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ACUTE RESPIRATORY INFECTIONS

1987 PROGRAMME REPORT

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1. INTRODUCTION

The WHO Programme for the Control of Acute Respiratory Infections (ARI) was established in 1982, when the Thirty-fifth World Health Assembly adopted resolution WHA35.25 approving the Organization's Seventh General Programme of Work, Covering the Period 1984-1989 (1). The overall objectives of the programme are to reduce the morbidity, severity and mortality from acute respiratory infections, the major emphasis being on the prevention of death from pneumonia, which is the first or the second cause of infant and early childhood mortality in almost all developing countries and accounts for at least one-quarter of all childhood deaths in the world as a whole (2). The reduction of infant mortality is invariably given high priority in the developing countries; associated with this, there has been a growing recognition in recent years that control of the acute respiratory infections must be an essential part of primary health care and child survival programmes.

A medium-term programme on acute respiratory infections for the years 1984-1989 was formulated in 1983 with the participation of the six WHO Regional Offices (3). The programme's activities were aimed at fostering national and international action so that by 1985 a strategy for intervention at the community level would have been developed, and by 1989 most developing countries would have formulated national ARI control programmes. The essential activities of the programme had developed sufficiently by 1986 to allow it to prepare technical guidelines on case management, training modules, educational aids, and an operational manual for programme managers. In 1987, the programme began to move gradually from a developmental to an implementation phase, as a number of countries decided to establish national ARI control programmes, formulate technical policies and begin the requisite training of their health staff. The WHO ARI programme gave increasing support to these efforts, while continuing further research and development activities.

The programme has, therefore, two major components: a health services component, concerned with the application of the already available methods and strategies for the treatment and prevention of ARI in children; and a research component directed to discovering new and better methods and approaches for control. In previous programme reports (4) a promotion component, aimed at ensuring the necessary commitment of resources and professional and public support for the programme, was described. With the experience that has been gained, this work can now be subsumed under the normal work of programme management and is therefore no longer presented as a separate component.

This report describes the activities undertaken by the ARI programme in 1987.

2. HEALTH SERVICES COMPONENT

2.1 Control strategies

Following the recommendations of the Technical Advisory Group on Acute Respiratory Infections (TAG) that was established in 1983 (5), the programme adopted three control strategies that were considered feasible, scientifically sound, and socially acceptable: immunization, case management, and health education. These can be summarized as follows:

(a) At the start of a national ARI programme efforts should be made simultaneously to strengthen the expanded programme on immunization (EPI) since four of the EPI vaccines - namely, those against measles, diphtheria, pertussis, and tuberculosis - can prevent morbidity and mortality from lower respiratory infections. However, this alone is not sufficient, since three-quarters of ARI deaths in young children in developing countries are due to other causes, which these vaccines cannot prevent.

(b) Case management is the central strategy of the programme, because it can in the short term significantly reduce the mortality and case fatality from acute lower respiratory infections. Recent intervention trials have strengthened the evidence of the effectiveness of this strategy at the community level (see section 3.1).

(c) The third strategy, health education of the public and of parents in particular, was intended to comprise the educational aspects of the immunization and case management strategies as well as educational activities related to non-specific measures to reduce the risk of ARI morbidity, for instance, dealing with such conditions as malnutrition, vitamin A deficiency, low birth-weight, exposure to cold weather, and indoor air pollution. The content of the health education strategy as regards immunization and case management was subsequently defined in the guidelines and training materials prepared by the WHO ARI programme. The activities relating to the non-specific measures for morbidity reduction, on the other hand, were to be defined by each country in the light of the relative importance of the various conditions and the resources available.

In 1987 the WHO programme reviewed these strategies and concluded that:

(i) health education should be an integral part of the immunization and case management strategies rather than a distinct strategic objective; and

(ii) the most cost-effective strategies for reducing morbidity through non-specific measures should be defined by the WHO ARI programme for use by national programmes. These will be selected on the basis of a thorough analysis of the effectiveness, feasibility and cost of these non-specific measures that will be initiated during the 1988-1989 biennium.

2.2 Development of materials for programme implementation

During 1987 the programme made available, usually in English, French and Spanish, the following materials to assist in implementing their ARI programmes. The first six of these had already been completed in English at least by the end of 1986; except where otherwise noted, the International Children's Centre in Paris collaborated in preparation of the French translations, and the Regional Office for the Americas undertook the Spanish translations.

2.2.1 Case management of acute respiratory infections in children in developing countries (6). This guide gives the rationale for the standardization of case management and provides a classification of ARI in children taking into account the capabilities of different categories of health workers and the various levels of health services. It also presents information on the most useful simple supportive measures and on when the use of antimicrobials is warranted.

2.2.2 Respiratory infections in children: management at small hospitals (7). This document contains background notes presenting the scientific evidence in support of the recommended approach for the case management of ARI and a manual for daily use by physicians working in hospitals where radiographic and microbiological facilities are limited or non-existent. The latter section is being published as a separate pocket-size booklet, in English and French by WHO (8) and in Spanish and Portuguese by the Pan American Health Organization.

2.2.3 Training modules. Two training modules are available for use in training first-level supervisors: Management of the child with cough, and Management of the child with ear, nose or throat infection. They are similar in format to the modules used in training courses for these supervisors in the WHO Diarrhoeal Diseases Control Programme (CDD) and the Expanded Programme on Immunization (EPI) and can be easily integrated with those modules in courses for staff who may be responsible for the execution of the three programmes. The ARI modules can also be taught independently over 2 days to workers who have already had training in CDD and EPI.

