WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTÉ

A40/4

6 March 1987

FORTIETH WORLD HEALTH ASSEMBLY

Provisional agenda item 18.2

DIARRHOEAL DISEASES CONTROL PROGRAMME

Progress report by the Director-General

This report is presented for review in response to resolution WHA35.22, and describes the progress and current status of the Programme. It reviews the strategies being promoted for diarrhoeal diseases control; the activities and achievements of the health services component; the current global situation of cholera and approaches for its control; and the activities of the research component, including the progress made in priority areas. The final section describes the Programme's increased targets for 1989 and proposes lines of action to be followed by Member States in collaboration with WHO.

The report was examined by the Executive Board, which in its resolution EB79.R8, recommended a resolution for adoption by the Health Assembly. The report has subsequently been amended to take into account the latest information available, and the figures in the third preambular paragraph of the recommended resolution will need to be modified accordingly.

CONTENTS

1. BACKGROUND

1.1 The Diarrhoeal Diseases Control (CDD) Programme has its basis in resolution WHA31.44, adopted by the Thirty-first World Health Assembly in May 1978, in accordance with which WHO established a global programme with the objectives of reducing mortality and morbidity from diarrhoeal diseases and their associated ill-effects, particularly malnutrition, in infants and young children. In 1982 the Health Assembly reviewed the progress of the Programme, and in resolution WHA35.22 urged Member States to intensify their diarrhoeal disease control activities as an entry point to primary health care.

1.2 Since its inception the Programme has been built up on two main components: a health services component concerned with the incorporation of available knowledge on the treatment and prevention of diarrhoeal diseases into national primary health care programmes; and a research component, through which support is given to applied (health services) research to improve the delivery of existing control strategies, and basic (biomedical) research to develop and test new or better tools and approaches for control. While these two components are, for convenience, described separately below, their close linkage in one programme is meant to ensure that the research supported is highly relevant to the needs of control programmes, and that new research findings can be rapidly applied in such programmes.

1.3 The Programme has been guided by a Technical Advisory Group, composed of leading scientists and public health administrators, who meet annually and assure an independent review and evaluation of the Programme from the scientific and technical point of view. Since 1981 a Management Review Committee, composed of representatives of interested organizations of the United Nations system (WHO, UNDP, UNICEF), the World Bank, and three national representatives serving on a rotating (two-year) basis, has carried out an annual review of the management of the Programme, and of budgetary and financial matters in particular. The recommendations of these two groups are considered by an annual Meeting of Interested Parties, attended by representatives of governments and agencies that are contributing or are interested in contributing financial support to the Programme, and representatives from developing countries with control programmes. This meeting reviews the progress and plans of the Programme and receives pledges of financial support.

1.4 Since 1978 the Programme has received financial resources from 29 contributors (including WHO), totalling US$ 49.5 million. The Programme's estimated budget for the 1986-1987 biennium is US$ 19.5 million; its projected budget for the 1988-1989 biennium is US$ 22.8 million.

1.5 The following is a brief account of the present status and plans of the Programme. Further details of its activities are available in documents issued by the Programme, in particular its Fifth Programme Report.[1]

2. PROGRAMME STATUS

Health services component

Control strategies

2.1 There is a broad consensus that the greatest and most immediate impact on diarrhoeal mortality can be achieved through proper case management. The elements of this strategy include:

- prevention of dehydration, through early treatment of diarrhoea in the home using available or specially prepared solutions;
- treatment of dehydration, using oral rehydration salts (ORS) supplied throughout the health care system;
- prevention of the nutritional consequences of diarrhoea, through proper feeding during and after illness; and
- selective use of intravenous fluids for the treatment of severe dehydration, and of antibiotics for the treatment of cholera and shigella dysentery.

2.2 Successful implementation of this strategy, as spelt out in a WHO/UNICEF statement,[2] can reduce by as much as two-thirds diarrhoea mortality, case fatality, and treatment costs. It can also prevent many cases of malnutrition and persistent (or chronic) diarrhoea. It requires that all families be educated and motivated to treat diarrhoea correctly when it starts, using ingredients available to them in the home, and that all health workers involved in child care acquire skill and confidence in the use of ORS. There must be a balanced programme which ensures that families are on the one hand self-sufficient in caring at home for the vast majority of diarrhoea cases and, on the other, making use of the health services for treatment of the more severe cases requiring ORS or even intravenous fluid. Home solutions and ORS have a complementary role in case management and should not be considered as interchangeable alternatives (see also paragraph 2.7).

2.3 Based on an extensive review of the effectiveness, feasibility, and cost of other potential interventions for the reduction of diarrhoeal morbidity and mortality, the Programme has formulated a package of three additional strategies that deserve high priority in national CDD programmes. These are:

---

[1] Fifth Programme Report, 1984-1985 (document WHO/CDD/86.16).

[2] The management of diarrhoea and use of oral rehydration therapy: A joint WHO/UNICEF statement. 2nd ed. Geneva, WHO, 1985.

- improved nutrition, through uninterrupted breast-feeding for the first year of life and proper weaning;

- use of safe water, especially the collection of an ample supply from the safest source and its protection in the home from contamination; and

- good personal and domestic hygiene, particularly the use of latrines, care in disposing of babies' stools, and hand-washing.

These strategies are already being implemented to some degree in most countries. It is anticipated that they will receive increasing priority in national CDD programmes as oral rehydration therapy (ORT)[1] becomes more widely used and diarrhoeal mortality decreases. Measles immunization has also been identified as a high priority intervention, but since the WHO Expanded Programme on Immunization is actively collaborating with countries in that area it has not been included as a priority action for CDD.

