ANNUAL REPORT 1986

INTERNATIONAL CENTRE FOR
DIARRHOEAL DISEASE
RESEARCH, BANGLADESH

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June 1987

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The ICDDR, B publishes a journal, a newsletter, scientific reports, monographs, annotated bibliographies and many other items in the field of diarrhoeal diseases and on related subjects. Details of some of these publications may be found at the end of this report.

Printed by the Ruby Printing and Packaging Ltd., in Dhaka, Bangladesh

PREFACE

This is the eighth Annual Report of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

The ICDDR,B was established in December 1978, succeeding the former Cholera Research Laboratory which had been founded in 1961. The mandate of the ICDDR,B is to undertake and promote research on diarrhoeal diseases and on the related subjects of nutrition and fertility, to train and disseminate knowledge in these fields and to develop improved means to prevent and control diarrrhoeal diseases in developing countries.

The ICDDR,B has its headquarters in Dhaka, the capital of Bangladesh, and runs two field stations, one in Matlab Upazila of Chandpur District and the other in Teknaf Upazila in Cox's Bazar District. The Centre has projects in several other parts of Bangladesh and provides technical assistance at two Diarrhoea Control Centres in Saudi Arabia.

In 1986 the ICDDR,B was reorganised into four Divisions: Community Medicine, Laboratory Sciences and Epidemiology, Clinical Sciences and Population Science and Extension. More details of the planned structure of the Centre are given in the Director's Introduction. In 1986 there were people from 17 different countries working at the Centre, including Belgium, Canada, Czechoslovakia, France, Guyana, India, Poland, the UK and the USA.

The form of the 1986 Annual Report is very similar to last year's: once again every scientist in the Centre has been asked to write a brief summary of their work, and what you see here are those reports edited and arranged according to the general field of research, often with a brief introduction or explanation of the significance of the research. This arrangement places less emphasis than last year on the administration of the Centre and more on the actual work done.

If you would like to know more about particular work described here, or if you have any comments on this report, then please write to the Director, ICDDR,B, P O Box 128, Dhaka 2, Bangladesh.

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DIRECTOR'S INTRODUCTION

The International Centre for Diarrhoeal Disease Research, Bangladesh had serious difficulties to overcome during 1986. The financial problems already evident in 1985 had to be resolved otherwise the Centre's existence might have been endangered. Stringent measures had to be taken to contain costs and all the Centre's activities were affected, as well as its staff: in a period of less than 18 months the number of international personnel had to be reduced by 50%. The loss of many staff, some of them very senior scientists, was a harrowing experience for us all and caused disquiet and criticism in several circles. Because of these problems many donors, while maintaining or even increasing their support, also insisted on thoroughly evaluating the scientific activities and administration of the Centre. Several teams of reviewers came to Dhaka; all made positive reports with many valuable suggestions.

Despite the sharp drop in money available for the general support of the Centre, the ICDDR,B still had to maintain its normal activities during the year and, whenever possible, to improve them. These activities cannot be sizeably reduced in the short term: 85% of the Centre's income from donors is committed to projects, while the aid given to tens of thousands of sick people cannot be interrupted. I believe this report shows that during a difficult year the ICDDR,B has still vigorously and successfully pursued its mandate.

Helped by the external reviewers mentioned above, the Centre has begun a critical examination of its work and methods of operation. One of the first and probably most important objectives was to set scientific priorities; the Scientific Programme Committee of the Board of Trustees was instrumental in initiating and guiding this process. Details of the scientific priorities of the Centre in the coming years are given in the first section of this report, on page 5.

As a part of this process of critical self-examination the organisation of the Centre was simplified: the five former Scientific Working Groups were reduced to four Divisions and given new titles to reflect more accurately the developments in scientific interests of the Centre and the growth and change in responsibilities of its different parts.

CLINICAL SCIENCES DIVISION

The main responsibility of this Division is the Dhaka Treatment Centre, the Centre's main hospital, with three departments:

- Clinical Services (treatment for diarrhoea and Surveillance Programme)
- Clinical Research (clinical medicine, pathophysiology, drugs, ORS)
- Child Health (nutrition rehabilitation, preventive medicine)

COMMUNITY MEDICINE DIVISION

There are two main sections which encompass several current projects:

- Urban Health (Urban Volunteers Programme)
- Rural Health (Matlab MCH-FP Programme, Matlab Treatment Centre, Teknaf Station, Mirzapur Handpump Project, Chandpur ORS Project)

LABORATORY SCIENCES AND EPIDEMIOLOGY DIVISION

This Division incorporates all activities of the Centre's laboratories in Dhaka, Matlab and Teknaf and includes:

- Laboratory Services Department (all research and diagnostic labs)
- Immunology and Bacterial Genetics
- Cholera Vaccine Trial Project

POPULATION SCIENCE DIVISION

This Division includes parts of the Centre concerned with demography, operations research and populations studies, as well as their major tool in this work - the mainframe computers.

- Population Science Department (sociological and statistical demography).
- MCH-FP Extension Project
- Computer Services Department

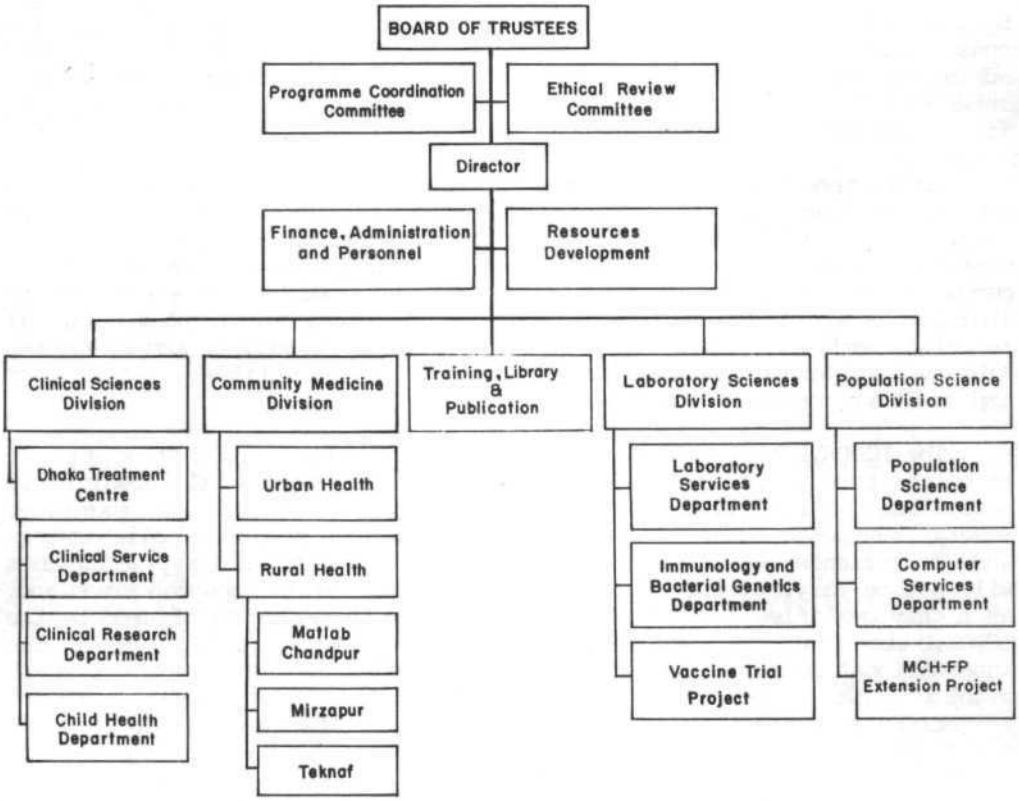
In the future the epidemiology part of the Laboratory and Epidemiology Sciences Division may be incorporated in the Community Medicine Division. The planned structure of the Centre is shown diagrammatically on the next page.

The many activities of the former Nutrition Working Group are now incorporated in the Divisions of Community Medicine and Clinical Sciences. This does not indicate a diminished interest in Nutrition in the Centre but reflects the fundamental interaction between nutrition and infection: that nutritional problems can rarely be viewed in isolation and that malnutrition and disease often occur together.

In the reorganisation of the Centre the Training, Library and Publications Branch was incorporated administratively into the Resources Development Division. The Centre's library has possibly one of the best collections of medical journals in the subcontinent. Computers are now being used more and more by the library to create databases of references and to prepare publications.

With the help of donors the ICDDR,B played a major part in organising the Second African Conference on Diarrhoeal Diseases. This most worthwhile involvement will be continued, with special efforts to include participants from Francophone Africa.

Much effort during the year has gone into evaluating and improving the Centre's administration. The accrual system of maintaining accounts has been introduced in the Finance Office, where more and more work is being done on computers. The Personnel Office has gone through the time consuming task of completely reviewing and updating the Staff Rules and Regulations while the important issue of the Centre's personnel system, considered by many as ill-adapted, is being examined by experienced consultants. Finally, many measures to reduce costs have been introduced in the Administrative Services Office.



THE PLANNED ORGANISATION OF THE INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

In these efforts to improve the efficiency of the Centre and the quality of its work I have been assisted greatly by my friends and colleagues in the Council of Associate Directors: AN Alam, M Badrud Duza, MR Bashir, I Ciznar, R Dery, HAN Janssen, MGM Rowland, DA Sack and Md Shahabuddin.

Donors to the Centre have continued to be very helpful throughout 1986 by maintaining or even increasing their financial contributions, by funding consultancies, and by their reviews of the Centre s work and administration. This help and their many expressions of sympathy and interest have made it possible for the ICDDR,B to continue its work, fulfil its obligations and prepare for the future.

As an independent, international biomedical research centre in a developing country, with important responsibilities for serving and training, the ICDDR,B is in an almost unique position. Over the years the Centre has built up considerable resources and means to carry out its mandate. It has the confidence of many thousands of patients and healthy individuals who willingly participate in clinical and epidemiological research, well-equipped laboratories, field stations, a comprehensive library, an animal house, advanced computer facilities, and, most importantly, competent and devoted staff.

The ICDDR,B still has many problems to be solved, and 1987 may prove to be the turning point. The Centre's precarious financial situation is stable but the underlying problem is not yet resolved. The incumbents of several key posts in science and administration — excellent collaborators and good friends — will be leaving the Centre in 1987 and replacing them will not be easy: there are few experts in the disciplines concerned and, as highly qualified consultants have stressed, the salaries offered by the ICDDR,B to its professional staff are no longer attractive on the international scene. The problem is compounded by the fact the ICDDR,B might very well need more professional scientists. Its infrastructure and scientific potentials are clearly underused because of a lack of scientists, while the Centre also suffers more and more from the lack of capital funds.