2.2.4 Operational Manual (9). The manual provides managerial information for the planning, implementation and evaluation of ARI control programmes. A set of exercises is also available for use in workshops for programme managers (10).

2.2.5 Audiovisual training aids. Two sets of 24 slides each on the management of cough in children, one for use in Africa and the other for use in Asia, have been produced by Teaching Aids at Low Cost (TALC), Institute of Child Health, London, under a contract with WHO. The slides illustrate the steps in the management of a child with cough as recommended by the programme and are accompanied by a record cassette containing an explanation of the slides. A French version is in preparation, and a Spanish adaptation was produced in 1987 by the National Institute of Epidemiology in Santa Fe, Argentina. This institute has been designated by the Pan American Health Organization and the UNICEF Regional

Office for Latin America as a reference centre for the collection, evaluation and promotion of training and educational material produced by the countries.

2.2.6 Video film. A video cassette describing the main respiratory signs that had been produced under contract for WHO by the Educational Resource Centre, Royal Children's Hospital, Melbourne, Australia, was made available in French and Spanish by WHO in 1987.

2.2.7 During 1987 two additional items were developed and made available in English; French and Spanish versions are being prepared:

(a) Two flip-charts for use in training and health education activities:

- A flip-chart entitled Acute Respiratory Infections has 21 pictures and legends describing the clinical management of both upper and lower respiratory infections. It is designed to help trainers to teach health workers how to care for children with respiratory infections.

- A flip-chart entitled Children with Coughs has 11 pictures and legends and is designed to help health workers talk to other persons about how they should care for children with coughs.

Both flip-charts are being distributed as prototypes and are meant to be adapted to the needs of national programmes.

b) A 42 x 60 cm poster, for use in peripheral health facilities and by community health workers, demonstrates with six colour pictures and brief legends how to discriminate among acute respiratory infections and treat them according to their severity. It is intended as an example of a "job aid", i.e., a quick guide to the important features of a particular task.

In addition, the programme contracted with the Educational Resource Centre in Melbourne, to produce a second video film, this one being concerned with the treatment of ARI in children. The two films produced by the Melbourne Centre eventually will be combined into a single cassette on ARI case management, covering both diagnosis and treatment.

Although every effort was made to maintain consistency in the technical content of this wide range of didactic materials, inevitably some inconsistencies have occurred. Moreover the use of these materials in regional workshops and national courses and the experience gained in intervention studies have brought to light some areas that can be improved. The programme will therefore convene in the first quarter of 1988 a small group of experts in the clinical management of ARI to recommend technical modifications to these materials, which will be revised accordingly.

In 1988 the programme will also initiate the preparation of modules for training programme managers in the planning, implementation,

supervision and evaluation of ARI control programme. In addition, a set of indicators for monitoring and evaluating national ARI programmes and tools for measuring these indicators will be developed.

2.3 Planning and implementation of national ARI control activities

By the end of 1987 ARI control programmes had begun to operate in 17 countries, most of them in Latin America (see Table 1). In all these countries technical guidelines have been prepared and a programme manager has been designated. Except in Costa Rica and Oman, where the programmes cover the entire country, the ARI control programmes in this group of countries have been started in a limited area (a few regions or a province) in view of resources constraints and the need to gain some initial experience with the case management strategy. In another 10 countries technical guidelines and a plan of operations have been prepared, but the programmes have not yet initiated activities. Two more countries (Argentina and Peru) have approved technical guidelines but have not yet developed a plan of operations. Thus in a total of 29 countries the ministry of health has taken some initial steps to plan or implement a national ARI control programme.

To date WHO staff and consultants have collaborated in analysing the background information and drafting technical guidelines and plans of operations in all WHO Regions: Africa (Malawi, Zimbabwe), the Americas (14 Latin American countries), the Eastern Mediterranean (Oman, Tunisia), Europe (Turkey), South-East Asia (Burma, Indonesia, Nepal and Sri Lanka), and the Western Pacific (China, Fiji, Laos, Malaysia, Papua New Guinea, Philippines, Samoa, Solomon Islands, Tonga, and Viet Nam).

The approach to planning has been similar to that adopted for diarrhoeal disease control (CDD) programmes. For example, it is felt that:

(a) the delivery of ARI programmes must be integrated with the delivery of other primary health care services (e.g., those for diarrhoeal disease control, immunization, nutrition, and the provision of essential drugs) since many of the activities concerned are similar and are executed by the same personnel;

(b) ARI programme strategies and plans of operation should be written as a distinct document before activities are initiated but should be incorporated into the national health plan;

(c) such plans must describe and analyse the current situation, set objectives and targets for reducing ARI severity and mortality in children, and for rationalizing the use of antimicrobials, schedule activities for several years, establish monitoring and evaluation mechanisms, and indicate budget allocations; existing plans can be strengthened once new training material for programme managers becomes available.