Implementation of national programmes

2.4 In the development of national CDD programmes, WHO has given high priority to the strengthening of programme management, starting with careful planning. At the end of 1986 110 countries had plans for CDD programmes, comprising 87% of the 125 target countries and an estimated 98% of the total population of those countries; the plans were operational in 93 countries. By the end of the 1986-1987 biennium, plans will have been prepared by all target countries. In all countries with operational programmes a CDD programme manager with support staff has been appointed at the central level, though the programmes themselves are being implemented as an integral part of maternal and child health and other primary health care services, using existing health care personnel. Because diarrhoeal diseases are so common and there is a simple and highly effective approach to their treatment, activities for their control can result in mothers and other family members gaining confidence in their ability to care for themselves and in communities being more actively involved in health care; thus they are a valuable entry point for other preventive and curative services of primary health care.

Training

2.5 Managerial and technical training are priority areas of the Programme. By the end of 1986 at least 8450 senior health staff had taken part in supervisory skills training courses, though participants represent only around 5% of the target group. Many countries have made use of the "Treatment of diarrhoea" module in the supervisory skills course to train peripheral-level health workers. Both this course and the programme managers' training course are at present being revised to provide more information on household ORT solutions, preventive control strategies (see paragraph 2.3), and better approaches for planning, monitoring, and evaluating Programme activities. Since 1983 CDD supervisory skills training has often been combined with training under the Expanded Programme on Immunization, and since 1986 it has been possible also to combine training in the treatment of acute respiratory infections. A training module on child spacing is under development. It is estimated that by the end of 1986 6% of health staff had received training in diarrhoea management, which includes "hands-on" training in ORT. Many of these courses are given in regional, subregional or national diarrhoea training units established in all WHO regions. In the African Region three subregional training units have been established in Angola, Ethiopia, and Senegal, and three more units are being set up in Cameroon, Malawi, and Zaire as part of an agreement between the Regional Office and the Control of Childhood Communicable Diseases project sponsored by the United States Agency for International Development. To help ensure the effectiveness of courses run in these units, the Programme has developed a training package on clinical management; this includes a Director's Guide which describes how to plan, conduct, and evaluate courses and assist participants in establishing units, and contains lecture and audiovisual materials for use in courses.

---

[1] The term oral rehydration therapy (ORT), as used throughout this report, is defined as the administration of fluid by mouth to prevent or correct the dehydration that is a consequence of diarrhoea.

2.6 Recognizing that, in the long-term, appropriate training of students entering the health care professions is the best means of ensuring proper diarrhoea case management, the Programme has given emphasis to the strengthening of teaching of diarrhoeal disease control strategies in medical and paramedical training institutions. In collaboration with the Expanded Programme on Immunization workshops have been organized in numerous countries to review and modify the curricula of schools for nurses, midwives, and health assistants. The Programme is producing, with the assistance of the USAID-funded PRITECH project, a manual outlining procedures for the establishment and operation of small diarrhoea units in teaching hospitals, and learning materials for medical students during their paediatrics and community medicine rotations. Because many health workers in developing countries receive training - or are influenced by medical teaching and practices - in developed countries, the Programme has also been promoting the use of ORT in developed countries through participation in training courses in medical and paramedical institutes in France, Italy, the Netherlands, Sweden, the USSR, the United Kingdom and the USA. It is also collaborating closely with the International Paediatric Association in the organization of global, regional, and national workshops at which senior representatives of paediatric societies in developed and developing countries discuss appropriate approaches to diarrhoea management and prevention, and possible ways in which paediatricians can support national CDD programmes.

Promotion of oral rehydration therapy

2.7 A review carried out by the Programme[1] has shown that approaches to early home treatment of diarrhoea vary widely. Salt-sugar solution has been the home fluid promoted most frequently. However, numerous constraints have been associated with its preparation and use, such as the uncertain availability and variable quality of sugar, and at times also of salt, the lack of suitable utensils for measuring the ingredients and water, and mothers' difficulty in learning, retaining, and using the skills required for proper preparation and administration. For this reason, more attention is now being given to the use of food-based solutions (e.g. gruels, soups) with which mothers are already familiar. As a general guide, national programmes should select for use home solutions that are physiologically appropriate and easy to prepare accurately, and for which the ingredients and utensils are widely available. The choice of solution may require operational research, and should take into account such factors as traditional practices for diarrhoea treatment, knowledge and beliefs about the cause of diarrhoea, the composition and availability of common food-based solutions, the availability and cost of sugar, the availability of a standard measuring utensil, and the ability of national CDD programmes to provide training for health workers and ORS supplies to treat cases of dehydration. Guidelines on the selection of a home solution for use in national CDD programmes have been developed.[2]

2.8 Almost all national programmes are using ORS as a universal solution for the treatment of dehydration. WHO and UNICEF have jointly issued new guidelines for ORS production,[3] which include detailed recommendations for production of the new, more stable ORS formulation containing 2,9 grams of trisodium citrate, dihydrate, in place of 2.5 grams of sodium bicarbonate.[4] In 1986 an estimated 270 million one litre-equivalent ORS packets were produced worldwide, representing a five- to six-fold increase over the number of packets available in 1981. Local production accounted for 56% of the total supply, UNICEF provided 24%, and the remaining 20% came from other external suppliers and commercial importation. It is expected that the percentage of locally produced packets will increase as more countries undertake production. The advantage of local production is that it allows the use of a country-specific presentation and a dose corresponding to the size of a container that is available nationwide. By the end of 1986 47 developing countries were producing ORS. WHO and UNICEF collaborated closely with many of these countries in the purchase of equipment and in establishing quality control procedures. When requested by ministries of health, this

---

[1] Oral rehydration therapy for treatment of diarrhoea in the home (document WHO/CDD/SER/86.9).

[2] A decision process for establishing policy on home therapy for diarrhoea (document WHO/CDD/SER/87.10).

[3] Oral rehydration salts: Planning, establishment and operation of production facilities (document WHO/CDD/SER/85.8).

