

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Defending our borders

Strong national defence must include protecting the population from microbial invaders.

$864 billion
Global military spending 1995

$15 billion
Estimated global spending for prevention and control of AIDS, TB and malaria, 1995

23 million
Military and civilian deaths from war 1945-1993

150 million
Estimated deaths from AIDs, TB and malaria since 1945

not been eradicated in a few remaining countries in 1977, the world might still be paying a heavy price today. Unforeseen was the imminent emergence of HIV/AIDS.

Immunization with the smallpox vaccine – made from a live weakened virus – would now be fatal for many people whose immune system is impaired by HIV. Just a few years delay and global eradication of smallpox may have become impossible without the discovery of a new vaccine.

Had smallpox not been eradicated – at a cost then totalling $300 million – it could be among the top six infectious killers in the world today. Without past concerted efforts to fight the disease, smallpox would still be causing at least a million deaths a year and costing governments billions of dollars in health care costs.

These lessons have been overlooked. The progress that the world can make today against infectious diseases may not be possible a decade from now. Increased drug resistance and the unforeseen emergence of new microbes could close the current window of opportunity for controlling infectious diseases.

**Value for money**

With a budget not much larger than that needed to construct and operate a large modern hospital, WHO provides exceptional value for money. WHO contributes to healthy human development by:

- setting standards of quality and safety for medicines and health products
- bringing together medical experts from around the world to coordinate research efforts
- monitoring and measuring disease trends
- alerting countries to unexpected disease threats
- mobilizing the world's response to health emergencies
- advising decision-makers on health priorities
- helping to direct donor resources to effective projects
- identifying the most cost-effective policies and strategies for prevention and control

WHO's website is at www.who.int
Many countries do not yet use WHO recommended policies

Money can be wasted in preventing and controlling infectious diseases if effective public health policies are not in place. Over the years, the World Health Organization and its technical partners have redeveloped low-cost strategies based on clinical best practice in Member States, operational efficiency, scientific breakthroughs, cost-effectiveness and, above all, on what works best. When deployed effectively, these strategies can save millions of lives.

The problem is that many countries are still not using these strategies — or not deploying them widely enough to make a difference. For example, Integrated Management of Childhood Illnesses, a strategy with the potential to save millions of children's lives every year, has only been adopted in 57 countries so far and, to date, the strategy has not been implemented throughout any one country. Expansion of IMCI and other effective strategies is often slowed due to weaknesses in a country's health system, such as the lack of available medical supplies or difficulties in retaining qualified — but extremely overburdened — medical staff.

The DOTS strategy for TB is highly cost-effective. It can detect the disease and cure up to 95% of TB patients — even in the poorest countries — and is effective in preventing the spread of drug-resistant forms of the disease. But it is still a strategy waiting to be used. In 1996, only 15% of all TB patients had access to DOTS. Only half of WHO's Member States have adopted DOTS so far. And of those that have, one in three have not yet made the treatment available countrywide.

In Eastern Europe — where TB rates are among the highest in Europe — the health system is still struggling to maintain outdated control measures such as the unnecessary annual screening of all children, revaccination and hospital treatment. Although several pilot projects of DOTS have been launched in this region, expansion programmes have been neglected due to lack of political commitment, shortage of funds and an unsustainable supply of drugs.

Malaria is a particular risk for women during pregnancy. Pregnant women are more likely to die from malaria — either during pregnancy or at a later date — due to chronic anaemia. Many suffer miscarriages or premature births and give birth to low-weight babies. Babies are occasionally even born with malaria after being infected in the womb.

To prevent this, WHO recommends that all pregnant women in high-risk malaria areas should
Health policy void

Countries adopting WHO policies
Countries not adopting WHO policies

Adopted by all countries

212 countries and territories

0 50 100 150 200 250

Routine childhood immunization
HIV/AIDS education in schools
DOTS to control TB
Integrated Management of Childhood Illnesses

120 developing countries only

Number of countries not adopting an intervention where it would be appropriate to do so.

Source: WHO
Many factors contribute to the spread of infectious diseases

In many countries, lack of funds and inadequate use of existing cost-effective tools to fight infectious diseases are compounded by a failure to take account of the health impact of other sectors.

All too often, the key determinants of health – as well as the solutions – lie outside the direct control of the health sector. They are rooted in areas such as sanitation and water supply, environmental and climate change, education, agriculture, trade, tourism, transport, industrial development and housing. Yet many countries lack the capacity to measure the impact of other sectors on health. Unless these issues are addressed, it can be difficult to prevent or even control some infectious diseases.

The link between environmental quality and health, for example, is critical. Over 10% of all preventable ill-health today is due to poor environmental quality – conditions such as bad housing, overcrowding, indoor air pollution, poor sanitation and unsafe water.

Bad housing and poor environmental conditions have the greatest impact on acute respiratory infections and diarrhoeal diseases. And children are worst affected – accounting for as much as two-thirds of all preventable ill-health due to environmental conditions.

In developing countries, about 700 million people – mainly women and children in poor rural areas – inhale harmful smoke from burning wood and other fuels. They are increasingly at risk from acute respiratory infections, especially pneumonia. Over a billion people lack access to safe drinking water – increasing their vulnerability to diarrhoeal and parasitic diseases. In Africa, Asia and Latin America, at least 600 million urban dwellers live in unhealthy homes or neighbourhoods. Almost 800 million people worldwide lack access to health services.

Elsewhere, changes in land and water use can also have a major impact on the incidence and pattern of disease. Deforestation, agricultural development, dams and irrigation schemes can trigger outbreaks of parasitic or other infectious diseases through favouring the spread of malarial mosquitoes or freshwater snails that spread schistosomiasis. Most at risk are the over half a billion poor people who live in ecologically fragile regions. Other diseases affected by environmental change include lymphatic filariasis, dengue fever, leishmaniasis, Chagas disease and bacterial meningitis.

Meanwhile, an increase in global warming could have a similar impact on the spread of
## Not only a health problem

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<thead>
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<th>Minor, indirect or no factor</th>
<th>Important factor</th>
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Source: WHO estimates, based on available information
tropical diseases. A temperature rise of only 1-2°C over the next 50 years could extend the range of malarial mosquitoes further north – increasing the proportion of the world’s population at risk of malaria and other mosquito-borne diseases such as dengue and lymphatic filariasis.