TABLE 1 - Status of ARI Control Programmes, December 1987

Region and Country	MOH unit responsible	Technical guidelines	Plan of operations	Implementation started	Coverage
<u>AFRICA</u>					
Malawi	EPID	Draft	Draft	-	-
Swaziland	EPID	Draft	Draft	-	-
Tanzania	EPID	Yes	Yes	Yes	3 regions
Zimbabwe	EPID	Yes	Yes	Yes	1 province
<u>AMERICAS</u>					
Argentina	TRI	Yes	-	-	-
Bolivia	MCH	Yes	Yes	Yes	-
Brazil	TRI	Yes	Yes	Yes	2900 health centres
Colombia	MCH	Yes	Yes	Yes	25 health centres
Costa Rica	MCH	Yes	Yes	Yes	National coverage
Ecuador	MCH	Yes	Yes	-	-
El Salvador	EPID	Yes	Yes	Yes	1 health area
Guatemala	EPID	Yes	Yes	Yes	3 departments
Honduras	EPID	Yes	Yes	Yes	632 health centres and posts
Mexico	EPID	Yes	Yes	Yes	2160 health units in 2 states
Panama	MCH	Yes	Yes	Yes	5 health regions
Paraguay	MCH	Yes	Yes	Yes	3 health regions
Peru	MCH	Yes	-	-	-
Venezuela	MCH	Yes	Yes	-	-
<u>EASTERN MEDITERRANEAN</u>					
Oman	MCH	Yes	Yes	Yes	National coverage
Sudan	EPID	Draft	Draft	-	-
Tunisia	MCH	Yes	Yes	Yes	3 governorates
<u>EUROPE</u>					
Turkey	MCH	Yes	Yes	Yes	1 province
<u>SOUTH-EAST ASIA</u>					
Burma	EPID	Yes	Yes	-	-
Indonesia	EPID	Yes	Yes	Yes	9 provinces
Sri Lanka	EPID	Yes	Yes	-	-
<u>WESTERN PACIFIC</u>					
China	MCH	Yes	Yes	-	-
Samoa	-	Yes	Yes	-	-
Solomon Islands	-	Yes	Yes	-	-
Viet Nam	TRI	Yes	Yes	Yes	Selected provinces

Abbreviations: EPID: Epidemiology/communicable diseases
MCH : Maternal and child health
MOH : Ministry of health
TRI : Tuberculosis and respiratory infections

2.4 Training

To promote the preparation of programme plans inter-country workshops were convened by WHO regional offices at which the ARI programme strategies and the available material were introduced to senior staff of the ministries of health. The first two such workshops were organized at the end of 1986 - in New Delhi for the South-East Asia Region, and in Manila for the Western Pacific Region. Six more workshops were organized in 1987, attended by 170 participants from 38 countries in three WHO Regions (Table 2). Over a period of five days, the participants reviewed the technical bases of an ARI programme, used the two training modules on case management, discussed the content of the operational manual, and applied the acquired knowledge to solving exercises related to programme implementation.

While the scheme for these workshops is capable of improvement, they have proved useful in familiarizing the ministries of health with the WHO materials that are available. As has already been mentioned, training modules will be prepared with which to equip programme managers with the skills they require to implement ARI programmes.

Table 2. ARI inter-country workshops for programme managers held in 1987

Place	Region	Month	Number of Countries	Number of Participants
Harare, Zimbabwe	Africa, Subregion III	April	7	26
Santa Fe, Argentina	Americas, Southern Cone	May	4	22
Washington, DC, USA	Americas, Caribbean	June	8	12
Cochabamba, Bolivia	Americas, Andean countries	June	5	41
San Salvador, El Salvador	Americas, Central America	September	7	50
Alexandria, Egypt	Eastern Mediterranean	October	7	19
Total			38	170

During 1987 middle-level courses were attended by 582 participants from 25 countries (Table 3). These courses were held for staff responsible for training and supervising peripheral health workers at a district or provincial level. In seven of these courses the two ARI modules on case management were used together with CDD supervisory skills modules that teach skills and knowledge related to community participation, training, setting of targets, monitoring of performance, and evaluation. In the other courses, devoted exclusively to ARI, material adapted from the ARI inter-country workshops was utilized.

Table 3. ARI courses for middle-level supervisors held in 1987

Region and Place	Number of participants	Associated with	Coverage
<u>AFRICA</u>			
Cameroon	32	CDD/EPI	7 countries
Mauritius	32	CDD/EPI	3 countries
United Republic of Tanzania	70	-	-
Zimbabwe	30	Birth spacing	-
<u>AMERICAS</u>			
Brazil	30	CDD	-
Dominican Republic	25	CDD	-
Ecuador	25	CDD	-
Paraguay	25	CDD	-
<u>SOUTH-EAST ASIA</u>			
Bhutan	20	CDD/EPI	-
Indonesia	50	PHC	-
Sri Lanka	27	CDD	2 countries
<u>WESTERN PACIFIC</u>			
China	58	-	17 provinces
Laos	30	-	7 provinces
Samoa	40	-	-
Solomon Islands	18	PHC	-
Viet Nam	70	-	16 provinces
Total	582		

Training on ARI case management for general practitioners and paramedical staff responsible for delivery of health care was intensively pursued in Latin America, where 11 844 health staff had reportedly been trained in 12 countries by the end of 1987. Elsewhere, only Viet Nam reported conducting 18 clinical courses in 1987 for 370 trainees. In all of these countries there is some doubt whether this training is sufficient to inculcate the skills required for proper ARI case management. The experience in the CDD programme has been that such training must include actual or simulated practice in case management to have the desired effect. In due course, the ARI programme plans to provide guidelines for this training.

During 1987 the first regional ARI training unit was established at El Chatby Hospital in Alexandria, Egypt, for countries in the Eastern Mediterranean Region. In December, the unit organized its first national course for physicians. In the 1988-1989 biennium the ARI programme plans to prepare training objectives and curricula for use in such units. It is hoped that regional or national units will be established in many countries during the next three years to provide centres in which to train senior health staff in ARI case management. These courses should allow participants to spend at least half their time in the actual treatment of cases with various degrees of severity.