[4] Other ingredients in ORS include 3.5 g sodium chloride, 1.5 g potassium chloride and 20 g glucose in one litre of water.

collaboration has been extended to local commercial manufacturers who are assisting in meeting national requirements. In providing this assistance the Programme has stressed the importance of the private and public sectors working together to develop a uniform ORS formulation and packet label.

Communications

2.9 Countries that have committed a considerable amount of resources to informing the public on the proper treatment and prevention of diarrhoea (e.g. Egypt, Honduras) are among those with the most successful CDD programmes. The effective communication activities have focused on the needs of consumers, not just providers, and have been undertaken as an integral part of a comprehensive control programme which includes adequate training of health personnel and a dependable supply of ORS. Such activities can use a mixture of approaches, including the mass media, traditional media (e.g. folklore), printed materials, schools, and face-to-face interaction, to convey standardized messages that are specially designed for the target audience. As in other programmes (e.g. the Expanded Programme on Immunization), short-term intensive "campaigns" to sensitize the public to ORT or other control strategies cannot be effective unless they are undertaken as part of a long-term plan of activities for achieving programme targets. To improve the understanding and use of communication approaches in national CDD programmes, a manual is being prepared for programme managers, describing the steps in the communication process, the CDD programme manager's role at each step, and the assessment and use of public and private sector resources to support communication activities. Through the appointment of a joint WHO/UNICEF staff member in early 1987, the capacity of both organizations to provide technical assistance in this area has been greatly strengthened.

Evaluation

2.10 The Programme has been collaborating with countries in documenting the extent of the diarrhoea problem and in monitoring the progress of their programmes and evaluating their impact. As of December 1986 49 countries had conducted 193 morbidity, mortality, and treatment surveys, using a common protocol prepared by the Programme. The results showed that, globally, each child under five years of age has an average of 3.5 attacks per year and about one-third of all deaths in this age group are diarrhoea-associated. The highest rates for diarrhoea morbidity, diarrhoea-associated mortality, and proportion of deaths associated with diarrhoea are found in the African Region. The Programme is developing guidelines to improve the accuracy of the surveys so that they may be used to demonstrate the impact of programmes, while at the same time exploring other approaches for the measurement of mortality. The Programme has also prepared guidelines for establishing sentinel reporting systems using a small number of selected health facilities as a tool for monitoring national programmes. Such a system could be used simultaneously to monitor other programmes (e.g. acute respiratory infections, and the Expanded Programme on Immunization), and should be seen as complementary to routine reporting systems.

2.11 As of December 1986 the Programme had participated, often with other international and bilateral agencies, in 48 formal external evaluations or reviews of national CDD programmes carried out in 43 countries. Approximately one-half of these also assessed one or more other components of primary health care, especially the Expanded Programme on Immunization. Such reviews constitute an independent evaluation of national programmes and provide an opportunity for an exchange of experience for programme managers from neighbouring countries. The protocol for these reviews is being improved to facilitate its use and to include information on the preventive strategies.

2.12 Since 1984 governments have provided the Programme with information obtained from surveys, surveillance systems, programme reviews, and special studies on access to and use of ORS and household solutions, using a standard format. The data available to date show that the estimated global minimum rate of access to ORS in the population of the developing countries (excluding China) increased from 4% in 1982 to 51% in 1985, and even to 70% in the South-East Asia Region (Figure 1). The estimated minimum proportion of diarrhoea cases in children below the age of 5 treated with ORS rose from 5% in 1983 to 11% in 1985 (excluding China); if the proportion treated with a salt-sugar solution (information on other household solutions being as yet incomplete) is also included, the global minimum ORT use rate in 1985 was 18% (Table 1). This rate may have prevented 500 000 deaths from diarrhoea in 1985. Efforts will be made to develop similar types of indicators for some of the other Programme strategies in the years ahead.

