ACUTE RESPIRATORY INFECTIONS

Technical Presentation

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The aims of this presentation are as follows:

1) to summarize the principal features of the problem of acute respiratory disease as it affects morbidity and mortality throughout the Western Pacific Region;

2) to review briefly the likely factors involved in the causation of acute infectious diseases of the respiratory tract;

3) to review developments that are relevant to the treatment and control of acute respiratory infections;

4) to outline an approach to the development of an effective international prevention and control programme for the Region, detailing the benefits which commitment to such a programme by all countries or areas in the Region could bring;

5) to define the characteristics of a national acute respiratory disease surveillance unit and its possible contribution to the national and regional control of acute respiratory diseases.

1. INTRODUCTION

The diseases subsumed under the general rubric of acute respiratory disease (ARD) include influenza, acute otitis media, measles, whooping cough, diphtheria, sinusitis, nasopharyngitis (including coryza), rhinitis, pharyngitis, tonsillitis, laryngitis, tracheitis, acute bronchitis, bronchiolitis and pneumonia. The term "acute respiratory disease" theoretically should also include asthma and hay fever. Those two allergic conditions can be confused diagnostically with acute infections of the respiratory tract and infections may exacerbate them. This presentation will not however deal further with those two problems, although they constitute a significant load on clinical services in many countries.

1.1 The magnitude of the problem

Collectively, acute infectious diseases of the respiratory tract are the leading cause of morbidity in many countries or areas of the Region and in a number of countries they are the leading cause of mortality. Their exact contribution to community ill health is difficult to measure, but they account for a vast amount of loss of productivity and for a very significant amount of health service utilization. Two well-documented examples underline the fact that this is an unresolved problem for developed and developing countries alike. (See Tables 1-3)

In Australia, which has the lowest mortality rates from pneumonia-influenza for the Region, acute respiratory infections (ARI) account for 29% of all new disease episodes presenting themselves to family doctors, and they are the leading cause of loss of time from work. They are also the only communicable diseases remaining among those listed as the principal causes of death.
In the Philippines, where death rates from ARI in childhood are as much as 70 times higher than those for children in Australia, acute respiratory infections are the leading cause of death and also the main cause of use of health services.

Table 1 is a tabulation of age-specific death rates for one year from all causes and from pneumonia-influenza in seven countries or areas of the Region for which death certification permits such analysis. While influenza epidemics produce fluctuations in the rates from year to year, the magnitude of intercountry differences does not alter greatly from year to year.

In the less developed countries especially, respiratory infections are a serious cause of premature mortality. In the Philippines, 39% of deaths between the ages of one and four years are attributed to pneumonia-influenza. It is generally true to say that, wherever premature mortality is high in the developed countries, pneumonia-influenza contributes disproportionately to mortality rates. Table 1 also underlines the fact that, even in those countries or areas where life expectancy is high, respiratory infections are significant contributors to mortality at all ages.

Table 2 provides some comparative data on death rates from various disease entities in six countries or areas for the two age groups, 1-4 years and 45-54 years. It is clear that, both in the developed and developing countries, respiratory infections, as contributors to premature mortality, rank highly alongside disease entities which have customarily commanded the attention of public health authorities.

2. FACTORS INVOLVED IN CAUSATION OF RESPIRATORY INFECTIONS

Acute disease of the respiratory tract may be caused by a huge number of micro-organisms and they may involve the respiratory tract at various levels and in varying combinations (Table 4). Animal experiments suggest that some organisms may act together synergistically: for example, influenza and mycoplasma infection of the respiratory tract may pave the way for lower respiratory tract infection by pneumococci. The factors influencing the transmission and effects of those micro-organisms are imperfectly understood. It is known that a number of potentially pathogenic bacteria can be carried in the upper respiratory tract of normal individuals without causing ill effects. For most respiratory pathogens, it is believed that droplet spread from person to person is the chief method of transmission and that a number of natural defence mechanisms determine whether or not an individual will develop an infection when the organism lodges in his upper respiratory tract.

Once lodged, it seems that a number of protective mechanisms are available to minimize proliferation of organisms. These include the cilia and secretions of cells lining the tract, the mechanical integrity of those cells, the presence of a specific antibody, and non-specific factors both
in the secretions and in the bloodstream. Clinical and laboratory studies have shown that these defence mechanisms may be impaired by a variety of factors, including rapid temperature change, intoxication by alcohol, splenectomy, impaired nutrition and impaired immune competence.

There has been a dramatic fall in death rates from ARI in many of the developed countries around the world since the middle of the nineteenth century.

At the turn of the century, the death rates from pneumonia-influenza in Japan were of the order of 266 per 100,000 per annum. By 1975 they had fallen to less than one ninth of that, namely 28.7 per 100,000 per annum. Similar changes have been recorded in other developed countries. (Currently, it is estimated that Papua New Guinea's death rate ranges somewhere between 90 per 100,000 and 570 per 100,000 for different population groups.) This fall generally preceded the advent of vaccines and potent antimicrobial drugs. The evidence suggests that social and environmental factors play an important part in predisposing to mortality. The most obvious mechanisms would seem to be sub-nutrition, inadequate clothing and housing, overcrowding and exposure to climatic variations.

It is relevant to ask whether the changes in mortality that have been noted in developed countries are predominantly a result of changed germ transmission or of altered host defences. The fact that countries with low mortality still experience quite massive respiratory infection attack rates, suggests that the decrease in mortality has been achieved at least partly by enhancing host defences against organisms which, the evidence suggests, continue to circulate widely in those countries. However, arguments of this kind must at present be somewhat speculative as we have remarkably little data and almost a complete lack of methodology by which to make sound, international, epidemiological and microbiological comparisons on these vital issues.

2.1 Establishing the role played by individual pathogenic agents

Many pathogenic agents can be involved in ARI. The agents have different ecological needs, methods of identification and modes of action. Often they act synergistically and in various combinations. Before planning national treatment and control programmes, all countries need to have basic information about the role being played by causative agents in the spectrum of ARI in their country.

There are considerable logistic and technical difficulties in establishing the causative role played by pathogens in individuals suffering from ARI and, for that reason, adequate studies are rare and tend to have been carried out in the past mainly in the more affluent countries where laboratory resources are more adequate. The following are some of the difficulties involved:

1. Some of the bacterial agents believed to cause ARI are also commonly "carried" in the nasopharynx of healthy individuals.