The ICDDR,B overcame many problems in 1986 and the future looks far brighter than a year ago. But the time has now come to call on all current and potential donors to act, in consortium, to commit the means to provide stable conditions so that the ICDDR,B can realize its full potential.

Roger Eeckels MD DTM
Director

SCIENTIFIC PRIORITIES — 1987 ONWARDS

In 1986 the Programme Coordination Committee (see p 76) established the following priorities for scientific research in the coming years at the International Centre for Diarrhoeal Disease Research, Bangladesh.

WATERY DIARRHOEA

The ICDDR,B should maintain its interest in cholera and other watery diarrhoeas, conditions that have been the mainstay of its scientific activities since the foundation of its predecessor, the Cholera Research Laboratory, and including:

- the oral cholera vaccine trial and the wealth of studies derived from it
- further studies on oral rehydration solutions for use by doctors, paramedics and by patients themselves
- research on feeding during illness to counter the nutritional losses due to diarrhoea.

INVASIVE DIARRHOEA

Shigellosis or bacillary dysentery should be studied as the most important form of invasive diarrhoea and a major cause of death in developing countries, including:

- the epidemiology of shigellosis
- studies to aid the development of a vaccine against shigellosis, including detailed laboratory research on antigens and antibodies
- the evaluation of new drugs to treat resistant strains
- clinical and pathophysiological studies of the severe and life-threatening complications of shigellosis.

CHRONIC DIARRHOEA AND MALNUTRITION

The severity of diarrhoeal disease is all too frequently determined by the patients' nutritional status, while repeated or lengthy bouts of diarrhoea often lead to malnutrition. This vicious circle is compounded when breast-feeding is halted too early and by bad weaning practices. The chronic diarrhoea and malnutrition syndrome has been selected as a new research priority for the Centre and preliminary studies began in 1986, including clinical, community and laboratory studies of this important and ill-defined condition.

CHILD SURVIVAL: MORBIDITY AND MORTALITY

The very high death rate among infants and children in less developed countries requires scientific research, including:

- studies to identify nutritional, clinical, behavioural and environmental factors which put mothers and children at risk of disease and death
- studies to evaluate simple diagnostic methods to detect these risks
- studies to evaluate simple, cost-effective ways of preventing disease and death

POPULATION STUDIES

For many years the ICDDR,B and its predecessor have been collecting information about populations in Matlab and in Teknaf -- the Demographic Surveillance Systems -- to create a unique demographic record. This includes an important body of facts about organising, monitoring and evaluating family planning activities. This information is used by the MCH-FP Extension Project, in collaboration with the Government of Bangladesh, so that other parts of Bangladesh can profit from the experience gained in Matlab. The Centre's future research priorities include:

- the use of the demographic information for population studies, mainly in the subjects of fertility, morbidity and mortality
- further support for field projects on other priority topics
- a continuation of the activities of the MCH-FP Extension Project

ENVIRONMENTAL MICROBIOLOGY

This new subject for study has been selected because of the possible importance of an aquatic reservoir for some organisms causing diarrhoeal diseases, and particularly for Vibrio cholerae. The topic has also been selected because of its public health importance, because of the presence of members of staff with expertise in this field, and because of opportunities for international collaboration.

It must be stressed that these topics are not isolated fields of study, that in many ways they overlap and are interrelated: environmental microbiology should help us to understand the epidemiology of cholera; new oral rehydration solutions might prevent the development of chronic diarrhoea; simple indicators to detect malnutrition early will help us to understand the causes of this condition and to treat it as early as possible; and demographic studies will yield information on factors which influence health and disease and can help to determine ways to improve the health of mothers and children.

These priorities for research were identified during 1986 and some of the specific topics, notably Chronic Diarrhoea and Environmental Microbiology, are not strongly represented in this Report. This will change in future reports.

Although the fields of study described above will have priority in the next few years, the Centre will also continue research on other topics related to diarrhoeal diseases, nutrition and fertility, and will make the best possible use of its resources, facilities and skills to examine other important biomedical problems for developing countries such as Bangladesh.

TRANSMISSION OF DIARRHOEA

Most diarrhoeal pathogens are transmitted directly from person to person, although often a vehicle of infection such as food or water is involved. If the cycle of transmission is to be broken effectively then accurate information about reservoirs of infection, about the spread of diseases and about ways to interrupt transmission must be obtained. This section therefore includes studies in the fields of epidemiology, public health engineering, health education and environmental microbiology.

Studies on the mode of transmission of diarrhoea
(Principal investigator: FJ Henry)

The aim of this study was to assess the relative importance of water-borne transmission of diarrhoea compared with transmission by person to person contact — water-washed transmission. Children in two areas were studied: 56 in Zinzira where the water sources and sanitation had been improved, and 81 in Nandipara, without good water and sanitation facilities. Tests were carried out to detect bacterial contamination on the hands of each child and in each child's drinking water. The presence and concentration of bacteria detected was then related to the annual incidence of diarrhoea for each child.

In both areas the incidence of diarrhoea was significantly correlated with contamination of fingers but not of water, despite a greater degree of contamination of the water sampled.

Studies on diarrhoea in slum communities
(Principal investigator: FJ Henry)

Previous research has shown that in the urban slum of Zinzira, which has 50 latrines and 10 tube-wells, children experienced fewer attacks of diarrhoea than children in the peri-urban village of Nandipara without such facilities. The incidence of watery diarrhoea was not significantly different between the two communities but the incidence of dysentery was twice as high in Nandipara which lacked latrines and tube-wells. Although episodes of diarrhoea lasted twice as long on average, this difference could be explained by the greater frequency of dysentery.

Because the apparent effect of having clean water and latrines on the transmission of diarrhoea varies according to the cause of the diarrhoea, the impact of improving sanitation could be underestimated if the cause and duration of diarrhoeal diseases are not taken into account. The strong association between dysentery and stunting described in the work in Teknaf (see p 32) emphasises the broad benefits afforded by improving water supplies and sanitation.

Diarrhoea and hygiene education
(Principal Investigator: Bonita Stanton)

In 1985, as a part of the Urban Volunteer Programme (see p 49), a study was begun to evaluate the effect of improving hygienic practices on the incidence of diarrhoea among nearly 2000 families in 51 slum communities. Since then the number of episodes of diarrhoea in children less than 6 years old has been recorded. During the first year after the health education programme began, the rate of diarrhoea in episodes per 100 person weeks was 7.55 in the 754 children whose parents had not received the health education compared with 5.9 in the 636 children whose parents had been taught, a statistically significant difference ($P < 0.0001$).

There were no differences in growth between the two groups of children: at the start and one year after the study started, the children were on average 76% of weight for age according to the NCHS standards.

Mirzapur handpump project
(Principal investigators: KMA Aziz and Bilqis Amin Hoque)

This project has two aims. The first is to evaluate the effect of providing tube-wells, latrines and health education on the incidence of diarrhoea in one area of Mirzapur in comparison with an area without these extra facilities. The second is to test and modify an improved handpump which works reliably and is not affected by a fall in the water table below suction level, about 10 metres below ground.

By the end of the year 151 experimental Tara handpumps and 2 Wavin handpumps had been installed in the study area of Mirzapur and 95% of households had a two-pit water-sealed latrine. During 1986 educating people about using handpumps and latrines was intensified by training 199 female volunteers from 25% of the households.

In 1986 the exclusive use of handpump water for all purposes increased to 19% of households in the study area whereas in the comparison area it remained at about 2%. As in the previous years a failure to use handpump water to wash clothes soiled with faeces was one of the main reasons for this low percentage in the study area, though for many purposes such as drinking, tube-well water was used by all people.

The incidence of diarrhoea in all age groups continued to fall during the year in both the study and comparison areas, but was lower in the study area.

Two water consumption surveys were undertaken in 1986. It was found that the most water was consumed by people who shared their tube-well with few other people, usually less than 20. The consumption of water did not change significantly between surveys. However, those people who shared a tube-well with more than 20 others showed an increased consumption of water between the two surveys, perhaps a result of the health education.

The ICDDR,B is continuing to evaluate the Tara handpump in Mirzapur. Many of them were improved during 1986 and they may become the standard pump for areas of Bangladesh where the water table is low.

Faecally contaminated drinking water is the most common means by which cholera is spread. The pathogen, Vibrio cholerae, is rapidly killed by drying but survives for several days in clear, fresh water and may even multiply in slightly salty water with some dissolved organic material or on the surface of aquatic plants.

Beginning in 1986 the ICDDR,B began studies to understand how the seasonality of the disease is related to the survival of the bacterium in the waters of Bangladesh. This is the start of research on one of the newly defined priorities for the ICDDR,B, Environmental Microbiology (see p 6), and many of the studies planned will be carried out in collaboration with the University of Maryland.

The role of aquatic flora in the survival of Vibrio cholerae in the environment
(Principal investigator: S Islam)

The aim of this study is to examine the hypothesis that cholera may remain endemic in an area because of the ability of the 01 serotype of Vibrio cholerae to survive and multiply on the surface of aquatic flora such as water plants and phytoplankton. Samples from the environment have been collected from parts of Bangladesh during the non-cholera season. Laboratory studies are underway to examine aquatic flora as possible reservoirs of infection or as sites of multiplication. This study is being carried out as a research project for the Ph.D. degree at the London School of Hygiene and Tropical Medicine.

MORBIDITY AND MORTALITY

For every 1000 live births in Bangladesh in 1983, 117 infants did not survive their first year of life and a further 104 did not reach their fifth birthday. A death rate of 20% among infants and children is not uncommon in developing countries such as Bangladesh and for this reason Child Survival has been identified as a priority for research at the ICDDR,B (see p 5). If the means to reduce this high death rate are to be found then accurate information about the major causes of morbidity and mortality is needed so that the most effective interventions can be planned. And because the health of a child is inextricably bound to the health of its mother the illnesses of women of child-bearing age must also be studied.

Although much of the work of the ICDDR,B is concerned with diarrhoeal diseases, the study of diarrhoea often overlaps with other problems of health. For example: patients are commonly admitted to hospital with other diseases as well as diarrhoea, so how are they related and what are the effects when they occur together?

Causes of lower respiratory tract infections in children both with and without concurrent diarrhoea.
(Principal investigators: DA Sack, Farida Huq (IPH), M Rahman and Nazmun Nahar (DMCH)

Acute respiratory tract infections are a major cause of morbidity and mortality in children in Bangladesh. At the Dhaka Treatment Centre of the ICDDR,B children with diarrhoea and concurrent pneumonia often need to be admitted to the ward, and about 10% of these children may die. The aim of this study is to examine the causes of lower respiratory tract infections in children aged less than 5 who come to the ICDDR,B with diarrhoea. The clinical part of this study is being done in collaboration with the Dhaka Medical College Hospital (DMCH).

