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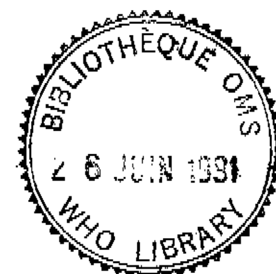
programme for control of acute respiratory infections

INTERIM PROGRAMME REPORT

1990



World Health Organization

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1. INTRODUCTION

All scientific work is incomplete - whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time.

Sir Austin Bradford Hill

Acute respiratory infections (ARI) are responsible for one quarter to one third of all deaths in infants and young children. The vast majority of these deaths occur in developing countries. In absolute figures, some 4 million young children succumb every year to pulmonary infections. In addition, ARI account for 30%-50% of visits by children to health facilities and 20%-40% of hospitalizations. They are the conditions for which antibiotics are most frequently used, often unnecessarily, in outpatient services. The annual incidence of pneumonia, the most severe manifestation of ARI, ranges from 10% to 20% among children below 5 years of age in developing countries, reaching levels as high as 80% in rural areas where relevant risk factors such as malnutrition and low birth weight are highly prevalent.

The global Programme for the Control of Acute Respiratory Infections (ARI) was officially initiated in 1984 as a distinct programme under Disease Prevention and Control in WHO's Seventh General Programme of Work covering the period 1984-1989. The World Health Assembly has approved its continuation within the Eighth General Programme of Work for the period 1990-1995.

Because of the magnitude of the problem, the ARI Programme must be seen as an important part of efforts directed towards child survival. The central objective of the Programme is to reduce the severity of and mortality from ARI, in particular pneumonia, in children. This objective is endorsed in the Declaration of the World Summit for Children, New York, 30 September 1990, which established the goal of reducing by one third the deaths due to ARI in children under 5 years during the years 1990-2000.

Other objectives of the Programme are: to reduce the severity of and prevent complications from acute upper respiratory infections (AURI) in children; to reduce the inappropriate use of antibiotics and other drugs for the treatment of ARI in children; and to reduce the incidence of acute lower respiratory infections (ALRI) in children.

To meet its objectives, the Programme has been built up on two components: (a) a **health services** (or control) component, which is concerned with the planning, implementation, and evaluation of national ARI programmes, including the transfer of available knowledge on control strategies through the dissemination of information and the training of national staff in technical and managerial skills; and (b) a **research** component, which is concerned with the promotion, support, and evaluation of research to develop new or improved control tools and approaches for application in countries. While for convenience these two components are described separately below, there is a close interrelationship between the health services and the research activities. The research focuses on priorities indicated by the needs of the services activities, and consequently the research findings can be rapidly applied in control programmes.

Immunization is a specific strategy to prevent ARI caused by measles, pertussis, and diphtheria. Other cases will be prevented by the introduction, when available, of effective, safe, and inexpensive vaccines against the organisms that are the most common causes of pneumonia in children. In the long term, morbidity will be prevented by the gradual reduction of relevant risk factors for pneumonia such as malnutrition and low birth weight.

The most immediately available measure to avert most pneumonia deaths is treatment with an appropriate antibiotic. Therefore, case management is the central WHO strategy for the control of ARI. Activities are addressed to increasing the access of the population to health workers who are able to provide correct care to children with pneumonia, and to enhancing the knowledge of parents and motivating them to seek care for their children as soon as they perceive the signs of pneumonia. Any progress that is made in implementing these activities will contribute to reducing mortality from pneumonia in children.

The achievements of the health services and research components of the Programme since 1984, and the current status of activities, are to be examined by the Executive Board and the World Health Assembly in 1991. The report submitted to these organs also outlines the action that needs to be taken by Member States, in collaboration with WHO, in order to achieve the targets set for 1995. The Programme will take note of the views of the Executive Board and the World Health Assembly on the work accomplished to date and will follow their recommendations as to future policy and directions.

In September 1990, at the 40th session of the Regional Committee for Africa in Brazzaville, the Member States of that Region collectively committed themselves to designating ARI as a major priority area for action and to applying known effective measures for control in the context of primary health care. The regional ARI programme will be discussed at the 41st Regional Committee in Bujumbura in 1991.

This report is an interim summary of the services, research, and development activities undertaken by the ARI Programme in 1990, the first year of the 1990-1991 biennium. A more detailed biennial report will continue to be issued in even-numbered years in line with the reporting and budgeting cycles of the WHO regular programme and regular budget.

2. HEALTH SERVICES

Technical policies and guidelines

The WHO protocol for the management of cases of acute respiratory infections by staff in first-level health facilities and by community-based health practitioners focuses on identifying cases of pneumonia among the many children with cough or difficult breathing in order to ensure that they receive antibiotic therapy. Recognition of pneumonia is based on two clinical signs, fast breathing and indrawing of the lower chest wall. The combination of these signs, as defined by WHO, has high sensitivity and specificity for the diagnosis of pneumonia. The presence of chest indrawing indicates severe pneumonia and, if feasible, a child with this sign should be urgently referred to a hospital where injectable antibiotics, oxygen, and more intensive medical and nursing care are available. The guidelines provide special instructions for the recognition and treatment of pneumonia in young infants (less than 2 months of age), because the etiology and clinical manifestations in these infants differ from those in older children.

At the beginning of 1990 the Programme completed the revision of its technical guidelines on case management. On the basis of recent research information and field experience changes were introduced in the recommendations relating to terminology for classifying ARI episodes, signs of pneumonia in young infants, definitions of fast breathing and chest indrawing as signs of pneumonia in older children, and the management of wheeze. The new edition of the guidelines has been printed in English under the title "Acute respiratory infections in children: Case management in small hospitals in developing countries. A manual for doctors and other senior health workers" (document WHO/ARI/90.7). French and Spanish versions are under preparation. A manual for first-level health facilities has been completed and will be published in 1991 under the title "The management of the young child with an acute respiratory infection. Practical guidelines".

A coloured ARI Case Management Chart was produced which presents the key elements of the revised clinical protocol for the management of a child with cough or difficult breathing. This is supplemented by a second chart on the management of a child with an ear or throat problem. These charts were designed for use in training courses and to serve later as job aids (as wall posters or desk displays) at first-level health facilities.

A series of technical review papers was initiated in 1990 with the aim of disseminating information on the technical bases of the WHO policies on case management. The first paper – "Antibiotics in the treatment of acute respiratory infections in young children" – was issued under the reference WHO/ARI/90.10. The subjects of other papers that are under preparation and will be available by mid-1991 are: scientific bases of the ARI case management strategy, use of bronchodilators in the treatment of wheeze in young children, cough and cold remedies, oxygen therapy in young children, technical justification for age-specific definitions of fast breathing, a review of the technical options for ARI control programmes, and an annotated bibliography on the case management of pneumonia in children.

Until now the Programme has not made any specific recommendations on measures to reduce the risk of pneumonia. Although there is some information on a number of risk factors, their relative importance and the extent to which they can be prevented through feasible and cost-effective strategies have not yet been determined. The Programme has secured the collaboration of the Maternal and Child Epidemiology Unit, London School of Hygiene and Tropical Medicine, in undertaking an analysis of available information on the effectiveness, feasibility, and cost of interventions that seek to prevent risk factors for pneumonia (and also bronchiolitis), with the ultimate goal of identifying feasible strategies for the prevention of these infections.

Development of appropriate technology

In the 1988-1989 biennium the Programme identified a number of technologies that could play an important part in the delivery of ARI case management in developing countries. It continued in 1990 to collaborate closely with UNICEF in developing several of these. *Significant progress was made in three main areas.*

Respiratory rate timers

In order to identify children with fast breathing, health workers must count chest movements over a half- or one-minute-period and therefore a reliable timing device is required. Specifications for a one-minute timer that can produce an audible alarm after 30 and 60 seconds and is robust, accurate at extreme temperatures and high levels of humidity, waterproof, and noncorrodable were distributed to interested manufacturers. Three prototype models were received

through UNICEF from companies in Denmark, Singapore, and the United Kingdom. To assess the performance of these prototypes, to identify problems related to timer design, and to study their ease of use when operated by peripheral health workers, three field-tests were carried out. These took place in the Gambia with the collaboration of The Johns Hopkins University and UNICEF; India with the collaboration of the Survival for Women and Children Foundation (SWACH), Chandigarh; and Nepal with the collaboration of John Snow International/Intercept, Boston. In addition, prototype timers were assessed by consultants in Bolivia and Egypt. In each of these studies community-based health workers were successfully trained to operate the timing devices. The audible alarm produced by these devices allows health workers to focus their visual attention on the respiratory movements of the child. Comparisons with watches showed that while health facility staff could be trained to use both timing devices and watches, community-based health workers (such as village health workers in the Gambia and village health workers and auxiliary nurse midwives in India) found it much easier to learn to use the timing devices; also, training in their use was substantially shorter and less complex than that required for the use of a watch with a digital display or a second hand. The timing devices appeared to be well accepted by mothers. In the Indian field-test, mothers called the timer the "pneumonia-recognizing instrument" in their local language. The community-based health workers at all sites unanimously preferred the timing devices to either a watch or a sandglass. The field-tests suggested a number of improvements in design features.

A laboratory-test protocol was prepared together with Ashdown Consultants in the United Kingdom to confirm the functional adequacy and satisfactory performance of these devices and to identify areas for improvement in design or construction. After a review of possible test houses the British Standards Institute in Hertfordshire, United Kingdom, was selected to conduct the laboratory testing in accordance with the WHO/ARI "Test schedule for electronic respiration timers". This schedule examines performance, reliability in adverse climatic conditions, and physical robustness. In 1991 the Programme will consider the findings from both laboratory- and field-tests and make recommendations for improvements to the manufacturers. UNICEF will take action to procure a supply of timing devices for use by ARI programmes in developing countries.

Oxygen supply equipment

Oxygen administration is a life-saving supportive measure for children with severe pneumonia or severe wheeze. In 1989, experts drew up specifications for an oxygen concentrator that would perform satisfactorily under the working and environmental conditions encountered in small hospitals in developing countries. More than 20 manufacturers from seven countries were invited to submit machines for testing at an independent laboratory in the United Kingdom selected by WHO.

In 1990 four of these manufacturers submitted oxygen concentrators for laboratory testing. After initial failures with two machines, the oxygen concentrator manufactured by Puritan Bennett, Hounslow, United Kingdom, was resubmitted with modifications and was found to meet the WHO/ARI internal standard. The testing of models from the other three manufacturers will be completed in early 1991.

In view of the need for adequate training materials to support the introduction of this technology in developing countries, the ARI Programme, in collaboration with Ashdown Consultants, undertook the preparation of a product information leaflet, a user manual, and maintenance and repair manuals. These documents will be distributed widely to developing countries. Close contact with the WHO Clinical Technology Programme and the World Federation of Societies of Anaesthesiologists has continued throughout this period in recognition of the potential applicability of oxygen concentrators in other areas of clinical medicine (e.g., anaesthetics) in developing countries. In 1991, models of oxygen concentrators that meet the WHO/ARI standard and can be made available at reasonable cost will be stocked (each with a two-year supply of spare parts and relevant training materials) by the UNICEF Package and Assembly Centre (UNIPAC). A number of developing countries have contacted UNICEF expressing interest in this technology. Recent studies have shown that, apart from its potential to increase the availability of oxygen therapy in small hospitals in developing countries, this method of delivering oxygen can produce substantial cost savings compared with delivery from conventional oxygen cylinders.

The Programme also began to investigate the possible utility of oxygen pressure failure alarms. These devices sound an alarm when the pressure in an oxygen cylinder falls below a critically low level, thus signalling to health staff that the oxygen supply is about to run out. An Australian manufacturer has been contacted and examples of this device will be assessed in hospitals in developing countries in early 1991.

Devices for nebulizing bronchodilators

The Programme recommends the use of nebulized salbutamol when a rapid-acting bronchodilator is clinically indicated (e.g., for a child with wheeze and respiratory distress). An electric air compressor is

generally used to nebulize the bronchodilators. However, since most first-level health facilities in developing countries are not equipped with this expensive instrument, or cannot always use it because of electricity failures, alternative methods of nebulization have been explored.

A study conducted jointly by the University of Colorado and the National Jewish Center for Immunology and Respiratory Medicine in Denver, USA, showed that, despite the pulsatile flows generated by foot- and hand-pumps, they could successfully drive jet nebulizers and were not inferior to continuous flow devices such as an air compressor. Care must be taken to select the most efficient combination of pump and nebulizer so as to minimize the considerable physical effort required to deliver a clinically effective dose of bronchodilator. This study examined the ability of different combinations of four pumps and three nebulizers to generate a given volume of appropriately-sized particles (less than 5 micrometers in diameter) that will reach the peripheral airways and thus be clinically effective.

Since this study showed that the performance of the jet nebulizer unit was very important in determining overall performance, the Programme undertook an extensive review of the literature on 20 currently available jet nebulizer units in order to identify the most appropriate one for use with hand- or foot-pumps. The results of this investigation were communicated to UNICEF so that it could reassess the nebulizer unit stocked by UNIPAC.

In parallel with this activity, the Programme collaborated with Ashdown Consultants in drawing up a laboratory-test procedure for hand- or foot-pumps. The test schedule includes examination of the following parameters: physical robustness, reliability in adverse climatic conditions, pressure/flow performance characteristics, and energy required to operate the pump for 10 minutes.

In 1991, the Programme should be in a position to recommend an efficient and effective foot-pump and nebulizer combination, and will make available supporting technical data.

Planning and implementation of national control programmes

During 1990 emphasis was placed on: (i) the preparation or revision of national technical guidelines for case management, consistent with recent advances in scientific knowledge and WHO recommendations; (ii) the preparation of national plans of operation leading to a phased implementation of the case management strategy, initially through the network of first-level health facilities and first-referral hospitals, then through community-based health practitioners, and finally through increased involvement of the community; and (iii) the elaboration of annual workplans focused on feasible subtargets for activities addressed in the initial stages of the programme to increasing the access of the population to correct case management. The priority activities at these stages include the training and supervision of health staff, and the provision of drugs and equipment to health facilities.

The criteria for determining that a national programme is operational have been defined (see Table 7 on page16)[1]. One of the major targets of the Programme is for operational control programmes to be established by 1995 in all countries with an infant mortality rate (IMR) greater than 40 per 1000 live births per year. In these countries most community-acquired pneumonias in children are the bacterial infections targeted by the Programme's case management strategy in order to reduce mortality. The United Nations World Population Division in 1988 listed 88 countries with an IMR that exceeded this level (Figure 1).