2. Entry to the lower respiratory tract and proliferation of a carrier bacteria may be facilitated by an upper respiratory infection with a virus or mycoplasma.
3. Viruses and mycoplasmas are known to cause lower respiratory invasion in their own right.

4. Optimal studies of the role of bacterial pathogens in ARI require collection of specimens before bacterial drugs are administered. With the widespread use of antibacterial drugs for ARI at the primary care level, tight clinical discipline and routine specimen collection must often take place at that level.

5. The tight clinical discipline required is often in conflict with the financial interests and time constraints of the clinician and it can be argued that the information gained does not directly benefit the patient he is treating. Ethical questions arise when the investigation additionally carries with it patient discomfort (collection of blood and lung fluid) and inconvenience (collection of paired specimens for virology) and even risk (pneumothorax or haemothorax from lung tap).

6. The lack of consensus about what constitutes evidence of causality and the technical limitations of complete microbiological and serological assessment.

It will be apparent from this rather daunting but still incomplete list of problems that any serious attempt to define the roles played by pathogens in a community requires a multidisciplinary approach involving close cooperation between clinicians, epidemiologists, bacteriologists, parasitologists, virologists, immunologists and patients.

2.2 Establishing the role played by social, environmental and nutritional factors

The earlier discussion underlines the fact that excessive preoccupation with pathogenic agents might obscure vital approaches to prevention and control. Success in reducing mortality in developed countries in the early part of this century does not appear to have been a direct consequence of actions directed towards specific germ control. Rather, it would seem that respiratory infection death rates fell in parallel with improvements in housing, nutrition and hygiene, thus modifying the susceptibility of host defences of populations in the developed countries to death from those infections. Specifying the role played by social, environmental and nutritional factors in human respiratory infections is no less daunting than specifying the role of individual pathogenic agents, nor can it be undertaken in isolation from the task of identifying individual agents. However, the need is urgent. It is entirely possible that well-focused research could identify cheap and simple nutritional supplements, which, when added to staple foods, could enhance respiratory defence mechanisms.

A major impediment to progress in this area is that there has been no international agreement on terminology or methodology in undertaking laboratory and epidemiological studies of ARI. Some standardization of terms and methods is an essential prerequisite to studies which compare the incidence of respiratory infections in different social and environmental circumstances. To the multidisciplinary team described above, which is needed to establish the role played by individual pathogenic agents, must
be added the special skills of nutritionists, social scientists and environmentalists if, in the development of effective control strategies, we are to identify the particular social, environmental and nutritional interventions that will change the morbidity and mortality of such infections.

3. APPROACHES TO THE TREATMENT AND PREVENTION OF ACUTE RESPIRATORY INFECTIONS

3.1 Clinical treatment and the role of antibiotic treatment

There is widespread agreement that viruses are the principal initiators of acute respiratory disease, and there is also good evidence that bacteria may either super-infect the virus-damaged respiratory tract or cause clinical infection on their own. It is difficult, even for experienced clinicians, confidently to distinguish those patients whose symptoms are due exclusively to virus infection from those whose respiratory tracts are already invaded or at serious risk of invasion by bacteria. Without the availability of detailed laboratory studies, health workers generally tend to err on the side of caution. In the more developed countries, where health services are well staffed and supplied, antibiotics which are effective against bacteria are often over-prescribed. At the same time, in countries where primary care services are sparse or limited, life-saving antibiotics are often under-prescribed and potentially salvageable lives are being lost as a consequence.

Antibiotics are often life-saving in patients with severe lower respiratory infection, and they can reduce morbidity and possible life-threatening complications in patients with sinusitis, exudative tonsillitis, exudative pharyngitis and acute otitis media.

If antibiotics are to be used in the most appropriate possible way, there is a need in all countries to educate health workers in recognizing those who will most benefit from their use. Further, health workers at all levels need to have available to them a range of antibiotics that is deemed suitable for the prevailing bacterial pathogens. In each country there is a need for appropriate clinical categorization of patients with respiratory infection and for simple guidelines that are based upon accurate knowledge of the clinical probabilities.

3.2 Oxygen as a life-saving measure

There is good evidence that oxygen is a life-saving measure in severe respiratory infections of childhood (Table 5). There are logistic difficulties, however, in making oxygen available as part of the peripheral health services. Difficulties arise also in ensuring that such supplies as are made available are not dissipated on children who do not need that form of therapy. Once again, education of health workers is an important factor.

3.3 Other supportive measures

For patients who do not warrant antibiotics or oxygen therapy, simple supportive measures to minimize discomfort and decrease the likelihood of
serious complications can be widely taught. Those include the clearing by suction of nasal airways of small children in whom obstructed airways can interfere with feeding, the creation of a moist environment by the use of steam or wet cloths to diminish laryngo-spasm, and the use of simple pharmacological agents, including simple antipyretics to lower temperature and antitussive and antispasmodic drugs to diminish troublesome cough or wheeze. One problem which can arise in the absence of adequate health education is that parents of young children who really require life-saving measures such as oxygen or antibiotics may obtain a false sense of security from the symptomatic measures, especially if they are prescribed by health workers. Wherever symptomatic measures are prescribed, it is essential that parents are alerted to the signs and symptoms of complicated and serious respiratory infection.

3.4 Need for standardized terminology and management decision trees

International communication between health workers on the subject of ARI is often confused by ambiguity in the use of clinical diagnostic terms. This problem is compounded for epidemiologists and health administrators trying to come to grips with it by the fact that, even if clinical terms were to be used uniformly by doctors, many patients suffering from ARI are not examined by an experienced clinician. For some years, there has been a recognized need for simplification in methods of diagnosis to permit appropriate notification and epidemiological surveillance. The need is for simplified clinical categories of such infections which are based upon symptomatology and can be used by relatively inexperienced health workers. The approach outlined in Figure 1 presents such a categorization and is an attempt at reconciling the needs of epidemiologists, administrators, primary care clinicians and clinicians at a more sophisticated level of competence. It should be emphasized that the vast majority of respiratory infections belong to the mild category and warrant simple out-patient supportive care only. Decision trees such as this one, which was developed by a 1979 WHO Scientific Group on Viral Respiratory Diseases, could simplify teaching of primary care clinical workers and lead to standardization of epidemiological reporting. Extensive operational research is needed, however, to validate the approach outlined and to fill out the details of management as they might apply at different levels of a national health system.