2.5 Monitoring and evaluation

Although it is still too early to present results of monitoring, surveillance and evaluation activities, efforts have been undertaken in two areas that are worthy of note.

2.5.1 Morbidity, mortality and treatment surveys

The experience of the WHO CDD and EPI programmes is that special surveys can be useful for collecting reliable data on morbidity, mortality and treatment, which are often difficult to obtain through the routine information systems in developing countries. Because the magnitude and the target age group of the ARI and CDD programmes are similar, efforts have been made to organize joint ARI/CDD surveys using the cluster sample survey method, which has been widely used by the CDD programme. Combined ARI/CDD surveys were undertaken during 1987 in Brazil (Belém, Fortaleza, Brasilia, and Sao Paulo), Dominican Republic, Paraguay, and Venezuela in the Region of the Americas, in Haryana State, India, and in Sichuan Province, China. In these surveys data were collected through home visits on episodes of ARI during the past 2 weeks and on deaths from ARI during the past 12 months.

By the end of 1987 results were available from three of these surveys.

- In Fortaleza, Brazil, 20 deaths were registered among 1303 children 0-4 years old (0-4-year mortality rate, 15.3 per 1000; infant mortality rate, 64.9 per 1000). Among these deaths, 30% were ARI-associated. The 2-week incidence of ARI was 51.5%.
- In Haryana State, India, 258 deaths were recorded among 15 025 children surveyed (0-4-year mortality rate, 17.2 per 1000; infant mortality rate, 65.1 per 1000). Of these deaths, 37, or 14.3%, were ARI-associated. The 2-week incidence rate was 24.2%.
- In Sichuan Province, China, a survey of 7126 children 0-4 years old revealed a 0-4-year mortality rate of 23.2 per 1000 and an infant mortality rate of 65.5 per 1000. Pneumonia was reported to be the leading cause of death, accounting for 36% of all deaths. Among the 59 children who apparently died from pneumonia, 38 died at home, mostly because of the parents' unawareness of the severity of the disease.

One of the major concerns of these surveys has been the reliability of retrospective mortality information. An issue which has not yet been dealt with adequately is the definition of death from ARI (or pneumonia, more specifically), either as a direct or as an associated cause. A more adequate definition of a case of ARI and of pneumonia is also needed. Further developmental work on these issues will be conducted in 1988 in order to improve the present ARI survey questionnaire.

2.5.2 Surveillance of bacterial drug resistance

A global surveillance system was organized in 1987 to monitor the drug resistance of Streptococcus pneumoniae and Haemophilus influenzae, the two most common bacterial agents of pneumonia and otitis media in infants and young children. As a first step institutes were designated to coordinate these activities. The Streptococcus Department, Statens Seruminstitut, in Copenhagen, Denmark, is now coordinating the surveillance of drug resistance to S. pneumoniae. Strains sent from national laboratories are being tested for sensitivity to oxacillin (an indicator of penicillin sensitivity) and cotrimoxazole. At the end of 1987 laboratories from 10 countries had agreed to send it strains (Gambia, Kenya, and Mauritania in the African Region; Argentina, Chile, Peru, and Venezuela in the Region of the Americas; Saudi Arabia in the Eastern Mediterranean Region; and Malaysia and Papua New Guinea in the Western Pacific Region). The surveillance of Haemophilus influenzae drug resistance is to be coordinated by the Public Health Laboratory Service, John Radcliffe Hospital, Oxford, United Kingdom.

As from 1988 the programme will begin to strengthen the capability of national laboratories to undertake drug resistance surveillance for their national ARI programmes. This will include courses in bacteriological diagnostic methods, similar to that held in 1987 at the Institute of Hygiene and Epidemiology in Hanoi, Viet Nam.

3. RESEARCH COMPONENT

Since the inception of the WHO ARI programme, the limited resources available have been used primarily to support research to determine the feasibility, impact, and best means of implementing the case management strategy. In addition, a few other clinical, epidemiological and etiological studies have been funded.

Cooperation has also been established with the Board on Science and Technology for International Development (BOSTID), US National Research Council, Washington, DC, which sponsors research on the etiology and epidemiology of ARI in children in developing countries.

At its meeting in March 1987 the Technical Advisory Group on Acute Respiratory Infections recommended that a plan for the programme's research component be developed which identified priority topics and activities (11). A draft plan was accordingly prepared by the Secretariat (12); it will be finalized in May 1988 by a group of experts who will meet in Hanover, Federal Republic of Germany. The ARI programme hopes then to be able to expand its support of research activities in a significant manner.

The following paragraphs summarize the results of research supported by the ARI programme during the past few years and describe certain other related activities; particular emphasis is placed on results that became available and activities that took place in 1987.

3.1 Intervention trials

When WHO initiated the ARI programme, it was widely believed that little could be done to reduce childhood mortality from pneumonia in developing countries. In 1982, a group of epidemiologists convened by WHO formulated a design for research into the feasibility and the impact on childhood mortality of a prototype ARI intervention that could be carried out by community health workers following a standard case management protocol. This protocol based the management of a child with a cough on three signs: inability to drink, chest indrawing, and fast breathing. The design was originally intended for research in rural areas in which there was a high infant mortality rate and health care was given by paramedical personnel and community health workers.