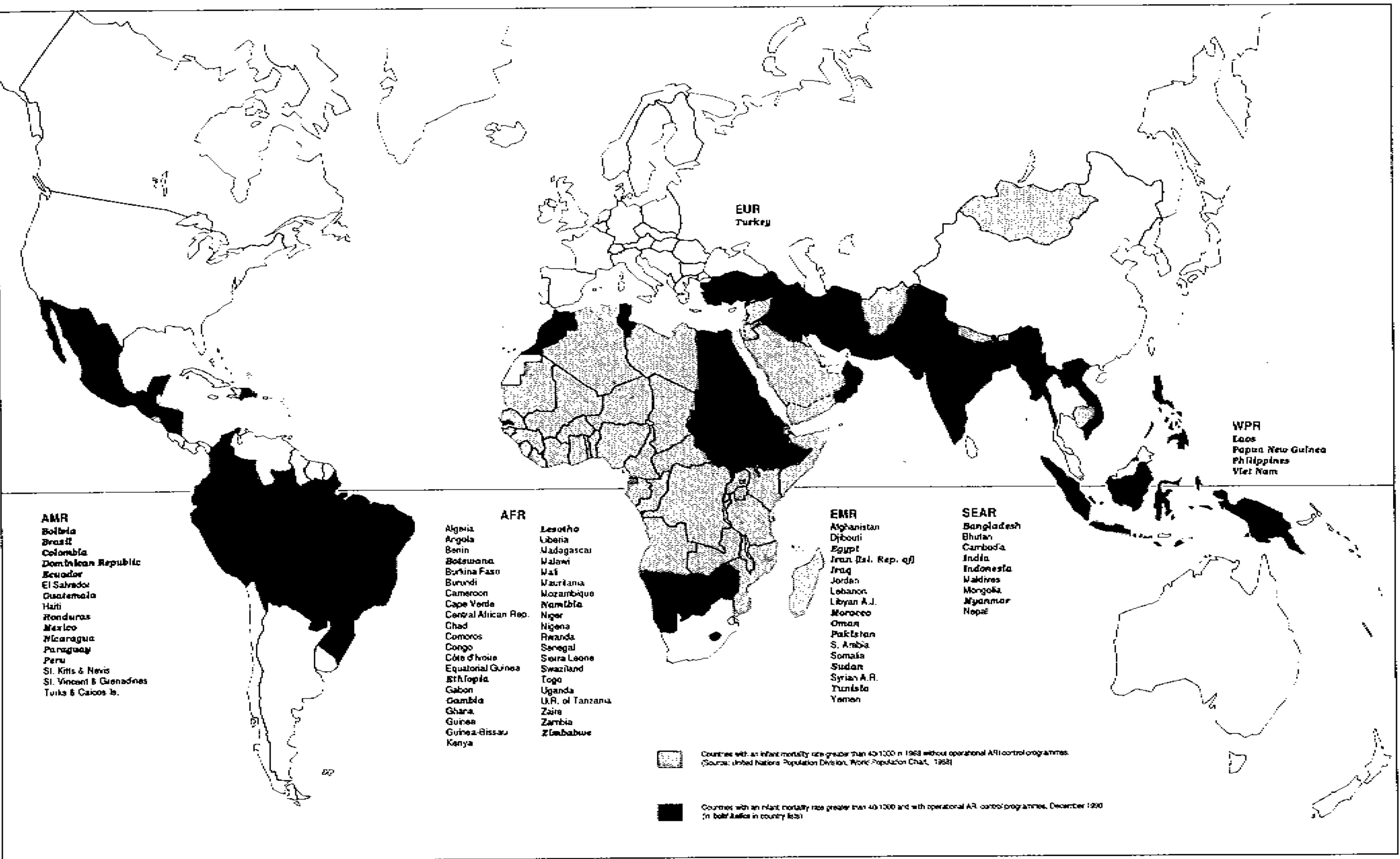
By the end of 1990, plans of operation for ARI control programmes had been prepared in 39 such countries in the six regions (Table 1, Annex 1). In 34 of these, stage I activities have been implemented at least in one province or region in such a way that they meet the criteria for operational programmes (Figure 1). Thus, 39% of the Programme's main target countries had operational programmes by the end of 1990. Twelve started operations during 1990 (a 50% increase over the 1989 figure) and six have reported national coverage with stage I activities (training, supervision, and supplies in first-level health facilities and first-referral hospitals): Oman, Zimbabwe, and four countries in the Americas: Colombia, Guatemala, Honduras, and Paraguay.

Table 1 and Annex 1 show that *operational programmes have also been established in 13 non-target countries,* including China and Thailand where an IMR greater than 40 per 1000 can be found in large sections of the population.

In total, by the end of 1990, 59 countries had designated a national programme manager and issued technical guidelines on case management, 54 had prepared plans of operation, and 47 had operational programmes.

[1] Programme for the Control of Acute Respiratory Infections. Fourth Programme report, 1988-89. Document WHO/ARI/90.7 (1990).

Figure 1
Countries with an infant mortality rate greater than 40/1000 with and without operational ARI control programmes, 1990



"The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries."

Table 1: Number of countries and territories with technical guidelines, plans of operation, and operational programmes, December 1990

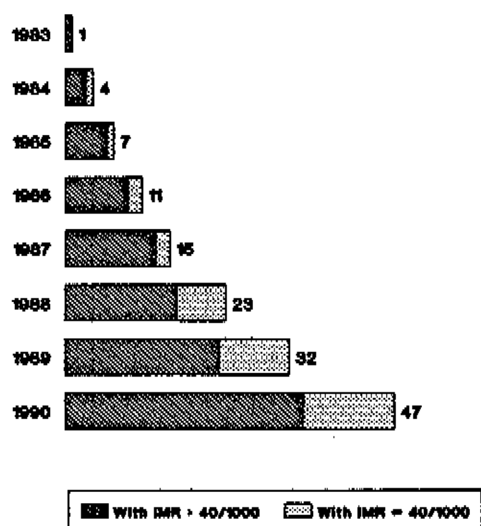
Region	Technical guidelines	Plan of operation	Operational programmes
Main target countries*			
African Region (AFR)	10	9	6
Region of the Americas (AMR)	12	11	11
South-East Asia Region (SEAR)	5	5	4
European Region (EUR)	1	1	1
Eastern Mediterranean Region (EMR)	9	9	8
Western Pacific Region (WPR)	4	4	4
Sub-Total	41	39	34
Other countries and territories			
Region of the Americas (AMR)	7	5	4
South-East Asia Region (SEAR)	2	2	2
Western Pacific Region (WPR)	9	8	7
Sub-Total	18	15	13
Total	59	54	47

* Countries with an infant mortality rate greater than 40/1000 in 1988. Source: United Nations Population Division, World Population Chart, 1988, United Nations, New York.

Figure 2 shows the increase in the number of operational programmes each year from 1983 (when the first programme started in Pará state, Brazil) to 1990.

Figure 2
Operational ARI programmes
1983-1990

Number of countries



During 1990, 10 WHO staff members and eight consultants visited 39 countries and territories to collaborate in formulating ARI programme policies, revising technical guidelines, and preparing plans of operation. The countries and territories visited are as follows:

Africa:	Ethiopia, Namibia, and Zimbabwe
Americas:	Argentina, Belize, Bolivia, Brazil, Dominican Republic, Ecuador, Guatemala, Mexico, Nicaragua, Paraguay, and Uruguay
South-East Asia:	Bangladesh, India, Indonesia, Myanmar, Nepal, Sri Lanka, and Thailand
Eastern Mediterranean:	Djibouti, Egypt, Iran (Islamic Republic of), Iraq, Morocco, and Pakistan
Western Pacific:	China, Cook Islands, Fiji, Laos, Malaysia, Northern Mariana Islands, Papua New Guinea, Palau, Philippines, Samoa, Vanuatu, and Viet Nam.

Efforts to plan and implement control programmes need to be accelerated in the next three years. The Programme will assist countries that have already initiated activities in taking stock of their initial achievements and failures, and in making adjustments in their guidelines and operational procedures that will guarantee a sustainable expansion of the programme in order to increase the access of the population to correct case management. Target countries that have not yet started activities, especially those with a high IMR, will be encouraged to begin the planning process and receive all necessary assistance.

Training

Managerial and supervisory materials

The development of managerial and supervisory training materials has been a priority area of activity at the global level. A course designed for managers of national ARI programmes was developed with the collaboration of ACT International, Atlanta, USA, and printed in English and Spanish at the beginning of 1990. The French and Portuguese versions have been completed, and will be tested in 1991. The course includes five modules covering the knowledge and skills needed by programme managers to formulate national policies, set programme targets and subtargets, plan and monitor activities, estimate the cost of drugs, and evaluate progress in the achievement of targets.

A module for supervisory skills courses named "Management of the young child with an acute respiratory infection" was produced with the collaboration of ACT International, and printed in English, Portuguese, and Spanish. The French version has been completed and will be printed in 1991. The module provides the knowledge and skills needed to assess, classify, and treat children with ARI, focusing on the identification and treatment of pneumonia. It places emphasis on practical exercises, in particular counting the respiratory rate and identifying lower chest indrawing. It includes the viewing of a video showing children with and without a variety of signs of ARI. The participants are expected then to practise the skills they have learnt by examining healthy and sick children in an out-patient clinic and a hospital ward. The module is used not only for the training of mid-level supervisors but also in clinical training programmes for doctors and paramedical staff working at first-level health facilities, and it is included in the programme managers' course.

To assist countries in organizing the clinical practice recommended in the module, a guide for clinical instructors has been prepared and tested in a course in Addis Ababa, Ethiopia. The clinical instructor has to prepare for the health facility visit by identifying children with the signs of illness described in the module, demonstrate how to assess and classify the illness of children with ARI, and monitor participants as they practise case management. Guidance is given on how to perform these tasks.

A new videotape entitled "Assessment of the child with cough or difficult breathing" was filmed with the collaboration of government hospitals in India, Papua New Guinea, Thailand, and Zimbabwe; the technical production was assured by Chris Dent Publicity, Sheffield, United Kingdom. The videotape shows a wide range of examples of respiratory signs in children (normal and fast breathing, false and true chest indrawing, wheeze and stridor). It will be made available in 1991 for use in conjunction with the supervisory skills module on case management, and in clinical training courses.

Clinical materials

A national programme will be able to achieve the reduction of ARI mortality and its other goals only if doctors and other hospital staff, staff in health facilities, and community-based health practitioners all practise appropriate standard ARI case management. Therefore, a national ARI programme needs to train large numbers of health staff in standard ARI case management according to its own guidelines. An important step is the establishment of one or more ARI training units.

An ARI training unit (ATU) is a unit in a large hospital (such as at the national, provincial, or state level) that treats outpatients and inpatients with ARI and conducts training in standard ARI case management.

Each ATU will train doctors from large and small hospitals to manage paediatric outpatients and inpatients with ARI. These doctors will then implement standard case management in their own hospitals, by introducing appropriate policies, obtaining the necessary equipment and supplies, training staff, and monitoring standard case management procedures. Selected district-level hospitals, or large health facilities, will train health staff from first-level health facilities to manage children with ARI who can be treated at home and to refer children with ARI who need hospital care.

The Programme has worked in collaboration with ACT International in preparing packages of materials to support clinical training in ATUs and at district-level hospitals or large health facilities. Preliminary discussions defined the purposes, target audience, requirements, and training objectives. Consideration of the priority ARI skills and knowledge to be taught, and of the most appropriate teaching methods to be employed, led to a selection of methods to be developed. These two packages will consist of

lectures with accompanying slides, training modules with a guide for facilitators, guidelines to assist clinical instructors in organizing clinical practice sessions, video presentations, drills, case studies, and guidelines for the course director. Further development of these materials, including field-testing, will continue in 1991.

Materials for community-based health workers

The initial thrust of national ARI programmes has been to ensure that standard ARI case management is implemented in health facilities. However, since many children with pneumonia may never attend a health facility, some national ARI programmes may, at an appropriate time, expand their activities to include ARI case management in the community using the services of various types of health workers who spend all or a substantial proportion of their time in the community rather than at a health facility. The Programme has contracted Health Manpower Systems of the United Kingdom to begin the development of materials to support the training in ARI of such health workers. The training materials to be developed will be modular in design so that an appropriate training programme for a variety of situations and categories of health worker can be assembled. They will consist of visual materials (e.g., flipchart and pamphlet) for use by health workers in the community to support their health education and case management activities, materials for use by health workers during their training, a teacher's guide to training, and a guide to assist in the adaptation of materials to the local cultural context.

In order to gather information for the development of this project the Programme contacted the principal investigators of community-based ARI intervention studies in Bangladesh, India, Indonesia, Nepal, Pakistan, Philippines, and the United Republic of Tanzania, and national ARI programme managers in Colombia, Lesotho, Viet Nam, and Zimbabwe, to obtain details of their experiences in training community-based health workers and to collect samples of training materials used.

Programme managers' courses and workshops

Since the ARI Programme Managers' Course was first made available at the beginning of 1990, considerable interest has been shown by the regions and countries in organizing training courses using the WHO materials. Table 2 summarizes the courses conducted during the year; the details can be seen in Annex 2. There were seven intercountry courses attended by 199 participants from 62 countries, and 19 national courses in 15 countries for 697 participants. The national courses were mainly attended by intermediate-level managers. In several countries (Iran (Islamic Republic of), Pakistan, Philippines, Viet Nam) the courses combined the study of the WHO modules with examination of the national plan of operation. In this way the participants became acquainted with the principles and process of planning ARI activities as presented in the WHO Programme Managers' Course, studied thoroughly the national plan of operation and elaborated their own provincial or state plans for 1991. This experience indicated that the availability of a national plan of operation should be a pre-condition for organizing national courses for provincial or state programme managers: there are substantial benefits to be gained from learning the planning process by working with one's own provincial or state data, guided by the policies, objectives, and targets defined by the national plan.

The South-East Asia Region organized an intercountry workshop on the prevention and control of ARI in Jakarta, Indonesia, from 23 to 26 October; it was attended by 14 programme managers from eight countries. The meeting reviewed the status of the national control programmes and discussed in detail the training plans, the establishment of ATUs, the

Table 2: Programme Managers' courses held in 1990

Region	Inter-country courses			National courses	
	Number of courses	Number of countries	Number of participants	Number of courses	Number of participants
AFR	1	17	30	-	-
AMR	4	30	128	5	195
SEAR	1	2	14	4	67
EMR	-	-	-	3	99
WPR	1	13	27	7	336
TOTAL	7	62[a]	199	19	697

[a] Some countries were represented in two or even three courses. This figure represents the total number of different countries represented.

development of materials for face-to-face communication activities, and methods of supervision and monitoring. Problems and constraints in these areas were identified and possible solutions recommended.

In collaboration with the School of Public Health, University of Zagreb, Yugoslavia, the WHO Regional Office for Europe held an intercountry workshop on 26-28 September. The purposes were to review the situation of pneumonia in children and discuss the feasibility of organizing control programmes in areas of Europe with high infant mortality rates. There were nine participants from five countries (Albania, Romania, Turkey, USSR, and Yugoslavia). Currently at least 50% of births in the European Region occur in countries where the IMR is above 20 per 1000 live births. ARI, mainly pneumonia, is the first or second cause of death in young children. These countries include areas with a total population of approximately 113 million where the IMR is higher than 40 per 1000. The workshop concluded that an intensive effort should be made to accelerate the reduction of mortality from pneumonia in these areas, and recognized that the WHO policies and strategies for the control of ARI were perfectly suited to the prevailing conditions.