Poverty and malnutrition are other key factors that affect health. Malnutrition is particularly lethal in combination with infectious diseases such as pneumonia, malaria, measles and diarrhoeal diseases – the major killer diseases affecting children. It is an underlying factor in over half of all child deaths. In 1997, an estimated 160 million children were moderately or severely malnourished. More than one in four of the world’s population were estimated to be living in poverty – over a billion of them with incomes of less than $1 a day. Even in industrialized countries, 100 million people live below the poverty line.

The critical need for collaboration between health and other sectors has been highlighted most recently by efforts to prevent HIV/AIDS. A few governments have attempted to reduce individual vulnerability to HIV/AIDS through a cross-sectoral approach. The aim is to influence infrastructure development plans, laws, education, labour policies and the exercise of human rights, for example, in an effort to create an environment that makes it easier for people to avoid HIV/AIDS. This can involve providing incentives to enable girls to finish secondary education, boosting job and educational opportunities for women to break the cycle of economic and sexual dependency, and ending the criminalization of marginalized groups such as sex workers and injecting drug users. It can also involve carrying out impact assessments for development projects to foresee ways in which schemes could fuel the epidemic – through accelerating the pace of urbanization, for example, or splitting up families through creating the need for a migrant labour force.

In Thailand, where prostitution remains illegal, the government’s pragmatic approach to slowing down the epidemic has brought a significant decline in infections – especially among the young. The multisectoral approach included work with brothel owners to urge 100% condom use in brothels, the launch of mass media campaigns to encourage respect for women and discourage men from visiting sex workers, improved
educational and vocational opportunities for women to keep them out of the sex industry and improved access to care, as well as economic and social support for people living with HIV/AIDS.

In addition to the need for increased collaboration between the different public sectors which impact on health, there is a need to build partnerships with the private sector. The recent launch of the New Medicines for Malaria Venture— a joint initiative by the public and private sectors to develop new antimalarial drugs— is an example of efforts to harness greater public and private sector collaboration in developing new products for use in developing countries. Another example is the donation of drugs by industry free-of-charge to help eliminate infectious diseases with a high disease burden in developing countries. These include donations of drugs by pharmaceutical manufacturers SmithKline Beecham and Merck for the treatment of lymphatic filariasis and river blindness, and Pfizer for trachoma. In addition vaccine manufacturers have occasionally donated vaccines during outbreaks of disease, such as meningitis, for polio eradication, and for vaccine trials in developing countries.

WHO’s efforts to eradicate or eliminate diseases are a collaborative effort by global partnerships. WHO has forged strategic alliances with governments, ministries of health in developing countries, international development banks, foundations, the private sector, civil society, non-governmental and international organizations and other UN agencies.

Global efforts to eradicate polio, for example, have demonstrated what can be achieved through private sector collaboration. Rotary International, a private sector service organization, has raised $500 million to fund vast quantities of vaccine for mass immunization campaigns and to help equip a refrigerated cold chain for vaccine transport. Rotary has used its global network of over 28,000 clubs in 155 countries to enlist volunteers to carry out social mobilization campaigns, provide organizational skills for immunization campaigns, and administer polio vaccine drops to children.

Effective research

Research can help address the issue of inadequate use of existing cost-effective tools. The partnership of UNDP, World Bank and WHO in the Special Programme for Research and Training in Tropical Diseases (TDR) is testimony to the effectiveness of proper research.

In a recent TDR study in Ghana, simple prepackaging of drugs meant that 82% of patients complied with a full course of chloroquine tablets for malaria treatment, rather than 62% as in the control communities. In Kenya, after 14 shopkeepers serving a community of 5,000 were trained to offer information when selling antimalarials and fever-reducing drugs, the number of fever cases receiving treatment with chloroquine increased from 2% to 49% and the number treated with an adequate amount of chloroquine increased from 4% to 75%. Other studies on malaria treatment, including development of artesunate in a form that will save the lives of children with malaria, are also a part of TDR’s activities.

Information on TDR can be accessed at www.who.int/tdr
Diseases continue to catch the world off guard

As the battle to control known infectious diseases continues, other new threats have emerged. Diseases once thought to be retreating have made a deadly comeback. Even worse, new killer diseases have emerged – many of them neither preventable nor treatable.

The situation is getting worse, not better. Over the past two decades over 30 emerging diseases have been identified in humans for the first time. During the past ten years, outbreaks of old foes such as plague, diphtheria, yellow fever, dengue, meningitis, influenza and cholera have claimed many lives.

The increase in mass population movements, the massive growth in international travel, and the transportation of live animals and animal products have helped carry diseases into areas where they have never been seen before. In some cases, environmental change – deforestation for example – has brought humanity into closer contact with animals and insects that harbour diseases.

Over the past decade, more than two-thirds of emerging diseases are known to have originated from animals – both wild and domestic species.

Elsewhere, unusual seasonal weather patterns can affect animal habitats and cause a clustering of new diseases that affect humans. In 1993, an outbreak in the United States of a new disease, hantavirus pulmonary syndrome was sparked off by a drought that brought disease-carrying rodents into closer contact with humans. There were over 50 cases of the disease in several States. More than two-thirds died.

Meanwhile, changes in food production, handling and processing have increased the incidence of foodborne diseases such as salmonella, which comes from infected eggs, or a potentially fatal form of E. coli – triggering outbreaks of disease.

In the early 1990s, a major epidemic of diphtheria swept through eastern Europe. As the number of cases skyrocketed over the next three years the epidemic was declared an international emergency. In 1980, Europe accounted for less than 1% of diphtheria cases worldwide. By 1994, almost 90% of reported cases were occurring there. The region has also seen a dramatic increase in syphilis and other STIs over the past decade. In the Russian Federation between 1989-1995 there was a 40-fold increase in infection rates for syphilis, while rates in the Newly Independent States increased 15-30 times.