FIG. 1 ESTIMATED MINIMUM ORS ACCESS RATE 1982 – 1985

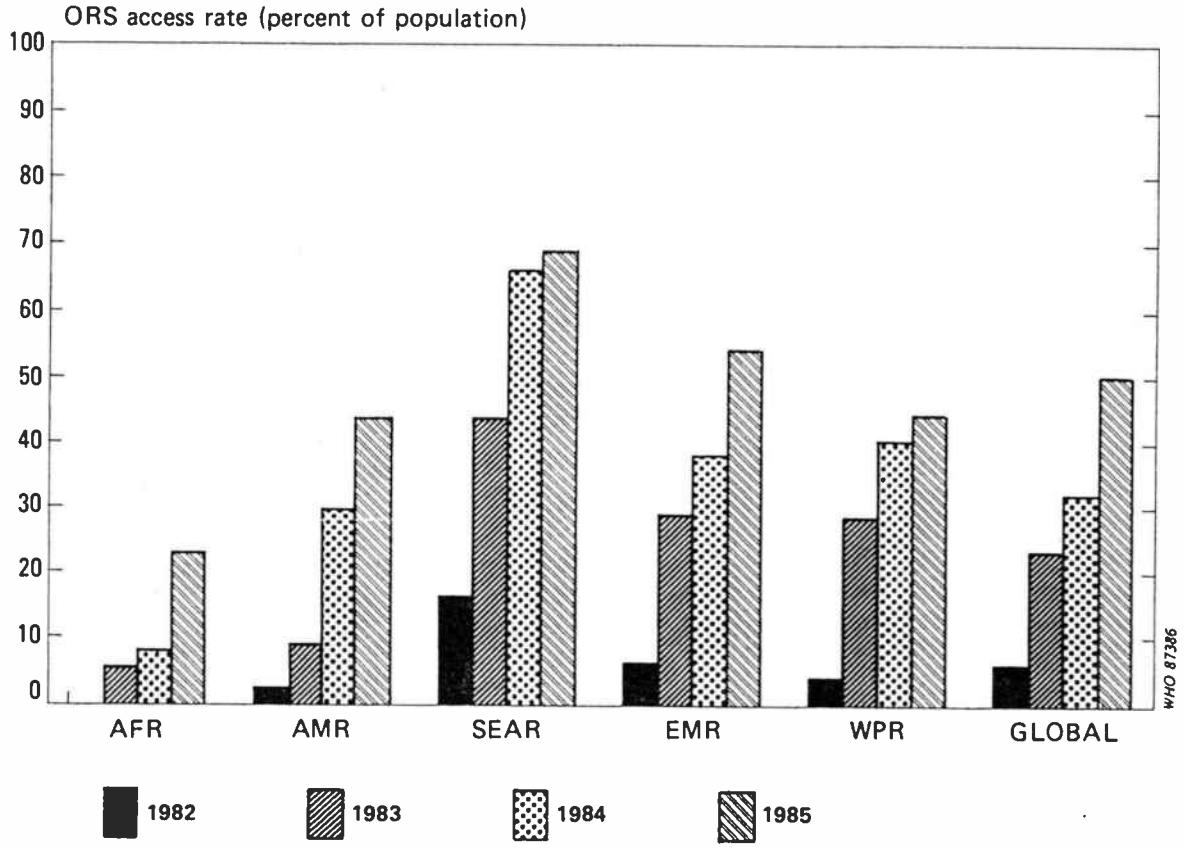

TABLE 1. ESTIMATED MINIMUM USE RATES FOR ORS AND ORT IN CHILDREN AGED 0-4 YEARS, 1983-1985, BY REGION AND GLOBALLY[a]

Region	ORS use rate			ORT use rate	
	1983	1984	1985	1984	1985
Africa	1	3	5	4	8
The Americas	2	12	10	12	10
South-East Asia	9	9	12	14	25
Eastern Mediterranean	6	12	17	21	22
Western Pacific[b]	9	13	22	27	32
Global[b]	5	8	11	12	18

[a] Use rates refer to the proportion of episodes of diarrhoea in children 0-4 years of age treated with ORS or ORT, respectively. ORT is taken here to mean ORS or sugar/salt solution. When estimates for both were available for a country, the midpoint betwen the sum and the greater of the 2 values was used as the ORT use rate. All numerators were calculated assuming no use of ORS or ORT in countries for which no data were available.

[b] Excluding China.

2.13 Programme reviews and special studies have documented significant decreases in diarrhoea admission rates and case-fatality rates and in the cost of treatment of cases in large urban hospitals in a number of countries where ORT has replaced intravenous therapy as the routine practice in the management of diarrhoea. This impact can be attributed to the higher efficacy and lower cost of ORT, and less frequent complications associated with its use. Experience has shown that, in any treatment facility, intravenous fluid is needed in no more than 5% of cases of diarrhoea, except for cholera where it may be required in 10-15% of cases. As demonstration of these advantages of ORS may be particularly useful to obtain support for national CDD programmes from senior health administrators and practitioners, it may be appropriate in the early stages of programmes to concentrate on ensuring that all children visiting major health facilities receive proper therapy; during such visits family members can be taught about home solutions and diarrhoea prevention. Once ORT is well accepted by senior health officials, activities to expand ORS access and use and to increase the use of home solutions can be more easily accelerated.

2.14 Programme reviews have also identified a number of constraints shared by national programmes. These include: inadequate training of health staff in diarrhoea case management, lack of standardized guidelines for treatment in health facilities, uneven distribution of ORS, failure to identify a household solution for early treatment of diarrhoea, and the need for improved supervision of CDD activities. The routine use of antidiarrhoeal preparations and antibiotics has been an almost universal observation. This is particularly disturbing, since they are costly, divert the attention of families from the need for rehydration and feeding during diarrhoea and, in the case of antidiarrhoeal preparations, are either of no efficacy or potentially dangerous in young children. The Programme is developing a manual which has been field-tested in Indonesia and Nepal and suggests a step-by-step approach to the costing of diarrhoea treatment in health facilities; it should help to document the extent and cost of use of these drugs. The natural desire to stop the diarrhoea, which is responsible for the popularity of these drugs, will hopefully be met by the development of an ORS solution which itself is antidiarrhoeal (see paragraph 2.24).

Collaboration with other WHO programmes and international and bilateral agencies

2.15 At the global, regional, and country levels the Programme has been collaborating extensively with other WHO programmes and international and bilateral agencies. For example, it is collaborating (a) with the Expanded Programme on Immunization, the Tuberculosis and Respiratory Infections Unit, and the Action Programme on Essential Drugs in the training of mid-level workers; (b) with the Expanded Programme on Immunization, the Joint Nutrition Support Programme, and the Division of Strengthening of Health Services in programme evaluations; (c) with the Pharmaceuticals Unit in ensuring a quality standard for ORS; and (d) with the Division of Environmental Health in the development and application of "minimum evaluation procedures" to examine the use and maintenance of water and sanitation facilities. As regards other agencies, close cooperation with UNICEF has accelerated the implementation of national CDD programmes in many countries. UNDP has provided valuable support to national CDD programmes, including the development of diarrhoea training units and the training of managers in 14 Asian countries. The Programme has also collaborated with UNIDO in local ORS production, with UNHCR in efforts to control cholera outbreaks in refugee populations, and with the "Child Alive" project of the League of Red Cross and Red Crescent Societies. The Governments of Denmark, Finland, Italy, Japan, the Netherlands, and Sweden have provided generous support to the Programme at both global and national levels, including the assignment of Associate Professional Officers to programmes in 15 countries, one regional office and the three Subregional Health Development Offices in the African Region. Bilateral agencies (representing Australia, Belgium, Canada, China, France, India, Japan, Morocco, Nigeria, Norway, Switzerland, the United Kingdom, and the USA) and private and voluntary organizations (Arab Gulf Programme for United Nations Development Organizations, Rotary International, Sasakawa Health Trust Fund, Ciba-Geigy) have also provided invaluable external support to the Programme at both global and national levels. In 1983 and 1985 WHO, together with the International Centre for Diarrhoeal Diseases Research, Bangladesh, UNICEF, UNDP and the World Bank, cooperated in the holding of a large international conference on oral rehydration therapy organized by USAID and attended by participants from more than one hundred developing countries.