National seminars and workshops

National seminars and workshops were held, with collaboration from WHO, in 18 countries. Annex 3 presents a detailed list of 76 such meetings; these are summarized in Table 3. Most meetings were organized to review the ARI situation and present the new or revised guidelines on case management to health services staff. Some of the meetings that were attended by a large number of participants were organized as awareness-raising conferences to promote the objectives and strategies of the national ARI programme and enlist the support of specialists in public health, paediatricians, and the medical profession in general; such meetings were held in Cuba, Egypt, India, Iran (Islamic Republic of), Myanmar, Pakistan, and Sudan. The meetings in Indonesia, Oman, and Zimbabwe reviewed the progress made in the implementation of the programme and planned its future development and activities.

Training of first-level supervisors

The Programme provided support to 117 courses on case management which were held in 20 countries for a total of 3222 participants with responsibility for training and supervising health staff at first-level health facilities (Table 4). In most of these courses the revised WHO supervisory skills module on case management of ARI (in English or Spanish) was used; in some, the two earlier modules were used. A field-test version of the French translation was used in Morocco, and a translation into the national language (with local adaptation) was used in Papua New Guinea and Viet Nam. The module has been translated into the national languages (and in most cases adapted according to national guidelines and local conditions) for use in training activities in 1991 in Bangladesh, China, India (Hindi and Tamil), Laos, Myanmar, Nepal, Sri Lanka, Sudan, and Vanuatu.

Training in case management

Complete data on the numbers of workers at first-level health facilities who have received clinical training is not available to the Programme. In 1991 a data reporting system ("country programme profiles") will be established that will include this information. The Programme continued to promote the establishment of ATUs with responsibility for clinical training on a permanent basis. By December 1990, 36 units had been established in 10 countries (Table 5). The staff of the ATUs established in three provinces in the Islamic Republic of Iran were trained by a WHO consultant at a workshop at Pakdasht, near Teheran, on 5-8 March. The ATUs in Latin America organized 33 courses for 393 participants, and those in the Western Pacific organized 12 courses for 180 participants.

A Regional Training Course on Clinical Management of ARI was organized by the ATU at San Lazaro Hospital, Manila, Philippines, from 18 to 22 June. The course was attended by 11 participants from nine countries. The objectives were to train participants to give standard case management to children with ARI, and to prepare them to establish ATUs and

Table 3: National seminars and workshops held in 1990

Region	Number of countries	Number of meetings	Number of participants
AFR	2	9	129
AMR	6	6	348
SEAR	5	49	1886
EMR	4	11	448
WPR	1	1	25
TOTAL	18	76	2836

conduct training courses. The course included a few lectures; however, most of the time was devoted to a self-learning module on case management, a clinical exercise using a video film, technical demonstrations (oxygen therapy, administration of bronchodilators, use of the otoscope), and clinical practice in an outpatient department, an emergency ward, an inpatient ward, and a neonatal unit. The course provided useful experience to guide the further development of the materials for ATUs described on page 8.

Communication

Modification of the behaviour of families is necessary to reduce mortality from pneumonia in developing countries. Pneumonia can kill young children in a few days, and delays in providing care can result in the infection becoming so severe that the child cannot be saved. The effectiveness of the case management strategy depends on the recognition of signs by the mother and prompt care-seeking from a trained health care provider. In some countries, a significant proportion of pneumonia deaths may be attributable to inappropriate or poor household responses to a child with signs of pneumonia. These may include inability to recognize the early signs of pneumonia, treatment with home remedies, other causes of delay in seeking care, having recourse to inappropriate health care providers, or poor compliance with therapeutic recommendations.

Table 4: National supervisory skills courses held in 1990

Region	Number of countries[a] and territories	Number of courses	Number of participants
AFR	2	10	300
AMR	7	18	636
SEAR	1	1	40
EMR	3	8	158
WPR	7	80	2088
TOTAL	20	117	3222

[a] AFR Ethiopia, Namibia
AMR Argentina, Brazil, Colombia, Dominican Republic, Mexico, Paraguay, Uruguay
SEAR India
EMR Egypt, Morocco, Sudan
WPR Cook Islands, Northern Mariana Islands, Fiji, Palau, Papua New Guinea, Philippines, Viet Nam

Table 5: ARI training units established by December 1990

Region	Country	Number of units	City
AFR	Zimbabwe	2	Harare, Bulawayo
AMR	Argentina	1	Sante Fe
	Brazil	2	Belem, Porto Alegre
	Colombia	7	Armenia, Bogota (2) Bucaramanga, Cartagena, Manizales, Medellin
	Mexico	5	Guanajuato, Jalisco, Mexico, Nuevo Leon, Zacatelas
EMR	Egypt[a]	12	Assiut, Alexandria, Cairo, Ismailia, Menoufia, Sohag
	Iran (Islamic Rep. of)	3	Mashad, Shahrekord, Tabriz
	Sudan	2	Khartoum
WPR	Laos	1	Vientiane
	Philippines	1	Manila
TOTAL	10	36	-

[a] The unit at El-Chatby Hospital, Alexandria, has been designated EMR Regional Training Centre for the Clinical Management of Acute Respiratory Infections

In the initial stages of a national programme, in which emphasis is laid on increasing access to correct ARI case management through first-level health facilities and community-based health practitioners, efforts should focus on face-to-face communication between health workers and families, especially mothers. Mass media activities aimed at promoting services should be implemented at a later stage, after correct case management through trained health providers who are regularly supplied with drugs has been made available countrywide.

A key element of the ARI case management strategy is teaching health workers how to communicate effectively with mothers. The WHO technical guidelines on case management, and the training modules for programme managers and first-level supervisors contain home care instructions to be communicated to mothers. These will also be included in the materials for ARI training units and community-based health practitioners.

The most important part of the home care instructions is advice on the signs that indicate when the mother needs to seek care from a trained health care provider for a child with an acute respiratory infection. In the WHO materials the general instruction is that mothers should be advised to bring a child for care if s/he has fast or difficult breathing, or is not able to drink, or becomes sicker. However, these instructions are not appropriate for all mothers. Since some understanding of the household management of ARI is necessary for all national ARI programmes and involves collecting country-specific information, the Programme has given priority to the development of a protocol for focused ethnographic studies (see page 20). The data collected can be used by national ARI programmes to identify the communication approaches that are most likely to change community and family behaviour and lead to an increase in the use of correct case management.

The Programme revised the prototype visual materials prepared in earlier years (flipcharts, set of slides, poster) to make them consistent with the revised technical guidelines on case management. The new versions will be printed in 1991.

With support from WHO and other agencies, particularly UNICEF, many countries have developed health education materials for face-to-face communication based on the WHO flipchart "Children with coughs". National flipcharts were produced in Fiji, Laos, Sudan, Vanuatu, and Viet Nam. Leaflets and posters depicting the signs of pneumonia for mothers and other caretakers were produced in Bolivia, China, Colombia, Laos, Mexico, Myanmar, and Thailand.

Together with UNICEF, the Programme co-sponsored a meeting on Household Management of Diarrhoea and Acute Respiratory Infections, organized by The Johns Hopkins University School of Hygiene and Public Health, Baltimore, USA, on 4-6 April 1990, and presented a background paper on the household management of ARI in children. The report of the meeting[2] provides an overview of the guidelines for the household management of ARI, including recognition of the signs that suggest pneumonia, care-seeking, compliance with case management recommendations, supportive home care, communication activities, and strategies for changing behaviour.

Monitoring and evaluation

In the Programme Managers' Course, the Programme proposes 14 priority indicators from a list of 38 possible ones to assess the achievement of operational targets: seven to determine the rate of access to correct case management and seven to measure the rate of use of correct case management. One module of the course is devoted to evaluation; it describes the indicators, identifies the data needed to measure them, suggests possible sources from which the data can be obtained, and provides guidelines for the analysis and interpretation of the results.

Routine reporting systems

Most countries that have initiated control activities have established a simple system for collecting data to monitor operations based on a regular review of registry records. In practice, the records are rarely accurate and complete. Nevertheless, countries are being advised to establish or improve the routine recording of essential information and periodic reporting since an analysis of the data may be useful for broadly characterizing the quality of case management in health facilities, and estimating the access indicator.

From an analysis of such data reported recently by national programmes and consultants' reports some positive changes in clinical practices as a result of training undertaken by the Programme were identified. A few examples are as follows:

- In Papua New Guinea, a comparison was made of children with ARI referred for hospitalization at two health centres before and after training of the health staff (Table 6). In the period January-September 1987, 2929 children with signs of ARI were reported and 406 of them – 13.9% – were referred for hospitalization. After the staff of the health centres had been trained to use the new

[2] *Household Management of Diarrhoea and Acute Respiratory Infections.* Occasional paper No. 12. The Johns Hopkins University School of Hygiene and Public Health, Institute for International Programs, Baltimore (1990).

Table 6: ARI cases treated and referred to hospital before and after programme implementation in Kerowagi and Kup Health Centres, Papua New Guinea

Period[a]	Total ARI cases in children	Cases referred to hospital	
		Number	Percentage
Before programme implementation January-September 1987	2929	406	13.9
After introduction of the programme January-September 1988	5765	311	5.4
October 1988-June 1989	5869	125	2.1

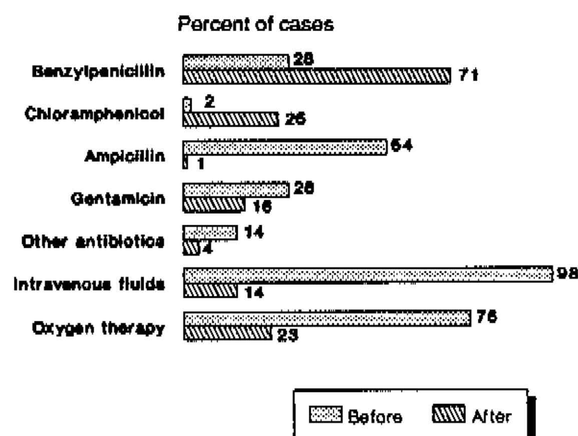
[a] Standard ARI case management was introduced in the period October-December 1987, during which the staff was trained.

guidelines for case management, in which precise indications for referral to hospital are defined, a marked reduction in the number of children with signs of ARI hospitalized was observed: among 5765 cases treated in the period January-September 1988, 311 children – 5.4% – were hospitalized; this percentage was further reduced to 2.1% in the subsequent period, from October 1988 to June 1989. No modifications had been introduced in the reporting of cases and referrals that could have biased the comparability of these data. It was noted that although the total number of children with signs of ARI attending the health centres increased after the personnel had been trained, the implementation of the guidelines resulted in a significant reduction in both the percentage and the absolute number of hospitalized cases.

- Introduction of the technical guidelines for the treatment of pneumonia in Tacloban City Medical Centre, a referral hospital of the Philippines, produced significant changes in clinical practices. Figure 3 shows the use of several therapies in hospitalized children with pneumonia during a 3-month period immediately before the introduction of the programme in 1989, in comparison with a similar period one year later. In accordance with the national guidelines, ampicillin was replaced by benzylpenicillin for the treatment of severe pneumonia, and gentamicin-containing combinations were replaced by chloramphenicol for the treatment of very severe pneumonia, i.e., there was a shift from expensive to less expensive, but equally or more effective, injectable antibiotics. For instance, the daily cost of a course of benzylpenicillin is two to three times less than that of injectable ampicillin. The use of intravenous fluids, which may be harmful in a child with pneumonia, decreased from 98.0% to 14.3%. The use of oxygen therapy, which is expensive and unnecessary in children who are not very severely ill, was reduced from 76.0% to 23.4%. The changes in therapeutic measures should not be seen as an effort designed primarily to reduce hospitalization costs; they also resulted in a significant improvement in the quality of clinical management of severe cases of pneumonia admitted into the hospital.

These two documented examples illustrate the potential benefits that can be derived from ARI programmes: a reduction in hospital costs through more appropriate case management. Although they refer to only a few health units, the same results have been observed in other health services in which ARI programme activities have been introduced, such as training and supervision of staff and adequate logistic support. Another immediate programme benefit that has been documented through the examination of records in some countries is a reduction in the use of antibiotics for mild forms of ARI (coughs and colds), as reported in the Fourth Programme Report for 1988-1989[3].

Figure 3
Treatment of pneumonia before and after initiation of the ARI Programme*



* Tacloban City Medical Centre, Philippines, 1989-1990

[3] Programme for the Control of Acute Respiratory Infections. Fourth Programme report, 1988-89. Document WHO/ARI/90.7 (1990).

The Programme has developed a questionnaire seeking information for a country programme profile to help programme managers to gather annually the information needed to measure the indicators related to the achievement of operational targets. The form contains questions on the access of the population to standard case management, which can be answered through an examination of clinical records and reports, and registers at provincial and central levels. No questions on use indicators are included since their measurement requires special surveys for which the Programme has not yet developed the appropriate instruments. The country programme profile was tested in Colombia in January 1991.

Health facility practices survey

The Programme has begun to prepare a health facility survey instrument that will enable programmes to evaluate training activities systematically by documenting the practices of health staff in the assessment and treatment of cases of ARI. The method is designed to determine the extent to which health providers conform to national case management guidelines in assessing patients with ARI, administering antibiotics and other drugs, and providing advice on the home care of children. The guide will include several questionnaires for: interviewing health personnel, interviewing mothers and other caretakers, reviewing clinical records, checking the drugs and equipment needed for case management, and directly observing health staff while they assess and treat children with ARI. Preliminary information for the preparation of the guide has been collected in India. A set of questionnaires to evaluate health workers' performance in outpatient services was prepared and will be tested in India in the first half of 1991. Experience gained in this field-test will be used to guide the further development of this survey instrument. The questionnaires and guide for in-patient services will be developed later in 1991, once the ATU materials for the teaching of hospital care have been completed.

Household morbidity and treatment survey

Since the ARI cases seen in health facilities represent only a fraction of actual cases occurring in the community, a community-based survey is necessary to assess ARI morbidity patterns and treatment practices. In the early stages of programmes it will be particularly important to assess the proportions of mothers and other caretakers who know when it is appropriate to seek care and who actually seek care when they see the relevant signs in their children.

It is not yet clear whether the incidence of pneumonia can be measured through simple, feasible and reliable cross-sectional surveys that can be used by all programmes. In January, the Programme convened a meeting of experts in ARI surveys and social scientists to discuss methodological issues relating to the measurement of episodes of pneumonia through home visits and to develop protocols for several field studies to address these issues. Preliminary studies to test the survey questionnaires and to solve certain methodological próblems were conducted in 1990 in Ghana with the collaboration of the London School of Hygiene and Tropical Medicine, United Kingdom; in Peru with the collaboration of the Institute of Nutritional Research, Lima; and in the Philippines with the collaboration of the Centers for Disease Control, Atlanta, USA, (see page 23). In view of the complex issues involved in the development of this methodology, further expert opinion and advice will be sought in 1991.