In Africa during 1996-1998 there were outbreaks of meningitis involving 300 000 cases.
Large outbreaks
Selected outbreaks of more than 10 000 cases, 1970 – 1990

**Dengue fever** 344 000 cases were reported in an outbreak in Havana, Cuba in May 1981.

**Rift Valley fever** infected 200 000 people and caused 600 deaths in Egypt in 1977.

**Visceral leishmaniasis** caused 100 000 deaths in the western upper Nile of Southern Sudan in 1965-87.

**Hepatitis C** was first identified in North America in 1989. There may now be as many as 170 million infectious carriers of the disease worldwide.

**Diphtheria** Since 1993, diphtheria cases have skyrocketed in the Russian Federation and Newly Independent States. Over 50 000 cases were reported in 1995.

**Cholera** An outbreak of cholera in Latin America infected over 500 000 people in 1991.

**Hepatitis A** 300 000 cases were reported in an outbreak in Shanghai in 1989.

**Meningitis** An outbreak in Sao Paulo in 1974 caused 30 000 cases. There were 187 000 cases in an outbreak in Africa in 1996.

**Typhus** 100 000 cases emerged in Burundi between 1996 and 1998.

**Anthrax** In Zimbabwe over 10 000 people became sick during the largest outbreak of anthrax ever reported in the 1970s.

**Dengue fever** One out of five people in New Delhi, India, became sick with this disease during a 1982 outbreak.
and 35,000 deaths. East Africa was hit by major cholera epidemics which affected tens of thousands of people in over ten countries. An earlier cholera epidemic in the Americas – the first for over a century – involved over a million cases and about 11,000 deaths. In 1992 a new cholera strain was detected in the Bay of Bengal and has already spread to ten other countries.

Elsewhere dengue, and the more serious dengue haemorrhagic fever, are also on the increase as the mosquito which carries the disease extends its reach – establishing new habitats in the Americas and parts of Africa and Asia. Over the past 40 years the number of cases has increased at least 20-fold. And the number of cases of dengue haemorrhagic fever – which may occur after a second or third attack of dengue fever – has increased over the same period. The disease is now hyperendemic in many countries. In 1996, seven countries in Africa reported deaths from yellow fever – another viral haemorrhagic disease which is spreading into new areas.

Sudden explosions of rodent or human plague have occurred over the past decade. In 1994, human plague reappeared in Malawi, Mozambique and India – after a 15-30 year absence. There was an outbreak of epidemic typhus in Burundi from 1996-1998 which affected up to 100,000 people. The disease – which is carried by lice – has in the past emerged during wars or famine.

Today there are other deadly diseases to contend with: HIV/AIDS, Ebola haemorrhagic fever, Lassa fever, Marburg virus, a new form of animal influenza in humans, Legionnaires' disease and a new variant of Creutzfeldt-Jakob disease (nvCJD). Some are believed to have emerged from rainforests and crossed the species barrier to infect humans. Others are amplified from deadly co-infections with diseases such as TB or

**Funding is needed early to prevent epidemics**

Donor funding for HIV/AIDS interventions in developing countries

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![Graph showing funding amounts](image)

Donor funding to support countries in the initial stages of the AIDS epidemic

Donor funding to support countries where AIDS is widespread

Source: WHO/GPR funding database as analysed in Pyne, National and International Response in the HIV/AIDS Epidemic in Developing Countries, 1997
leishmaniasis and HIV/AIDS.

An outbreak of Ebola haemorrhagic fever in the former Zaire in 1995 was a dramatic reminder of the need for constant vigilance in the face of emerging diseases. Although only a small outbreak of 316 cases, over three-quarters of those who became ill died. About a third of the victims were health care workers who came into contact with blood or body fluids. Two years later, in a smaller outbreak in Gabon, there were 58 cases and 43 deaths. Ebola haemorrhagic fever is one of the most virulent infectious diseases known to medical science. No treatment or vaccine is available and 50%–90% of those affected die.

Global alert and response

No country is safe from infectious diseases. In a world of rapid air travel, outbreaks of infectious disease leave populations and nations vulnerable. WHO's Outbreak Verification network is linked to the WHO global surveillance system, a worldwide network of laboratories and reporting sites that collects information on reported and rumoured outbreaks nationally and worldwide. Once confirmed, information is made available immediately on the World Wide Web, and WHO forms partnerships to investigate and contain those outbreaks which could spread internationally and require concerted action.

- Information on current outbreaks can be accessed at www.who.int/emc/outbreak_news/index
Near misses

Over the past two decades, explosive epidemics of unidentified and re-emerging diseases have given the world a few close calls. Some have affected international trade and tourism. Others have led to the mass slaughter of poultry and farm animals. Some have overwhelmed a country’s health services and diverted resources from elsewhere. Almost all have caused fear and panic.

The appearance of pneumonic plague in Surat in India in 1994 led thousands to flee to other areas – at the risk of spreading the epidemic elsewhere. The outbreak highlighted the need for good disease intelligence systems. Early identification of the cause followed by a rapid response can prevent a small outbreak from becoming a major epidemic.

During 1997, the vast majority of countries had at least one infectious disease outbreak. Several had as many as eight. Some of the diseases involved – cholera, plague, typhoid, and meningitis – were old foes. Others – like the new variant Creutzfeldt-Jakob disease, a bird influenza affecting humans for the first time and a virus carried by pigs – were less familiar.

If a global disease surveillance system had not been in place the outcome could have been disastrous. Ultimately national surveillance systems need to be strong enough, not only to provide constant alert and rapid response to outbreaks of endemic diseases, but also ready to respond to a sudden unexpected outbreak of a known or unknown disease. The emergence of the HIV/AIDS pandemic in the 1980s is a devastating example of what can happen when the world is looking the other way.

Reporting systems are the intelligence network that underpins disease control and prevention. Without this framework in place it is impossible to track where disease is occurring, measure progress in disease control targets, monitor antimicrobial drug resistance, or provide an early warning system for outbreaks and the emergence of new diseases. Surveillance data is also needed to assess where resources should go for maximum cost-effectiveness.