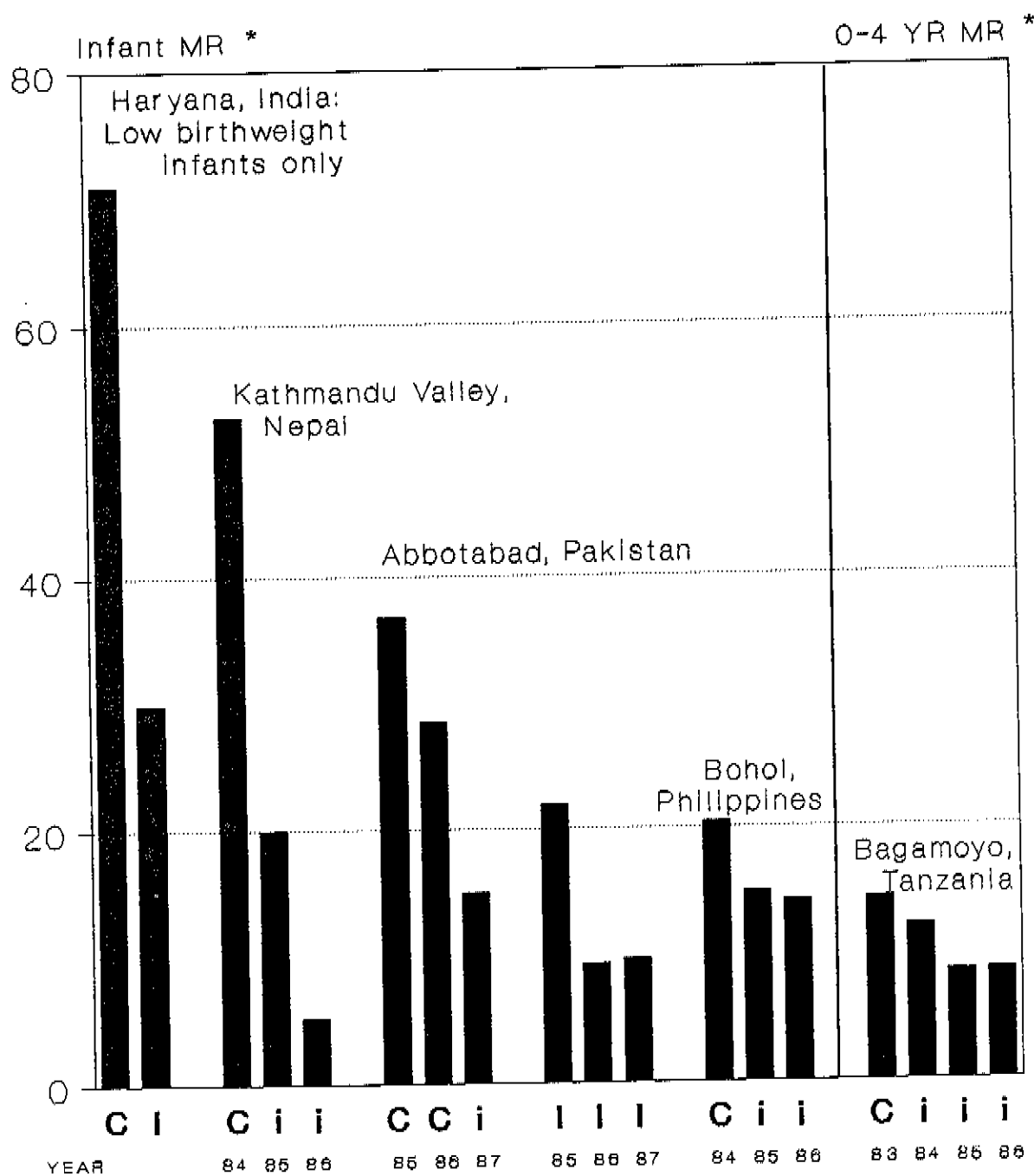
Two projects had provided a basis for this work. In Punjab State, India, in 1971, a primary health care programme developed simplified treatment protocols to allow paraprofessional health workers to provide antibiotic treatment for children with pneumonia in the community (13). In Papua New Guinea, simplified classifications based on respiratory rate and chest indrawing were devised to allow health workers to classify and treat or refer life-threatening ARI. The importance of bacterial infection with two predominant pathogens (Streptococcus pneumoniae and Hemophilus influenzae) in fatal pneumonia was documented (14). Experience in both projects suggested antibiotic treatment directed at these pathogens could lower the case-fatality rate from pneumonia.

Ten interventions studies were initiated between 1983 and 1985. Following similar protocols, four studies compared mortality results in an intervention area with those in a concurrent control area (Abottabad, Pakistan; Bagamoyo District, Tanzania; Bohol, Philippines; and Haryana State, India). Because of local circumstances or financial constraints, two studies compared pneumonia mortality in children before and after implementing the intervention (Kathmandu Valley, Nepal, and Kederi, Indonesia). Four of the 10 projects did not proceed further than the collection of baseline information before being discontinued, either because local working constraints precluded the gathering of reliable information (Somalia) or because the infant mortality rate was too low to permit the measurement of the impact (Kenya, Sri Lanka, and Tunisia).

In three of these studies immunization activities were implemented along with ARI case management (Nepal, Indonesia, and United Republic of Tanzania). The impact of these projects represents that achieved by the two interventions. Most recently, a study of ARI case management as the sole intervention in the absence of any other disease control programmes has been initiated with USAID support in Jumla, Nepal, in an area with very high infant and child mortality rates and serious malnutrition.

The five completed studies have all shown that the case management protocol is simple enough to be understood and applied by community health workers, and that it can significantly reduce the mortality rates from acute lower respiratory infections in children (see Figure 1). In all studies, total mortality was also reduced. Preliminary results from Jumla, Nepal and from Indonesia also indicate significant reductions in total mortality and mortality from acute lower respiratory infections.