Cholera control

2.16 Because of its epidemic potential, cholera remains a special concern of health officials, even though in endemic areas it accounts for no more than 5-10% of all diarrhoea cases. Since the beginning of the present (seventh) pandemic of cholera in 1961, cholera has been reported by 93 countries, primarily in Africa and Asia. In many countries, for reasons that are unknown, the disease, while seasonal, has often occurred in three- to four-year cycles. During 1984 cholera was reported by more African countries than at any time since 1978. Since then, large outbreaks with high case-fatality rates have occurred in West Africa and in both refugee and indigenous populations in East Africa. Reasons for the high case-fatality rates have included inadequate surveillance systems for early detection of cases, poor access to health workers, shortage of supplies and transport, use of inappropriate treatment, poor nutritional status of the affected population, and traditional practices (e.g. at funerals) which facilitate disease transmission.

2.17 The current situation and control of cholera in Africa were discussed during three subregional working group meetings on technical cooperation among developing countries held in Côte d'Ivoire, Kenya, and Mauritius in March 1985. In June 1986 a meeting to review strategies for the control of cholera was organized by Subregional Health Development Office I and attended by representatives of ministries of health and the interior from 10 countries in West Africa. The consensus of these meetings was that cholera control can best be achieved by implementing a national CDD programme that applies the recommended control strategies: proper treatment of cases (especially with ORT) to prevent death, widespread delivery of practical health education messages promoting the use of clean water, safe food, sanitation facilities, etc., and the strengthening of surveillance systems to detect early cases so that control measures can be applied promptly. The meetings further recognized that cholera vaccination and quarantine (cordon sanitaire) are ineffective as control measures and can delude the population into thinking they are protected, and that chemoprophylaxis using appropriate antibiotics can only be justified in families where multiple cases have been diagnosed. Close intersectoral cooperation in implementing control measures both before and during epidemics has been shown to be important to mobilize communities to take the necessary steps to control the disease and avoid panic. Early

detection of epidemics is crucial to reduce cholera deaths and is helped by a rapid and frank exchange of information between countries according to the provisions of the International Health Regulations.

2.18 The Regional Committee for Africa considered a report of the Regional Director on the CDD Programme at its thirty-sixth session, in September 1986. The Committee recognized that considerable progress has been made by Member States in the execution of national programmes, and in resolution AFR/RC36/R9 it called on the Regional Director to continue to collaborate with governments in developing and strengthening planning, training, and evaluation activities. Furthermore, it asked WHO to continue to provide the necessary assistance to countries facing cholera epidemics.

2.19 The Programme has recently issued revised guidelines for cholera control[1] and provides technical cooperation to affected countries and advice to international and bilateral agencies on the appropriateness of supplies and equipment requested during epidemics. Technical cooperation of a similar nature has also been provided during outbreaks of shigellosis.

Research component

Research management

2.20 Following an extensive review of available knowledge on diarrhoeal diseases, in 1980 the Programme established three global Scientific Working Groups (SWGs) to manage biomedical research in the areas of (a) bacterial enteric infections: microbiology, epidemiology, immunology, and vaccine development; (b) viral diarrhoeas: microbiology, epidemiology, immunology, and vaccine development; and (c) drug development and management of acute diarrhoea. At their initial meetings each SWG developed a five-year research plan and identified priority areas for research. In addition, regional SWGs were established at the WHO regional offices to manage applied (health services) research that is closely linked to the activities of national CDD programmes. Within this management framework, all research proposals submitted are subjected to peer review and financial support is awarded to projects that are in priority research areas and of high scientific merit. As at 31 December 1986 these SWGs had awarded support to 392 projects in 82 countries, 61% of which were undertaken in developing countries. As of 31 December 1986 some 360 scientific publications had stemmed from research funded through the Programme.

2.21 As from January 1986, in accordance with the advice of the Technical Advisory Group, the global SWGs have been reorganized according to the following areas:

- immunology, microbiology and vaccine development
- case management
- epidemiology and disease prevention.

This reorganization gives greater emphasis at the global level to epidemiological, control-oriented research, while support continues to be given to research that will lead directly to improved means of reducing diarrhoea morbidity and mortality - specifically, new and improved vaccines, simple and inexpensive diagnostic tests, more effective oral rehydration solutions, optimal diets for use during and after diarrhoea, and antisecretory drugs. It also calls for an increased emphasis on the strengthening of developing country institutions, especially in ways that will ensure the proper performance and interpretation of epidemiological and intervention-related studies.

Research activities

2.22 The SWG on Immunology, Microbiology and Vaccine Development is primarily concerned with the development, and especially the testing (in animals, volunteers, and field trials), of vaccines against the diseases that account for the greatest proportion of diarrhoea episodes in the first years of life, or have high epidemic potential. Emphasis is being placed on the development of oral vaccines, since intestinal immunity is primarily responsible for protection against diarrhoea pathogens and is best stimulated by the oral route. It is hoped

[1] Guidelines for cholera control (document WHO/CDD/SER/80.4 Rev.1 (1986)).

that, when fully developed, several of these vaccines will be incorporated into national expanded immunization programmes. The SWG also supports the development and testing of simple and inexpensive diagnostic methods required for epidemiological studies, and research to identify new diarrhoeal pathogens. There were 65 active projects as at 31 December 1986.