Today, efforts are under way to strengthen national surveillance systems through epidemiology and laboratory training, and to help countries establish integrated surveillance systems. The aim is to improve surveillance capacity through streamlining activities and establishing good reporting systems in which information is shared – and used – at the national, regional and global levels. This reinforced approach is being pioneered in Africa.

At a global level, WHO has established an
Unexpected outbreaks
Examples of emerging and re-emerging infectious diseases 1994-1999

 Anthrax
 Brucellosis
 Cholera
 Crimean-Congo haemorrhagic fever
 Cryptosporidiosis
 Dengue haemorrhagic fever
 Diphtheria
 Ebola haemorrhagic fever
 E.coli O157
 Echinococcosis
 Enterovirus 71
 Epidemic meningitis
 Hendra
 Human monkeypox
 Influenza A (H5N1)
 Influenza A (H9N2)
 Lassa fever
 Leptospirosis
 Lyme borreliosis
 Malaria
 New variant CJD
 Nipah
 Omsk haemorrhagic fever
 O'nyong-nyong fever
 Plague
 Poliomyelitis
 Reston virus
 Rift Valley fever
 Ross River virus
 Typhoid
 Venezuelan equine encephalitis
 West Nile fever
 Yellow fever

Source: WHO
Medicines are losing their effectiveness

The dramatic upsurge in the spread of drug-resistant microbes over the past decade is undermining today’s efforts to control infectious diseases. As diseases once thought to be under control become increasingly resistant to the arsenal of available drugs, the spectre of incurable infectious diseases looms large. The fight against five of the six deadliest diseases — TB, malaria, pneumonia, cholera and HIV — is severely affected.

Although antimicrobial resistance affects industrialized and developing countries alike, its impact is far greater in developing countries. The problem is that the switch from normally less expensive first-line drugs to second or third-line drugs involves a dramatic escalation in the price of treatment. In some of the poorest countries, the prohibitive cost of lengthy treatment and replacement drugs means some diseases are too expensive to treat.

In low-income countries — which may spend no more than $7 per capita on health — the cost of treating a case of multidrug-resistant TB, likely to be as high as $1 500–$4 000 a patient, is out of reach. In some Asian countries, the cost of treating a child for bacterial meningitis increases from $20 to $110 whenever second-line drugs are needed.

And the cost of treatment for acute respiratory infections — the most frequent cause of child deaths — increases from $5 to $40 for a course of antibiotics.

In addition, multidrug-resistant forms of diseases can become untreatable in any country — at any price — once the options have been exhausted. Pharmaceutical manufacturers have found it difficult to develop new antibiotics and other drugs fast enough to replace those that have become ineffective.

**Tuberculosis:** A 1997 report on anti-tuberculosis drug resistance pinpointed “hot zones” around the world where a significant percentage of cases are resistant to the most commonly prescribed drugs. Unless checked, this could propel a wave of tuberculosis that is difficult — even impossible — to cure using drugs. In some countries in eastern Europe, more than one in five TB patients have multidrug-resistant TB.

**Malaria:** Chloroquine — once the first-line treatment — is no longer effective in over 80 of the 92 countries where malaria is a major public health problem. In some places in Africa people use chloroquine more often than aspirin — taking it regularly for minor fevers, aches and pains. This
Antimicrobial resistance

Malaria
Quinine and mefloquine in Thailand

Note: There is already complete resistance to chloroquine and sulfadoxine-pyrimethamine in Thailand

45% resistance

Tuberculosis
Short-course chemotherapy in Portugal

13% single drug resistance

Staphylococcus
in Japan

60% multidrug resistance

4% multidrug resistance

The world is becoming a smaller place for microbes

In the Middle Ages deadly plagues were shipped from one continent to another – carried by flea-infested rats on board ships. Today they travel by plane – carried by airline passengers from one corner of the earth to another. And all in a matter of hours.

As the number of international airline passengers has soared from two million a year in 1950 to over 1.4 billion today, the world has been slow to recognize the implications for public health.

Deadly airborne diseases such as pneumonic plague, influenza and TB can easily spread in crowded airport lounges, on a jumbo jet or by passengers after their return home. And infectious diseases can also be carried across borders by their animal or insect hosts. Disease does not respect national boundaries.

In the United States in 1977, over 70% of the passengers on board an airliner grounded for several hours were infected with influenza by a fellow passenger.

In 1978 and again in 1992, poliovirus was imported into Canada by people travelling from western Europe. Eleven people were affected by polio paralysis in the first outbreak – all of them people who had refused immunization.

In South Africa in 1996, a health worker was infected with Ebola by a patient who had entered the country to seek medical care during an outbreak in Gabon. The South African government asked WHO to establish a screening system for airline passengers travelling from other parts of Africa.

In the early 1990s, a flight attendant with active TB is believed to have infected up to 23 fellow crew members over the course of several flights. In 1994, a person with active TB is believed to have infected six fellow passengers on a flight from Chicago to Honolulu.

In 1996, travellers returning to the United States and Switzerland developed yellow fever. They had not been vaccinated against the disease.

There have been reports of a surprising number of malaria deaths in northern countries following unrecognized infection through a blood transfusion or a one-off mosquito bite near an international airport. Brussels, Geneva and Oslo have all had recent cases of airport malaria. Malaria deaths are not uncommon among travellers who develop unexpected fever after
Frequent flyers
Most popular air routes between continents, 1997

Percentage increase in international arrivals, 1993 to 1997

Source: World Tourism Organization/International Civil Aviation Organization
returning to their home country. In northern countries where the disease is rarely seen, doctors may fail to diagnose malaria in time.

Infectious diseases can cross borders in other ways too. In 1985, the aggressive tiger mosquito - normally found in Asia - slipped unnoticed into the United States inside a shipment of water-logged used tyres from Asia. Within two years the mosquitoes - capable of transmitting yellow fever, dengue and other diseases - had established themselves in 17 States.

In Sub-Saharan Africa, HIV was spread among migrant workers, who later carried the disease back to their homes, and by lorry drivers, who bought sex at truck stops on their way across the continent.