The organisms isolated from the nasopharynx and throats of children with diarrhoea and a respiratory tract infection will be compared with the organisms isolated from the following: children at the ICDDR,B with diarrhoea but without a respiratory tract infection; children at the DCMH with a lower respiratory tract infection but without diarrhoea; and children with neither diarrhoea nor a lower respiratory tract infection but admitted to the DCMH for other reasons.

Work began in January 1986 and about 175 patients were enrolled during the year. This study, which is being done in collaboration with laboratories of the Institute of Public Health (IPH), involves culturing bacteria and viruses from nasopharyngeal aspirates, throat swabs and blood, and testing blood and urine for evidence of infections. Preliminary results indicate that respiratory syncytial virus and pneumococci are the most common infections.

Measles is still a common and serious disease of children in developing countries and diarrhoea often occurs concurrently or during the first few months after the infection, probably because of a depressed immune response. Thus measles, diarrhoea and health are intimately linked. So does immunisation against measles indirectly protect children against other diseases of childhood and thereby reduce the risk of dying?

The impact of measles vaccination on growth and morbidity
(Principal investigator: Nigar Shahid)

The aim of this study was to assess the impact on growth and morbidity due to diarrhoea of vaccinating young children against measles. Three hundred and fifty six children aged from 9 to 24 months who had been vaccinated against measles were matched with 990 children who were reported neither to have had measles nor been vaccinated against measles. The children were visited every other day to record illnesses such as diarrhoea and respiratory tract infections, and were weighed and measured once a month. Blood samples were obtained from all children at enrollment and at the end of the project, and from any child who had an attack of measles or who was vaccinated.

The results are still being analysed but 98% of children had no antibodies to measles in their blood when enrolled in the study and the degree of seroconversion 21 days after vaccination was variable. The death rate among vaccinated children was significantly lower than among children who were not vaccinated. Vaccinated children gained more weight than non-vaccinated children, but this difference was not statistically significant.

Measles vaccination and the risk of dying
(Principal investigator: J Clemens)

The aim of this study was to evaluate the impact on mortality of vaccinating children against measles by comparing the numbers of children who died in two areas of Matlab in which there was an intensive programme of vaccination with children in two adjoining areas in which vaccination was much less readily available.

Between April 1982 and December 1984, 536 children aged from 10 to 60 months died within the two areas under study. Each child who died was matched by age and gender with two children who had lived beyond the date at which their partner had died, so for each death, or case, there were two survivors, or controls. An analysis of the attributed cause of death and whether or not the cases and controls had been vaccinated against measles was then performed.

Vaccination against measles reduced the risk of dying for children aged between 10 and 60 months by 36% ($P < 0.0001$). For those deaths due to measles, or attributed to diarrhoea, respiratory illness, or malnutrition, vaccination reduced the risk of dying by 57% ($P < 0.001$). No decline in the protective effect of the vaccine was observed during the two years after vaccination for children vaccinated in 1982. The conclusion of this study was that vaccination against measles is responsible for a pronounced and sustained reduction in the risk of dying in rural Bangladeshi children.

The ICDDR,B provides domiciliary and clinic-based family planning services in part of the Matlab area being studied by the Demographic Surveillance System (see pages 50 and 36 respectively). Little is known about infections of the female reproductive tract associated with the different methods of family planning. If the common infections can be diagnosed by fieldworkers on the basis of signs, symptoms and a few simple diagnostic tests such as vaginal pH, then appropriate treatment can be given on the spot.

Infections and morbidity related to family planning
(Principal Investigator: Judith Wasserheit)

The goals of this project were to assess the incidence and nature of reproductive tract infections in Bangladesh, to examine the association between infections and four family planning methods (IUD's, oral contraceptive pills, injectable contraceptives, and tubectomy), and to develop algorithms to assist in diagnosing and treating these infections in circumstances where few diagnostic facilities are available.

A preliminary analysis of results has revealed that over one fifth of the women in the Matlab MCH-FP Project have reported symptoms of reproductive tract infections. Complaints and signs of reproductive tract infections as well as confirmed infections were most common among tubectomized women and those using IUDs. Vaginal infections were identified most frequently, particularly those due to anaerobic bacteria. About one in every eight women with symptoms was found to have abnormal vaginal secretions which could not be classified in any of the three commonly recognized categories of vaginitis. These observations are being examined further.

Algorithms to assist in diagnosing and treating infections are being developed on the basis of the following: the prevalence of different types of infections, the relationship between the results of simple non-invasive tests and specific infections, and the relative risks of infections according to each method of contraception.

The Demographic Surveillance System (DSS) has been collecting information about births and deaths in Matlab for over 20 years. Although the specific cause of death is often unknown because there is no physician on hand and no pathologist to do a necropsy, the cause of death can often be reliably attributed by interviews with the dead person's family. This information can serve to highlight the common health problems of rural people and the relative risks that they pose to different groups in the community. With this information health services can then be improved or redirected to meet the greatest needs.

Deaths of children younger than 5 years in Matlab
(Principal investigator: V Fauveau)

When a child dies within the Matlab DSS area a death registration form is filled in by a Health Assistant. These forms for the last year were given to three physicians who assessed independently the most likely cause

of death. If there was a disagreement then the majority opinion prevailed or more information was collected if necessary. Using a new classification of the causes of death (see DSS report p 36) an analysis indicated that 41% of neonatal deaths occurred in children with a low weight at birth, 44% of all post-neonatal deaths were associated with respiratory tract infections and 28% of all deaths in childhood were associated with chronic diarrhoea in conjunction with malnutrition.

Deaths of women of child-bearing age in Matlab
(Principal investigator: V Fauveau)

The aim of this study was to ascribe a cause of death for all women between the ages of 14 and 44 years who died in the Matlab DSS area during the last 10 year. The most likely cause of death was assessed by a physician based on interviews with the woman's family. There were 1054 deaths of which 389 were maternal deaths, a rate of 5.5 maternal deaths for every 1000 live births. There were 20% fewer deaths in the Matlab MCH-FP area compared with the control area, a fact which was attributed mainly to the family planning services provided, though the risk of dying associated with child-bearing was not significantly different in each area.

A more detailed analysis of the 389 deaths associated with pregnancy and childbirth indicated that 20% were due to post partum haemorrhage, 14% to the complications of an induced abortion, 12% to toxaemia or eclampsia, 7% due to post partum sepsis and 6% due to the complications of obstructed labour.

Accurate information about the causes of diarrhoea and whether pathogens are sensitive to antibiotics or not is important not only for treating severe cases of diarrhoea or dysentery but also for detecting trends in diarrhoeal diseases. For this reason a systematic sample of patients at the Dhaka Treatment Centre of the ICDDR,B are tested for the pathogens causing their diarrhoea. The surveillance system generates a great deal of information which is available to the physicians and scientists of the Centre for them to start research, to examine theories about the epidemiology of diarrhoeal diseases, and to evaluate the procedures and benefits of the treatment centre. In addition, the results of this systematic sample are provided each week to the Government of Bangladesh.

Surveillance programme, Dhaka Treatment Centre
(Principal investigator: AN Alam)

Between 150 to 300 patients attend the diarrhoea treatment centre each day and the annual total is usually around 70,000. Because it is impractical to collect full clinical and microbiological information from each patient, every twenty fifth patient who attends the treatment centre is examined in some detail. This provides representative information on certain pathogens in a 4% sample of patients attending the hospital. The incidence of pathogens identified in 1986 are shown in Tables 1 and 2 on the following page.

Table 1

Results of the microbiological culture of stools from the systematic sample of 4% of patients who attended the Dhaka Treatment Centre of the ICDDR,B during 1986.

Month	No. of patients	Salmonella spp	Shigella spp	01 Vibrio cholerae	Other vibrios
January	181	1	19	36	1
February	164	0	10	26	0
March	253	1	16	41	1
April	315	2	27	51	9
May	299	4	40	89	5
June	208	1	33	31	3
July	186	0	31	26	2
August	180	3	18	20	9
September	172	2	29	21	17 *
October	223	3	41	52	46
November	190	2	28	50	47
December	241	0	36	66	38
TOTAL	2612	19	328	509	178
(%)		0.7	12.6	19.5	6.8

* Procedures to detect Aeromonas and Plesiomonas improved

Table 2

Results of the microscopical examination of 72% of stools from the systematic sample of 4% of patients who attended the Dhaka Treatment Centre of the ICDDR,B during 1986.

Month	No. of patients	Entamoeba histolytica	Giardia lamblia
January	131	0	2
February	121	2	3
March	179	3	6
April	229	3	6
May	213	3	6
June	144	2	3
July	140	1	4
August	135	3	10
September	134	2	9
October	153	6	4
November	140	4	6
December	158	0	0
TOTAL	1877	29	59
(%)	71.9	1.5	3.1

WATERY DIARRHOEA

Cholera is the archetypal watery diarrhoea, a disease which can cause a massive loss of fluid into the gut and bringing about death by dehydration unless the lost fluid is replaced. The organism which causes the disease, Vibrio cholerae, produces a toxin that stimulates the cells of the gut wall to secrete fluid. Cholera is endemic and epidemic in Bangladesh and was much more common than usual in 1986: in Matlab where the epidemiological data are most reliable, there were more than 5 cases of cholera for every 1000 people. These figures are derived from current research on the impact of an oral cholera vaccine.

Cholera vaccine trial.
(Principal Investigator: JD Clemens)

Recent research on immunity to cholera has shown three things. First, that cholera vaccines given orally are probably more active than injected ones -- they appear to stimulate intestinal immunity better. Secondly, the B subunit of cholera toxin is a safe and effective means to stimulate antitoxic immunity. Thirdly, if antitoxic and antibacterial immunity are stimulated together, the antibody responses are synergistically protective.

In cooperation with the WHO and the Government of Bangladesh, the ICDDR,B began a field trial of two vaccines in January, 1985. The vaccines consisted of either whole killed Vibrio cholerae cells in combination with the B subunit of cholera toxin (BS-WC vaccine) or whole killed cells without the B subunit (WC). The placebo used in the trial was prepared from heat killed Escherichia coli (K12 strain). The vaccines and the placebo were administered with an antacid solution in 3 doses 6 weeks apart. The constituents of the vaccines, the doses, dosing intervals and the antacid used were all based on the results of research at the ICDDR,B and elsewhere which had demonstrated the likelihood that such a vaccine would succeed.

Over a 5-month period 64,398 people consumed adequate amounts of the oral vaccines or placebo which they had been randomly assigned to receive. Table 3 presents results for the first six months of surveillance for cholera after the vaccines had been administered. During this period the combined BS-WC vaccine had a protective efficacy against cholera of 85% while the efficacy of the WC vaccine was 58%: both values are statistically significant.