3.5 Relevant developments in the clinical management of acute respiratory infection

3.5.1 Antiviral drugs

Despite an enormous amount of research to discover drugs of low toxicity with a broad spectrum of antiviral activity, the effort has so far been relatively unproductive. Two drugs - amantadine and rimantadine - have been used extensively and shown to have some antiviral activity in vivo against influenza A viruses. A derivative of rimantadine is also active against influenza B. These agents are too specific and too expensive to warrant their widespread introduction, but they may have a role to play in local containment of influenza epidemics. The search for cheap broad spectrum antiviral drugs continues to engage the attention of the world scientific community, but there is little more than hope on the horizon.
Recent reports from China\textsuperscript{5} suggest the possibility of traditional herbal medicines, including radix astragalus, inducing interferon production and stimulating an increase in secretory IgA levels. If those reports of laboratory and clinical studies are confirmed, they could represent a significant approach to both prevention and clinical management of viral respiratory infections.

3.5.2 Antibiotic resistance

In recent years a growing number of bacterial respiratory pathogens have been displaying resistance to the more conventional and more widely used antibiotic drugs.\textsuperscript{6} Particularly ominous is the repeated change in sensitivity of the pneumococcus, a common respiratory pathogen which has been demonstrating increasing resistance to penicillin and other antibiotics in countries where those drugs have been widely used.\textsuperscript{7} The prospect of broad spectrum antibiotic resistance by common respiratory pathogenic agents has serious implications for future clinical management of ARI. To date, the levels of resistance encountered have not raised insuperable clinical difficulties. However, the speed with which resistance appears to be increasing in some countries emphasizes the desirability of evolving planned national strategies to minimize those effects. Such strategies can only be evolved from a programme which includes systematic monitoring of levels of resistance of common pathogens in defined population groups.

3.6 Relevant developments in respect to preventive approaches

3.6.1 Immunization against influenza

Because of the dramatic effects of influenza on mortality and community morbidity, considerable efforts have been made to improve the effectiveness of immunoprophylaxis against influenza in recent years. The more or less continuous process of antigenic drift, which represents the gradual alteration in the antigenic constitution of influenza strains and the occasional appearance through antigenic shift of a mutant representing an essentially new virus, makes it necessary to keep influenza vaccines up to date by the incorporation of currently active viruses. In theory, at least, mass immunization against influenza on a nationwide scale, could serve to prevent epidemic occurrence or halt its spread. However, immunization on such a scale has never been achieved and there are considerable logistic difficulties in implementing such programmes, quite apart from their massive expense. Continuous monitoring is required to keep public health authorities informed as to the antigenic nature of the virus or viruses currently circulating in a population. There is evidence that, using the currently available killed virus vaccines, protection may be as high as 90%, but the duration of protection with those vaccines may not justify mass use. At the present time, influenza vaccines tend to be used primarily in selected population groups - for instance, individuals with known underlying chronic or debilitating disease and the elderly - as well as public service groups, to prevent disruption of critical public needs such as police and fire protection, transportation and medical services.

Considerable efforts are currently being made to produce attenuated live influenza virus vaccines which could be both more potent and less
reactagenic than existing killed virus vaccines. There is a possibility that recombination techniques will produce attenuated strains that could significantly enhance the effectiveness of immunoprophylaxis against this ubiquitous problem. 8

3.6.2 Measles vaccine

The use of safe and effective live measles virus vaccines has profoundly changed the face of measles in countries where they have been widely used. 9, 10 Logistics and cost factors have prevented this vaccine from reaching the target group of children under the age of 5 years in developing countries where measles sometimes causes as many as 5% of premature deaths. There remains controversy over the optimal age of immunization.

Under the age of 12 months, sero-conversion is less than optimal. Yet, in many developing countries, attack rates in children of that age are such as to make it desirable to consider immunization as early as 7-1/2 months of age. The frequently observed but still poorly understood relationship between measles and kwashiorkor underlines the importance of providing protection for children in high malnutrition areas at the earliest possible time. 11

3.6.3 Diphtheria and pertussis vaccines

Combined with tetanus toxoid, these vaccines are of proven effect in changing childhood mortality. Diphtheria toxoid is safe and efficient and is given the credit for virtual abolition of the disease from countries with high infant immunization rates. 9

The rapid decline in incidence of whooping cough in immunized populations is generally characterized by a change in clinical pattern, with mild forms predominating. 12 Unprotected populations can experience tragically high fatality rates, 13 and this is particularly true in conditions of overcrowding and poverty. About half the deaths occur in children under the age of one year. 14 Improved production techniques under the expanded programme on immunization have rendered toxicity of pertussis vaccine extremely rare.

3.6.4 Pneumococcal vaccines

Although there are now 83 distinct serotypes of pneumococcus, epidemiological studies have demonstrated that the number of strains which commonly cause serious disease of the middle ear and the lower respiratory tract is relatively small (approximately 20). Polyvalent vaccines, comprising the capsular polysaccharide of up to 14 of the highly invasive serotypes, have now been shown to be both safe and effective in the field. 2, 15 The recent introduction of a 14-valent pneumococcal vaccine in double blind randomized controlled trials in Papua New Guinea resulted in a significant reduction in crude mortality, both in adults and children. These vaccines, because of their multiple components, are not cheap at present, but are commercially available. Important questions about the duration of their efficacy and the optimal age for immunization of infants need to be answered before they can be considered for mass immunization programmes. Furthermore, a necessary
prerequisite to mass immunization is knowledge about the role played by pneumococcal serotypes in the spectrum of respiratory infection of the country concerned. At this stage there is a need for carefully evaluated studies of the impact such vaccines have on community morbidity and mortality. There are some grounds for optimism that in certain situations these vaccines could play an important role in the prevention of severe respiratory infections in the future.

3.6.5 Possibilities for future immunization against respiratory syncytial virus, parainfluenza virus, adenovirus, mycoplasma pneumoniae and rhinoviruses

A high priority has been assigned to the development of an effective vaccine against respiratory syncytial virus (RSV), which has only one serotype and is believed to be responsible for large numbers of deaths in early infancy, and for significant morbidity in early childhood. There is also the possibility that infection with the organism in early childhood can predispose to chronic damage to the lower respiratory tract. Early attempts to develop a killed virus vaccine against the organism were unsuccessful in protecting infants against infection. Since naturally acquired infection with the virus confers protection against significant disease on reinfection, a live attenuated virus which would achieve an initial infection without the severe disease of the natural virus would appear to be the logical and rational choice as an immunogen. To that end, attempts are being made at present to develop a temperature sensitive, genetically stable mutant that can be administered intranasally. Such a vaccine might significantly alter infant mortality rates in the very young, but a development phase of some years is likely before a mass immunization approach could be considered.