Measurement of ARI-associated mortality

The measurement of ARI mortality poses even greater challenges than the development of morbidity surveys, since problems related to maternal perception of the signs of pneumonia are augmented when mothers need to recall events that happened during the past 12 months or longer. A simple and reliable survey guide to measure overall childhood mortality has been developed and validated in the Gambia, Peru, and the Philippines in collaboration with the Centre for Population Studies, London School of Hygiene and Tropical Medicine. This guide is available for use by interested countries, though it provides only limited information on specific causes of mortality. A verbal autopsy questionnaire that seeks to achieve a more accurate estimate of ARI-associated mortality is still being tested.

Assessing the use and cost of drugs

Country programmes need certain information in order to evaluate the progress made in achieving the targeted reduction in the inappropriate use of antibiotics and other drugs (cough and cold medicines) in the treatment of ARI. With the assistance of a health economist from the United Kingdom, the Programme analysed the issues involved in measuring the use and cost of drugs. Three approaches were adopted for the preparation of the guidelines:

- Information on drugs prescribed by first-level health facilities will be gathered through surveys of practices in health facilities (see above). Experts on assessing the use of drugs will revise the pertinent questions. Although the sample used in these surveys is not representative of the

whole health infrastructure of the country, the information will provide a rough estimate of the general situation.

- Information on drugs used in the community for ARI (those that are prescribed by health workers in first-level facilities, private practitioners, and community-based health practitioners; and those that are self-prescribed) will be gathered through household treatment and morbidity surveys (see page 14).

- Information needed to estimate the cost incurred by the health authorities in providing drugs for ARI in children will be collected at different levels of the health system: procurement of drugs at the central level, distribution of drugs by the central pharmacy, reports from pharmacies at first-level health facilities, and reviews of clinical records. A guide for the collection and analysis of this information will be prepared in collaboration with the WHO Action Programme on Essential Drugs.

Evaluation of national programmes

As national programmes move towards countrywide coverage, a programme review is recommended to determine the progress made towards achieving the operational targets, establish where the activities can be improved, and make more specific plans for the continuation of the programme. As noted on page 5, six main target countries have reported achieving national coverage in implementing stage I activities in their ARI programme. A countrywide survey was conducted in one of these to assess the situation. A total of 108 health facilities were visited and 202 health workers were interviewed. The most important findings as regards ARI were as follows: (i) despite the considerable efforts invested in training since 1987, less than 50% of the health workers said they had received training in ARI; the lowest percentages were found in hospitals; (ii) most large health institutions did not keep a record of staff who had attended a training course, and were unable to ensure a correct rotation of staff for courses; (iii) trained health workers had a fairly good knowledge of how to classify and treat children with signs of ARI, but often failed to put their knowledge into practice; the training courses had been mainly theoretical, and insufficient to transfer new skills and change incorrect habits and practices; (iv) the performance of trained health workers was markedly better in areas with regular supervision than in other areas; (v) cotrimoxazole had been out of stock in 40% of the health facilities in the six months prior to the survey. This evaluation highlighted serious weaknesses in the quality of the delivery of ARI case management. The recommendations gave emphasis to "hands-on" learning in training courses, better supervision of health staff, and a regular supply of essential antibiotics to ensure proper implementation of the technical guidelines for case management.

Surveillance of antibiotic resistance

Since community-acquired bacterial pneumonia in children is mostly caused by *Streptococcus pneumoniae* and *Haemophilus influenzae*, a logical concern is that the standard antimicrobial treatment (cotrimoxazole, ampicillin, amoxycillin, or procaine penicillin) might become increasingly ineffective in places where there is a mounting prevalence of strains resistant to these antibiotics. There is therefore a clear need to establish national drug resistance surveillance systems that are able to assess the current situation and monitor future trends and changes.

With the collaboration of the Division of Bacterial Diseases, Centers for Disease Control, Atlanta, USA, the Programme has developed a manual for the surveillance of antimicrobial resistance, which describes the epidemiological and microbiological procedures that are essential for national ARI programmes.

While developing the manual a number of important gaps in knowledge were identified, the most important of which is the correlation of antibiotic resistance between nasopharyngeal and invasive isolates of *S. pneumoniae* and *H. influenzae*. Other questions that require investigation are the correlation of the results of disk diffusion tests (usually used by laboratories to determine bacterial drug resistance) with minimum inhibitory concentration (MIC) values, and the definition of criteria for interpreting the drug resistance data that can guide national programmes in deciding their policy on standard antimicrobial treatment.

Before finalizing the manual, the Programme convened a meeting of specialists in paediatric respiratory diseases and antimicrobial therapy, as well as bacteriologists and epidemiologists, to analyse and advise on these technical issues, review the epidemiological and laboratory chapters, and suggest ways of introducing the manual and starting surveillance activities in developing countries. The meeting which took place in Geneva in December 1990 took into account the research findings described on page 25. The manual has been revised in accordance with the recommendations of the meeting and will be field-tested in several countries, including Pakistan and the Philippines, in 1991.

In the Western Pacific Region a consultant visited the Solomon Islands, Tonga, and Vanuatu to review the laboratory activities and train staff in the isolation, identification, and susceptibility testing of *S. pneumoniae* and *H. influenzae*.

Current status of the Programme

The major targets of the Programme relate to countries having an infant mortality rate (IMR) greater than 40 per 1000 live births per year (see page 5). Table 7 presents targets for the years 1995 and 2000, and an estimation of their level of achievement when the Programme started in 1984 and at the end of 1990.

The number of operational programmes at the end of 1990 proceeds from a known baseline and assumes gradual growth until achievement of the full target in 1995. This would mean that, by then, all the countries in the developing world that in 1988 had an IMR greater than 40 per 1000 live births will have an operational programme, at least in some regions or provinces.

An important Programme target concerns the training of facility-based case management providers; some 10 000 had been trained by December 1990. It is expected that this number will rise to 100 000 by the end of 1995 and to 300 000 by the end of 2000. Although these are large absolute figures, they would represent only a fraction of the facility-based staff who provide health care for children. Training is proving to be one of the most challenging activities of the Programme.

The rate of access of the population to a health provider (health staff or community-based practitioner) who is adequately trained in the correct case management of pneumonia and regularly supplied with free or affordable antibiotics was estimated to be 5% in 1990; this is based on the number of health workers who have received training in case management and on the assumption that the relationship between training and access in the case of ARI is similar to the relationship that existed between training and access to oral rehydration salts at a similar stage in the development of the Diarrhoeal Disease Control Programme. Access is expected to increase to 50% in 1995 and 75% in 2000 in the target countries.

The estimated rate of childhood cases of pneumonia treated with recommended antibiotics was 12% in 1990 and is expected to increase to 40% in 1995 and 60% in 2000.

The Programme is developing instruments to measure the above targets, which will be revised annually according to the progress made by country programmes.

Table 7: ARI programmes in countries with an infant mortality rate greater than 40/1000,[a] Progress and targets for 1995 and 2000

Category of target		Total	Status in		Targets for	
			1984	1990	1995	2000
General Programme Target						
Countries with operational[b] ARI control programme:	Per cent	100.0	3.0	39.0	100.0	100.0
Training Target						
Facility-based staff trained in case management:	Number	2 000 000	1 000	10 000	100 000	300 000
	Per cent	100.0	-	0.5	5.0	15.0
Access Target						
ARI standard case management access rate:[c]	Per cent	100.0	-	5.0	50.0	75.0
Use Target						
Childhood pneumonia cases treated with recommended antibiotics:	Per cent	100.0	8.0	12.0	40.0	60.0

[a] Source: United Nations Population Division, World Population Chart 1988, United Nations, New York.
In 1988, 88 countries had an infant mortality rate greater than 40/1000 live births. Status in 1984 and 1990 is calculated using this denominator which may change in future years.

[b] Operational: Having a well-formulated plan (with targets, specified activities, a description of monitoring and evaluation methods), technical guidelines on case management, a designated programme manager, planned activities being carried out and monitored in at least one part of the country, and a funded budget.

[c] Access of the population to a health provider (health staff or community-based practitioner) who is adequately trained in the correct case management of pneumonia, and regularly supplied with free or affordable antibiotics for the treatment of pneumonia.

3. RESEARCH

Research policy and management

Establishing research priorities

The Programme's research priorities, funded projects, and research workplan were reviewed by the Technical Advisory Group (TAG) at its fifth meeting in March 1990 (see page 29). The TAG requested that priority continue to be given to important case management topics, to behavioural research, and to the validation of evaluation methods in view of the need for these in national programmes.

Research management

The TAG reviewed the research management plan[4] implemented in 1989, which is designed to focus research on priority topics identified by an analysis of the needs of the services component of the Programme. The TAG encouraged the Programme to maintain this close inter-relationship between services and research activities, which is consonant with the recent recommendations of the Commission on Health Research for Development.

Projects supported in 1990

In total, 17 new projects received financial support in 1990; in addition, nine projects initiated prior to 1990 were given further support (Table 8 and Annex 4). These projects are being carried out in 17 developing countries (Figure 4). In addition, three projects in Egypt (funded by the Ministry of Health/USAID Child Survival Project), and a project in Haiti (funded by USAID), which is part of the WHO multicentre study on clinical signs and etiological agents of pneumonia, sepsis, and meningitis in young infants (see page 19), were given technical support and provided with diagnostic reagents and reference laboratory services.

The research being carried out with support from the Programme is summarized in the following sections.

Table 8: New research projects supported by the ARI Programme, by research area, 1988-1990

Research area	Number of projects supported in		
	1988	1989	1990
Case management	2	7	7
Behavioural	0	4	5
Health systems	0	2	5
Prevention	1	1	0
TOTAL	3	14	17

Case management research

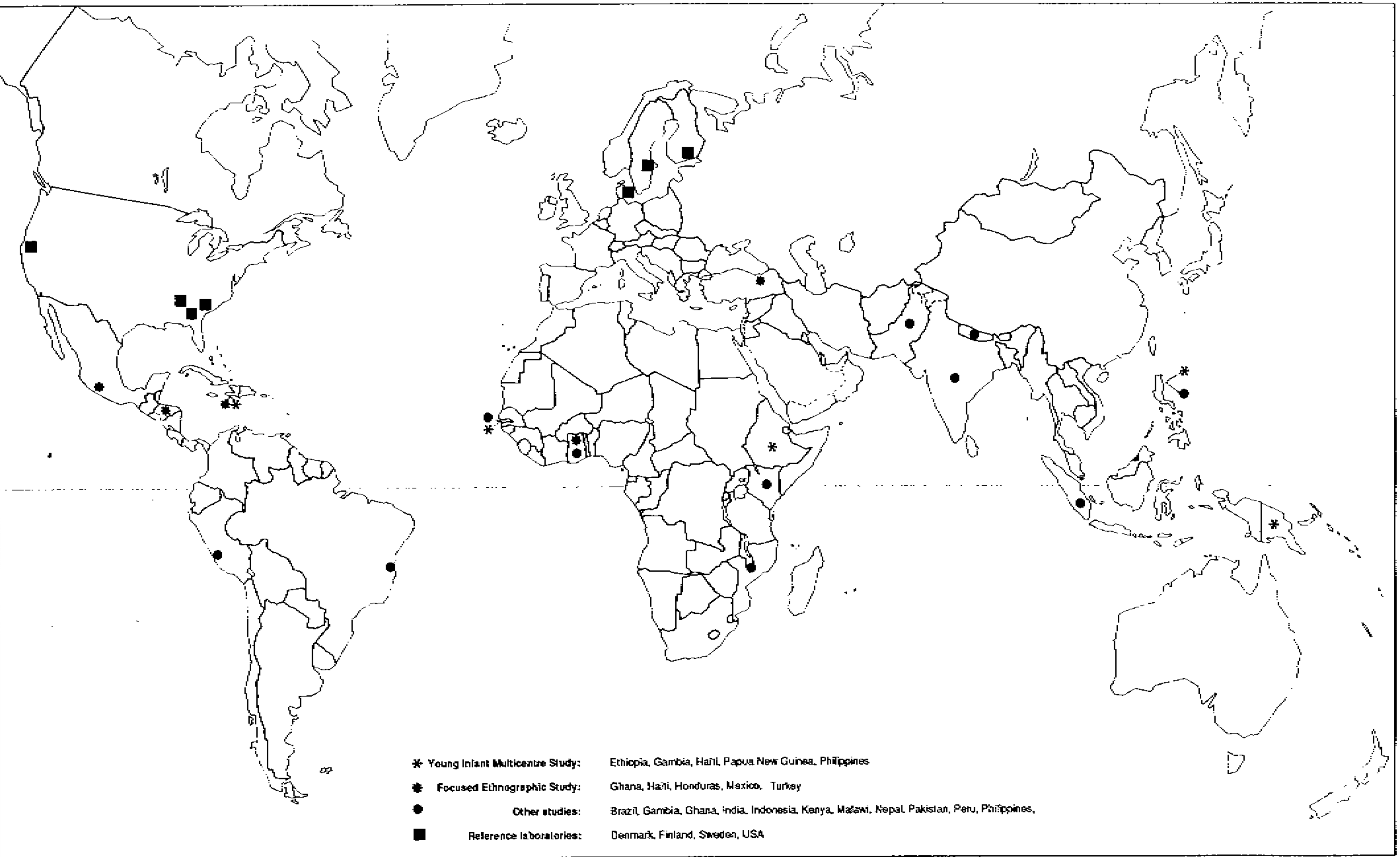
Measurement of the respiratory rate

Experience in training health workers to count the respiratory rate has been analysed in several projects and examined in several field-tests of sounding timers (see page 3). Research workers in Ghana, Peru, and the Philippines performed numerous counts in infants and young children at home. In the Philippines, the health workers' counts for 60 seconds, using a sounding timer, were within 10 breaths per minute of counts by supervisory staff on repeat examinations on the same day in 92% of children. In Ghana, workers were taught to count to the threshold of 50 breaths per minute, then look back at their watch to see how long this has taken. This method was successful, though tedious, since it took more than a minute in children without fast breathing; supervisors suggested counting to the 30-second threshold to speed up the measurement and avoid episodes where the count had to be aborted because the child became agitated.

Preliminary results from studies at several institutions indicate that both a 30- and a 60-second measurement of the respiratory rate are adequate in children 2 months of age and older. Either option can be chosen by national programmes. Sounding timers currently being field-tested have both a 30- and a 60-second alarm.

[4] Guidelines for the management of research activities. Document ARI/RES/89.1 Rev.1 (1990).

Figure 4
Location of research studies supported by the Programme (new and continuing support) in 1990



"The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries."