These results for the 6 months immediately after vaccination indicate that the BS-WC vaccine provides good protection and that the WC vaccine gives moderate protection.

A more detailed analysis has indicated that in the short term the protection afforded by each vaccine was similar for adults and children. Both vaccines also protected against severe cholera to the same extent that they protected against mild cholera. Neither vaccine caused any detectable

side effects. With these encouraging preliminary results, surveillance for cholera will continue for several years to define the precise duration and degree of protection afforded by the vaccines.

In addition to testing the efficacy of the vaccines against cholera, the trial will have several other scientific benefits. Many biological and socio-behavioural factors which may increase the risk of contracting cholera as well as other diarrhoeal diseases are being assessed comprehensively. Of specific interest are nutritional status, blood groups, serum antibody concentrations, antibodies secreted in breast milk, gastric acidity (see below p 18) and environmental contamination.

Table 3

Occurrence of cholera in the first six months after oral vaccination with either the B-subunit/whole cell vaccine (BS-WC), the whole cell vaccine (WC) or a placebo of Escherichia coli K12. Only people who received all three doses are considered in this analysis.

	VACCINE OR PLACEBO RECEIVED		
OUTCOME	BS-WC	WC	E.coli K12
Cholera	4[a]	11[b]	26
No cholera	21137	21126	21194
Total	21141	21137	21220

[a] Protective efficacy = 85% (95% confidence interval 62-94%).
[b] Protective efficacy = 58% (95% confidence interval 15-80%).

(See also papers B 22 and B 23 in the Publications List beginning on p 79)

The trial of the oral cholera vaccine has stimulated a great deal of research into the effects of the vaccine itself. One approach to the analysis of the best way to stimulate immunity is to examine which components of V.cholerae provoke the strongest antibody responses in both people who have been vaccinated and in those who have had the disease. Once the most immunogenic antigens have been identified, and assuming they have no toxic or harmful effects, it may then be possible to use techniques of genetic engineering to produce large quantities of the antigen for making new or improved vaccines.

The immunogenicity of the B-subunit/whole cell oral cholera vaccine
(Principal investigator: I Ciznar)

Using techniques of crossed immunoelectrophoresis against antiserum raised in rabbits, it has been found that the vaccine which gave greater protection against cholera in the vaccine trial, the mixed B-subunit and whole cell preparation, contains 10 cell-associated antigens in addition to

the B-subunit. These antigens include lipopolysaccharides, flagellar antigen, haemagglutinin and outer membrane proteins. This research is being used to compare and examine the antigens which have stimulated local and systemic immunity in vaccinated people.

An immunochemical analysis of V.cholerae antigens with emphasis on phenotypic variations in carbohydrate antigens: its implications for vaccine development
(Principal investigator: I Ciznar)

Using crossed immunoelectrophoresis with antiserum raised in rabbits, Vibrio cholerae 01 was found to contain at least 29 antigens common to all serotypes and biotypes of V.cholerae. Various chemical treatments of carbohydrate antigens did not reveal any more antigenic determinants.

The immune responses of people with cholera was studied by a technique of crossed electrophoresis with an intermediate gel. This technique indicated that people with cholera produce antibodies during their illness to 8 to 12 antigens including lipopolysaccharides, cholera toxin, flagellar antigen and outer membrane proteins.

It is possible that constituents of the oral cholera vaccine may stimulate some degree of immunity to species closely related to V.cholerae which also cause disease.

Assessing cross protection between an oral cholera vaccine and other members of the family Vibrionaceae
(Principal investigator: BA Kay)

One of the two oral cholera vaccines contains whole killed Vibrio cholerae cells and the B subunit of cholera toxin. The aim of this study is to examine the possibility that this vaccine may afford some degree of protective immunity against other members of the family Vibrionaceae, which includes the genera Plesiomonas and Aeromonas as well as Vibrio.

As a part of this study antibodies to components of the oral cholera vaccine were raised in rabbits by parenteral vaccination. The antiserum was then reacted in crossed immunoelectrophoresis with antigens obtained by lysing species of the family Vibrionaceae. Varying degrees of reactivity were observed indicating that the oral cholera vaccine has antigens in common with other members of the family Vibrionaceae. The importance of this in relation to antigens in the oral cholera vaccine is still being studied.

An additional aspect of this research involves examining the production and immunological properties of a toxin similar to cholera toxin which has been reported to be produced by members of the Vibrionaceae. All strains used in this study are beirg tested for toxin production using the same techniques used to detect cholera toxin: an enzyme linked immunosorbent assay and tests involving cells in culture.

The two princial means of diagnosing Vibrio cholerae at the moment are by microbiological culture and by dark-field microscopy. The former takes over 24 hours and the latter is not a particularly sensitive technique. For these reasons a simple test is required which can be accomplished quickly, particularly where laboratory facilities are poor. The reagents used in many simple tests are often antibodies obtained from the serum of animals which have been vaccinated with preparations of the organisms in question, because reactions between antigens and antibodies are often highly specific and can be made visible to the naked eye. Such reagents can then be supplied for use in the most rudimentary circumstances.

A coagglutination test to diagnose cholera
(Principal investigators: M Rahman and DA Sack)

This test was developed to detect Vibrio cholerae simply and rapidly in faeces, thus confirming the diagnosis of cholera. In this technique killed and preserved bacteria (Staphylococcus aureus) are used as a particle which is coated with antibodies against V.cholerae 01. When these coated particles are mixed with a culture medium inoculated four hours earlier with a patient's stools, the particles clump together if V.cholerae 01 is present. This coagglutination is visible to the naked eye.

The results of the new test agreed with the results of the usual microbiological culture in 161 out of 165 samples tested, with only one false positive and three false negative results. The test is cheap and simple to perform, particularly where laboratory facilities are poor.

The oral cholera vaccines used in the trial were given with a solution of sodium bicarbonate to neutralise the acidity of the stomach and so protect the antigens in the vaccines from being damaged. Yet an acid stomach serves as a natural barrier to infection as it usually kills most bacteria before they can reach the intestine and cause disease. For this reason somebody with hypochlorhydria, a low stomach acidity, may receive effective protection from an oral vaccine but may be vulnerable to intestinal infections. Little is known about the prevalence of hypochlorhydria, mainly because previous tests involved inserting tubes into the stomach and measuring the acidity of its secretions, a cumbersome and skilled procedure. For these reasons a simple test is required.

The validation in Bangladesh of a non-invasive test for gastric acidity
(Principal investigator: FPL van Loon)

This research is an evaluation of a simple, non-invasive test to estimate gastric acidity as a first step in examining any relationship between protective immunity to diarrhoeal diseases and gastric pH.

After receiving a small meal of flavoured casein to stimulate normal gastric acidity, 10 volunteers swallowed 150 mg of magnesium. This reacted with the hydrochloric acid produced in the stomach to liberate hydrogen which was measured on expired breath. A strong correlation was found between the concentration of hydrogen in the breath and the pH of gastric fluid obtained by intubation.

Further research is now underway to study hypochlorhydria as a risk factor for getting cholera and the role this condition may play in people who contract cholera in spite of receiving the vaccine.

Nausea and vomiting are common symptoms of acute cholera. If the emptying of the stomach is impaired this could act to reduce the effectiveness of oral rehydration solutions, although there is some evidence that patients with cholera show less vomiting when treated with rice ORS than with sucrose ORS.

Gastric emptying during cholera
(Principal investigators: FPL van Loon and AM Molla)

The aim of this study was to compare the rate at which both rice ORS and sucrose ORS were emptied from the stomach by measuring the dilution of a dye administered with each solution. The study involved 24 adults during and after recovery from acute cholera and the results indicate that both type of ORS are emptied from the stomach at the same rate.

Escherichia coli is a normal inhabitant of the human intestine as well as one of the most common causes of diarrhoea in the tropics. The apparent paradox in this statement may be explained by the fact that there are both harmless and pathogenic strains of the organism: enterotoxin producing E.coli can cause a diarrhoea as acute as cholera. For this reason it is important to be able to distinguish between different strains of E.coli, and there are two main ways to do this. First, by seeing how well a pure culture of each strain grows in the presence of different drugs: a strain may be sensitive or insensitive to certain drugs, the combination of which may uniquely characterise that strain. Secondly, by exposing pure strains of E.coli to different bacteriophages (viruses which infect bacteria) to see if they are killed or not: again a pattern of susceptibility or insusceptibility may be provided to characterise each strain uniquely.

Bacteriophages as an aid to tracing strains of Escherichia coli from cases to their contacts
(Principal investigator: KA Monsur)

Thirty-one bacteriophages have been identified and are being used to study the transmission of enterotoxigenic Escherichia coli among people taking part in the cholera vaccine trial and in an examination of the usefulness of such a system for identifying strains of E.coli. Already it has been possible to trace strains of E.coli from infected people to their contacts.

Several hundred enterotoxigenic and enteropathogenic Escherichia coli have been tested so far and a number of major groups have been identified, though the majority of strains cannot be placed in these groups. It appears that it is not uncommon for an individual to have simultaneous infections with more than one toxigenic E.coli, an observation which has been confirmed by a study of their plasmids.

Only certain strains of E.coli can cause diarrhoea, strains which must be distinguished from the harmless commensals which naturally colonise the intestine. When colonies of E.coli appear on the culture medium used to isolate and grow them, a number of colonies are sub-cultured and then tested for their ability to produce two toxins, one stable when heated, the other labile. The current tests for these toxins are expensive and tricky procedures involving cells in culture or infant mice. A simple test to confirm the presence of enterotoxigenic E.coli in faeces is required.

A test for the enterotoxins of Escherichia coli
(Principal investigator: DA Sack)

Antibodies to heat stable (ST) and heat labile (LT) toxins were used in an enzyme-linked immunosorbent assay (ELISA) to test 131 isolates of E.coli for their ability to produce enterotoxins. Compared with the current test for LT using Y1 adrenal cells, the ELISA was 87% sensitive if the specimen was tested once and 98% sensitive if tested twice. Compared with the current test for ST using infant mice, the ELISA yielded a sensitivity and specificity of 97%.

The reagents for these ELISAs were provided by Dr Anne Marie Svennerholm of the University of Gotheborg in Sweden, and mean that the tests are easy to perform and quick: the results can be available in less than 12 hours when previously it took over 48 hours to detect enterotoxigenic E.coli. The test is now being used routinely in Matlab and will be introduced into the laboratories in Dhaka in 1987.