Tourism, international travel and migration are all helping to spread disease. The number of refugees and displaced people has increased nine-fold over the past two decades. In 1996, as many as 50 million people worldwide had been uprooted from their homes - 1% of the world's population. Refugees and displaced persons living in overcrowded, unsanitary conditions are at risk of outbreaks of cholera and other waterborne diseases.

In 1991 in Peru, a ship carrying contaminated water from Asia in its ballast tanks sparked off a cholera epidemic that spread rapidly throughout South and Central America. About 11 000 people died.

### Diseases affecting tourists

Exiting tourists with infectious diseases, Thailand 1995

- Respiratory Infections: 8%
- Fever (cause unknown): 6%
- Malaria: 4%
- Hepatitis: 4%
- Gonorrhoea: 4%
- Other: 10%

Diarrhoeal diseases: 64%

Source: Ministry of Health, Thailand
Quoted in WHO/EMC Annual Report, 1995

### Malaria in the United Kingdom

A total of 8 353 cases of imported malaria in the United Kingdom between 1987-1992

- Immigrants: 11%
- Visitors to the UK: 19%
- Tourists: 16%
- Expatriates: 5%

Visiting friends and relations: 49%

Source: Behrens, Travel Morbidity in Ethnic Minority Travellers
The International Health Regulations require governments to report all cases of three diseases – cholera, plague and yellow fever. The aim is to provide a rapid international alert system for diseases of international public health importance. The system is designed to steer a course between maximum protection against these diseases and minimum interference with world traffic and trade. But many countries fail to report outbreaks – deterred by the threat of potential economic losses. And the rules are difficult to enforce. Today these regulations are being revised and broadened to provide an early warning about outbreaks of any deadly diseases.

An outbreak anywhere in the world must now be treated as a threat to virtually all countries – especially those that serve as major hubs for international travel. Without an active global disease surveillance system in place to provide an early warning of outbreaks, the export of infectious diseases could become a growth industry.

**Increased international travel**

![Graph showing increased international travel](source: World Tourism Organization, 1993)

**Hi-tech disease mapping**

The latest computer technologies are used in HEALTHMAP, the WHO/UNICEF partnership for mapping infectious diseases. Through computer-generated geographical display systems the prevalence of infectious diseases is mapped in relation to the surrounding topography and health care infrastructure. This powerful technology permits reconciling health problems with the needs in countries or at the regional or global level. HEALTHMAP’s simplified training programmes permit transfer of mapping technology to those countries most in need.

- HEALTHMAP information can be accessed at [www.who.int/ctd/html/hmap.html](http://www.who.int/ctd/html/hmap.html)
Development of new drugs and vaccines

Over the past few decades we have learnt to our cost that diseases are an ever-moving target. Dangerous microbes adapt to survive. And we must always be one step ahead if we too are to survive. The race is on to find new low-cost tools which can be used not only to step up the prevention of diseases, but to improve and accelerate their diagnosis and treatment as well.

In drug development, urgent efforts are under way to develop new drugs to treat diseases like malaria, tuberculosis and pneumonia which are rapidly becoming resistant to first-line drugs. Without a new generation of low-cost drugs, some diseases could become untreatable in countries which cannot afford to buy more expensive second-line drugs. Also being tested are new combination therapies to treat diseases such as lymphatic filariasis, river blindness and malaria – using more than one drug to increase effectiveness and lower the risk of developing drug-resistance. Other priority drugs include a new oral drug which could help reduce deaths from visceral leishmaniasis and a new, non-injectable, quick-acting drug to treat severe cases of malaria.

Top of the global priority wish-list in vaccine development today are vaccines against acute respiratory infections, diarrhoeal diseases, HIV/AIDS, malaria, tuberculosis and dengue. Of these, a vaccine against HIV/AIDS is arguably the most important since no cure exists and mortality is high. For people living with HIV/AIDS today the disease is still fatal, although some have access to life-prolonging drugs.

Efforts are also under way to reach the one in five children who are still not immunized each year through national immunization programmes. This includes efforts to lower vaccine delivery costs, simplify the administration of vaccines, and reduce the number of immunization contacts needed.

HIV/AIDS vaccine

Until now, efforts to develop a safe and effective vaccine have been hampered by failure to evoke or identify a protective immune response. However, the recent launch of the first-ever large-scale human trials of HIV vaccines in the United States and Thailand represents a major step forward. If these efficacy trials are successful, it is hoped they will pave the way for the development of similar vaccines to protect against HIV/AIDS in Africa. Even if they are not successful, they are expected to provide valuable information
## In the pipeline

<table>
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<tr>
<th>Drug</th>
<th>Pre-development</th>
<th>Preclinical</th>
<th>Clinical/regulatory</th>
<th>Post-regulatory</th>
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<td>Research to discover new tools.</td>
<td>Developing potential new tools and safety testing in animals.</td>
<td>Testing in humans for safety and efficacy.</td>
<td>Registered and on the market but being investigated further.</td>
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<td>SCH 56592</td>
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<td></td>
<td>Paromomycin, Mitellosine</td>
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<td>ALM/alum+BCG</td>
<td>ALM + BCG id for Old World</td>
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<td>ALA + BCG id for New World</td>
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<td>MLA im for New World</td>
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<td>Malaria</td>
<td>Paramyosin+Quil-A GST (S28), GST (S32)</td>
<td>GST+alum (S28)</td>
<td>Arteether im</td>
<td>Artesunate iv Pyronaridine CPGN/DAP</td>
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<td>SP166+alum SP166+QS21 AMA-1+SEPPIC RTS,S</td>
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<td>Ellornithine</td>
</tr>
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</table>

Note: These are examples of just a few of the many drugs and vaccines under development for infectious diseases.

Source: WHO/PRD
for future research efforts. The trials involve 5,000 volunteers in the United States and 2,500 volunteers in Thailand. Results are due in 2001.

Until recently, research has been hampered by the lack of animal models to test vaccines and by the ability of the virus to mutate with every new infection. As most initial vaccine research focused on the type of virus most common in North America and Europe, research must now be intensified on virus types from developing countries, where over 90% of infections occur.