Figure 1 Acute Lower Respiratory Infection- Specific Mortality Rates (MR)



C= control area (or year)
I= intervention area
i= intervention in previous control area

* Infant MR = deaths/ 1000 livebirths;
0-4 YR MR = deaths/ 1000 children <5 yr.

Some additional information on these studies is presented below. Full details can be found in the report of the meeting on Case Management of Acute Respiratory Infections in Children: Intervention Studies (document WHO/ARI/88.2).

(a) In Bagamoyo District, United Republic of Tanzania (15), an ARI intervention programme was implemented by village health workers. The programme included health education in the home to inform the mothers or other caretakers about the signs of moderate and severe ARI, treatment in clinics of moderate cases with cotrimoxazole, and the referral of severe cases. The same system of surveillance for births and deaths was carried out in the intervention and control areas. The intervention resulted in a reduction in mortality from acute lower respiratory infections. Figure 1 presents the change within the control area after case management was initiated in the second year. While this reduction was statistically significant, outside consultants reported that an even greater reduction could have been achieved had the case management protocol been better implemented. Although immunization coverage was increased, measles cases continued to occur. Field staff have reported that survival rates for cases of measles-associated pneumonia have improved since they started using the case management protocol.

(b) In a before-and-after comparison study organized in Kathmandu Valley, Nepal (16), trained lay reporters collected data by fortnightly household visits in the study area. When a child died, a health assistant conducted a "verbal autopsy". A central level team made periodic visits to check the quality and completeness of the information gathered. After one year of data collection, a case management intervention was introduced in which primary health care workers used oral ampicillin as a first-line drug for moderate and severe ARI cases and chloramphenicol as the second-line drug. Referral to hospital was difficult due to poor access. The results showed a marked fall in the mortality from acute lower respiratory infections among infants and among 1-4-year-old children during the intervention years, as compared with the baseline surveillance year (see Figure 1). Most deaths from acute lower respiratory infections in the intervention years were among children whose parents had continued to use traditional healers in spite of the educational efforts.

(c) In Ambala District, Haryana State, India (17), the feasibility of standard case management for ARI and its impact on mortality were evaluated in low-birth-weight infants, a group at high risk of death from acute lower respiratory infections. In both the intervention and the control areas, the birth weight of newborn children was recorded within 48 hours of delivery and all babies weighing less than 2500 g were included in the study. Study households were visited weekly by trained field workers to record episodes of illness and outcome until the child reached 1 year of age. The health workers in the intervention area were instructed in recognizing moderate and severe ARI and gave oral penicillin to moderate cases and referred severe cases. This programme significantly reduced the case-fatality rate in low-birth-weight infants, from 24.6% (in the control area) to 8.7% (in the intervention area). Figure 1 shows the substantial reduction achieved in mortality from acute lower respiratory infections in low-birth-weight infants.

(d) In a mountainous area of Abbotabad District, Pakistan, 20 villages were selected for the intervention programme, while eight villages served as the control. Community health workers in the intervention area were trained to recognize moderate and severe cases of ARI and to refer them to the nearest basic health unit or dispensary for treatment. If such referral was not possible the cases were treated with cotrimoxazole by the health worker. Referral to hospital was feasible in only a few cases because of the limited number of beds in the district hospital and the difficulties of providing transportation. Figure 1 shows the sustained reduction in mortality from acute lower respiratory infections in the intervention area and the rapid fall when the intervention was implemented in the control area.

(e) In Bohol Island, Philippines, mortality data were collected in the study population for one year prior to the intervention to allow a before-and-after comparison. Monitoring of deaths was done by three complementary methods: a household survey every six months, continuous reporting by informants who visited homes twice a month, and routine reports by the health services. After one year a standardized ARI case management intervention was introduced in half the area, in which clinic midwives were instructed to classify children with cough and treat moderate and severe cases of pneumonia. The reduction in mortality from pneumonia not associated with measles among children 0-4 years of age was small but greater in the intervention than in the control area. (Figure 1 presents the change in the pneumonia mortality rate not associated with measles in the intervention area). Among the reasons for the limited impact were inadequate education of those who cared for the children, difficulties in providing prompt referral, and the inability of the community health workers to prescribe antimicrobial treatment. About two-thirds of the children who died from acute lower respiratory infections in both the intervention and the control areas had not received any medical care.

3.2 Clinical and etiological studies

Since the scheme for ARI case management in young children is based on a clinical classification made by paramedical health workers, it is obviously important to verify how well the workers can recognize signs and symptoms after a short training period, and whether the proposed classification is adequately sensitive and specific for diagnosis.

Two studies to this end have been supported by the programme, one in Mandalay General Hospital in Burma, and the other at Omdurman Hospital, near Khartoum, Sudan. Health assistants were trained to recognize ARI-related signs and symptoms and to classify ARI cases as mild, moderate or severe. They were then deployed to screen children who presented at the outpatient department of the hospital and record their observations. The children were then examined by a paediatrician, treated as appropriate and followed up. A comparison was made of the observations and classifications made by the paramedical workers and paediatricians. The results of both studies are now being analysed.

WHO treatment guidelines recommend procaine penicillin as the best injectable antibiotic for the treatment of moderate ARI cases. However, in many countries, the administration of five daily doses of procaine penicillin is not operationally feasible at first-level health

facilities. Although benzathine penicillin is not as good a choice, since it is not always effective against *Haemophilus influenzae* infection, its ease of administration in a single dose might outweigh this technical disadvantage. A clinical trial to compare the efficacy and feasibility of ARI treatment with procaine penicillin and with benzathine penicillin is being carried out in Para State, Brazil, with the support of the WHO Regional Office for the Americas.