Cryptosporidium is a protozoan parasite of the large intestine which causes an acute watery diarrhoea, usually of a limited duration. There is no effective drug treatment yet available. Cryptosporidium appears to belong to a single species genus and is a zoonosis, an organism directly between animals and man, and many species of vertebrates have been shown to be infected. It is only within the last 10 years or so that Cryptosporidium has been shown to be a cause of diarrhoea and it is now being quite intensively studied in many developing countries.

The epidemiology of Cryptosporidium in Bangladeshi children
(Principal investigator: M Rahman)

The aim of this study was to compare 20 children with cryptosporidiosis with 20 matched but uninfected partners in terms of their nutritional status and the presence of infected animals in the household. Once infected children were identified all other members of the family and their domestic animals were tested for infections with Cryptosporidium.

The study is complete and there is evidence that cryptosporidiosis can cause a prolonged and life-threatening diarrhoea. Major problems were encountered in studying the domestic animals with which the infected child could be in contact because in the slums where this study was conducted animals belonging to many people may range freely throughout the household.

SHIGELLOSIS

If cholera is the archetypal watery diarrhoea then shigellosis or bacillary dysentery is probably the archetypal invasive diarrhoea. The disease is caused by four main species of the genus Shigella: S.dysenteriae, S.boydii, S.flexneri and S.sonnei. One serotype of Shigella dysenteriae can cause particularly severe dysentery and illness, due mainly to a toxin produced during the proliferation of the organism in the wall of the colon. The stools produced during shigellosis are characteristically small, frequent, bloody and mucoid.

As in cholera, the treatment of shigellosis involves adequate rehydration, although the diarrhoea does not usually cause the same degree of dehydration. In severe cases of shigellosis antimicrobial drugs must be given if the disease is not to cause persistent damage to the intestine and the prolonged excretion of organisms.

Laboratory research on shigellosis at the ICDDR,B is mainly concerned with different approaches to developing a vaccine. The first approach involves manufacturing an avirulent strain which stimulates immunity but does not cause disease.

Isolating attenuated mutants of Shigella spp. and evaluating them as possible candidates for a vaccine
(Principal investigator: ZU Ahmed)

Avirulent mutants of Shigella could be candidates for a live vaccine against shigellosis. The loss of virulence may be because of a change in the metabolism of the organism or because of a change in its requirements for growth in the human gut. However it is crucial that any mutation must be stable -- there must be very little chance of it reverting to its former virulence. The chances of this happening can be reduced by having more than one mutation in the strain and by ensuring that the mutation involves many base pairs in the genetic code so that the chance of the original code reappearing is negligible.

The aim of this study is to bring about mutations in Shigella and select strains which have unusual requirements for growth. The first mutant which is being looked for is one which will grow well at 30 `C but only slowly at 38 `C. Such a strain would be likely to show poor growth at the temperature of the human intestine and should not cause disease, but it must be able to grow well enough to stimulate immunity.

A second mutant which is being looked for is one which has a defect in the metabolism of thymine so that the cells are dependent on a high concentration of exogenous thymine for their growth.

Another mutant which is being searched for is unable to metabolise galactose so that toxic intermediates accumulate in the cell, thus growth is limited and the cells die before they can become pathogenic. This last

mutant occurs in strains of Salmonella and the gene responsible for this defect, the gal E gene, has been isolated by researchers working at the University of Adelaide under Professor Derrick Rowley. A 450 base-pair sequence has been deleted from the gene and transferred to a plasmid which has been introduced into Shigella. Unfortunately after screening 31 000 clones so far no gal E mutant of Shigella has yet been obtained. The reasons for this are being investigated.

Once suitable mutants have been isolated they will be tested for their ability to stimulate immunity using rabbits which have been treated so that the infection can become established. One possible candidate has been isolated so far and is being tested.

Another approach to developing a vaccine is to find out which antigens of Shigella spp. stimulate the strongest immune response. As it is likely that the infected host first comes into contact with the surface of bacteria, the outer membrane proteins (OMPs) of Shigella spp. are being studied. Pure OMP's prepared in different ways are being reacted in various techniques of electrophoresis with antibodies taken from rabbits immunized by injection with pure OMPs, and with antibodies from people who have had shigellosis. This will demonstrate any differences in immune responses stimulated artificially or naturally, and will indicate which OMPs are most immunogenic and perhaps the best possible candidates for a vaccine. Once the best OMP's have been isolated then purified and tested for toxicity, the genes responsible for the proteins must be identified as the first stage in an exercise in genetic engineering to manufacture pure OMP's. That is the theory and this is what is being done at the ICDDR,B.

Local and systemic antibody responses to Shigella outer membrane proteins in patients with dysentery.
(Principal investigator: I Ciznar)

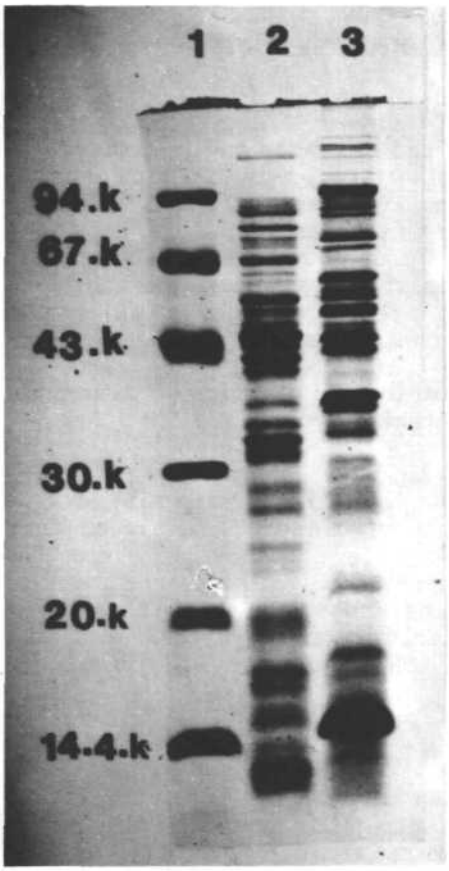
Methods to prepare outer membrane proteins of Shigella dysenteriae type 1 and Shigella flexneri have been established and compared. A preparation containing 4 major OMP's has been prepared as a standard. An analysis of serum from patients with shigellosis has shown that antibodies to all 4 OMP's are synthesised during the illness. However, crossed immuno-electrophoresis has shown that other antigens such as Shiga toxin and lipopolysaccharides also stimulate antibody production as well.

Serum and intestinal fluid from patients infected with Shigella dysenteriae type 1 are now being collected and will be analysed in order to compare the local and systemic antibody response to different antigens.

The outer membrane proteins of Shigella spp. grown under different conditions.
(Principal investigator: F Qadri)

The outer membrane proteins of Shigella dysenteriae type 1 grown in different media were compared using SDS-polyacrylamide gel electrophoresis and by crossed immunoelectrophoresis. The number of OMP's which reacted with antiserum raised in rabbits was found to depend on the media in which the bacteria were grown: the most OMP's were detected in organisms grown in

a medium used to produce cholera toxin from Vibrio cholerae 01.



Proteins can be separated by virtue of the fact that they move at different speeds through a gel under the influence of a potential difference according to the size of the molecule, a process called electrophoresis. This plate shows outer membrane proteins of a strain of S.dysenteriae type 1 prepared in two different ways (lanes 2 and 3) along side several markers of known molecular weight (lane 1). The OMPs in lane 2 were prepared using a water extraction method and those in lane 3 by a sucrose gradient ultra- centrifugation procedure. The gel was 15% SDS-polyacrylamide and the markers were phosphorylase b (molecular weight 94,000 = 94k), bovine serum albumin (67k), ovalbumin (43 k), carbonic anhydrase (30k), soya bean trypsin inhibitor (20k) and alpha-lactalbumin (14.4k).

The surface properties of Shigella spp. were also studied in other ways in an attempt to find simple tests which correlated with the ability to invade tissues and become pathogenic, which is usually indicated by the ability of the strain of Shigella to cause ulceration -- Sereny's test. The ability to bind the dye Congo red and to aggregate in a solution of ammonium sulphate was compared with Sereny's test, and with the number and size of the plasmids detected in each strain by electrophoresis in agarose. Congo red bound to all 70 strains of Shigella spp. which were tested, though to different degrees. No correlation was found between both binding Congo red and aggregation in salts and the presence or absence of specific plasmids which might be associated with invasiveness. However there was an association between Sereny's test and whether the colonies formed on agar plates were pigmented or not.

Another approach to developing a vaccine involves characterising stongly pathogenic species and strains of Shigella to see how they differ

from less pathogenic or harmless strains. Once antigens related to pathogenicity have been identified they can be purified and examined as possible candidates for inclusion in a vaccine.

Some characteristics of strains of Shigella dysenteriae type 1 associated with epidemics of shigellosis.
(Principal investigator: Khaleda Haider)

The aim of this study is to examine the plasmids and resistance to antibiotics of strains of Shigella dysenteriae type 1 isolated from various parts of the world. Of the 175 strains from 10 locations which have been examined so far, 90% of them have in common three plasmids of the same size while 66% appear to have the same plasmids plus another smaller plasmid. Work is continuing using gene probes for resistance to specific antibiotics to identify the location in the organisms of the genes which are responsible for the resistance to antibiotics.

The relationship between outer membrane proteins and plasmids of pathogenic and nonpathogenic strains of Shigella dysenteriae type 1
(Principal investigator: Khaleda Haider)

In Shigella flexneri a plasmid has been found to be responsible for an outer membrane protein which is related to virulence. The aim of this study is to examine any relationship between the outer membrane proteins and plasmids of virulent and avirulent strains of Shigella dysenteriae type 1. Work is underway using 2 wild strains and 8 mutants with altered plasmids to study differences in their outer membrane proteins. The wild strains are all invasive, produce Shiga toxin and stimulate virulence marker antibodies; the mutants do not.

It takes at least 48 hours to diagnose shigellosis by culturing the organisms from faeces, so there is a need for a quick and simple diagnostic test. Antibodies raised in animals to unique antigens are often used as the basic reagents in diagnostic tests because the reaction between antigen and antibody can be highly specific.

A coagglutination test to diagnose shigellosis
(Principal investigator: M Rahman)

The aim of this study was to develop a coagglutination technique to detect Shigella O antigen in faeces and rectal swabs from patients with suspected shigellosis.

Heat-treated Staphylococcus aureus stablised in formaldehyde were coated with serum containing antibodies raised in rabbits to Shigella dysenteriae type 1, S.flexneri and S.sonnei. When the S.aureus come into contact with Shigella O antigen present in faeces the bacteria then clump together or coagglutinate due to the reaction between antibodies on their surface and the antigens in stool. This reaction occurs when there are as few as a million bacteria/ml of stool.