**Pneumococcal vaccine**

Although low-cost drugs are available to treat pneumonia, many children die because they fail to get treatment in time. And the disease is becoming too expensive to treat in some countries as the available drugs become less effective due to increasing drug-resistance. Although pneumococcal vaccines already exist, they are not effective in children under two – the highest-risk age group.

A new, improved vaccine would be a major breakthrough in preventing pneumococcal pneumonia – the biggest childhood killer.

Four manufacturers are now carrying out clinical trials on new pneumococcal vaccines. The most promising are modelled after the Hib conjugate vaccine which has been highly successful in reducing bacterial meningitis and pneumonia in the industrialized countries.

**Malaria vaccine**

The need for malaria prevention measures and the spiralling rate of resistance to antimalarial drugs could be reduced by an effective vaccine. But no effective vaccine has yet been developed against a parasite — and the challenges are formidable.

A large number of malaria vaccines are under development. Several of the more advanced are now being tested in Asia, Africa and the United States. The most extensively studied is a vaccine developed in Colombia (SPf66). Although initial promising results have so far not been replicated in other studies, this vaccine has now been modified to increase its potency. And there are hopes that this second-generation vaccine could provide the much-needed breakthrough in malaria prevention. Another advanced-stage vaccine, which might be able to prevent the onset of disease in someone already infected, is now being tested in the Gambia and Kenya. The cost of developing a malaria vaccine has been estimated at $50 million over the next 10 years.

**New antimalarial drugs**

One promising new product is an oral treatment for cases of uncomplicated malaria in Africa. Development of this new drug (a combination of chlorproguanil and dapsone) is a collaborative
effort involving the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR), the United Kingdom Department for International Development (DFID), and the pharmaceutical manufacturer SmithKline Beecham.

Another promising new product is a suppository (artesunate) for malaria sufferers who are too sick to take oral medication. It is quick-acting, easy to administer and can "buy time" for people with severe malaria living in remote areas who might not survive the journey to hospital.

Diagnostic tests for sexually transmitted infections (STIs)

New diagnostic tests for sexually transmitted infections (STIs) currently under development could help prevent their spread, ensure prompt and more effective treatment and provide a valuable weapon in the fight against HIV/AIDS. The currently available tests are too expensive for use in developing countries and laboratory analysis is not always available. To make matters worse, syndromic case management – a cost-effective way of treating STIs on the basis of the symptoms alone – is often inadequate for women as they may have no symptoms of infection. Simple diagnostic tests are also required for other diseases including TB and malaria.

Microbicides

Efforts are continuing to develop a vaginal microbicide that could inactivate HIV and other microbes that cause sexually transmitted diseases. This would be a major breakthrough in efforts to protect women who are unable to enforce condom use.

Women are biologically more vulnerable than men to sexual transmission of HIV and account for 75% of all new infections today. Unlike the female condom, which is visible, vaginal microbicides could be used without a male partner's consent.

Providing finance for malarial drugs

WHO's new Medicines for Malaria Venture (MMV) is a joint public-private sector initiative which aims to develop antimalarial drugs and drug combinations for distribution in poor countries. Partners include the World Bank, Global Forum for Health Research, The Rockefeller Foundation and the Wellcome Trust. Industry participants include the International Federation of Pharmaceutical Manufacturers Associations and the Association of British Pharmaceutical Industries.

MMV will help develop new drugs for malaria at a rate of one every five years. MMV will create a fund and operate by financing and resourcing projects in a cost-effective manner. A funding commitment of $15 million a year, rising to $30 million, is being sought. MMV aims to accelerate R&D on new drugs and bring them to the market.

Medicines for Malaria information can be accessed at www.who.int/ctd
The need for intensified research

Infectious diseases figure low on the global health research and development agenda. In 1992, global spending on health research was $56 billion – less than 4% of total global expenditure on health. And of that, no more than 10% was allocated to research relating to the health needs of developing countries – mainly infectious diseases.

The combined investment in research and development into ARI, diarrhoeal diseases and TB – which kill over 7 million people a year – was $133 million (about 0.2% of global spending on health research and development). Yet these three diseases together account for almost one-fifth of the global disease burden. Malaria, which accounts for 3% of the disease burden globally and almost 10% in sub-Saharan Africa, fared as poorly – attracting about 0.1% of research funds.

In contrast to the limited funds available, the research needs for infectious diseases are vast. Some of the research needed involves cutting-edge science – sequencing the genome of the major disease-causing microbes, for example, or discovering ways of slowing the spread of antimicrobial drug resistance. Other critical research needs include the discovery of new affordable drugs, vaccines and diagnostic tests. In some cases, these are needed to lower costs, improve compliance and replace drugs that have been compromised by antimicrobial resistance.

Equally important is the need for research to find ways of making more widespread and better use of existing cost-effective tools such as vaccines, multidrug therapy, bednets and an integrated approach to childhood illness. Meanwhile, research is also needed to establish the disease burden in individual countries, so that health systems can respond effectively to today’s and future health needs in the most cost-effective way.

A top priority today is the urgent need to develop new low-cost antimicrobial drugs to replace drugs that have become ineffective due to antimicrobial resistance. Without this ongoing research and development, diseases such as TB, malaria, pneumonia and dysentery could become untreatable in countries which cannot afford available second- or third-line drugs.

To help accelerate the discovery of new drugs to treat malaria, a new joint initiative has been launched involving both the private and public sector. The New Medicines for Malaria Venture (MMV) aims to develop one new affordable antimalarial drug every five years.

Elsewhere, research is under way to develop new low-cost drugs that could improve compliance with drug therapy by shortening the course or
Health research by both public and private sectors devoted to health problems in developing countries.

Global health R&D funding devoted to AIDS, malaria, acute respiratory infections, diarrhoeal diseases and TB.

Source: Global Forum for Health Research, 1996
Source: Investing in Health Research & Development, 1996
simplifying the treatment. The drop-out rates for DOTS therapy for TB, for example, could be greatly improved if the multidrug therapy could be combined in a single tablet and the length of treatment reduced from the minimum 24 weeks now required. For leprosy, efforts are being made to develop new drugs which could both increase the effectiveness and shorten the duration of multidrug therapy.