Pneumonia, sepsis, and meningitis in young infants

Ability of first-level health workers to assess and decide whether young infants have a serious bacterial infection

At Kenyatta Hospital and two maternal and child health clinics in Nairobi, Kenya, three high school graduates without previous medical training and three nursing students assessed and classified the illness of 201 infants 7 to 84 days old after several days' training using draft WHO materials. The same infants were also examined by a paediatrician with five years' postgraduate training, and 40 were admitted with a diagnosis of pneumonia (23), sepsis (7), meningitis (7) or possible malaria (3); six (15%) of these infants died. The minimally trained health workers would have admitted 36 of the 40 infants and 19 other infants who were considered by the paediatrician not to require admission. However, of the four infants "missed" by the health workers, three were febrile and three had chest retractions. *The health workers' ability to estimate that a sick infant "appears ill" correlated well with the paediatrician's classification of degree of illness.* A multivariate analysis is currently being performed.

Clinical signs and etiological agents of pneumonia, sepsis, and meningitis in young infants

The WHO multicentre study on clinical signs and etiological agents of pneumonia, sepsis, and meningitis in young infants started enrolling infants at two hospitals in the Gambia in September 1990 and will start enrolment in February 1991 in Ethiopia (Ethio-Swedish Children's Hospital, Addis Ababa), Haiti (Hospital Justine, Cap Haitien), Papua New Guinea (Institute of Medical Research, Goroka), and the Philippines (Philippines General Hospital and the Research Institute for Tropical Medicine, Manila). All sites (shown in Figure 4) will send isolates (or smears from nasopharyngeal aspirates or swabs) to reference laboratories.

Standardized clinical evaluations, based on detailed clinical definitions, will be performed following training and monitoring of reliability in the observation of clinical signs. Laboratory methods have been agreed upon for the bacteriological and virological studies. To optimize the bacteriological yield, bottled commercial media for blood culture are being supplied to all sites.

Pharmacokinetics of cotrimoxazole and chloramphenicol

The pharmacokinetics of intramuscular and oral chloramphenicol is being investigated in young infants at Quezon City Hospital in the Philippines. In the Gambia, the pharmacokinetics of intramuscular chloramphenicol is being studied also in severely malnourished children.

Sites in Sudan and Turkey are being explored for a study of oral cotrimoxazole in young infants. The assays for trimethoprim and sulphamethoxazole will be performed at the Children's Hospital in Helsinki, Finland.

Pneumonia and malaria

Overlap in clinical presentation of pneumonia and malaria

Both malaria and pneumonia are important contributors to childhood mortality in many communities. The ARI case management strategy and the current case management recommendations of the WHO Malaria Control Programme both rely on case detection by clinical signs and empirical treatment with an antimicrobial. Clinical overlap may result in some children being misclassified and subsequently being given the wrong treatment, or treatment that is too narrow, i.e., antimalarial therapy ony when antibacterial therapy is needed as well. The overlap in the clinical presentation of the two diseases was studied in Malawi. A total of 1 605 children were enrolled in the study based on the presence of a cough (69%), a fever within 48 hours (85%), or both cough and fever (63%). All subjects received a clinical assessment, blood smear, oxygen saturation measurement by pulse oximetry, and haemoglobin determination. Those with fast breathing or a positive malaria smear also had a chest radiograph. The results are currently being analysed. In April 1991, the Programme will convene a meeting to review the results from this investigation and another study in the Gambia; in particular, it will examine the correlation of high fever and malaria with radiographic abnormalities, fast breathing, and other clinical signs of pneumonia. The Programme's radiology working group is reading the X-rays from both studies.

Efficacy of cotrimoxazole as an antimalarial drug

In malarious areas, children presenting with signs suggesting pneumonia and with fever are often treated with both an antibiotic and an antimalarial drug. If cotrimoxazole is efficacious in the treatment of malaria in young children, then this drug could be used alone (in the absence of signs suggesting severe or cerebral malaria). To examine this question, the Programme provided support to a study in Malawi in which 46 children with a cough and fast breathing and *Plasmodium falciparum* parasitaemia (>2000 asexual parasites/mm^3) were treated with a 5-day course of cotrimoxazole. *All the children rapidly achieved a parasitiological and clinical cure, which was maintained during 14 days of follow-up. In a study supported by the Medical Research Council in the Gambia, cotrimoxazole proved to be an effective antimalarial in 65 asymptomatic children with P. falciparum parasitaemia (>2500 parasites/mm^3), three with otitis media who also had malaria, and in seven children with pneumonia.* Research proposals will be considered by the WHO Special Programme for Research and Training in Tropical Diseases on investigating the impact of the use of cotrimoxazole and on the sensitivity of *P. falciparum* to cotrimoxazole and pyrimethamine-sulfadoxine (Fansidar). The effectiveness of cotrimoxazole as an antimalarial when a full 5-day course is not completed is also a topic of interest.

Wheezing

For most children under 5 years with wheeze, no objective measure of the severity of airway obstruction is available. To manage wheezing children, health workers must be able to assess the response to bronchodilator therapy and decide which children require hospitalization. A study at El Chatby Hospital, Alexandria, Egypt, and The Johns Hopkins University, Baltimore, USA, will explore a clinical scoring system and compare the efficacy in infants of salbutamol administered by foot-pump nebulizer and oral salbutamol. The study in Alexandria will also try to evaluate the role of viral and bacterial agents in first episodes of wheezing. It is being funded by the USAID-supported Child Survival Project of the Ministry of Health, Egypt. Monoclonal antibodies for the detection of viral pathogens and reference laboratory and technical support have been provided by WHO.

Standard definitions of clinical and radiological findings

For studies on the clinical signs that predict pneumonia, reproducible detection of these signs is a necessity. To this end, standardized definitions of clinical signs were used to train clinicians who will enrol infants in the multicentre study (see page 19). Demonstration of the signs using video and audio tapes and physical assessments of hospitalized children will help to improve the reliability of clinical observations. A study is being carried out to assess the interobserver variability of the four radiologists who are reviewing all chest X-rays from studies supported by the Programme.

Alternative antibiotic treatment regimens

Less expensive antibiotic regimens consisting of two doses a day are being explored for home treatment of pneumonia. Currently cotrimoxazole is chosen by most national programmes because it is inexpensive (US$ 0.16 per 5-day course) and is given twice daily. In contrast, three doses a day are recommended for amoxycillin and the cost per 5-day course is US$ 0.47. Adding probenecid to amoxycillin would boost the peak serum level and extend the duration of action, permitting two doses a day with a reduced total daily dose. The Programme is reviewing the pharmacokinetics of probenecid in infants and young children, and plans to obtain a combined formulation for further evaluation.

As part of the study on clinical signs and etiological agents of pneumonia in severely undernourished children in the Gambia, oral cotrimoxazole and chloramphenicol are being compared.

Behavioural research

Focused ethnographic study of ARI

The Programme has given priority to the development of a focused ethnographic study protocol which details research procedures to be used to generate descriptive ethnographic data on beliefs and practices related to pneumonia and other respiratory conditions that can be used in the implementation of national programmes. Specifically, the data are intended to be used for the following purposes:

- To develop effective home care advice and other recommendations for appropriate communication with mothers of young children. Of particular importance is the documentation of signs and symptoms (and associated terms) by which mothers recognize illness and which correspond, in whole or in part, to clinically diagnosed pneumonia.
- To identify factors that facilitate or constrain prompt seeking of care from a trained provider of standard case management for pneumonia.

- To identify relevant maternal expectations concerning antibiotic and other drug therapy and to anticipate common problems affecting compliance with treatment.
- To identify other relevant cultural characteristics and conditions that are likely to have a strong influence on community responses to programme activities.
- To improve household morbidity and treatment surveys, the questions and terminology of which can be adapted to take account of community perceptions and practices.

Data collection uses ethnographic research procedures, including more formal techniques, such as: interviews with key informants and a sample of 30 mothers in the home using scenarios; sorting tasks (to correlate illness names with signs and symptoms and to sort these by severity); examining mother's preferences between pairs of health care providers; and open-ended interviews about past ARI episodes using a checklist of topics. Both key informants and mothers are shown a video presentation of children with pneumonia and other acute respiratory infections, in order to correlate terms used by mothers with the clinical signs of pneumonia. Mothers bringing children with ARI to a clinic and to a traditional healer are interviewed and their reports of signs and symptoms are correlated with the findings of a physical examination of the child. Other research procedures include presentations of scenarios to pharmacists, home inventories of medications for children, and interviews with practitioners and mothers of children who have died from pneumonia.

The study objectives demand a level of structure and focus that is unusual in the experience of medical anthropologists. To facilitate the task, the protocol provides forms for recording and tabulating the results of the research procedures and guidance for the analysis of the data. The findings of the study are presented in the form of answers to a set of questions to ensure that the ethnographic data are translated and communicated in a fashion that facilitates their application. An example of culturally modified home care advice, derived from a study in Navrongo, Ghana, is presented in Box 1.

The protocol is intended for use by researchers trained in anthropology or other social scientists with interviewing skills and experience in community based research. In preparation for the field work, the researcher learns the main features of the case management policies recommended by WHO and is trained to recognize the two key signs, fast breathing and chest indrawing, for the clinical diagnosis of pneumonia. Experience in the initial field-tests has demonstrated that, in the hands of experienced fieldworkers, the study can be completed in 5-6 weeks. Key results from studies that used the protocol in Haiti, Honduras and Turkey are summarized in Box 2.

1

Home care advice for Kassina-Nankani District, Ghana

Watch for the following signs and return quickly if they occur:

- *chaprisi bobga* or *bobe ngari* ("tight ribs" or "tight chest")
- *vose ligera* or *vose sugela* ("panting" or "shallow breathing")
- NOT ABLE TO DRINK
- *goom baala* ("weak, sleepy child")

Also, return quickly if your child shows signs of:

- *miisi, biili nyo, biili kosigo* or *miokosigo*
- Give more fluids, such as Zomko, and increase breast-feeding
- Soothe the throat and relieve the cough with herbal infusions mixed with peanut butter
- Don't give your child Rubb or Chinese Rubb mixed with water to drink.

Studies in several societies have suggested that the following generalizations may be useful, though further research is still needed:

- Pneumonia is thought to be caused by maternal negligence: either the mother's failure to avoid conditions that give rise to illness or her failure to provide proper care for a mild illness. Maternal fear of criticism or public exposure of her child's illness may delay care-seeking outside the home and increase the time spent trying home remedies.
- Pneumonia is believed to occur only as the endpoint of a progression that begins with a mild illness. In such settings, it is possible that care-seeking may be delayed if a child develops pneumonia rapidly without an antecedent upper respiratory illness.
- Signs of pneumonia and asthma overlap. Children labelled as asthmatics may be less likely to be taken for care in a timely fashion when they develop signs of fast or difficult breathing.

A group of consultants and social scientists from Bolivia, Indonesia, and Mexico were trained in the use of the focused ethnographic study protocol at a workshop held in Solis, Mexico, on 4-10 November. The study protocol is currently being field-tested, with the help of consultants and national social scientists trained in the use of the research techniques. Many of the ethnographic methods developed will be useful for subsequent "basic" behavioural research studies.

Haiti

In Jéremie, Haiti, the serious illnesses associated with the signs of ARI are *bronch*, *koklich*, and *opresion*, while *grip* is the term most widely used to refer to mild respiratory infections. Medical practitioners in the region equate *bronch* with pneumonia, *opresion* with asthma, and *koklich* with pertussis. However, the signs and symptoms mothers associate with these terms suggest that the local illness categories are not directly congruent with biomedical translations. The three illness categories share many of the same signs and symptoms, and on viewing the video tape, mothers used the terms *opresion* and *bronch* with almost equal frequency to describe children with signs of pneumonia.

A key feature of the local explanatory model of ARI is the idea of progression, in which a less serious illness is thought to "fall into" a more serious one. However, there appears to be little cultural consensus about the sequence in that some mothers believe that *koklich* leads to *opresion*, while others think that *grip* turns into *bronch*, which in turn leads to *opresion* and then to tuberculosis.

The latter is a fatal condition, whereas earlier illness in the sequence can be self-limiting. In contrast to cultures in which caretaker negligence or mismanagement is seen as the cause of progression, appropriate early treatment is not thought to prevent the development of more serious illness.

High fever and cough, rather than "fast" or "difficult" breathing, are the primary triggers for seeking care. Signs of severe pneumonia, *vante monte desan* (chest indrawing), or *kot danse* ("dancing ribs") are other triggers. Traditionally, mothers try three days of home treatment with herbs and oil massage before seeking external help. In many families fathers take an active role in the decision to seek help. Herbalists and other traditional healers are not usually consulted for children with signs of pneumonia. Most mothers expect the health care provider to conduct a physical examination and give cough syrup for a child with signs of pneumonia, while about half expect an injection and/or medication.

An urban population in Honduras

In an urban area in Honduras, the population recognizes fast breathing (*cansancio*), difficult breathing (*ahoguio*), and chest indrawing (*se ven las costillas*), but they do not necessarily consider these symptoms in the same light as do physicians. *Cansancio* is usually recognized if it is especially distinct, but is not necessarily considered a sign of severe illness. In fact, it is sometimes seen simply as a side effect of fever (*fiebre*). *Ahoguio*, on the other hand, is practically always seen as very serious, and is considered a sign of asthma.

Cough (*tos*), especially persistent cough, *ahoguio*, and high fever (*fiebre*) are the most prominent triggers for seeking health care outside the home.

Home treatment is the first reaction to ARI episodes in most cases. The most common remedies for coughs and colds are aspirin, herbal teas (eucalyptus, camomile, anise), Vick Vaporub, animal fat (*manteca*), and a wide selection of pharmaceuticals. In the small sample of households surveyed, a variety of cough medicines were encountered, including bronchodilators, antitussives, and a small number containing antibiotics.

When mothers seek health care outside the home, they have a variety of options. These include the government hospital, a health centre, various private clinics (with and without inpatient facilities), pharmacies, and a small clinic operated by a religious organization.

In general, the mothers much prefer the private clinics, because they feel that they receive better attention and better medicines there, with less time spent waiting. For most families, however, the cost of the service in the private clinics is prohibitive. The religious clinic is a good alternative for cases that are not so severe but, like the health centre, it has long waiting times.

For serious ARI, the government hospital is better than the health centre, and the waiting times are shorter. The hospital has particular advantages if there is a possibility that hospitalization will be required. On the other hand, it is clearly inferior to the private clinics, particularly those with inpatient facilities.

The pharmacies are an important source of health care, especially if the mother feels that the illness is similar to previous episodes. In such case the pharmacist may still give advice, but the main concern is to obtain adequate medication. Visiting a pharmacy requires much less time than waiting for a consultation at the health centre or the hospital.

Traditional healers are unlikely sources of health care for children with ARI in this urban population, though they are known to be utilized frequently in rural areas.