2.23 The major activities of this SWG are:

(1) Evaluation of new live oral typhoid vaccines. Results available from three field trials under way in Santiago, Chile, of an enteric-coated vaccine (Ty21a) developed by the Swiss Serum and Vaccine Institute indicate that three doses administered during one week give 60% protection for at least three years. While the vaccine is effective, it is considerably less so than in an earlier trial in Egypt, where it was given in a liquid formulation and offered 96% efficacy over three years. Accordingly, a modified liquid formulation (simpler to administer than the one in the Egyptian trial) is now being evaluated in Chile and Indonesia. Also under development is a new live oral typhoid vaccine created by recombinant DNA techniques, which have already proved effective in designing vaccines to prevent salmonellosis in cattle. This vaccine should be ready for evaluation in field trials by 1987.

(2) Development and field testing of cholera vaccines derived from avirulent live bacteria and non-living antigens. The Programme is collaborating with the International Centre for Diarrhoeal Diseases Research, Bangladesh, the Institut Mérieux, France, the University of Göteborg, Sweden, and the National Bacteriological Laboratory, Sweden, in a field trial of an oral vaccine containing killed vibrios and the non-toxic B-subunit of cholera toxin. After one year of surveillance this vaccine, given in three doses, has offered 63% protection in children and adults. While surveillance is continuing, research is under way to find a simpler method for delivery of this type of vaccine. Concurrently, research is being carried out to develop a safe live vaccine, and to identify the most important protective antigens of Vibrio cholerae 01.

(3) Studies aimed at a more complete characterization of the protective antigens for inclusion in a vaccine against enterotoxigenic Escherichia coli (ETEC) diarrhoea. These include research to determine the genetic mechanisms that control the production of these antigens, and the immunological response to them. There has been some success in developing vaccines against ETEC diarrhoea in animals, especially in calves, the results of which suggest that, to be effective, a vaccine needs to convey protection against both ETEC toxins and the bacterial antigens that facilitate intestinal colonization.

(4) Studies of the virulence factors of Shigella dysenteriae type 1 and their genetic control, and evaluation of prototype hybrid Shigella vaccines. These vaccines are formulated by inserting material that is responsible for stimulating immunity to Shigella into a "carrier" bacterium such as E. coli or the Ty21a typhoid vaccine. It is anticipated that field trials of a Ty21a-S. sonnei hybrid vaccine will begin by 1988.

(5) Development and testing of candidate rotavirus vaccines, including attenuated or naturally avirulent human rotavirus strains, attenuated heterologous (animal) strains, genetic reassortants (containing genes of human and animal strains), and live bacteria containing cloned rotavirus genes responsible for the expression of protective antigens. Trials under way in Finland, the Gambia, Peru, Sweden, and the USA, with support from the Programme, are evaluating the efficacy of attenuated bovine or rhesus rotavirus strains in young infants. Initial results indicate that one dose of the bovine strain conveys 80-90% protection against severe disease in developed countries, but only 65% protection when given in three doses to infants in developing countries. As the rhesus strain is more immunogenic, it is believed that its efficacy in developing countries may be greater. Field trials of a genetic reassortant strain and a second, less attenuated bovine strain will begin in 1987.

(6) Evaluation of different approaches to vaccine delivery aimed at the protection of vaccines during passage through the stomach; such protection is required to ensure the "take" of most living or non-living oral vaccines.

(7) Establishment and development of a centre for the trial of vaccines against infectious diseases at Mahidol University, Bangkok; this will be the first facility for the testing of vaccines in volunteers in a developing country.

(8) Development of simplified tests for detection of the heat-stable toxin of ETEC, identification of enteropathogenic E. coli (EPEC), phage-typing of V. cholerae 01, and diagnosis of typhoid fever, amoebiasis and giardiasis. Research supported by the Programme has already contributed to the use of a simple "Biken" gel diffusion test developed in Japan to identify the heat-labile toxin (LT) of ETEC, a serotyping scheme for Campylobacter jejuni developed in Canada, and an ELISA test for detecting rotaviruses developed by the WHO Collaborating Centre for Human Rotaviruses in the United Kingdom.

2.24 The SWG on Case Management supports research concerned with improved, cost-effective treatment of diarrhoeal diseases. Following the successful development of a more stable ORS formulation by this SWG (see paragraph 2.8), particular emphasis is being placed on the development and testing of more efficient ORS formulations and household ORT solutions. Support is also given to research aimed at determining optimal diets for use during and immediately following diarrhoeal episodes to minimize the adverse effects of diarrhoea on nutritional status. A third area receiving attention is the development and evaluation of antidiarrhoeal (including antisecretory) drugs. To help accelerate this research, the Programme has strengthened institutes in Burma, Egypt, and Peru to enable them to undertake clinical trials, and plans to strengthen additional institutes in 1987. Where appropriate, the Programme has collaborated with the pharmaceutical industry in the evaluation of particular drugs. As at 31 December 1986 there were 39 active projects.

2.25 The major activities of this SWG are:

(1) Development of an ORS formulation and household ORT solutions that can decrease diarrhoea volume and duration, while replacing fluid and electrolyte losses, and thus increase the acceptability and use of ORT. Ingredients being studied for an improved ORS are actively absorbed organic solutes (e.g. glycine), glucose polymers or starches (e.g. maltodextrins), and whole cereal powders (e.g. cooked rice powder); the latter may also be useful as a basis for household ORT solutions. An initial series of 25 clinical trials of different ORS formulations has been initiated in 16 institutes, the results of which will be available in 1987 and will indicate the direction for future studies. Parallel research is under way to determine the stability of these formulations stored under tropical conditions.

(2) Evaluation of the impact of different home ORT solutions on the incidence of dehydration, nutritional status, and demand for ORS from the health services; these studies will provide important information for the operation of national CDD programmes.

(3) Study of the efficacy of ORS in seriously malnourished children; this has important implications for the treatment of diarrhoea under famine conditions.