Because of the severity of illness produced by the parainfluenza viruses in infants and very young children, efforts to develop suitable vaccines have been under way for some years. Up to the present, a number of inactivated virus preparations have been tested for protective efficacy and the results have been consistent in showing that such vaccines, although they elicit a good antibody response, lack protective capacity. As with respiratory syncytial virus, current efforts are directed towards development of temperature sensitive mutants of parainfluenza virus types 1 and 3, the two types most frequently associated with severe lower respiratory disease. Successful development of such or similar mutants appears promising. Vaccines containing those modified viruses would have to be administered in early infancy, probably under the age of 6 months.

A total of 34 antigenically distinct serotypes of adenovirus have been associated with human infections. But it is a relatively unusual cause of ARI in civilian populations, representing about 5% of all acute respiratory disease under age 5. The infrequency of severe adenoviral disease in that age group raises the question of the practical value of immunization against the offending serotypes. Live virus vaccines orally administered in enteric-coated gelatine capsules have been shown to be highly effective in lowering the incidence of acute respiratory disease caused by the immunotypes against which the vaccine is devised. Those vaccines are currently used in military populations who tend to have a
high incidence of infection. Their broader application is inhibited by the fact that protection against adenoviral respiratory disease in the military, caused by an immunotype represented in the vaccine, may be so effective that the strain is replaced in the population by another not represented in the vaccine. In the absence of epidemiological information about the importance of the pathogen in civilian populations, it seems that the difficulties and logistics of mass immunization would militate against their widespread use at the present time.5

Mycoplasma pneumoniae infections affect both the upper and lower respiratory tract and occur most frequently between the ages of 5 and 30 years. The organism is widely distributed and probably contributes appreciably to respiratory morbidity in some communities – especially servicemen, where up to 30% of new recruits develop infections and up to 5% may develop pneumonia. Formalin inactivated vaccines have been developed against this organism and have been shown to be non-toxic and 50% efficacious in preventing infection and disease.17 The applicability of such a vaccine to communities has not yet been widely canvassed, nor is the contribution that the organism makes to community morbidity and mortality adequately documented, especially in developing countries, although one African study suggested that it was relatively unimportant.18

At present, there are some 110 distinct immunotypes of rhinovirus, which can give rise to the common cold syndrome of rhinorrhea, obstruction of the nasal passages, sneezing, pharyngeal discomfort and croup. Problems with preparing a vaccine containing all known immunotypes seem at present virtually insurmountable, since data derived from virus isolation and serological studies indicate that rhinoviruses enjoy a cosmopolitan distribution.19 To bring the problem of specific prophylaxis within reasonable reach of solution, it has been considered that certain immunotypes may be present, or circulate within, given geographical areas, and they would be the candidates for incorporation into a vaccine. However, there is no firm basis on which to make a distinction between rhinovirus types of high prevalence and those of low prevalence. Reports of the existence of antigenic relationships between some of the rhinoviruses offer a glimmer of hope that such relationships might be exploited in the formulation of a vaccine.

Since secretory nasal antibody appears to play an important role in resistance to infection with rhinoviruses, and since parenteral innoculation of viruses is not very effective in eliciting such antibody, development of a vaccine in the future will ostensibly have to be based on the use of living, suitably attenuated, viruses possibly for intranasal administration.

4. AN APPROACH TO THE DEVELOPMENT OF EFFECTIVE PREVENTION AND CONTROL PROGRAMMES

4.1 Intercountry cooperation with WHO playing a coordinating role

Since the problem of ARI is global, affecting different Member States in different ways, all Member States may be able to contribute in some way to its solution. WHO can act as a catalyst and coordinate the disparate efforts being made by institutions and individuals
throughout the Region. In each Member State, the problems and the available resources to deal with them will differ. Therefore, in those countries which place a high priority on the problem, there is a need for precise specification and an approach to clinical management and prevention that is realistically geared, not only to the problem itself, but to the local availability of drugs, vaccines and technical expertise. In view of the impressive reduction in acute respiratory infection mortality that has already been achieved in developed countries, and the approaches that are already available or likely to be available in the future, the halving of premature mortality and of morbidity throughout the Region during the next 20 years appears to be a realistic objective for a WHO coordinated programme.

The proposed programme will depend for its success upon intercountry sharing of information and upon operational research that involves systematic testing of new control strategies as they become available. It is suggested that developing and developed countries alike should establish monitoring systems using standardized methodology to permit intercountry epidemiological comparisons, and the rapid transfer of new control strategies from one country to another.

4.2 Defining the problem at the country level

In the early stages of a programme directed towards the problem, it seems desirable that individual countries should focus the limited resources they will have to invest on small surveillance centres of excellence. Defined population groups should be identified, believed to typify the problem of ARI. Usually such a population group ought to be no smaller than 5000 and no greater than 50 000, and should be located in reasonably close proximity to centres where good laboratory resources are available. The surveillance units do not need to be elaborate, or to have sophisticated resources, in order to make a substantial contribution to the management and control of respiratory infections in the country concerned. A WHO model surveillance unit is currently being established in the Highlands of Papua New Guinea, where the methodology of surveillance is being developed and adapted for use in developing countries. The principal purpose of developing such units is to focus attention and resources upon three questions:

(1) Which groups in the population are at greatest risk of developing acute respiratory infections?

(2) Which pathogenic organisms are most frequently involved?

(3) In the light of current available technology and resources, which strategies aimed at lowering the incidence, severity and outcome of respiratory infections are likely to be most appropriate for the health services of the country concerned?

Monitoring of the defined population should include the social and environmental circumstances of individuals, the prevalence of various viral, mycoplasmal, bacterial and parasitic respiratory pathogens in the community, the sensitivity of pathogenic agents to available chemotherapy, and the actual levels of morbidity and mortality encountered. The
centres of excellence will also become the places where new strategies for control, including vaccine trials, health education approaches, identification of high-risk individuals, and modifications in standard treatment approaches for countrywide implementation, can be first tested. The designation by participant Member States of one or more of such units would be the first step in evolving a control programme.