Turkey

In the city of Erzurum, Turkey, the apprently more serious illnesses associated with ARI are *zaturre, bronsit, cigerlerini usutmus*, and *astim*. Milder respiratory symptoms are often diagnosed as *grip* (signalled by coughing and fever, stuffy or runny nose, and related signs) and *usutme* (translated by medical staff as "the common cold"). Health workers equate *zaturre* with pneumonia, *bronsit* with bronchitis, and *astim* with asthma. The term *cigerlerini usutmus* apparently refers to an ALRI with fever, strong cough, fast/difficult breathing, and other symptoms indicating considerable severity.

The causes of respiratory illnesses are primarily based on catching cold, meaning that a child was not properly wrapped or clothed after bathing, or there was a too abrupt transition from warm to cold. Excessive cooling of parts of the body (especially the back or the feet) can also cause the illness.

The more serious respiratory illnesses are commonly thought to have been caused by the worsening of a cold or influenza (*usutme* and *grip*). Carelessness of mothers is frequently mentioned in the explanations of how small children catch cold as well as in explaining the transition to a more serious ALRI. Contagion is not often considered to be a factor in causing these illnesses (except with reference to tuberculosis.

Symptoms such as rapid or difficult breathing, chest indrawing, and nasal flaring are not well recognized in this population. Instead, more attention is focused on fever, coughing, loss of appetite, listlessness, and other general signs. Considerable attention is paid to unusual or strange breathing and chest noises, such as *hiritti* ("grunting/wet, rattly breathing noises"). ■

Basic behavioural research

The focused ethnographic study cannot adequately describe the distribution of perceptions, behaviours, and household management practices in a country or identify household characteristics and other risk factors that are associated with adverse practices and outcomes. Little is currently known about the determinants of household management and modifiable risk factors. The Programme is currently seeking advice from experts on the design of studies to identify:

- modifiable determinants of behaviours and household management practices that result in **failure to give children with pneumonia timely, correct case management**. These key elements of household management have multiple determinants, only some of which can be modified by ARI programme activities. It is likely that a number of factors are common to diverse cultural settings.

- modifiable behavioural risk factors for pneumonia incidence or severity, i.e., key practices (besides lack of recognition of pneumonia, delayed care-seeking, or poor compliance) that are associated with either an increased incidence of pneumonia or particularly severe or fatal episodes[5].

For example, at the present time, it is not known whether specific hygiene behaviours or other childcare practices contribute to the early nasopharyngeal carriage of respiratory bacterial pathogens (*H. influenzae* and *S. pneumoniae*) or to the incidence and severity of pneumonia and other serious bacterial infections in young infants (less than 2 months of age). The importance of hand-washing before handling a young infant or allowing only the mother to handle the neonate is not known. In many societies the mother and the neonate are kept in seclusion for the first 1-2 months. The variation in these cultural practices, their change over time, and the perceived benefit in preventing serious illness will be reviewed.

Other risk factors that may be modifiable include chilling and habits that increase exposure to indoor air pollution.

Health systems research

Measuring episodes of pneumonia

Although it is impossible to measure the incidence of pneumonia accurately on the basis of a mother's recall of her child's illness, several methodological studies are attempting to validate methods of identifying particularly serious ARI episodes for which health care should have been sought. This would allow national programmes to estimate, from household survey data, the proportion of caretakers who sought treatment for a recent episode of ARI when needed: this is referred to as an "ARI episode of concern". In the home care instructions, mothers are told to seek care for a child with an ARI who has fast or difficult breathing, who is not able to drink, or who becomes sicker, because some of these children will have pneumonia.

[5] Behavioural research priorities. Document WHO/ARI/RES/90.2 (1990).

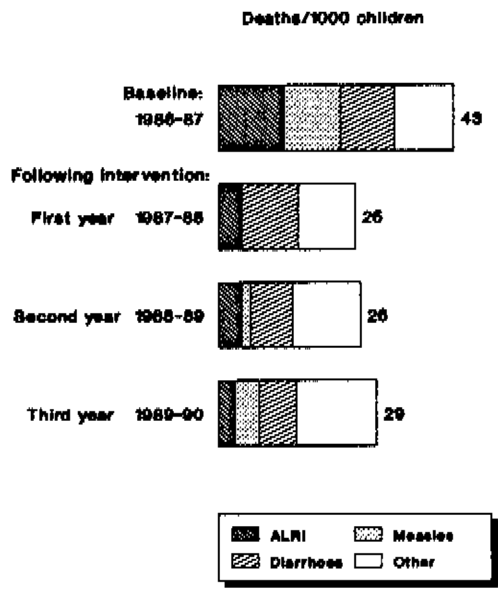
Three studies (in Ghana, Peru, and the Philippines) are comparing the frequency of ARI episodes of concern when different questioning frames are used (prompted versus unprompted questions about ARI signs and symptoms, 2- versus 4-week recall), and the effect of using cultural illness categories to describe recent ARI episodes. Validation of maternal reporting is being sought by comparing the frequency of reported episodes with incidence data from ongoing surveillance for pneumonia episodes, by comparing the mother's report of fast or difficult breathing with the child's respiratory rate and other clinical signs, by returning to question a mother 2 and 4 weeks after an episode of pneumonia or a simple cough or cold (identified during a previous home or clinic visit), and by repeat interviews. The results of these studies and several others to explore maternal recall of past ARI episodes will be reviewed at a meeting in July 1991. The results will be used to complete the development of the ARI household morbidity and treatment survey instrument and manual.

ARI intervention studies

Further evidence that the ARI case management strategy has an impact on pneumonia mortality has become available in the last year. The design and results of several ARI intervention studies have been summarized in previous Programme reports and other publications[6-9].

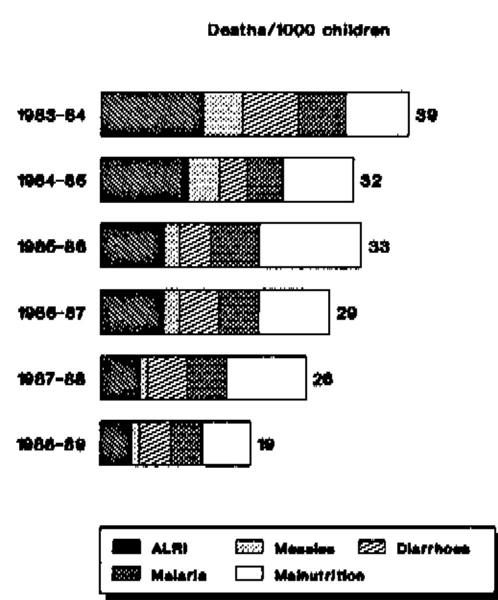
In the project in Kediri, Indonesia, reductions in total and ALRI-specific mortality were sustained in the third and final intervention year (Figure 5) despite a higher rate of measles deaths in that year. During the last two intervention years, 433 children were classified as severe cases based on chest indrawing, inability to drink, or cough for longer than 30 days. All these children were referred by the community-based *kaders* for treatment at the health centre, which resulted in a very low case-fatality rate (8 deaths - 1.8%). Traditional birth attendants, healers, and other practitioners continued to be the most common sources of care for children who died. This aspect will be investigated in 1991 using the focused ethnographic study protocol (see page 20).

Figure 5
Causes of under-5 mortality
Kediri, Indonesia, 1986-1990



The project supported by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) in Bagamoyo, United Republic of Tanzania, has provided primary health care services (including ARI case management) and followed cause-specific mortality in approximately 20 000 children. Figure 6 summarizes six years of mortality surveillance in the project. Improvements in the supply of drugs to the village health workers in 1988 probably contributed to the further declines in total, ALRI-, and malaria-specific mortality recorded in 1988-1989.

Figure 6
Causes of under-5 mortality
Bagamoyo, Tanzania, 1983-1989



From: D. Neuvians & F.D. Mtango. Longitudinal study of mortality in children under five years of age in a rural district of Tanzania. Paper presented at the XIIth Scientific Meeting of the International Epidemiological Association, Los Angeles, USA, 5-9 August 1990.

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6 Case management of acute respiratory infections in children: Intervention studies. Document WHO/ARI/88.2 (1988).

7 Khan, A.J., Khan, J.A., Akbar, M. et al. Acute respiratory infections in children: A case management intervention in Abbottabad District, Pakistan. *Bulletin of the World Health Organization, 68*: 577-585 (1990).

8 Programme for the Control of Acute Respiratory Infections. Programme Report 1988. Document WHO/ARI/89.3 (1989).

9 Programme for the Control of Acute Respiratory Infections. Fourth Programme report, 1988-1989. Document WHO/ARI/90.7 (1990).

In the USAID-supported study in Jumla, Nepal, in which ARI case management delivered by specially trained community agents was the sole health care intervention, a dramatic impact on mortality was documented. A trend analysis over three years, taking into account the length of time the project had been in progress in each area and standardizing for other temporal changes, showed a statistically significant decline in total mortality of 28%. WHO provided support for the analysis of the data.

Additional evidence of a significant impact on mortality has recently become available from another intervention study carried out in Gadchiroli, India. Health workers from government primary health centres and village health workers were trained to manage children with cough using the WHO protocol with a single respiratory rate threshold of 50; children with pneumonia were treated with cotrimoxazole syrup. Traditional birth attendants who had difficulty counting were trained to use their visual impression of fast breathing, utilizing the WHO training video. Parents were instructed to seek treatment for signs suggesting pneumonia. After a year of intervention, both the ALRI-specific and the total mortality rate were significantly lower in the intervention area compared with control villages[10].

Surveillance of antibiotic resistance

Two studies in Pakistan have explored the suitability of nasopharyngeal isolates for national surveillance of antibiotic resistance in *S. pneumoniae* and *H. influenzae*. Nasopharyngeal swabs and blood cultures were obtained from three groups of children 2 to 59 months of age who presented to hospital with cough or difficult breathing: children with chest indrawing or danger signs ("severe pneumonia or other severe disease"), children with fast breathing but no chest indrawing (classified as "pneumonia"), and children without any of these signs and a rectal temperature of 39°C or greater. Figure 7A shows the high rates of bacteraemia due to *S. pneumoniae* and *H. influenzae* found in these children (the three groups are combined in this analysis). Nasopharyngeal swabs were also obtained from a group of healthy children presenting for immunization. An additional study collected nasopharyngeal samples from a group of children with ARI or no disease in a rural area.

The results of the study indicate that the prevalence of drug resistance was similar for invasive isolates and upper airway isolates obtained from sick children when data from the three group were combined; pneumococcal serotypes were also similar for both isolate types (Figure 7B). These data suggest that nasopharyngeal swabs from children with signs suggesting pneumonia can be used to estimate the prevalence of antimicrobial resistance among strains causing invasive disease.

These data, and reviews of the published literature and unpublished data from the Gambia, Papua New Guinea, and the Philippines, led the expert group convened by the Programme in Geneva in December 1990 (see page 15) to conclude that *surveillance systems can be initiated based primarily on nasopharyngeal isolates from children with clinical signs of pneumonia* (a smaller sample of invasive isolates being collected, where feasible, to confirm the nasopharyngeal results). Further research and an analysis of the existing data will be conducted in several countries as surveillance systems are started, to confirm the adequacy of the correlation between nasopharyngeal and invasive isolates and to further simplify the laboratory procedures.

Despite laboratory evidence of high rates of cotrimoxazole resistance in *S. pneumoniae* and *H. influenzae*, few reports of clinical failures in the treatment of pneumonia with cotrimoxazole have been received; the alternative drug (amoxycillin) would be much more expensive for the national ARI programmes. A study will be initiated in 1991 in Pakistan to evaluate the clinical efficacy of cotrimoxazole therapy for children with pneumonia as a function of the antimicrobial susceptibility of the organism found on blood culture. The study will also compare the effectiveness of cotrimoxazole and amoxycillin in a setting with apparent high levels of resistance to cotrimoxazole. It will be jointly supported by WHO, USAID/Management Sciences for Health, the Centers for Disease Control, Atlanta, USA, and the Ministry of Health of Pakistan.

Appropriate technology

The Programme's developmental work in the area of appropriate technology was supported by research on sounding timers and foot-pump nebulizers (see page 3).

Disease prevention research

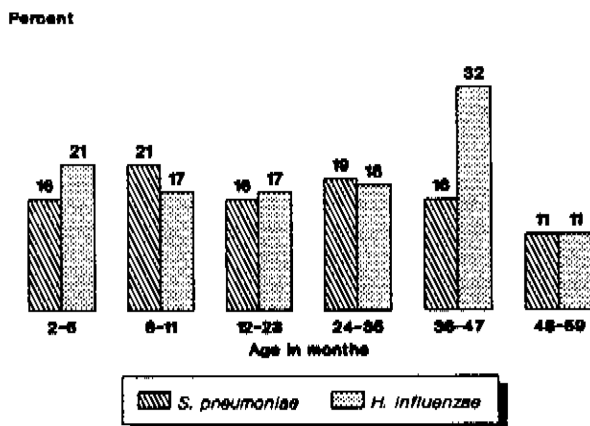
Risk factors for pneumonia

A population-based case-control study of death in young children was carried out in Bagamoyo, United Republic of Tanzania, with joint support from GTZ and WHO. Overall, 55% of children who died had not utilized any kind of allopathic or non-traditional care (village health worker, dispensary, health centre, or

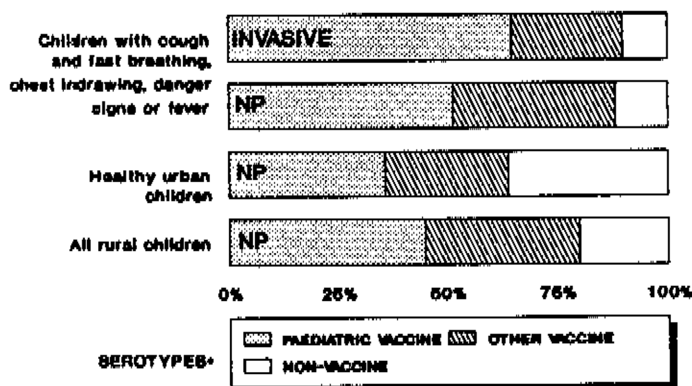
[10] Bang, A.T., Bang, R.A., Tale, O., et al. Reduction in pneumonia mortality and total childhood mortality by means of community-based intervention trial in Gadchiroli, India. *Lancet*, 1: 201-206 (1990).

Figure 7
Bacteriological studies in children with cough and fast breathing, chest indrawing, danger signs, or fever in Rawalpindi and Islamabad, Pakistan, 1989-1990

A. Rates of bacteraemia with *S. pneumoniae* and *H. influenzae* by age



B. Distribution of pneumococcal serotypes in invasive and nasopharyngeal (NP) isolates, compared with NP isolates from healthy urban children and all rural children



* Paediatric vaccines (6,14,18,19,23)
Other vaccines (1,2,3,4,5,7,8,9,10,11,12,15,17,20,22,33)

hospital). The main reasons given were preference for traditional medicines, absence of drugs, and distance from such care. Verbal autopsy ascribed 25% of deaths to pneumonia; 39% of these deaths occurred in the first 6 months of life. In a multivariate analysis, significant independent associations of the following factors with death from all causes were found: the mother being the sole decision-maker for treatment; use of water from a village well, pond, or river rather than tap water; the child eating with others; and the child sleeping in the room where cooking is done[11].