(4) Identification of locally available foods that are well accepted and adequately absorbed by infants and young children with diarrhoea. Factors being considered include age, phase of illness, etiology of diarrhoea, dietary content, and traditional attitudes to feeding during diarrhoea. Clinical trials of selected diets are being performed in hospitalized patients, outpatients, and at home. These studies follow research already conducted by the Programme which has shown that diarrhoea patients fed early during their illness have a better clinical and nutritional outcome than those fed conservatively, and that infants given unrestricted breast-feeding during ORT have a significantly shorter duration of illness. The present studies should lead to the development of more precise guidelines on the dietary management of acute diarrhoea.

(5) Evaluation of antibiotics, antisecretory agents, antimotility agents, traditional medicines, and other agents widely used in diarrhoea treatment, with the intention of identifying those that are effective and should be more widely used, and those that are ineffective and should not be promoted. Research already completed has shown that a popular antimotility drug, loperamide, does not have antisecretory properties. For the few diseases where antibiotics or antiparasitic drugs are warranted (e.g. cholera), simpler dose regimens are being evaluated in an effort to determine the simplest effective course of therapy.

(6) Studies of intestinal secretion in the pathogenesis of different diarrhoeal diseases. The information derived will assist the development of new antisecretory drugs that will inhibit or reverse intestinal hypersecretion. One area being studied is

calcium transport by the small intestine, as it is thought that enterotoxins may act upon this process to stimulate absorption or inhibit the secretion of water and electrolytes.

2.26 The SWG on Epidemiology and Disease Prevention supports studies seeking (a) to evaluate the impact of interventions (other than vaccines and case management) that are thought to be potentially cost-effective or are of uncertain effectiveness in preventing diarrhoeal disease morbidity and mortality; (b) to clarify risk factors and features of transmission of certain diarrhoeal diseases; and (c) to elucidate the epidemiology of persistent diarrhoea. As at 31 December 1986 22 projects were being supported in this relatively new Programme area.

2.27 The major activities of this SWG are:

(1) Research on the efficacy, cost, and optimal means of implementation (using innovative health education approaches) of the following control interventions aimed at reducing diarrhoea morbidity and/or mortality either by reducing the transmission of diarrhoea agents or by strengthening the ability of the child to cope with infection:

- Weaning: Research is focused on the key weaning foods and practices that facilitate the spread of the major bacterial pathogens and/or lead to impaired nutritional status. The effect of specific changes in weaning practices on growth and on the incidence, severity, and duration of diarrhoea is being assessed and methods for their promotion through weaning education programmes are being developed and tested.

- Breast-feeding: Case-control studies are being undertaken to determine the level of protection against diarrhoea mortality afforded by breast-feeding in various socioeconomic settings, and the association between breast-feeding and the incidence and severity of diarrhoea of specific etiology. The cost and impact of breast-feeding promotion activities on diarrhoea morbidity and mortality rates are also being evaluated to determine the most cost-effective ways to promote breast-feeding.

- Water supply and sanitation: In collaboration with the Division of Environmental Health, a case-control study protocol has been developed to measure the impact of improved water supply and sanitation facilities on diarrhoea incidence; it is being used in Malawi, Nicaragua, the Philippines, and Rwanda.

- Personal and domestic hygiene: Behavioural research is under way to clarify the relationship between specific practices that may promote transmission (e.g. unhygienic handling of food, improper storage of water) and the risk of diarrhoea of known etiology. Studies will be conducted in various cultural and socioeconomic settings to measure the impact of carefully designed education programmes on behaviour, etiological causes of diarrhoea, and diarrhoea severity and incidence. They will document the feasibility, acceptability, and cost of the intervention, and assess its dependence on pre-existing resources.

- Vitamin A: In collaboration with the Nutrition unit, studies are being organized to determine whether vitamin A deficiency, even without xerophthalmia, predisposes to increased diarrhoea incidence and severity, and whether vitamin A supplementation during diarrhoea provides protection.

(2) Research to elucidate the epidemiology of diarrhoeas that contribute significantly to morbidity and/or mortality and whose main epidemiological features remain unclear, including those for which vaccines are being developed. These are: cholera, typhoid fever, shigellosis, ETEC diarrhoea, rotavirus diarrhoea, giardiasis, amoebiasis, and diarrhoea due to cryptosporidia. Studies of this type have already shown that chickens are a major source of *C. jejuni* infection and that *V. cholerae* can persist in environmental waters for prolonged periods and serve as a reservoir of infection. The etiology of measles-associated diarrhoea and the cost-effectiveness of measles immunization in decreasing diarrhoea incidence and averting diarrhoea deaths are also being examined. These studies follow a group of 30 general etiological studies already supported by the Programme, which have demonstrated that the etiology of diarrhoea is much the same worldwide, and that a known pathogen can be identified in at least 60-65% of cases presenting to health facilities for treatment and 30-40% of all cases in the community.

(3) Community-based research to define and quantify the problem of persistent diarrhoea (estimated to account for about 5% of diarrhoea cases and 25% of all diarrhoea deaths) and to identify children at high risk. The impact of persistent diarrhoea on subsequent morbidity, growth, and mortality is also being assessed. Eventually, specific approaches towards its prevention and treatment will be tested.

2.28 To undertake the epidemiological studies described, it will be necessary to strengthen epidemiological and social science research capability in developing country institutes. Accordingly, the SWG is seeking to identify some 10 specific institutions in different parts of the world that are already active in diarrhoeal disease research and have both the potential and the desire to undertake the necessary field research. Once identified, these institutes will receive the institutional support required to undertake such studies, including the award of short-term training fellowships and the provision of facilities and equipment. It is estimated that these selected institutes will undertake up to 50% of the projects supported by this SWG.