In some countries, the resources needed to undertake such surveillance are already available and simply need to be focused on the problem. Other countries will need assistance to establish their units. It is important that surveillance should be established in typical populations representative enough to permit strategies found to be successful to be widely disseminated throughout the country.

4.3 Currently available strategies for dealing with the problem

At the present time, it would seem that the following four proven approaches are available which could substantially lower morbidity and mortality. Surveillance units should begin by exploring them:

(1) upgrading standards of primary health care for ARI;
(2) health education programmes;
(3) mass immunization in infancy using triple antigen and measles vaccines and selective immunization of high-risk groups with influenza and pneumococcal vaccines;
(4) identification of high-risk groups and development of special programmes for them.

4.3.1 Upgrading of primary care in the management of acute respiratory infections

Standard treatment regimens, designed to maximize the impact of scarce antibiotics and oxygen among those who need them most, are likely to have immediate applicability. Operational research is required to ascertain where the "roadblocks" to effective care are in a particular country. The choice of antibiotics for standard treatment regimens should take due cognizance of the current status of antibiotic resistance in the community. The methods of instructing primary care workers in standard treatment regimens will vary from country to country. The use of decision trees in such instructions could hasten the effectiveness of the implementation of standard regimens.

A simple operational research approach to the identification of "roadblocks" in clinical care may be retrospective analysis of a sample of people who have died from ARI, with a view to ascertaining problems relating to accessibility to care, availability of drugs and oxygen, time of presentation in the course of illness, and perceptions about respiratory illness by the local population.

4.3.2 Health education programmes

A considerable amount could be achieved by well-organized health education programmes. The vast majority of ARI are self-limiting and
will not be complicated by life-threatening conditions. A small proportion of cases need to be seen by health professionals in order to receive life-saving antibiotics and oxygen. The remainder can be managed by supportive measures without recourse to professionals. An immediate task for health educators is:

(1) to train parents and families in the identification of cases that need life-saving therapy; and

(2) to ensure that they are making adequate use of the personal supportive resources they can arrange for themselves, when life-saving therapy is not required.

4.3.3 Immunization

As indicated above, this is a rapidly advancing area. Potent and safe vaccines against measles, whooping cough, diphtheria, pneumococcus and influenza are already available. Attenuated live, orally administered, vaccines may well become available shortly for RSV and parainfluenza viruses. The task at present is to identify who should receive those preparations, as and when they become economically feasible for the country concerned. That decision depends not only on the safety and efficacy of the vaccines but also on prevailing epidemiology. On the basis of coordinated clinical laboratory and epidemiological data collected from surveillance units, countries will be able to decide on the most appropriate use of available vaccines.

4.3.4 Identification of high-risk individuals

Some individuals are more prone to severe respiratory infections than others. The extremes of age are two examples. Death from respiratory infection is also more likely in the malnourished and in those who are immune-deficient in various ways. Primary care, health education and immunization should therefore be particularly directed towards those at highest risk. Surveillance units will need to develop methods for identifying and reaching such high-risk groups.

4.4 Need for research as part of a WHO control programme

4.4.1 Operational research

Application of the treatment and prevention approaches already available can be impeded by inadequate training of health workers, inappropriate availability of drugs, inaccessible primary care services and the inappropriate allocation of resources. The existence of national surveillance units will necessarily result in a critical examination of those factors and in new endeavours to improve the efficiency of existing health services.

WHO has begun to develop methods for conducting operational research into acute respiratory disease (ARD) control, and the proposed regional programme envisages the refinement of simple techniques which can be transferred from the model surveillance unit at Goroka, Papua New Guinea to new surveillance units as they are established. The use of standard methodology will permit inter-unit epidemiological comparisons and should result in new approaches to treatment and health education that will minimize ARD.
4.4.2 Research in the laboratory

It is clear that more research is required to obtain the necessary foundation for the development of better and more effective vaccines, essentially free from toxic and other adverse reactions and which produce a measurable and highly effective protective immunity against infection and, in so far as possible, resistance to reinfection. There is still a great deal of uncertainty about the pathogenesis of the major viral respiratory diseases. For example, considerably greater understanding and appreciation are needed of the immunological phenomena involved in establishing a resistant state, and in the immunopathologic, and perhaps genetic, mechanisms involved in the exaggerated responses seen in naturally infected individuals previously inoculated parenterally with RSV vaccines.

Although inactivated virus vaccines have been available for the prevention of influenza for more than a quarter of a century, they have not been applied widely enough to protect populations against epidemics or to halt epidemics once they have started. This is because of the problems of antigenic drift, antigenic shift and the short duration of protection. Basic research into new methods of treatment and protection against influenza continues to deserve high priority.

The more highly developed countries have a vital role to play in basic research. They have well-developed laboratory resources and personnel available to work on such projects, but their activities are often not focused upon the needs of ARD control. WHO should continue to play an important coordinating role by monitoring research and focusing the attention of universities and research funding bodies on the urgent needs of the international programme.

4.4.3 Intercountry cooperation

Both developing and developed countries have reason to be interested in identifying new and effective methods of ARD control. Developing countries have a more severe mortality problem, but developed countries have a serious morbidity problem. In evaluating new control strategies, some approaches will be best tested in situations where morbidity is the main difficulty and where sophisticated monitoring of outcomes is possible. Other strategies may be better tested where mortality is known to be high. Intercountry cooperation in the evaluation and transfer of new strategies is an important component of the proposed programme.

5. CHARACTERISTICS OF NATIONAL ACUTE RESPIRATORY DISEASES SURVEILLANCE UNITS

5.1 Definition

An ARD surveillance unit provides a meeting point for the various disciplines involved in the monitoring, care and investigation of acute respiratory diseases in defined communities; a centre of excellence for research into methods of control and ultimately the focal point from which control measures can be developed and evaluated.
5.2 Functions

The functions of a unit can be summarized as follows:

1. monitoring of mortality and morbidity attributable to AFD in defined populations;
2. definition of population groups and individuals at special risk of ARD;
3. monitoring of agents responsible for ARD and of their biological properties;
4. description of the environmental conditions (including physical, cultural and social) that influence the incidence of ARD in defined populations;
5. description of host factors (including immunological, behavioural, nutritional and genetic) that determine susceptibility to ARD in the defined populations;
6. assembly, analysis, evaluation and dissemination of those data;
7. evaluation and monitoring of ARD control measures;
8. training of personnel concerned with ARD surveillance and control;
9. research into methods of improving the effectiveness of control activities;
10. formulation of recommendations to administrative authorities.