Data collection has been completed in a study of risk factors for pneumonia in young children in Brazil. The results are expected by the end of 1991. The Programme is also providing technical support for an ethnographic study in Indramayu, West Java, Indonesia, prior to a case control study (funded by the Thrasher Research Fund) on risk factors for pneumonia which will take advantage of ongoing community surveillance of a large cohort of children.

Preparations for an *H. influenzae* type b vaccine trial

A study in the Gambia, supported by the Programme, is defining age-specific attack rates for invasive disease caused by *H. influenzae* type b (Hib), based on surveillance at major hospitals and clinics. This is a preparatory investigation for a trial of the efficacy of an Hib-conjugate vaccine that is proposed to be carried out in that country. During 8 months, 52 cases of invasive Hib disease were identified (mostly meningitis). The median age was 7 months, and 18% of cases were younger than 4 months. *This age distribution, affecting younger groups than in developed countries, emphasizes the need to immunize early in infancy, giving the first dose of vaccine at about 2 months of age, probably in combination with DPT. It also points to the need for a vaccine that evokes appreciable protection after the first dose*, so that any delay in further immunization would have a minimum effect on the prevention of Hib disease. Studies are also under way in the Gambia to compare the safety and immunogenicity of candidate Hib conjugate vaccines, on the basis of which the most appropriate one will be selected for trial. Plans for further studies to evaluate the Hib-conjugate vaccines in the Gambia were discussed at a meeting of international advisers in Veldhoven, Netherlands, in September.

[11] Mtango, F.D.E., Neuvians, D., Broome, C.V. et al. Risk factors for childhood deaths in children <5 years old in Bagamoyo District, Tanzania. Submitted for publication.

4. INFORMATION SERVICES

World interest in the control of acute respiratory infections has increased considerably. This is reflected in the growing demand for technical and managerial information from ministries of health, international agencies, and non-governmental organizations.

The global newsletter *ARI News*, produced by the Appropriate Health Resources and Technologies Action Group (AHRTAG) in London, United Kingdom, with support from WHO and UNICEF, remains the main vehicle for the dissemination of information on ARI to staff in ministries of health, hospitals, first-level health facilities, and teaching institutions in developing countries. During the year three issues in English were distributed: number 16, on pertussis; number 17, on the relationships between vitamin A deficiency and ARI; and number 18, on cough medicines and mixtures. The circulation figure was increased from 25 000 copies in 1989 to 40 000 in 1990. The WHO Regional Office for the Americas translated four issues (numbers 13 to 16) into Spanish, and distributed them as two volumes in 40 000 copies (*Noticias sobre IRA*, Volumes 6 and 7). The WHO Regional Office for the Eastern Mediterranean initiated an Arabic version containing selected articles from past issues and 1000 copies of the first volume were distributed. Attempts were made to recommence the publication of the French version, which had been interrupted due to lack of funds in 1988: AHRTAG obtained quotations for the translation work from institutions in Paris and Dakar, and requests for financial support were sent to several agencies. It is hoped that this version will appear again in 1991.

During the year the Programme issued 17 documents and papers for general distribution (Annex 5). The mailing list currently contains about 900 addresses of institutions, public health managers, teachers of paediatrics, and scientists who are interested in ARI, most of whom are in developing countries.

An illustrated brochure (document WHO/ARI/90.17) describing the purposes, strategies, and components of the Programme was produced for distribution to ministries of health, the media, and other agencies.

The Regional Office for the Americas published a review in Spanish of the magnitude of the problem, and advances in the control of ARI in the Americas; it was prepared with the collaboration of the National Institute of Epidemiology, Santa Fe, Argentina. The review provides detailed information on mortality from all causes and from pneumonia (and influenza, according to the International Classification) in infants and children 1-4 years old (for the years 1970, 1986, and the most recent year in which the information was available) for each country of the Region.

The Regional Office for the Eastern Mediterranean produced a paper entitled *Acute respiratory infection in relation to children in Arab world and Arab child's health*, which was published by the Arab Council for Childhood and Development.

Staff of the Programme participated in the plenary session on ARI in children and in a symposium on ARI intervention studies during the World Conference on Lung Health, held in Boston on 20-24 May. The Director-General of WHO highlighted the magnitude of the ARI problem in developing countries and the possibilities for its control in his address at the closing session of the Conference[12].

[12] Address by Dr Hiroshi Nakajima, Director-General of the World Health Organization, *Bulletin of the International Union Against Tuberculosis and Lung Disease*, *65*: 10-11 (1990).

5. PROGRAMME MANAGEMENT AND RESOURCES

Organization

Since 1 October 1990, the ARI Programme at WHO headquarters is administratively a unit of the Division of Diarrhoeal and Acute Respiratory Disease Control (CDR). The establishment of this new Division changed the *de jure* situation of the ARI Programme, which had until then been under the administrative responsibility of the Director of the Diarrhoeal Diseases Control (CDD) Programme. The Director of the Division and his staff provide general direction and managerial support to the global Programme. At headquarters, the ARI staff is composed of four professionals (a programme manager, a programme development coordinator, a research component coordinator, and a services component coordinator), an administrative assistant (this post was established in 1990), and three secretaries.

The ARI Programme at headquarters is responsible for the planning and implementation of developmental and research activities, and for global coordination of the services component. The regional offices are responsible for all collaborative activities with countries that are implementing ARI prog rammes. Each regional offices has designated a full-time or part-time officer for ARI activities within its programme for Disease Prevention and Control, with the exception of the Region of the Americas where ARI (together with CDD and EPI) forms part of the Maternal and Child Health Programme.

Programme review bodies

Technical Advisory Group

The scientific and technical review of Programme activities is the responsibility of a Technical Advisory Group (TAG) composed of six leading experts in public health and six scientists from outside WHO. The Group has met every two years since 1983. In 1989 the issue of the periodicity of the TAG meetings was considered by the Meeting of Interested Parties, which recommended that, in even years, a small group of TAG members meet instead of the entire group, in order to review the annual report, follow up on the recommendations of the previous meeting, and advise on specific matters including budgetary issues. The first such meeting took place in Geneva on 5-6 March 1990[13]. At this meeting the Group:

- endorsed the target of a one-third reduction in mortality from pneumonia in young children by the year 2000 recommended by the Programme and adopted by the Bellagio IV Conference organized by the Task Force for Child Survival in Bangkok on 1-3 March 1990;
- encouraged the Programme to maintain the close inter-relationship between services and research activities, which had led to the formulation of focused research priorities related to important policy questions on ARI control;
- welcomed the close collaboration between WHO and UNICEF and endorsed in particular the joint support given to national programmes and the uniform recommendations in respect of drugs and equipment;
- noted with concern that insufficient progress had been made in the African Region in the planning and implementation of national control activities, and urged the Programme to increase the efforts and resources required to ensure a more rapid development of control activities in that Region;
- reaffirmed its view that highest priority should be given to research in the areas of case management and behaviour, and to the validation of evaluation methods for national programmes;
- endorsed the targets proposed by the Programme for 1995, and the efforts being made to develop instruments to measure progress in the achievement of those targets.

[13] Report of the fifth meeting of the Technical Advisory Group. Document WHO/ARI/90.6 (1990).

Management Review Committee

At its tenth meeting in New York, USA, on 30 March 1990, the CDD/ARI Management Review Committee (MRC) was informed of the status and approaches of the ARI Programme and its plans for 1990[14]. The Committee:

- welcomed the close integration of the services and research activities and endorsed the research management plan;
- recognized the complexities of the technical issues involved in the case management strategies, and encouraged the Programme to identify ways of effectively communicating these issues to non-specialist audiences;
- endorsed the revised 1990-1991 budget, noting the substantial increase in contributions to the Programme, and commending the open budgeting and accounting procedures;
- endorsed the budget projections for the financial period 1992-1993, recognizing that the proposed funding level might be raised in the future if funds became available and effective strategies could be identified for the prevention of ARI.

Meeting of Interested Parties

The status and plans for development of the Programme, and a review of recent research efforts in the area of case management, were presented to the donor community at the tenth Meeting of Interested Parties (MIP) of the CDD and ARI Programmes on 28 June 1990. The MIP expressed satisfaction with the Fourth Programme Report for 1988-1989 and with the considerable progress made by the Programme; accepted the revised budget for 1990-1991; requested that the distribution of resources between the services and the research component be kept under constant review; indicated its general approval of the projections for the 1992-1993 biennium; and appealed to other possible contributors to provide support to the Programme.

Resources and obligations

The Programme's financial position at the beginning of 1991 is shown in Table 9.

[14] Report of the tenth meeting of the Management Review Committee. Document CDD/ARI/MRC/90.1 (1990).

Table 9: Financial position of ARI Programme as of 1 January 1991 (US$)

Balance available on 1 January 1990	1 859,991
Amount received since 1 January 1990	5 200 164
Amount pledged since 1 January 1990	280 185
Total available and pledged	7 340 340
Estimated obligations 1990-1991	9 336 000
Estimated shortfall 1990-1991	1 995 660

The resources available to the Programme by source of funds for the periods 1982-1985, 1986-1987, 1988-1989, and 1990-1991 are given in Table 10. During 1990, contributions were received from or pledged by 11 countries and agencies.

Table 11 is a summary of the actual obligations of the Programme for 1988-1989, and revised estimated obligations for 1990-1991.

Table10. Resources received by the Programme 1982-1991 (as of 31 December 1990)

SOURCE	1982-1985	1986-1987	1988-1989	1990-1991 Available	1990-1991 Pledged
REGULAR BUDGET	US$	US$	US$	US$	US$
Global and Interregional	857,006	624,365	601,924	496,400	
Regions	808,636	560,311	1,072,837	1,526,400	
TOTAL REGULAR BUDGET	1,665,642	1,184,676	1,674,761	2,022,800	
OTHER SOURCES					
Australia			291,215	172,350	
Denmark				243,984	
Finland			229,489	203,647	
Germany			31,928		
Italy			641,892	85,602	36,704
Japan		145,000	70,632		
Netherlands		175,951	357,850	468,257	
Sweden	216,336	547,140	653,432	396,845	
United Kingdom			1,154,780	278,250	
United States of America			56,391		
Pan American Health Organization		68,800			
United Nations Children's Fund			100,000	100,000	
United Nations Development Programme			399,316	904,000	
Arab Gulf Programme for United Nations Development Organizations (AGFUND)	320,000				
Federation of Finnish Lung Disease Associations (FFLDA)				167,579	243,481
Kellogg Foundation	34,000	68,000			
Sasakawa Health Trust Fund	385,854	156,300			
Interest			169,600	156,850	
TOTAL OTHER SOURCES	956,190	1,161,191	4,156,525	3,177,364	280,185
TOTAL	2,621,832	2,345,867	5,831,286	5,200,164	280,185

Table 11: Summary: Actual obligations incurred in 1988-1989 and revised estimated obligations for 1990-1991

Programme Component	Actual obligations 1988-1989	Revised estimates 1990-1991	
	US$	US$	%
I. HEALTH SERVICES			
Global and interregional	843,992	1,509,000	16.2%
Regional	1,951,291	4,750,000	50.9%
Sub-total	2,795,283	6,259,000	67.0%
II. RESEARCH			
Global and interregional	733,067	1,949,000	20.9%
III. PROGRAMME MANAGEMENT AND SUPPORT			
Global and interregional	740,123	1,128,000	12.1%
TOTAL			
Global and interregional	2,317,182	4,586,000	49.1%
Regional	1,951,291	4,750,000	50.9%
TOTAL	4,268,473	9,336,000	100.0%

ANNEX 1: STATUS OF NATIONAL CONTROL PROGRAMMES, DECEMBER 1990

Region and country[a]	MOH unit responsible[b]	Technical guidelines	Plan of operation	Year in which implementation started	Coverage
AFRICA (AFR)					
MAIN TARGET COUNTRIES					
Botswana	FHE	Yes	Yes	1989	1 district
Ethiopia	FHE	Yes	Yes	1990	2 districts
Gambia	EPD	Yes	Yes	1989	1 region
Lesotho	MCH	Yes	Yes	1990	3 areas
Malawi	TRD	Yes	Yes	-	-
Namibia	CHE	Yes	Yes	1990	4 regions
Swaziland	MCH	Yes	Yes	-	-
U.R. of Tanzania	EPD	Draft	Draft	-	-
Zambia	DCO	Yes	-	-	-
Zimbabwe	MCH	Yes	Yes	1987	national
AMERICAS (AMR)					
MAIN TARGET COUNTRIES					
Bolivia	MCH	Yes	Yes	1985	14 areas
Brazil	MCH	Yes	Yes	1982	3 states
Colombia	MCH	Yes	Yes	1986	national
Dominican Rep.	MCH	Yes	Yes	1990	1 area
Ecuador	MCH	Yes	Yes	1989	6 regions
El Salvador	MCH	Yes	-	-	-
Guatemala	MCH	Yes	Yes	1985	national
Honduras	MCH	Yes	Yes	1984	national
Mexico	EPD	Yes	Yes	1986	4 states
Nicaragua	MCH	Yes	Yes	1990	1 region
Paraguay	MCH	Yes	Yes	1985	national
Peru	MCH	Yes	Yes	1989	4 departments
OTHER COUNTRIES					
Argentina	MCH	Yes	Yes	1989	4 provinces
Belize	MCH	Yes	Yes	-	-
Chile	EPD	Yes	-	-	-
Costa Rica	MCH	Yes	Yes	1986	national
Panama	MCH	Yes	Yes	1984	national
Uruguay	MCH	Yes	-	-	-
Venezuela	MCH	Yes	Yes	1988	4 states
SOUTH-EAST ASIA (SEAR)					
MAIN TARGET COUNTRIES					
Bangladesh	EPD	Yes	Yes	1990	8 *upazillas* and 2 urban slums
India	MCH	Yes	Yes	1990	15 districts
Indonesia	EPD	Yes	Yes	1987	800 *puskesmas* in 27 provinces
Myanmar	EPD	Yes	Yes	1989	7 townships
Nepal	MCH	Yes	Yes	-	-

[a] Target countries are those with an infant mortality rate greater than 40/1000 in 1988. Source: United Nations Population Division, World Population Chart, 1988. United Nations, New York.