Studies of the etiology of ARI in children were started in 1987 in Lima, Peru, with the support of the Thrasher Foundation and the WHO Regional Office for the Americas, and in three sites in China - Beijing, Changchun and Guangzhou - with support from the WHO Regional Office for the Western Pacific. The study in China is focusing on the etiology of pneumonia.

Rapid techniques for the laboratory diagnosis of bacterial respiratory infections were assessed by a group of experts convened, in collaboration with WHO, by the Finnish Public Health Institute, in Helsinki, Finland, on 30-31 March 1987 (18); a research plan for the development and validation of these techniques in children was proposed.

3.3 Indoor air pollution studies

There are indications that high concentrations of acrid smoke and gaseous substances in the domestic environment may impair pulmonary defence mechanisms and thus serve as a risk factor for acute respiratory infections. This problem is of particular concern in infants and young children living in rural dwellings without proper ventilation. In collaboration with the WHO Prevention of Environmental Pollution unit, the ARI programme has initiated studies to assess the levels of indoor air pollutants stemming from the combustion of biomass fuel in rural areas. The first survey was carried out in Maragua, Kenya (19). Repeated 24-hour measurements of respirable suspended particles (RSP) and nitrogen dioxide (NO₂) were carried out in 36 randomly selected houses where cooking was done mostly on open fires of firewood or crop residues. The mean 24-hour average RSP measurement was 1400 micrograms per m³; this average was much higher during the 7 hours per day in which the fire was burning, reaching peak levels of up to 36 000. These levels exceeded by about 10 times the WHO recommendation for exposure to particulate matter for the general population.

A second study was carried out in the Basse area of the Gambia, in collaboration with the British Medical Research Council unit in Fajara (20).³ A mean 24-hour average RSP concentration of 1860 micrograms per m³ was found in homes. As some of the particles were from a source other than wood smoke (probably sand dust), the levels of wood smoke were believed to be somewhat lower than in Kenya, but they were still very high and likely to cause adverse effects on the lower respiratory tract of exposed persons, in particular young children.

Contacts have been established with ARI research project managers in Chandigarh, India, Lombok, Indonesia, and Goroka, Papua New Guinea, to determine their interest in evaluating the contribution to the incidence and severity of ARI of indoor air pollution caused by the combustion of biomass fuel.

3.4 Vaccine development

Effective, safe and inexpensive vaccines offer the best long-term solution to the prevention of acute respiratory infections, especially pneumonia. Within WHO, research to develop vaccines against respiratory viruses is supported at present by the Division of Communicable Diseases, under the guidance of a Steering Committee on Acute Respiratory Viruses established by a Scientific Advisory Group of Experts for Vaccine Development (SAGE). This steering committee has to date limited its support to projects for the development of vaccines against respiratory syncytial and parainfluenza type 3 viruses, and more specifically to basic research aimed at gaining a better understanding of the structure and properties of these viruses. Should this research lead to the development of candidate vaccines, the ARI programme will be responsible for supporting field trials to test their efficacy in children. A WHO staff member working with the ARI programme has been designated co-secretary of the Steering Committee on Acute Respiratory Viruses to ensure close cooperation between the programme and the Division of Communicable Diseases.

A Steering Committee on Encapsulated Bacteria has also been established under SAGE, but its efforts are concentrated on the development of vaccines against meningococcal infection. Accordingly, the ARI programme plans in 1988 to take full responsibility for the promotion and support of research and development concerning vaccines against Streptococcus pneumoniae and Haemophilus influenzae, the main bacterial agents causing pneumonia in children. In this effort the programme plans to build upon important progress already made in the development of polysaccharide vaccines. This includes:

- A new Haemophilus influenzae type b vaccine, composed of polyribosylribitol phosphate (PRP) conjugated to diphtheria toxoid (PRP-D), which has been shown to be significantly more immunogenic and protective than PRP alone in children 3-18 months of age (21) and has recently been licensed in the USA. Plans will be developed to evaluate the efficacy of this vaccine against pneumonia in children in developing countries.
- A pneumococcal polysaccharide vaccine, which provided 58% protection in children 6 months to 5 years of age living in one area of Papua New Guinea, but no protection in another nearby area (22). There is a need to test the vaccine in other populations, and support for this is being provided by the United States Agency for International Development. During 1987 an ad hoc group in which the ARI programme participated defined the desirable features of a site to test pneumococcal vaccines in children for the prevention of respiratory disease morbidity and mortality and proposed four areas as possible sites for future vaccine trials: the Eastern Region of the Gambia, Senegal, North-east Brazil, and the Apache and Navajo Indian reservations in Arizona, USA.

4. INFORMATION SERVICES

The provision of information on the acute respiratory infections continued to increase steadily in 1987 as a result of a growing awareness of the problem and efforts made by the programme and other interested organizations and agencies.

In 1987 the programme continued to support publication of its global newsletter, ARI News, under a contract with the Appropriate Health Resources and Technologies Action Group (AHRTAG) in London, United Kingdom. Contributions to the programme for the newsletter were made by the Swedish Agency for Research Cooperation with Developing Countries (SAREC), the Pan American Health and Education Foundation (PAHEF), and UNICEF. The newsletter is printed in English every four months and 25 000 copies are distributed free of charge. Issues Nos. 7-9 were published in 1987. No. 7 contained a review of the case management strategy in an ARI programme; No. 8 was devoted to a description of supportive measures for mild ARI cases; and No. 9 reviewed information on viruses causing respiratory infection.