A new generation of vaccines is under development which could save millions of lives. Dramatic advances in genetic engineering have produced a raft of vaccine contenders that will simplify immunization, boost the performance of existing vaccines and protect children against diseases which are not yet vaccine-preventable. In addition, new vaccines against diseases such as TB, malaria and acute respiratory infections could provide the first line of defence against drug-resistant microbes. Vaccines under development to address rotavirus, cholera, typhoid and shigellosis will help reduce the burden of disease caused by diarrhoeal disease.

The successful sequencing of the genome of the tuberculosis-causing microbe in 1998 was a major breakthrough that is expected to shed more light on which genes cause TB and to speed up the development of a more effective vaccine. Meanwhile progress in microbial genetics is also driving the development of new, improved vaccines against meningococcal meningitis, dengue fever and Japanese encephalitis.

In addition to the need to develop new or improved vaccines, research is also under way to simplify the administration of existing vaccines, reduce delivery costs, and boost immunization coverage. This includes research into ways of reducing the number of immunization contacts.
slow-release dose. Another priority is the development of new, safer ways of delivering vaccines—orally or nasally—that minimize the risk of injection hazards.

Research is also needed to develop low-cost rapid diagnostic tests to improve the accuracy of diagnosis and accelerate the start of appropriate treatment. Although rapid diagnostic dipstick tests for malaria are in the final stages of development, they are currently too expensive for widespread use in developing countries. Tests are also needed for TB, gonorrhea and sleeping sickness for use in developing countries.

However, in the short term a great deal could be achieved through research into ways of improving the use of existing tools—one of the most neglected areas of research. A 1997 study by WHO on TB research funding, involving 17 public and non-profit research funders, found that most of the $92 million they spent in 1995 was to extend the knowledge base and develop new tools. They spent least on research to improve the use of existing tools such as DOTS.

A number of initiatives have been launched to help improve the use of existing tools. They include efforts to improve the home management of malaria and other childhood diseases and provide clear information about the need for prompt referral for severely ill children.

Studies are being carried out to improve the follow-up by parents of health care advice from health workers and studies are under way to determine why some parents fail to seek care for sick children before it is too late.

Similarly, research is also critically needed to find ways of ensuring that newer, more expensive vaccines such as Hib and hepatitis B—which have proved so successful in the industrialized countries—can now be introduced into developing countries.

Into the new millennium

Investment in health research and development must be focused on disease priorities. WHO’s Global Burden of Disease appraisal for the year 2000 will provide the information for priority setting. Through detailed epidemiological estimates and projections, over 100 diseases will be studied and their impacts evaluated. Risk factors for disease will also be assessed and their importance projected under various scenarios.

Appraisals such as these will help to ensure the availability of the tools necessary to effectively continue the fight against infectious diseases.
A call for healthy development

By Dr Gro Harlem Brundtland

Health indicators are a common measure of progress. For decades, governments and donor agencies have used life expectancy and infant mortality to demonstrate the impact of social and economic development. The underlying assumption for this is sound. By improving the economic prosperity of countries in a sustainable and equitable way, improvements in health usually follow.

The opposite is also true. Development and a good social infrastructure are indicators of a healthy population. Where there are significant improvements in the health of families and the workforce, economic and social conditions often improve as well as economic output.

The interrelationships between health and development are so intertwined, that it is impossible to address one without the other. Improvements in community health depend on sustainable development. At the same time, health is a minimum requirement for development.

In the past two decades, the AIDS epidemic has made this interdependence obvious. One example is the relationship of AIDS with education. Prevention strategies are much more difficult where basic literacy skills are absent. At the same time, efforts to increase literacy have become an uphill struggle in many countries where the workforce has been devastated by HIV. In the United Republic of Tanzania, the investments in education required to yield expected standards have been increased substantially because HIV/AIDS is affecting an increasing number of teachers. Additionally, 20% fewer children attend school because parents are ill or dying as a result of HIV/AIDS.

Good health is at the heart of poverty alleviation

How does one break through the vicious circle of poverty causing illness, and illness causing poverty? Frustrations in identifying a simple path for human development can lead to ineffective responses.

One is to compartmentalize and focus health and development activities on singular, isolated projects as they can yield rapid and measurable progress. Unfortunately, accomplishments can soon unravel and prove to be unsustainable. Efforts to cure TB in refugee situations provide one such example. Well-meaning health workers often begin with what seems to be a straightforward task: treating every person diagnosed with TB. After a few weeks of treatment, the patient’s health will improve. But when refugees are returned to communities
Impact of development on infectious disease control

Safe drinking-water. The number of people with access to safe drinking-water has doubled from 40% in 1980 to nearly 80% in some countries, reducing the risk of diarrhoeal diseases.

Economic transition has affected health services and contributed to a resurgence of TB and diphtheria in the Russian Federation and Eastern Europe.

Mining settlements in the Amazon have contributed to an increase in malaria cases.

Hydroelectric dams in China, Egypt, Ghana and Senegal have led to an increase in schistosomiasis.

Adult literacy in developing countries has increased from 34% in 1977 to 49% in 1985. This increases access to health education messages.

Positive impact
Negative impact
lacking health services, it is unlikely that TB patients can continue their treatment for the entire six months required to cure the disease. These patients may ultimately develop virtually incurable multidrug-resistant types of TB and spread the disease throughout their communities.

Another way is to plan initiatives that are as comprehensive and encompassing as possible. But while well-coordinated multisector responses to poverty abound in theory, producing the desired results in practice has proven to be a challenge. Widespread reforms, prioritization and collaboration are more likely to succeed in countries where there is exceptional political leadership and the capacity to carry it through. Where such political leadership does not exist, development initiatives that attempt to address everything across sectors often risk achieving few measurable results.

Poverty and underdevelopment cannot be made to disappear by magic. To make progress, concrete and measurable contributions must be made in a coordinated way to remove the obstacles that prevent people from reaching their full human, economic and social potential. In any country, careful analysis of the evidence can
Impact of infectious disease control on development

**Vertical approaches** to disease control run the risk of compartmentalizing and distancing the health sector from other development activities.

**Economic development**
In addition to supporting the well-being of the public and the labour forces in other sectors, the health sector also produces goods and services that contribute to the national economy.