Preliminary results indicate that the test is not as sensitive as it should be to provide a useful diagnostic tool to diagnose S.flexneri but it

works well for S.dysenteriae. Work is underway to evaluate the possibility of increasing the sensitivity of the test by first incubating the faecal sample in an enrichment medium for 5 hours. The possibility of using monoclonal antibodies is also being studied.

Shigellosis is a serious disease in childhood, particularly for children who are malnourished, and it can cause a loss of protein into the intestine which may exacerbate current malnutrition. In well-nourished children the disease usually lasts no more than 10 days but in malnourished children the infection may persist for months, perhaps with several relapses. It also appears from the study reported below that people who have had shigellosis are at greater risk of dying than those who have had just diarrhoea. This evidence of a persistent effect of shigellosis and the problem of increasing resistance to the drugs used to treat the disease mean that shigellosis is a growing problem in Bangladesh and in other parts of South Asia.

Deaths after shigellosis in Matlab
(Principal investigators: N Huda and J Harris)

In this case-control study, 837 patients with shigellosis were compared with 1715 patients without shigellosis. Of the total of 2552 patients, 4.4% died within 6 months after the illness and 85% of these deaths occurred within 3 months. The death rate for people with shigellosis (5.6%) was twice that of people with diarrhoea (2.8%) but was not significantly different from those people with dysentery from whom Shigella was not isolated (4.9%). The main factor associated with a risk of dying was malnutrition. There was no difference in the case fatality rate between children infected with S.flexneri or S.dysenteriae.

Research at the ICDDR,B on shigellosis will expand considerably over the next few years as a result of a major grant from the United States Agency for International Development to study several aspects of this important infection. This work will include clinical studies on the processes of disease, research using experimental animals to study the disease in greater depth, research on immunity to shigellosis, research on the antigens of Shigella spp for possible inclusion in a vaccine, and finally, studies of the transmission of shigellosis — its epidemiology.

TREATMENT FOR DIARRHOEAL DISEASES

Many intestinal pathogens stimulate the cells lining the intestine to secrete fluid and electrolytes into the gut, losses which must be replaced before dehydration and an imbalance occrurs of electrolytes in the blood and tissue fluids. Rehydration can be accomplished using solutions of electrolytes administered intravenously, but this is an expensive procedure which requires close medical supervision and is fraught with dangers of contamination. If a dehydrated patient is treated with pure water by mouth then the imbalance of electrolytes will be exacerbated and the life of the patient may be threatened. The discovery that a solution of glucose enhances the absorption of water and electrolytes from the intestine revolutionised the treatment of mild to moderately severe diarrhoea: cheap and simple oral rehydration became possible. Severe dehydration due to acute watery diarrhoea may still require intravenous rehydration because the loss of fluid can be huge — up to 50% of body weight in 24 hours during severe cholera for example. And intravenous rehydration is still required when the patient is unable to take fluids by mouth or when there is circulatory collapse. But many episodes of watery diarrhoea can now be treated with oral rehydration solutions alone.

Oral rehydration solutions

Since the first oral rehydration solutions (ORS) were developed, many studies have been conducted to improve them: to enhance their absorption, to reduce nausea and vomiting, to reduce the duration of diarrhoea, and to provide more nutrients. The ICDDR,B has been deeply involved in this work and research on oral rehydration solution continued during 1986.

A comparison of the efficacy and digestibility of plantain-salt and rice-salt ORS with the standard glucose ORS
(Principal investigators: AM Molla and Asma Khanam)

The superiority of rice ORS compared with the standard WHO glucose ORS has been well established at the ICDDR,B: it is more palatable, it provides more energy, and it brings about a greater reduction in vomiting and the volume of stool produced. Although rice is the dietary staple in Bangladesh and most Asian countries, other cereals and roots are the staples elsewhere -- maize, millet, potato, wheat, cassava and sago for example. Plantain is a staple used by many people in east Africa and is used sometimes in Bangladesh to feed people recovering from illness. A study of plantain ORS and maize ORS is underway in Dar-es-Salaam, Tanzania, but because of a lack of facilities there the digestibility of the solutions cannot be studied. For this reason the aim of the present study is to compare ORS made from plantains with both rice ORS and glucose ORS as a means of rehydrating children with acute diarrhoea and to examine their digestibility. The effectiveness of the different solutions will be assessed in the usual way and their digestibility and absorption will be assessed by measuring glucose in the stools.

In 1986 170 children were studied. Table 4 shows whether oral rehydration was successfully accomplished or if it failed and intravenous rehydration had to be used. An analysis of the volume of ORS consumed and of the volume of diarrhoea produced is underway.

Table 4

The success or failure of rehydration judged by whether intravenous fluids had to be used to accomplish rehydration.

	Success	Failure	Total
Plantain ORS	57	5	62
Rice ORS	48	4	52
Glucose ORS	50	6	56
Total:	155	15	170

A clinical trial of oral rehydration using glucose ORS supplemented with alanine
(Principal investigators: FC Patra and DA Sack)

Studies on human volunteers have shown that the presence of the amino acid alanine in ORS enhances the absorption of water and electrolytes from the intestine. The aim of this study is to compare with the standard glucose ORS the effectiveness of the same oral rehydration solution containing alanine at a concentration of 90 mmole/l and with a slightly reduced concentration of glucose in order to maintain the osmolarity (90 rather than 111 mmole/l glucose). All other ingredients are the same. In a double blind study, 90 male patients older than 6 years will be randomly assigned to receive either the alanine and glucose or the normal glucose rehydration solutions. All patients will be rehydrated initially with an intravenous acetate solution, all will receive oral tetracycline for 48 hours and all will be fasted for 24 hours before starting to receive their assigned ORS.

Since the study began in June 1986, 55 patients have been studied.

Does solid food potentiate the efficacy of ORS?
(Principal investigators: NH Alam and AM Molla)

Research at the ICDDR,B and elsewhere has shown that cereals such as rice are as effective as glucose in oral rehydration solutions. It has also been shown that such oral rehydration solutions are superior to the traditional glucose ORS in their ability to reduce the volume of stool, to reduce the duration of diarrhoea, to reduce the volume of ORS required and to reduce vomiting. The WHO has term such solutions "super ORS".

In a study at the ICDDR,B it has been shown that the superiority of rice ORS over the WHO glucose ORS is only demonstrable in patients with cholera as long as the patients are not given any food. The aim of this

study is to examine whether solid food potentiates the effects of both types of ORS. The plan is to study 212 patients with moderate or severe dehydration due to cholera and treated in one of four different ways: (1) given glucose ORS and no food for 24 hours; (2) given glucose ORS and food throughout treatment; (3) given rice ORS and no food for 24 hours; and finally (4) given rice ORS and food from the beginning. The effects of these treatments will be assessed by measuring every eight hours the volume of ORS consumed and the volume of stools, vomit and urine produced. Serum electrolytes and body weight will also be measured.

The study began in 1986 and 17 patients were studied by the end of the year. The number enrolled so far is lower than expected because fewer patients attended the Dhaka Treatment Centre than normal between August and October.

Severe dehydration due to diarrhoea could be avoided in many cases if oral rehydration is given as soon as the diarrhoea begins. Simple solutions can be made in the home using domestic sugar and salt, or sachets of oral rehydration salts can be dissolved in clean water so that treatment can be started immediately. Treating diarrhoea promptly with a solution that provides nutrients as well as water and electrolytes may also help to prevent the faltering of growth which is such a common feature of diarrhoeal illnesses during childhood in countries such as Bangladesh.

The effectiveness of rice ORS for treating childhood diarrhoea at home
(Principal investigators: A Bari and ASMM Rahman)

The aim of this study, which was completed in 1986, was to compare the effectiveness of treating children with diarrhoea using locally made packets of rice ORS with the WHO glucose ORS, and to assess the possible benefits of rice ORS in terms of growth.

Three areas around Chandpur were used for this investigation. In one area mothers were trained to use an oral rehydration solution prepared from rice starch and a mix of electrolytes for treating their children less than 5 years old when they had diarrhoea; in another area mothers were trained to prepare and use the WHO glucose ORS; in the third area mothers were encouraged to use locally available services when their children had diarrhoea. Fieldworkers visited households each week to record episodes of diarrhoea. In addition a cohort of randomly selected children in each area were weighed each month and their height was measured every 3 months.

During the two-year study, over 30 000 episodes of diarrhoea were recorded, giving an attack rate of 3 per child per year. Rice ORS was used in 80 to 90% of episodes of watery diarrhoea and in 50 to 60% of episodes of dysentery. A similar rate of recovery was noted for children treated with both rice ORS and glucose ORS, but those receiving rice ORS needed treatment at hospital less often. The median duration of diarrhoea was less in children given rice ORS, fewer episodes lasted for more than two weeks and the children showed a better gain in weight.

Drugs

Drugs to kill or inhibit the multiplication of pathogens are traditionally the first line of attack in diarrhoea, but often they are unnecessary. Oral rehydration is usually sufficient to prevent a life-threatening illness and most diarrhoeal diseases are self-limiting: the pathogen multiplies, an immune response develops, the multiplication of the pathogen is inhibited and the patient recovers. Drugs are still required in certain circumstances however: when the organism is severely pathogenic, when the sick person is concurrently debilitated, or when the disease has gone on for an abnormal length of time. These are all typical examples of circumstances when drugs might be used to treat diarrhoea.

A single dose of doxycycline to treat cholera
(Principal investigator: AN Alam)

The aim of this study is to compare with treatment by tetracycline the effectiveness of treating cholera using a single dose of doxycycline. Two hundred adult patients will be randomly assigned in a double-blind manner to receive to one of the following three treatments: (1) a single dose of 200 mg of doxycycline given on the first day of treatment followed by placebo capsules for the next 2 days; (2) a single dose of 300 mg of doxycycline given on the first day of treatment followed by placebo capsules for the next 2 days; or (3) tetracycline given at a dose of 500 mg every six hours for 2 days. Intravenous rehydration will be given until oral rehydration is possible. The success of the drugs will be assessed by comparing the amount of ORS consumed and for how long V.cholerae are excreted in the stools.

By the end of 1986 72 patients have been enrolled. As this is a double blind study no results are available yet.

A double blind trial of berberine sulphate for treating childhood diarrhoea
(Principal investigators: GH Rabbani and M Shahrier)

Berberine, a plant alkaloid, has long been used as a treatment for diarrhoea in India and China. The drug inhibits toxin-induced diarrhoea in animals and is pharmaceutically marketed in India as well as in Japan. A recently study at the ICDDR,B has shown that a single-dose of 400 mg of berberine reduces the fluid-loss by 30%-50% in adults with diarrhoea due to Vibrio cholerae and enterotoxigenic Escherichia coli. This encouraging result in adults together with reports of the safety and efficacy of the drug in children has stimulated the present study, an evaluation of berberine sulphate for treating diarrhoea during childhood.