In 1987, Spanish and French translations also became available. The Spanish version is undertaken by the Pan American Health Organization with the collaboration of the UNICEF Regional Office for Latin America in Bogota, Colombia. Altogether 39 000 copies of issues No. 1-3 and 30 000 copies of issues No. 4-6 were published and distributed. Issue No. 1 of the French version (5000 copies) was printed and distributed with the participation of the International Union against Tuberculosis and Lung Disease.

The programme also continued to distribute its documents and publications and reprints of papers published in scientific journals and periodicals, free of charge, to about 800 addresses on a computerized mailing list. This list includes institutions, public health administrators, teachers of paediatrics, and scientists in developing countries who are interested in ARI. The full list of publications issued to date is available as document WHO/RSD/87.33 Rev.1.

In addition, a Bibliography on Respiratory Infections in Children is published every 6 months in English by the Pan American Health Organization with the collaboration of the US National Library of Medicine. Two numbers of Volume 6 were issued in 1987, 4000 copies of each, of which 3000 were distributed free of charge to developing countries and through the ARI programme mailing list.

In 1987, with the assistance of the WHO Division of Public Information and Education for Health, an information dossier was published in English and French for policy-makers, opinion-makers, members of the medical profession, and public health administrators. The dossier provides up-to-date information on ARI and addresses some of the technical, operational, legal and social problems which may impede the implementation of ARI programmes in developing countries and which a public information programme can help to overcome. It contains seven articles, a leaflet with photographs, and a set of charts.

5. PROGRAMME MANAGEMENT AND RESOURCES

5.1 Organization

Prior to the establishment of the ARI programme, the Organization carried out some activities related to acute respiratory infections through the units that were concerned with virus diseases and bacterial diseases. This work dealt mainly with the surveillance of etiological agents, particularly influenza viruses, and with the standardization of laboratory diagnostic methods. When it became operational in 1983, the new ARI programme was entrusted to the Tuberculosis unit, which was renamed the Tuberculosis and Respiratory Infections (TRI) unit.

On 1 August 1987, the ARI programme was placed under a common management with the Diarrhoeal Diseases Control (CDD) Programme. This decision was based on the following considerations:

(a) there are similarities in the nature and magnitude of the problems of acute respiratory infections and diarrhoeal diseases in children in developing countries;

(b) both programmes use case management strategies to reduce mortality and are exploring similar approaches (e.g., vaccination) to reduce morbidity;

(c) the ARI programme could benefit from the CDD experience in collaborating with governments in implementing control programmes and with scientists in supporting research, and in coordinating the efforts of multilateral and bilateral agencies.

At WHO Headquarters, the ARI programme is staffed by a programme manager. All the WHO Regional Offices have designated a focal point for ARI within the communicable diseases programmes, except the Regional Office for the Americas, where ARI is within the maternal and child health programme together with EPI and CDD. Full-time ARI medical officers are assigned in the Regional Offices for the Americas and for the Western Pacific. In the South-East Asia Regional Office an Associate Professional Officer is responsible for ARI activities under the supervision of the Regional Adviser in Communicable Diseases. In the African and the Eastern Mediterranean Regional Offices the staff member in charge of the CDD programme is also responsible for ARI. In the European Regional Office ARI is included among the functions of the Regional Adviser in Communicable Diseases.

At the outset a Technical Advisory Group (TAG) was established by the Director-General to advise the ARI programme on its priorities and to provide an independent assessment of its activities. As has been mentioned earlier, at its first meeting, in March 1983, the TAG defined the scope and strategies of the programme (5). At its second meeting, in March 1985, it assessed the progress made in 1983 and 1984 and recommended the preparation of technical and managerial materials for use by national ARI control programmes (23). At its third meeting, in March 1987, the TAG reaffirmed the aims and priorities of the programme, reviewed the new evidence on the impact of case management in reducing ARI mortality in children, and stressed the need to expand resources in order to accelerate the implementation of national control programmes and to support further research and development activities (11).

5.2 Resources

The resources made available to the programme from 1982 up to 31 December 1987 under all sources of funds are shown in Table 4. The programme had at that date received extrabudgetary contributions from seven agencies and organizations. In the 1986-1987 biennium US\$ 1 184 676 were available from the WHO regular budget and a further US\$ 1 161 191 were received from six contributors, making a total of US\$ 2 345 867.

The table does not include US\$ 100 000 which, upon WHO's request, were made available direct to ARHTAG, London, for the production and distribution of the ARI News by the Edna McConnell Clark Foundation (US\$ 30 000 in 1985), the Pan American Health and Education Foundation (US\$ 60 000 in 1985-1987) and UNICEF (US\$ 10 000 in 1987).

Table 4. Resources available to the ARI programme up to 31 December 1987 (in US\$)

SOURCE	1982-83	1984-85	1986-87
<u>WHO regular budget</u>			
Global and interregional	296 800	560 206	624 365
Regions	342 100	466 536	560 311
Subtotal, WHO regular budget	638 900	1 026 742	1 184 676
<u>Other sources</u>			
Japan			145 000
Netherlands			175 951
Sweden	75 000	141 336	547 140
Pan American Health Organization			68 800
Arab Gulf Programme for UN Development Organizations	40 000	280 000	
Kellogg Foundation		34 000	68 000
Sasakawa Health Trust Fund	91 050	294 804	156 300
Subtotal, other sources	206 050	750 140	1 161 191
TOTAL	844 950	1 776 882	2 345 867

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