**Confusion** among health officials surrounding the 1994 outbreak of the plague in Surat, India, undercut Indian tourism. More than 45,000 people cancelled their travel plans to India.

**Micro Credit** loans defaults due to illness have been reduced in Bangladesh and other countries through the strengthening of TB control and other community health programmes.

**Community organizing** by gays, lesbians and IV drug users in response to AIDS has strengthened the capacity of these communities to respond to other social issues. Health initiatives are frequently spearheads for developing community participation.

**National hospitals** Many developing country governments allocate more than half of their health budgets to hospitals, leaving little money for basic health services.

**Economic growth**
Ten years of the malaria elimination programme in Sri Lanka is estimated to have boosted national income by 13%.

**Worker productivity**
Weavers in India with chronic symptoms of lymphatic filariasis produced 27% less cloth than healthy weavers.

**School attendance**
Children in the Solomon Islands missed — on average — one week of school each year due to malaria, prior to the implementation of effective control strategies.

- Positive impact
- Negative impact
Days of work lost from malaria
Estimated average time lost by adults due to one episode of malaria

Identify priority health needs that can be addressed cost-effectively. This evidence must be advocated to new partners and other sectors, and they must be persuaded to contribute to an integrated approach. The vicious cycles of illness and underdevelopment cannot be broken by health projects alone. But progress can be achieved by a new generation of people concerned about health and development, who can involve new partners through persuasive presentation of the evidence.

This is why the World Health Organization believes that evidence-based decision-making and advocacy are at the core of its leadership role in health. The task of furthering health and development begins by identifying achievable and cost-effective initiatives that provide substantial benefits to communities. It also recognizes that in political decision-making, facts often do not always speak for themselves. Social conditions must be created through partnerships with governments, NGOs, the private sector, the media and grassroots community organizations to encourage leaders to make responsible choices.

Reducing the burden of infectious diseases is an achievable objective
Poverty breeds infections; infections breed poverty. The road out of this vicious cycle begins with efforts that contribute to a person's ability to meet basic needs. People cannot contribute to the economic progress of their family and community.
Priority steps for overcoming the burden of infectious diseases

Political support – particularly money, policies and multisector involvement – is required to overcome the burden of infectious diseases. By mobilizing political support to address the following priorities, much of the death and suffering caused by infectious disease could be prevented.

- Support for proven, effective and affordable priority strategies in controlling the most devastating infectious diseases, including:
  - Bednets and treatment strategies for rolling back malaria.
  - DOTS (Directly-Observed Treatment, Short-course) for stopping TB.
  - Childhood vaccinations for reducing deaths from measles and other preventable diseases.
  - IMCI (Integrated Management of Childhood Illnesses) for addressing diarrhoeal diseases.
  - HIV prevention strategies such as condom promotion, sex education and STI treatment for reducing the spread of HIV/AIDS.
  - Antibiotics used timely and appropriately for preventing pneumonia.
  - Strengthened health services and delivery systems in developing countries.
  - Intensified efforts to eradicate polio and guinea worm, and eliminate neonatal tetanus, leprosy, lymphatic filariasis, Chagas disease and onchocerciasis.
  - Expansion of surveillance systems that can alert the world to unexpected outbreaks, the emergence of new diseases and increased drug resistance.
  - Investment in the development of diagnostic tools, drugs and vaccines that can further improve our ability to affordably address the most serious and widespread infectious diseases.

when they are rendered helpless by infectious diseases. By fighting infectious diseases, major obstacles to development are removed. As this report has shown, infectious diseases are the heaviest health burden faced by the poor and the young. Just six infectious diseases cause over 90% of deaths due to infections. But in every case at least half – and in some cases nearly all – of these deaths could be avoided simply by using affordable interventions. Effective disease control strategies such as DOTS, IMCI, ORT, childhood vaccinations, insecticide-treated bednets, social marketing of condoms and many other interventions can make a big difference to people’s lives.

Healthy development

Healthy development requires the alleviation of the most devastating and avoidable health obstacles that slow economic and social development. It addresses the greatest health crisis of developing countries – infectious diseases – without simultaneously exchanging it for chronic and costly health problems that are rampant in richer
countries. Healthy development implements poverty alleviation strategies in ways that contribute – and do not damage – the health of communities.

In the past 25 years, we have witnessed significant progress in sustainable development. The end of the Cold War and the reversal of nuclear proliferation have reduced global military spending and have provided opportunities to increase spending in other sectors. On average, life expectancy has increased by nine years. Since 1975, child death rates in developing countries have been cut nearly in half.

This progress must be tempered with the sobering reality that one out of two people in developing countries will still die from an infectious disease and by the fact that HIV/AIDS is changing their demography. On average, most of these deaths could have been prevented for $5 per person.

Infectious diseases inflicted a new magnitude of suffering after the world entered the last millennium. Western civilization had emerged from the Dark Ages and was beginning to take advantage of new knowledge afforded by travel and urbanization. Unfortunately, bubonic plague, syphilis, cholera and other diseases also capitalized on these opportunities. The population of Europe was reduced by nearly half. Will the new millennium be any safer from infectious diseases?

Two futures are equally conceivable as we enter the 21st century. The rapid economic and scientific advances of the past decade can be built upon, and the impact of infectious diseases can be cut dramatically. Or, infectious diseases can continue to burden human development, new diseases can emerge and drug resistance can reverse the scientific progress of the past century. Unlike our ancestors of a thousand years ago, we know both the causes and the solutions for most of the epidemics that plague us. How will history refer to us if we fail to control infectious diseases at the beginning of the new millennium?

The Bottom Line

“Illness and death from infectious diseases can be, in most cases, avoided at an affordable cost. It is everyone’s interest that these obstacles to development be removed. Because of drug resistance, increased travel and the emergence of new diseases, we may only have a limited time in which to make rapid progress. Those who have received this report have a unique responsibility, as they are leaders in society who can make a substantial contribution to the prevention and control of infectious diseases.”

Dr Gro Harlem Brundtland, Director-General, World Health Organization
Building a foundation for
HEALTHY DEVELOPMENT