In this study 200 children with diarrhoea aged 1 to 15 years of age will be randomly assigned to receive either berberine given at a dose of 10 mg/kg body weight for 3 days or a placebo. The children will be rehydrated initially with intravenous fluids, then transferred to oral rehydration. The volume of fluid consumed and the volume of stools,urine and vomit produced will be recorded. This study is being conducted in collaboration with Dhaka Shishu Hospital.

In 1986 twenty eight patients were studied. As this is a double blind trial no results are available.

Ceftriaxone for treating typhoid fever
(Principal investigator: Asma Khanam)

Some unpleasant and hazardous side effects have been noted when treating typhoid with chloramphenicol. A previous trial of ceftriaxone at the ICDDR,B had shown that a 7-day course of treatment brought about an apparent bacteriological cure after only 3 days of treatment. For this reason the aim of the present study was to compare 5 days treatment with ceftriaxone with the usual 14 days treatment with chloramphenicol given at a dose of 60 mg/kg body weight until defervescence and 40 mg/kg thereafter. Ceftriaxone was administered by infusion in distilled water as a single dose of 4 g per day for adults and at a dose of 75 mg/kg body weight for children.

During the year 25 patients with bacteriologically proven infections with Salmonella typhi were studied. No complications were noted in people treated with ceftriaxone and there was only one failure to cure the infection.

Treating acute diarrhoea with "Bioflorin", a preparation of dried Streptococcus faecium
(Principal investigator: AK Mitra)

The widespread and often unnecessary use of antibiotics has had some adverse consequences. The most serious is the development of resistance to the antibiotics used, and for this reason alternative treatments are being sought. The proprietary nostrum called "Bioflorin" contains a freeze dried preparation of a group D Streptococcus, S.faecium. It is assumed that when viable organisms are introduced into the intestine they multiply and eventually inhibit by competition the growth of pathogenic species. The aim of this study is to evaluate the effectiveness of "Bioflorin" for treating acute watery diarrhoea.

Only adult males who have had diarrhoea for less than 48 hours and who have not received any drugs will be included in this study. It is proposed to study 100 people with cholera, 50 with enterotoxigenic Escherichia coli and 50 with shigellosis. The patients will be randomly assigned to receive either "Bioflorin" or a placebo once every 8 hours. The effectiveness of "Bioflorin" will be assessed by culturing pathogens from the faeces every day for at least 5 days after beginning treatment and by daily clinical examinations.

By the end of 1986 76 patients with cholera, 47 with enterotoxigenic E.coli and 7 with shigellosis had been studied. Which patient received which treatment will only be known at the end of the study.

Shigellosis or bacillary dysentery can cause a severe loss of blood into the gut and the disease can be persistent, particularly in malnourished children. The effects of the disease seem also to be long lasting as a study described in the previous section has indicated: people who have had shigellosis appear to have an increased risk of dying particularly during the following 3 months (see p 25). For these clinical

and epidemiological reasons severe dysentery should be treated with an effective antibiotic. Unfortunately pathogenic species and strains of shigellae appear to be able to develop resistance to antibiotics with remarkable speed so that several drugs are becoming increasingly ineffective, as evidence from both Dhaka and Teknaf shows.

Of 2,356 isolates of species of Shigella tested in the Dhaka Treatment Centre during 1986, 49% were resistant to ampicillin, 37% were resistant to cotrimoxazole and 27% were resistant to both ampicillin and cotrimoxazole. The position is even worse than this: 664 of these isolates were of the most virulent species and strain of Shigella, S.dysenteriae type 1, 71% of which were resistant to both ampicillin and cotrimoxazole.

During 1986 shigellosis was over 8 times more common in Teknaf than during the previous year, and shigellae were isolated from over 1,700 people. Infections with S.dysenteriae type 1 were particularly frequent during the latter half of the year, and most of the strains identified were resistant to all the commonly used antibiotics -- ampicillin, cotrimoxazole and nalidixic acid.

For these reasons there is a continual search for new drugs to treat shigellosis.

Ciprofloxacin compared with ampicillin for treating shigellosis
(Principal investigators: MA Salam and ML Bennish)

The aim of this study is to examine the effectiveness of treating shigellosis with ciprofloxacin, one of the newer quinoline antimicrobial drugs, by comparison with ampicillin.

Each patient will be randomly assigned to receive either 500 mg of ciprofloxacin every 12 hours or 500 mg of ampicillin every 6 hours. To ensure that treatment is given in a double blind manner, the patients treated with ciprofloxacin will receive placebo tablets between their doses of drug so that all patients are given tablets every 6 hours. The treatments will be given for 5 days and their effects will be assessed by microbiological and clinical means: how long organisms are excreted in the stools and how long the fever lasts, for example. Intestinal protein loss during the disease will be estimated by measuring the concentration of alpha-1-antitrypsin in faeces, and the presence of Shiga toxin in the stools will be detected by an ELISA.

Taking into account the fact that strains of Shigella resistant to ampicillin are quite common, according to statistical theory a sample of about 80 patients in each group will have to be studied. During 1986 a total of 91 patients infected with Shigella were studied of which 44 were infected with strains resistant to ampicillin. No results are available yet because it is not known which patient received which drug.

NUTRITION

The synergism between diarrhoea and malnutrition is well known. Research in Matlab has shown for example that malnourished children are far more likely to die of shigellosis than well-nourished children (see p 25). Although during the reorganisation of the Centre the Nutrition Working Group was not replaced with another separate Division, research on nutrition is still being pursued vigorously in the Centre by scientists who have been reassigned to the Community Medicine and Clinical Science Divisions. In addition, Chronic Diarrhoea and Malnutrition has been identified as a priority for research at the ICDDR,B (see p 5).

Studies on the interaction between diarrhoea and malnutrition
(Principal investigator: FJ Henry)

In this study in Teknaf, 1496 children aged between 5 and 24 months were weighed and measured, and information about the family and household was recorded. For 60 days afterwards the number and duration of episodes of diarrhoea was then recorded.

It was found that the incidence of diarrhoea was related to environmental but not to nutritional factors. However, the duration of the attack, and of dysentery in particular, was significantly and negatively correlated with height for age. In this community the synergism between diarrhoea and nutritional status appeared to be related to invasive diarrhoeas and chronic malnutrition.

(See Henry FJ et al. Dysentery, not watery diarrhoea is associated with stunting in Bangladeshi children. Human Nutrition: Clinical Nutrition, in the press.)

Many intestinal pathogens cause damage to the intestinal wall which may bring about a loss of tissue fluids and blood into the gut. Measuring this loss of nutrients or quantifying any abnormalities in the permeability of the intestine can be quite difficult, often because some nutrients may be reabsorbed lower down the intestine while others are excreted unchanged. So what is the significance of measuring the concentration of a blood or tisse substance in the faeces, has some been reabsorbed or is it excreted unchanged? For example, alpha-1-antitrypsin is a blood protein which is known not to be digested in the intestine, so its concentration in the faeces has been used to indicate the degree of intestinal damage. But the concentration of alpha-1-antitrypsin in the faeces only indicates leakage from the gut, not how much of what leaks has been reabsorbed. This has led to the search for tests which measure the permeability of the gut, both to absorbed and leaking nutrients. In one such test the concentration of the sugars lactulose and mannitol are measured in the urine after an oral dose. Lactulose is poorly absorbed in normal circumstances and mannitol is fairly

well absorbed under normal circumstances, so the ratio of the concentrations of these sugars in the urine indicates an abnormally permeable intestinal wall: when the gut is damaged more lactulose and less mannitol is found in the urine than normal.

Protein loss into the gut during diarrhoea in childhood
(Principal investigator: AN Alam)

The aim of this study is to estimate the loss of protein from the intestines of malnourished and well-nourished children with diarrhoea. The effect of zinc supplements on intestinal protein loss will also be studied. The investigation will involve 100 children aged between 1 and 12 years with uncomplicated diarrhoea of various causes. Estimates of intestinal protein loss and permeability will be made both during and 3 weeks after recovery from diarrhoea by measuring alpha-1-antitrypsin in the faeces and the concentrations of lactulose and mannitol in the urine after an oral dose.

This study only began at the end of 1986 so no progress report is available yet.

A great deal of the community approach to nutritional problems concerns vitamin A, a nutrient of great physiological importance and commonly deficient in the diet of many millions of people in the world today. The most common and well known symptoms of a vitamin A deficiency involve the eye and are called collectively "xerophthalmia" — literally "dry eye". Mild symptoms are night blindness and frothy white patches on the cornea called Bitot's spots. In cases of a severe deficiency permanent damage to the eye and blindness may occur.

Diarrhoea and illnesses in young children after vitamin A supplements.
(Principal Investigator: MU Khan)

Vitamin A is an important nutrient particularly for children, and there is some evidence that a dietary deficiency may affect a child's susceptibility to infection. The aim of this study is to examine the effect of an oral dose of vitamin A on illnesses among children, in comparison with children who did not receive a supplement. The incidence and duration of diarrhoeal diseases, respiratory tract infections and skin diseases will be monitored, in addition to nutritional status and the concentration of vitamin A in the serum.

During 1986 108 children were studied. Work is continuing.

Evaluating the risk of dying in the interval between doses of vitamin A six months apart
(Principal investigator: A Briend)

A recent study in Indonesia has claimed that providing capsules of vitamin A can reduce child mortality by as much as 40%. A study to validate this claim in which vitamin A is not given to a control group cannot be conducted in Bangladesh because of the high risk of nutritional blindness as a result of a widespread and common deficiency of vitamin A in

the diet. For this reason an indirect approach to examining the impact of vitamin A supplements on childhood morbidity and mortality in Matlab is underway.

In this study a vitamin A capsule is given to children every six months in villages randomly allocated into two groups so that the capsules are administered at different times of the year. Variations in mortality within the interval between providing vitamin A capsules will be monitored. About 90% of all children within the DSS area of Matlab are now being studied.

Vitamin A in breast milk following supplements given after childbirth
(Principal Investigator: Asma Islam)

Because totally breast-fed infants only receive vitamin A from their mother's breast milk, if the diet of the mother is deficient in vitamin A then the child may develop a deficiency disease or may be at risk of developing a deficiency disease when it is weaned.