5.3 Relationship of surveillance units to existing health services

It is anticipated that the organizational and administrative relationships between a surveillance unit and the national health structure will vary. It is intended that the activities of such units should be blended into the existing health care system, and that they will direct their efforts towards the strengthening and streamlining of clinical management and preventive activities. Such units would benefit from the support of already existing national influenza surveillance laboratories and national institutes of communicable disease. Those institutions can often provide the virological and epidemiological expertise required.

5.4 Size, nature and location of the population under surveillance by a surveillance unit

The population chosen for surveillance should be easily definable and should be in relatively close proximity to the laboratory which is to provide the microbiological services. The number of population groups to be brought under surveillance in any one country will depend upon the availability of resources and upon the priority accorded ARD
control in that country. As a general principle, quality should take precedence over quantity and countries with limited resources should ensure that one unit is collecting information of high quality and reliability from a defined population. In the first instance, surveillance should be established in a community group believed to have a significant ARD problem. As further resources permit, new populations may be brought under surveillance, and it may be desirable to add a population believed to have low respiratory infection, morbidity or mortality.

5.5 Types of data collected from surveillance populations

Four principal types of data should be collected:

5.5.1 Population identification data

This entails information about the social, environmental and demographic characteristics of the individuals who make up the population under surveillance. In some surveillance units, additional identifying information will relate to certain biological characteristics of the individuals.

5.5.2 Respiratory infections data

When patients in the surveillance area make use of health services for acute respiratory infections, all clinical findings and treatment should be entered on to standard data forms. A system of death notification needs to be established in the study area and, whenever this occurs, every effort should be made to ascertain the likely cause of death and to document the information.

5.5.3 Intervention data

This refers to things done to or for members of the population, either in an endeavour to change the respiratory infection pattern, e.g. immunization programmes or new methods of clinical management, or as a result of social or environmental change.

5.5.4 Laboratory data

Here is included information about micro-organisms recovered or serum specimens collected from patients suffering from ARD. Where feasible, serological surveys on healthy people will help to provide background information.

5.6 Use of surveillance unit data for programme planning

The problem of acute respiratory infection is not simply a viral problem, not simply a bacterial problem, and not simply a social or environmental problem. In different populations and at different times, these factors will be interacting in various ways. The data collection process is a means to the end of defining the most appropriate control strategy. In some populations the use of anti-bacterial vaccines or
nutritional supplementation may be deemed desirable. In others, control measures may centre around the upgrading of therapeutic services. The form in which data are collected from a surveillance population must permit their immediate use locally in defining and monitoring control strategies. At the same time it is desirable to be able to compare local data with data collected from other populations under surveillance.

It is desirable that, as ARD control measures are devised in a population under surveillance, they are carefully documented with a view to providing maximum information about their effects for the benefit of others who may wish to apply such strategies, either in the same country or in other countries with similar ARD patterns. The use of standard clinical and laboratory terminology and methodology by surveillance units will facilitate the rapid duplication of successful intervention methods in populations under surveillance with similar ARD patterns.

5.7 Staffing and organization of acute respiratory diseases surveillance units

Each surveillance unit should offer the following services:

5.7.1 Epidemiological surveillance

This should permit the documentation of changes in the population at risk, morbidity and mortality patterns within that population, and the occurrence of ARD and the micro-organisms responsible.

5.7.2 Treatment services

The clinical care available to ARD patients in the surveillance population should be relevant to the country concerned and within the limits of its resources. A country with a very low health budget should choose for its first surveillance population an area served by primary care services of a kind that can be realistically duplicated throughout the country. Research in the surveillance population will permit the national primary care of ARD to be constantly reviewed and upgraded in the light of detailed surveillance information.

5.7.3 Laboratory investigation services

A standard battery of bacteriological and virological techniques should be available to assist in identifying the role of the common viral, mycoplasmal and bacterial pathogens in the community. They could include influenza viruses, respiratory syncytial virus, adenoviruses, parainfluenza viruses and Mycoplasma pneumoniae, as well as pneumococci, haemolytic streptococci, Haemophilus influenzae, Klebsiella pneumoniae and Staphylococcus aureus.

5.7.4 Data collection and analysis

It is essential, if the units are to succeed in their aim, that the data information system serves the needs of the unit rather than vice versa. Coordination of demographic, social, clinical and microbiological data and the need to review change in the effects of intervention, require that each unit is served by a worker well versed in the modern techniques of data collection and analysis. In a multidisciplinary
unit of this kind, coordination of the activities of the various disciplines represented is crucial to its success.

6. CONCLUSION

There are compelling reasons for WHO to evolve a regional control strategy directed towards the complex problem of acute respiratory infections. Those infections are responsible for massive morbidity in all countries or areas, and very high premature mortality in many of the less developed countries. All countries or areas, therefore, have a vested interest in the problem and all can help contribute to its solution. New approaches to prevention and management of the infections are becoming available and need to be properly evaluated and applied where they will do the most good.

An impediment to past progress in control has been inadequate definition of the problem. In most countries, the role of the various respiratory pathogenic agents and the factors which influence their transmission and effects, are incompletely understood. Effective control measures will require coordinated efforts by epidemiologists, clinicians, microbiologists, immunologists, nutritionists, social scientists, and patients to define national problems and to help formulate the most suitable approaches to their solution.

A regional network of surveillance units has been proposed as an approach to this ubiquitous problem, and it is suggested that units modelled along the lines described in this paper should be established by those Member States according high priority to solving the problem of respiratory infections. The organizational and administrative relationship between a surveillance unit and the host country's existing health structure will vary. It is intended that the activities of the units should be blended into the existing health care system, and that they direct their efforts to a strengthening and streamlining of clinical management and preventive activities. The adoption of standard WHO methodology within the units will permit international epidemiological analyses of the problem and will enhance international cooperation, with a rapid transfer of successful strategies in prevention and control from one country to another.
7. REFERENCES


Table 1. Age specific mortality rates (per 100,000 population) from all causes and from pneumonia and influenza (ICD-8 Codes A90-92) for seven countries or areas in the Western Pacific Region 1974/1975.