2.29 Other research activities being undertaken by the Programme include the organization of scientific meetings to review recent advances and outline research priorities in areas of particular importance, the convening of workshops on clinical trials and on epidemiological research to assist investigators in designing and writing proposals for submission to the Programme for funding, and the holding of laboratory courses to provide training in up-to-date laboratory techniques for the isolation and identification of diarrhoeal pathogens. Efforts are also being made to foster research collaboration among institutes in developing countries and between such institutes and selected centres of expertise in developed countries.

2.30 In this component also, the Programme is collaborating closely with other programmes being carried out by WHO. For example, it is building upon the research strengthening activities of the Special Programme for Research and Training in Tropical Diseases by funding research in some institutes supported by that Programme. It is also coordinating the support it gives to projects with that given by other organizations and agencies (e.g. International Development Research Centre, Swedish Agency for Research Cooperation with Developing Countries, Thrasher Research Fund, United States Agency for International Development). Close collaboration exists with the International Centre for Diarrhoeal Diseases Research in Bangladesh, especially in clinical and vaccine-related research, through a UNDP-supported project and by direct support from the SWGs.

2.31 The regional SWGs, as at 31 December 1986, had awarded support to 125 applied or health services research projects in 56 countries. Their major objective has been to support research to improve the design and functioning of national CDD programmes by responding to problems identified in their establishment or implementation. While a number of studies supported by the SWGs have achieved this goal (e.g. by elucidating traditional beliefs and practices of communities and of health workers with regard to diarrhoea), this area of activity has been subject to considerable constraints. These include the general lack of interest among university scientists for this type of research, poor communications between ministry of health staff responsible for CDD programmes and university scientists, and inadequate definition of the problems requiring research. The Programme, in consultation with its Technical Advisory Group, is examining various ways of improving this area of activity.

Information services

2.32 World interest in diarrhoeal diseases control has expanded considerably during recent years as a result of the efforts of WHO's CDD Programme and of an increasing number of other organizations and agencies. A major task of the Programme has been to maintain a dialogue with such bodies, in order to ensure that information disseminated by these different sources is technically correct and consistent. Programme documents are distributed through a mailing list which now includes the names of some 6400 individuals and institutions worldwide. Among items distributed regularly are a "Bibliography of acute diarrhoeal diseases", produced twice a year in collaboration with the US National Library of Medicine, and a "Bibliographic bulletin on diarrhoeal diseases", produced by the International Children's Centre, Paris. The international newsletter "Dialogue on Diarrhoea", produced by the Appropriate Health Resources and Technologies Action Group, London, with partial support from the Programme, is the main vehicle for the dissemination of information on diarrhoeal diseases to peripheral level workers. The English edition has a circulation of 110 000, a French edition is

produced and distributed by the Organisme de Recherches sur l'Alimentation et la Nutrition africaines (ORANA) in Dakar (circulation 10 000), and composite editions have been published in Arabic, Portuguese (15 000 copies of each), and Spanish (9000 copies). Beginning in 1987, the Programme will prepare and distribute timely "updates" summarizing experience in various fields of activity and advances in different areas of research.

3. FUTURE DIRECTIONS

3.1 In 1986, in view of the commitment of governments and international and bilateral agencies to diarrhoeal diseases control and the rapid development of national programmes, the Programme in consultation with its Technical Advisory Group, revised the targets of its health services component for 1989 - the final year of the Organization's Seventh General Programme of Work (Table 2). Above all, the progress to date called for an advancement of the targets for ORS access and ORT use. Should the new 1989 target for use be reached, as many as 1.5 million diarrhoea deaths may be averted in that year.

TABLE 2. PROJECTED TARGETS - HEALTH SERVICES COMPONENT

Category	Current status[a]	Original 1989 target	Revised or new 1989 target
No. of operational programmes	93	80	126
Per cent staff trained in supervisory skills	5	-	20
Per cent staff trained in case management	5	-	20
No. of countries producing ORS	47	42	60
No. of programme evaluations	48	80	80
Per cent ORS access	51	50	80
Per cent ORT use[b]	18	35	50

[a] 1986 figures except for ORS access and ORT use for which 1985 figures are given.

[b] ORT = ORS or sugar/salt solution.

3.2 Achievement of these targets will not be easy. It will require strong political commitment from governments, which will need to provide sufficient financial resources and ensure that CDD is included in existing health services and recognizd as a high priority activity. It will call for programmes that have a clear strategy for the delivery and use of ORT in the home and in health facilities, forming the basis for all training activities. Adequate supplies of ORS need to be available where they are required and steps must be taken to discourage the promotion and use of antidiarrhoeal drugs. Special attention should be given to communication activities that are oriented towards the needs of consumers, not just providers, and are undertaken only after health workers have been trained and adequate supplies of ORS made available. Programmes must recognize the importance of monitoring and supervision, and have plans for evaluation that include the setting of realistic and quantified targets.

3.3 In most countries the case management strategy will remain a priority for action. As programmes develop, ORS access and ORT use rates will undoubtedly increase. To achieve a reduction in mortality, however, it will be necessary for ORT to be used correctly. This will require "hands-on" training of health workers, proper education of pharmacists, carefully designed communication activities, adequate supervision of health workers, and evaluation of ORT practice during programme reviews. It will be facilitated by the

development of an improved ORS formulation and home ORT solutions that can significantly reduce diarrhoea output. Effective ORT use should be one of the principal aims of all programmes.

3.4 At the same time, national programmes should give increasing attention to the implementation of strategies and activities to reduce diarrhoea morbidity. This applies particularly to countries that have achieved a low rate of diarrhoea mortality. Approaches are available that can achieve this objective, but their successful implementation will also require careful planning and well designed training, communications, and evaluation activities. The research being conducted by the Programme in the area of epidemiology and disease prevention is expected to find better ways of implementing control strategies, while studies in the area of immunology and vaccine development will produce new vaccines that will serve to reduce diarrhoea morbidity even further.

= = =