[b]
CHE: Child health
CHS: Child survival
DCO: Disease control
EPD: Epidemiology
FHE: Family health
MCH: Maternal and child health
PHE: Public health or primary health services
TRD: Tuberculosis and respiratory diseases

ANNEX 1 - continued

Region and country[a]	MOH unit responsible[b]	Technical guidelines	Plan of operation	Year in which implementation started	Coverage
SOUTH-EAST ASIA - Cont.					
OTHER COUNTRIES					
Sri Lanka	EPD	Yes	Yes	1988	4 provinces
Thailand	TRD	Yes	Yes	1989	13 sub-districts
EUROPE (EUR)					
MAIN TARGET COUNTRIES					
Turkey	MCH	Yes	Yes	1987	16 provinces
EASTERN MEDITERRANEAN (EMR)					
MAIN TARGET COUNTRIES					
Djibouti	MCH	Yes	Yes	-	-
Egypt	CHS	Yes	Yes	1990	6 governorates
Iran (Islamic Rep. of)	FHE	Yes	Yes	1990	3 districts
Iraq	EPD	Yes	Yes	1990	1 governorate
Morocco	EPD	Yes	Yes	1990	3 provinces
Oman	MCH	Yes	Yes	1987	national
Pakistan	MCH	Yes	Yes	1990	4 divisions
Sudan	EPD	Yes	Yes	1989	1 region
Tunisia	MCH	Yes	Yes	1986	3 governorates
WESTERN PACIFIC (WPR)					
MAIN TARGET COUNTRIES					
Laos	MCH	Yes	Yes	1988	5 provinces
Papua New Guinea	DCO	Yes	Yes	1988	4 provinces
Philippines	MCH	Yes	Yes	1988	15 provinces
Viet Nam	TRD	Yes	Yes	1984	126 districts in 37 provinces
OTHER COUNTRIES AND TERRITORIES					
American Samoa	PHE	Yes	Yes	1990	4 districts
Cook Islands	PHE	Yes	Draft	-	-
China	MCH	Yes	Yes	1988	327 counties in 30 provinces
Fiji	PHE	Yes	Yes	1988	national
Malaysia	EPD	Yes	-	-	-
Samoa	MCH	Yes	Yes	1990	4 districts
Solomon Islands	PHE	Yes	Yes	1990	national
Tonga	DCO	Yes	Yes	1989	3 districts
Vanuatu	MCH	Yes	Yes	1988	national
TOTAL					
MAIN TARGET COUNTRIES	-	41	39	34	-
OTHER COUNTRIES AND TERRITORIES	-	18	15	13	-
GRAND TOTAL	-	59	54	47	-

ANNEX 2: PROGRAMME MANAGERS' COURSES HELD IN 1990

Region and place	Month	Language	Number of countries	Number of participants and facilitators
INTER-COUNTRY COURSES				
AFR				
Kadoma, Zimbabwe	May	English	17	30
AMR				
Santa Fe, Argentina	May	Spanish	12	24
Guatemala, Guatemala	June	Spanish	10	37
Matamoros, Mexico[a]	July	Spanish	2	37
Bridgetown, Barbados	October	English	16	30
SEAR				
Colombo, Sri Lanka	October	English	2	14
WPR				
Suva, Fiji	October	English	13	27
Sub-total	7	-	62[b]	199
NATIONAL COURSES				
AMR				
Buenos Aires, Argentina	July	Spanish		39
Oaxtepec, Mexico	August	Spanish		48
Caracas, Venezuela	October	Spanish		43
Girardot, Colombia	November	Spanish		40
Managua, Nicaragua	December	Spanish		25
SEAR				
Delhi, India	January	English		22
Madras, India	February	English		23
Jakarta, Indonesia	March	English		10
Rangoon, Myanmar	August	English		12
EMR				
Cairo, Egypt	June	English		28
Shahrekord, Iran	August	Farsi		25
Islamabad, Pakistan	September	English		46
WPR				
Cavite, Philippines	March	English		50
Vientiane, Laos	October	Laotian		14
Tianjing, China	October	Chinese		45
Nanjin, China	November	Chinese		47
Viet Nam (3 courses)	-	Vietnamese		180
Sub-Total	19	-		697
TOTAL	26	-	-	896

[a] Course for the Mexican-American border states.

[b] Some countries from the Americas were represented in two or even three courses. This figure represents the total number of different countries represented.

ANNEX 3: NATIONAL SEMINARS AND WORKSHOPS HELD IN 1990

Region	Country	Number of activities	Number of participants	Comments
AFR	Lesotho	8	84	2-3-day seminars for staff of 3 health service areas
	Zimbabwe	1	45	1-day seminar on programme activities
AMR	Bolivia	1	28	Revision of guidelines on case management
	Colombia	1	35	Case management for teachers of paediatrics
	Cuba	1	80	Workshop on case management during National Congress on Epidemiology
	Ecuador	1	25	Revision of guidelines on case management
	Mexico	1	150	Workshop on ARI by the Division of Continued Medical Education, School of Medicine
	Peru	1	30	Workshop for teachers of paediatrics
SEAR	India	1	40	Workshop for national experts on ARI Control
		1	12	Seminar on monitoring of ARI activities
		2	150	Seminar on ARI for Schools of Nursing
		40	1400	Meetings on ARI of the Paediatric Associations
	Indonesia	1	54	National workshop
		1	50	Meeting with paediatricians of leading universities
	Myanmar	1	100	Meeting on ARI of the Medical Association
	Sri Lanka	1	30	Consultative meeting with the Paediatric Association
	Thailand	1	50	Meeting of regional ARI programme managers
EMR	Egypt	1	45	National workshop on ARI drugs
	Oman	2	250	Workshops for regional MCH staff
	Pakistan	7	125	Workshops for health managers
	Sudan	1	28	Workshop for provincial managers
WPR	Fiji	1	25	National workshop on ARI
TOTAL		76	2836	

ANNEX 4: NEW AND CONTINUING RESEARCH PROJECTS FUNDED BY THE ARI PROGRAMME (1 JANUARY 1990 TO 31 DECEMBER 1990)

Project No.	Title	Principal Investigator(s)

A. FINANCIAL AND TECHNICAL SUPPORT

1. CASE MANAGEMENT RESEARCH

Project No.	Title	Principal Investigator(s)
HQ89040	Pneumonia in malnourished children	Dr K. Mulholland Medical Research Council Fajara Banjul Gambia
HQ89037	The relationship of malaria and acute respiratory tract infections and the efficacy of cotrimoxazole for treatment of *Plasmodium falciparum* malaria	Dr J. Wirima Kamuzu Central Hospital P.O. Box 149 Lilongwe Malawi and Dr S. Redd International Health Program Office Centers for Disease Control Atlanta, GA USA
HQ90005	Pharmacokinetics of oral and intramuscular chloramphenicol in young infants	Dr L. Abraham Quezon City Hospital Manila Philippines
HQ89024 Continuing	Predicting severe lower respiratory illness in infants: The Babies' Breath Study	Dr P. Margolis University of North Carolina at Chapel Hill Chapel Hill, NC USA
HQ88157 Continuing	Epidemiology of acute respiratory illness in a community-based prospective study of Peruvian children 0-24 months old	Dr C. Lanata Instituto de Investigacion Nutricional Lima Peru
HQ89025 Continuing	Clinical detection of pneumonia, septicaemia or meningitis in infants less than 3 months of age	Dr J. Brady & Dr F. Onyango Kenyatta National Hospital Nairobi Kenya

Multicentre study of clinical signs and etiological agents of pneumonia, sepsis, and meningitis in young infants

Project No.	Title	Principal Investigator(s)
HQ89039	The aetiology of sepsis in Gambian infants less than 3 months old	Dr K. Mulholland Medical Research Council Fajara Banjul Gambia

ANNEX 4 - continued

Project No.	Title	Principal Investigator(s)
HQ89039	The diagnosis of pneumonia, sepsis and meningitis in filipino infants 0-2 months of age	Dr S. Gatchalian Research Institute for Tropical Medicine Alabang Muntinlupa Metro Manila Philippines
HQ89039	Clinical signs and etiological agents in pneumonia, sepsis, and meningitis in children under 3 months of age in PNG	Dr D. Lehmann Pneumonia Research Program Papua New Guinea Institute of Medical Research Goroka Papua New Guinea
HQ89039	The etiology of pneumonia and sepsis in infants below 3 months of age and accuracy of diagnostic criteria	Dr L. Muhe Department of Paediatrics Faculty of Medicine Addis Ababa University Addis Ababa Ethiopia
2. BEHAVIOURAL RESEARCH		
HQ90C01	Field study of the ARI ethnographic protocol, Jérémie, Haïti	Dr R. Bourdeau Child Survival Outreach Project Jérémie Haïti
HQ90C02	Field study of the ARI ethnographic protocol, Erzurum, Turkey	Dr L. Lohfeld Ankara Turkey and Dr A. Ozer Ataturk University Erzurum Turkey
HQ90C03	Field study of the ARI ethnographic protocol, Honduras	Dr P. Hudelson The Johns Hopkins University Baltimore, MD USA
HQ90C04	Field study of the ARI ethnographic protocol, Navrongo, Ghana	Dr S. Saenz de Tejada Division de Nutricion y Salud INCAP Guatemala City Guatemala
HQ90C05	Field test of the ARI ethnographic protocol, Solis, Mexico	Dr H. Martinez Instituto Nacional de Nutricion Tlalpan Mexico

ANNEX 4 - continued

Project No.	Title	Principal Investigator(s)
HQ89001 Continuing	Perceptions of mothers and health personnel about signs of severity in ALRI	Dr M. Fukumoto Instituto de Investigacion Nutricional Lima Peru
HQ89C02 Continuing	Development of ethnographic protocol	Dr G. Pelto University of Connecticut Storrs, CT USA
3. HEALTH SYSTEMS RESEARCH		
HQ90C06	Household survey methods study - Oriental Mindoro, Philippines	Dr E. Dayrit Department of Health Manila Philippines and Dr G. Himschall International Health Program Office Centers for Disease Control Atlanta, GA USA
HQ90CO7	Field test of prototype sounding timer in Nepal	Mr L. Brown One Elderberry Lane Worthington, MA USA
HQ90C08	Field test of prototype sounding timer in India	Dr V. Kumar House No. 66, Sector 24A Chandigarh India
HQ90C09	Study of alternative methods to obtain population-based information on childhood ARI	Dr D. Ross and Dr F. Binka Ghana Vitamin A Supplementation Study Navrongo Ghana
HQ89019 Continuing	Surveillance of antimicrobial resistance of *S. pneumoniae* and *H. influenzae* in Islamabad	Dr A. Ghafoor Executive Director Public Health Division National Institute of Health Islamabad Pakistan
HQ90001	Supplementary study of the surveillance of antimicrobial resistance of *S.pneumoniae* and *H.influenzae* in Pakistan	Dr A. Ghafoor Executive Director Public Health Division National Institute of Health Islamabad Pakistan

ANNEX 4 - continued

Project No.	Title	Principal Investigator(s)
SN:561 Continuing	ARI intervention study in Kediri, Indonesia	Dr R. Runizar Ministry of Health Jakarta Indonesia
4. DISEASE PREVENTION RESEARCH		
HQ89038 Continuing	Surveillance of *H. influenzae* disease in the Gambia	Dr B. Greenwood Medical Research Council Fajara Banjul Gambia
HQ88112 Continuing	Risk factors for pneumonia in young children	Dr C. Victora Universidade Federal dePelotas Pelotas Brazil
B. TECHNICAL/REAGENT/REFERENCE LABORATORY SUPPORT		
	Management of wheezing in infancy	Dr G. Aref El-Chatby Children's Hospital Alexandria Egypt and
	Clinical signs and symptoms associated with pneumonia and hypoxia	Dr A. Gadomski Child Survival Project Cairo Egypt
HQ89039	Study of the clinical features and etiologies of infection in young infants	Dr G. Lerebours Institut Haitien de l'Enfance Port-au-Prince Haïti and Dr B. Schwartz Centers for Disease Control Atlanta, GA USA

ANNEX 4 - continued

Organism	Reference Laboratory
C. REFERENCE LABORATORIES	
Anaerobes	Anaerobe Reference Laboratory (Dr L. Moore) Polytechnic Institute and State University Blacksburg, VA USA
Chlamydia trachomatis	Chlamydia Laboratory Department of Laboratory Medicine (Dr J. Schachter) University of California San Francisco General Hospital San Francisco, CA USA
Gram-negative organisms/staphylococci/ streptococci	Laboratory Section Respiratory Diseases Branch (Drs Facklam and Tenover) Division of Bacterial Diseases Centers for Disease Control Atlanta, GA USA
	Dept. of Pathology and Laboratory Medicine (Dr Beverly Metchock) Grady Memorial Hospital Atlanta, GA USA
Haemophilus influenzae	National Public Health Institute (Professor H. Mäkelä) Helsinki Finland
Immunofluorescence – adenovirus, influenza A and B, measles, parainfluenza, and RSV, (using monoclonals provided by WHO/CDC, USA (Dr A. Kendal) and National Bacteriological Laboratory, Sweden (Dr E. Norrby)	Department of Virology (Dr Monica Grandien) Department of Virology National Bacteriological Laboratory Karolinska Institute Sweden
Mycoplasma pneumoniae and *hominis*, *Ureaplasma urealyticum*	University of Alabama (Dr Gail Cassell) Birmingham Alabama, AL USA
Streptococcus pneumoniae	The Streptococcus Department (Dr Jorgen Henrichsen) Statens Seruminstitut Copenhagen Denmark

ANNEX 5: NEW PUBLICATIONS AND DOCUMENTS - 1990

Management and general interest:

Fourth Programme Report 1988-1989. Document WHO/ARI/90.7.

Report of the fifth meeting of the Technical Advisory Group, Geneva, 5-6 March 1990. Document WHO/ARI/90.6.

Acute respiratory infections – general:

Acute respiratory infections. Document WHO/ARI/90.7 (brochure).

Case management:

Acute respiratory infections in children: case management in small hospitals in developing countries – a manual for doctors and other senior health workers. Document WHO/ARI/90.5.

Supervisory skills: management of the young child with an acute respiratory infection (training module) 1990.

Management of the child with cough or difficult breathing. A case management chart, 1990.

Management of the child with an ear problem or sore throat. A case management chart, 1990.

Antibiotics in the treatment of acute respiratory infections in young children. Document WHO/ARI/90.10.

Case management research priorities. Document WHO/ARI/RES/90.1.

Clinical signs and etiological agents of pneumonia, sepsis, and meningitis in young infants. Document WHO/ARI/90.14.

Report of a meeting of the radiology working group, Geneva, 27-28 October 1989. Document WHO/ARI/90.13.

Epidemiology:

Outcome measures in prospective studies of childhood diarrhoea and respiratory infections: choosing and using them. Document WHO/CDD/EDP/90.2 - WHO/ARI/RES/90.4.

Control programmes:

ARI programme management. A training course (5 modules), 1990.

Khan, A.J. et al. Acute respiratory infections in children: a case management intervention in Abbottabad District, Pakistan. *Bulletin of the World Health Organization, 68:* 577-585 (1990).

Pio, A. Public health implications of the results of ARI intervention studies. *Bulletin of the International Union against Tuberculosis and Lung Disease, 65*: No 4 (1990). In press.