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All causes</td>
<td>Pneumonia and influenza</td>
<td>All causes</td>
<td>Pneumonia and influenza</td>
<td>All causes</td>
<td>Pneumonia and influenza</td>
<td>All causes</td>
</tr>
<tr>
<td>1</td>
<td>1615.5</td>
<td>66.5</td>
<td>4259.2</td>
<td>466.9</td>
<td>1500.0</td>
<td>200.8</td>
<td>1004.7</td>
</tr>
<tr>
<td>1-4</td>
<td>83.8</td>
<td>4.1</td>
<td>314.8</td>
<td>49.4</td>
<td>77.6</td>
<td>15.6</td>
<td>84.7</td>
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<td>5-14</td>
<td>36.2</td>
<td>.7</td>
<td>112.9</td>
<td>9.6</td>
<td>33.5</td>
<td>2.9</td>
<td>30.7</td>
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<tr>
<td>15-24</td>
<td>111.7</td>
<td>1.6</td>
<td>205.7</td>
<td>7.3</td>
<td>57.1</td>
<td>3.8</td>
<td>71.6</td>
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<tr>
<td>25-34</td>
<td>107.0</td>
<td>2.6</td>
<td>277.1</td>
<td>3.4</td>
<td>104.2</td>
<td>1.7</td>
<td>93.2</td>
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<td>35-44</td>
<td>226.9</td>
<td>5.9</td>
<td>516.6</td>
<td>10.2</td>
<td>233.7</td>
<td>14.0</td>
<td>196.9</td>
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<tr>
<td>45-54</td>
<td>634.2</td>
<td>13.2</td>
<td>1233.3</td>
<td>15.6</td>
<td>552.9</td>
<td>33.9</td>
<td>422.7</td>
</tr>
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<td>28.0</td>
<td>2314.6</td>
<td>37.9</td>
<td>1394.5</td>
<td>98.8</td>
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<td>65-74</td>
<td>3771.9</td>
<td>76.9</td>
<td>4591.0</td>
<td>51.0</td>
<td>2977.7</td>
<td>279.8</td>
<td>2960.5</td>
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<tr>
<td>75 and above</td>
<td>11723.1</td>
<td>455.8</td>
<td>7890.0</td>
<td>171.4</td>
<td>7216.1</td>
<td>1260.4</td>
<td>9947.4</td>
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<tr>
<td>All ages</td>
<td>868.4</td>
<td>24.7</td>
<td>689.0</td>
<td>29.5</td>
<td>485.3</td>
<td>50.3</td>
<td>631.1</td>
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</table>

Table 2. Age specific death rates (per 100,000 population) for age groups 1-4 years and 45-54 years by cause of death.

<table>
<thead>
<tr>
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</thead>
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<tr>
<td></td>
<td></td>
<td>1-4 years</td>
<td>45-54 years</td>
<td>1-4 years</td>
<td>45-54 years</td>
<td>1-4 years</td>
<td>45-54 years</td>
</tr>
<tr>
<td>Enteritis, diarrhoeal diseases</td>
<td>A5</td>
<td>4.6</td>
<td>0.4</td>
<td>0.9</td>
<td>0</td>
<td>1.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Respiratory tuberculosis</td>
<td>A6</td>
<td>0.1</td>
<td>0.8</td>
<td>0</td>
<td>21.2</td>
<td>0</td>
<td>10.8</td>
</tr>
<tr>
<td>Tetanus</td>
<td>A20</td>
<td>0</td>
<td>0.1</td>
<td>0</td>
<td>0.6</td>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>Measles</td>
<td>A25</td>
<td>0.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Infectious hepatitis</td>
<td>A28</td>
<td>0</td>
<td>0.1</td>
<td>0.6</td>
<td>2.4</td>
<td>0.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Neoplasms</td>
<td>A61</td>
<td>8.4</td>
<td>163.9</td>
<td>7.2</td>
<td>227.3</td>
<td>8.7</td>
<td>140.8</td>
</tr>
<tr>
<td>Diseases of circulatory system</td>
<td>A80-A88</td>
<td>0.7</td>
<td>270.4</td>
<td>2.5</td>
<td>118.8</td>
<td>2.1</td>
<td>125.6</td>
</tr>
<tr>
<td>Complications of pregnancy, childbirth</td>
<td>A112-A118</td>
<td>1.5</td>
<td>0</td>
<td>3.4</td>
<td>1.9</td>
<td>20.9</td>
<td>4.2</td>
</tr>
<tr>
<td>Congenital anomalies</td>
<td>A126-A130</td>
<td>11.2</td>
<td>2.5</td>
<td>10.9</td>
<td>0.2</td>
<td>10.9</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Note: The table provides age-specific death rates for various causes of death in different countries for the years 1974 and 1975.
<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1-4 years</td>
<td>45-54 years</td>
<td>1-4 years</td>
<td>45-54 years</td>
<td>1-4 years</td>
<td>45-54 years</td>
</tr>
<tr>
<td>Accidents</td>
<td>AE138-AE150</td>
<td>36.0</td>
<td>72.3</td>
<td>22.5</td>
<td>41.3</td>
<td>37.5</td>
<td>53.7</td>
</tr>
<tr>
<td>Poisonings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>A90-A92</td>
<td>4.1</td>
<td>13.2</td>
<td>15.6</td>
<td>33.9</td>
<td>7.1</td>
<td>8.0</td>
</tr>
<tr>
<td>influenza</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All causes</td>
<td></td>
<td>83.8</td>
<td>634.2</td>
<td>77.6</td>
<td>552.9</td>
<td>84.7</td>
<td>422.7</td>
</tr>
</tbody>
</table>

Table 3. Causes of presentation to general practitioners in Australia in 1974

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage of all new disease episodes</th>
<th>Percentage of all disease contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otitis media</td>
<td>2.4</td>
<td>1.5</td>
</tr>
<tr>
<td>&quot;Colds&quot; and &quot;urti&quot;</td>
<td>9.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Tonsillitis</td>
<td>3.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Influenza</td>
<td>5.3</td>
<td>2.6</td>
</tr>
<tr>
<td>Sinusitis</td>
<td>2.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Acute bronchitis</td>
<td>6.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Pneumonia/pleurisy</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29.8</strong></td>
<td><strong>18.5</strong></td>
</tr>
</tbody>
</table>


This table serves to underline the morbidity problem in a country where, generally, mortality is extremely low. Acute infections of the upper, middle and lower respiratory tract are the cause of nearly 20% of all encounters and nearly 30% of all new disease episodes seen by the general practitioner.

Recent community studies suggest that Australians, on average, experience 2.4 episodes of acute respiratory infection annually, 27% of which result in a consultation with a general practitioner.
Table 4. Micro-organisms believed to be implicated most frequently\(^1\) as causative agents in undifferentiated acute respiratory infections

<table>
<thead>
<tr>
<th>Number of known serotypes</th>
<th>Commonest Pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Viruses(^2,3)</td>
<td></td>
</tr>
<tr>
<td>Rhinoviruses</td>
<td>110</td>
</tr>
<tr>
<td>Parainfluenza viruses</td>
<td>4</td>
</tr>
<tr>
<td>Respiratory syncytial virus</td>
<td>1</td>
</tr>
<tr>
<td>Adenovirus</td>
<td>33</td>
</tr>
<tr>
<td>Influenza virus</td>
<td>3</td>
</tr>
<tr>
<td>Reoviruses</td>
<td>3</td>
</tr>
<tr>
<td>Measles virus</td>
<td>1</td>
</tr>
<tr>
<td>2. Mycoplasmas, chlamydia and rickettsiae</td>
<td></td>
</tr>
<tr>
<td>Mycoplasma pneumoniae</td>
<td>1</td>
</tr>
<tr>
<td>Chlamydia psittaci</td>
<td>1</td>
</tr>
<tr>
<td>Coxiella burnetii (Rickettsia burnetii)</td>
<td>1</td>
</tr>
</tbody>
</table>

\(^1\)This list is NOT exhaustive. A huge range of other viruses, bacteria and fungi in certain circumstances invade the respiratory tract. Plague and tuberculosis may quite commonly present with symptoms of ARD. The recently described Legionnaires bacillus is probably widespread and not infrequent.\(^2,4\)
3. **Bacteria**

<table>
<thead>
<tr>
<th>Bacterial Species</th>
<th>Number of Known Serotypes</th>
<th>Commonest Pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Streptococcus pneumoniae</em> (pneumococci)</td>
<td>83</td>
<td>Involved in otitis media, sinusitis, bronchitis and pneumonia as well as meningitis.</td>
</tr>
<tr>
<td><em>Haemophilus influenzae</em> (most untypable)</td>
<td>6</td>
<td>May act as opportunist in virus-infected respiratory tract</td>
</tr>
<tr>
<td><em>Streptococcus pyogenes</em></td>
<td>Especially Lancefield Group A</td>
<td>Tonsillitis, pharyngitis, otitis media and pneumonia</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>Many phage types</td>
<td>Pneumonia, sinusitis</td>
</tr>
<tr>
<td><em>Corynebacterium diphtheriae</em></td>
<td>3</td>
<td>Diphtheria</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>70 (Especially types 1,2)</td>
<td>Pneumonia</td>
</tr>
<tr>
<td><em>Bordetella pertussis</em></td>
<td>5</td>
<td>Whooping cough</td>
</tr>
</tbody>
</table>

4. **Parasites** - A number of parasites have a migratory or end stage in the lungs and can present with ARD
Table 5. Mortality in children with pneumonia considered by clinical signs and the availability of oxygen
Tari, Papua New Guinea

<table>
<thead>
<tr>
<th>Oxygen not indicated</th>
<th>Oxygen indicated by respiratory rate greater than 50/min and/or heart failure</th>
<th>Oxygen indicated by cyanosis and/or restlessness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not given oxygen</td>
<td>Given oxygen</td>
<td>Not given oxygen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Given oxygen</td>
</tr>
<tr>
<td>n =</td>
<td></td>
<td>Not given oxygen</td>
</tr>
<tr>
<td>Number who died</td>
<td></td>
<td>Given some oxygen but supplies ran out</td>
</tr>
<tr>
<td>Percentage mortality</td>
<td></td>
<td>Given oxygen</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Not given oxygen</th>
<th>Given oxygen</th>
<th>Not given oxygen</th>
<th>Given oxygen</th>
<th>Not given oxygen</th>
<th>Given some oxygen but supplies ran out</th>
<th>Given oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td></td>
<td></td>
<td>123</td>
<td>9</td>
<td>15</td>
<td>8</td>
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<td>2</td>
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<td></td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>1.6</td>
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<td></td>
<td></td>
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<td>40.0</td>
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</tbody>
</table>

N = 215 - Insufficient data for classification of remaining 65 cases, which included 3 deaths.

Source: Dr. D. Smith (to be published)
FIGURE 1. SIMPLIFIED CATEGORIES FOR NOTIFICATION AND MANAGEMENT OF ARD

Symptoms of respiratory infection, including various combinations of cough, runny or blocked nose, sore throat, facial pain, wheeziness, stridor, earache, fever usually less than 3 weeks duration.

(exclude aspirated foreign body)

Does the patient have difficult or rapid breathing? (excluding blocked nose)

\[ \begin{align*}
\text{No} & \quad \text{1 MILD ARD} \\
\text{Yes} & \quad \text{2 SEVERE ARD}
\end{align*} \]

Ear pain or persistent crying in infant or ear discharge or sinus tenderness or purulent nasal discharge or purulent sputum or exudate in tonsils or pharynx?

\[ \begin{align*}
\text{No} & \quad \text{Out-patient supportive care} \\
\text{Yes} & \quad \text{A supportive care plus antibiotics}
\end{align*} \]

Stridor or hoarseness?

\[ \begin{align*}
\text{Yes} & \quad \text{C In-patient moist air plus antibiotics plus fluids (Possibility of tracheostomy*)} \\
\text{No} & \quad \text{D In-patient antibiotics plus fluids plus ? antispasmodics if wheezing}
\end{align*} \]

Very rapid breathing, Rib indrawing, restlessness or cyanosis?

\[ \begin{align*}
\text{No} & \quad \text{Out-patient supportive care} \\
\text{Yes} & \quad \text{E Definite in-patient, fluids plus antibiotics plus oxygen plus digitalis* plus antispasmodics if wheezing}
\end{align*} \]

* Whenever possible when these are indicated, the patient should be referred for medical care.

PROBABLE CLINICAL CATEGORIES

- Common cold, pharyngitis, rhinitis, mild bronchitis
- Sinusitis, tonsillitis, otitis media, purulent-bronchitis
- Croup, laryngitis, epiglottitis
- Pneumonia with or without asthma