The aim of this study, which began in 1986 in Nandipara, is to examine the vitamin A status of a cohort of 30 mothers for 9 months after childbirth. Half of the mothers will be randomly assigned to receive within 24 hours of giving birth capsules which provide 200,000 units of vitamin A. The concentrations of vitamin A and retinol binding protein will be measured in cord blood, venous blood and in breast-milk before the vitamin A capsules are given, and will be measured in venous blood and breast milk after 1, 3, 6 and 9 months.

Malnutrition may act not only synergistically with infection so that when they occur together the consequences of each are greater than of either alone, but a malnourished person may also be predisposed to infections. Thus for two reasons a malnourished child has a greater chance of dying: because the likelihood of an infection is greater, and because the infection may be more severe. Finding malnourished children most at risk of dying and then treating them requires that they can be identified easily and early before malnutrition is too far advanced, but the currently recommended anthropometric criteria used to detect such children are not specific or sensitive enough.

Detecting children in the community most at risk of dying
(Principal investigator: A Briend)

A preliminary analysis of a prospective study conducted in Matlab has shown that if Community Health Workers measure the arm circumference of children every month they can detect at least 40% of children who might die within the next month from a preventable cause. By including information about illnesses in the analysis, the sensitivity and specificity of the assessment of risk is further improved. This suggests that child mortality can be decreased substantially by referring for medical attention children with a high risk of dying. For this reason a Nutrition Rehabilitation Unit was opened in Matlab in 1986 and its impact on the survival of severely malnourished children is now being evaluated.

An adequate period of breast-feeding is crucial for the health and growth of infants. For this reason the age at which they are first given supplementary foods is also important: breast milk should provide enough energy and nutrients for the first few months of life and supplementary foods are easily contaminated with bacteria which can cause disease.

Breast feeding, weaning and infant growth in rural Bangladesh
(Principal investigator: Shameem Ahmed)

The main objective of this study is to examine the effect of introducing supplementary foods on the growth of breast-fed infants. A group of 146 newborn children have been studied from birth until 1 year of age in a rural area in Chandpur District. The children were weighed and measured every 15 days, illnesses were recorded and a 24 hour dietary recall was made. Breast milk samples were collected from 30 randomly selected mothers every 3 months and the nutrient content of the milk was analysed.

An analysis of the relationship between the growth, morbidity and nutrient intakes of the children is underway. This study is being undertaken as research for the Ph.D. degree at the Institute of Child Health, University of London, UK.

POPULATION STUDIES

Demography, the study of populations, is an important part of the work of the ICDDR,B. Accurate information about vital events, morbidity and the movement of people provides the foundations for epidemiological research and allows the effects to be evaluated of ways to improve peoples' health.

In 1963 surveillance began of people living in villages in a rural area of Bangladesh called Matlab, about 70 km from Dhaka, and has continued on a large scale ever since. The data collected provides information about demographic trends and about the effect of a maternal, child health and family planning programme (see p 50) on people in one area of Matlab, the intervention area, compared with people in the remainder, the comparison area. The accurate information already collected and the organisation by which it is collected also provides a unique facility for research and is one of the main reasons why several trials of cholera vaccines have taken place in Matlab. At the beginning of 1986 surveillance was being carried out among about 205,000 people in 149 villages.

In 1976, after a census the previous year, surveillance also began in another rural area of Bangladesh, this time near the extreme south-eastern corner of the country in Teknaf. At the start of 1986 this surveillance system involved about 75,000 people.

Demographic Surveillance Systems
(Principal investigator: B Wojtyniak)

The Demographic Surveillance System (DSS) provides a unique resources for scientific research. Its objective is to obtain accurate information about all vital events (births, deaths, marriages, divorces), in-migration and out-migration in both Matlab and Teknaf.

Progress during the year

During 1986 the recording of vital events continued in both areas without any major change. However, 6 villages in Matlab disappeared because of erosion of land by the river Meghna, so the number of villages in the DSS area was reduced to 143. This had little effect on the population under surveillance because most villagers resettled within the DSS area, but more fieldworkers had to be hired to track and record the resettlement.

An improvement in reporting causes of death was one of the main objectives of the DSS during the year. In Matlab, Health Assistants were retrained in collecting information on the events and symptoms proceeding a death, and particularly in asking questions appropriate to the age of the deceased. The assessment of the most likely cause of death for children aged less than 5 years and for women of reproductive age was done independently by three physicians. The International Statistical Classification of Disease, Injuries, and Causes of Death was introduced

during 1986 to code causes of death, though a simplified classification has been proposed for routine purposes. Some results of a preliminary analysis of causes of death are presented on pages 12 and 13.

The reporting of causes of death in Teknaf was reviewed during 1986. In collaboration with the Centre for Diseases Control in Atlanta, USA, the causes of deaths during childhood in the last 4 years have been re-examined. Almost 30% of deaths of children aged between 1 and 59 months could be attributed to acute lower respiratory tract infections and 23% to diarrhoea and dysentery.

The DSS database

Considerable work occurred during 1986 on the computer database for the huge amount of information generated over the years by the DSS. The design of the database was improved with the help of two consultants from CIDA. When complete the database should provided unrivalled longitudinal information on the DSS populations for research in demography and epidemiology.

During the year the 1982 census file for Matlab was edited to detect errors. This involved cross-checking the same information collected about each member of a household, mothers, children, husbands, wives, and so on, to make sure that the information was consistent. Programmes were then developed to tabulate the information. The data on vital events occurring between 1982 and 1985 was edited and reviewed before being merged with the main DSS database for further cross-checking. Finally, using experience gained from creating the Matlab database, work began to develop a database for the Teknaf DSS.

Some demographic trends in Matlab and Teknaf are presented in Table 5. A significant and encouraging decrease in infant and child mortality was observed in 1985 in all DSS areas. The largest fall, in infant mortality from 114.8 to 84.4 per 1000, was seen in the Matlab Treatment area.

Research

The main research of the DSS during 1986 concerned the impact of famine on fertility, differences in the proportions of widows and widowers, the impact of child nutritional status on mortality, the demographic and socioeconomic factors correlated with an unsuccessful end to pregnancies, and an analysis of causes of death.

A study of the effect of the 1974-75 famine on fertility in 66 Matlab villages showed that there was an overall decline in fertility of 34%. This was partially compensated for by a 17% increase in fertility after the end of the famine. The recovery of fertility was lowest in young and old women, and in the poorest and richest.

The observation that there are 10 times more widows than widowers in Matlab was investigated during the year. An analysis of 5 years data indicates that this difference is due mainly to higher rate of remarriage among widowers than widows and because husbands have a greater risk of dying than wives as they tend to be older at marriage.

Table 5

Population Dynamics in the Matlab intervention area (M interv.), the Matlab comparison area (M comp.) and Teknaf, from 1978-1985.

Vital rates (per 1000)	Area	1978	1979	1980	1981	1982	1983	1984	1985
	M Treat.	12.5	12.1	11.3	11.9	12.5	12.1	13.4	10.0
All	M Comp.	13.8	15.6	14.8	14.4	15.9	18.0	17.3	14.1
deaths	Teknaf	14.7	15.9	12.8	14.2	13.6	14.7	17.1	12.8
	M Treat.	69.0	70.9	59.3	66.4	58.1	56.4	57.9	50.0
Neonatal	M Comp.	78.7	74.6	72.7	69.5	68.1	70.3	71.4	67.9
deaths	Teknaf	78.8	85.6	75.0	88.3	72.8	88.4	96.0	77.4
Post-	M Treat.	45.5	43.5	32.6	36.1	47.5	41.8	56.9	34.4
neonatal	M Comp.	47.0	43.3	41.3	45.0	50.2	42.2	55.7	49.3
deaths	Teknaf	54.3	57.1	46.8	51.2	46.1	65.4	57.3	45.9
Child	M Treat.	22.5	17.1	18.6	19.1	18.8	21.6	23.1	14.7
(1-4 y)	M Comp.	22.1	26.2	25.4	24.8	27.4	35.3	39.2	21.5
deaths	Teknaf	16.8	16.9	13.7	14.9	10.6	12.3	22.1	11.8
	M Treat.	32.1	34.9	37.1	35.3	36.9	33.8	30.7	34.3
Births	M Comp.	37.8	47.0	45.5	43.8	44.6	42.4	37.3	42.5
	Teknaf	45.1	55.6	52.4	51.5	54.2	53.4	54.8	54.4
Total	M Treat.	4.5	4.8	5.1	4.8	5.0	4.5	4.0	4.5
fert-	M Comp.	5.4	6.9	6.7	6.3	6.3	6.4	5.1	5.9
ility*	Teknaf	6.7	8.1	8.1	7.7	7.9	7.5	7.8	8.1
	M Treat.	19.6	22.9	25.8	23.4	24.3	22.3	17.3	24.3
Natural	M Comp.	23.9	31.4	30.6	29.4	28.8	25.8	20.0	28.4
increase	Teknaf	30.4	39.7	39.6	37.3	40.6	38.7	37.7	41.6

* per woman.

A study based on data from five villages in the Matlab DSS area on the relationship between child mortality and nutritional status, gender, the mother's education and household socioeconomic status, showed that nutritional status has the greatest influence on survival. It was also observed that the estimates of nutritional status made at the start of the study did not lose their power to predict the risk of dying throughout the 18 months of the follow up.

The importance of assessing nutritional status by measuring mid-upper arm circumference, its value as a predictor of the risk of dying and the benefits of breast feeding were studied in collaboration with members of the Community Medicine Division (see p 34). The DSS is also involved with the CMD in studies on the effect on morbidity and mortality of distributing

capsules of vitamin A (see p 33).

Of every 1000 pregnancies in the Matlab DSS area about 55 end in spontaneous miscarriages and about 33 as still-births. An analysis of factors associated with miscarriages indicated that the most important risk factors were the loss of a previous foetus and a young age. The factors associated with still-births again included the loss of a previous foetus, though this was more significant in older women, as well as nulliparity and a low socioeconomic status.

Using figures generated by the DSS for the growth in population an estimate of the population of Bangladesh in the year 2000 was made and the demand for medical facilities was estimated. The analysis suggests that it will be very difficult to meet a major objective of the World Health Organization -- to provide "health for all by the year 2000". If Bangladesh is to provide the same health care offered in Sri Lanka in 1972 then there will have to be 30 times more hospital beds, 5 times more physicians and 70 times more nurses.

The DSS was involved in 1986 with other studies which have made use of the DSS database and information gathering system. In collaboration with the Laboratory Sciences and Epidemiology Division and the MCH-FP Extension Project the effectiveness of vaccination against measles (see p 11) and tetanus has been assessed, and an analysis of mortality after shigellosis has been done (see p 25). Information from the DSS has also been used by the MCH-FP Extension Project and the Community Medicine Division for an analysis of maternal mortality.

A qualitative study of changes in fertility and mortality in Matlab
(Principal investigators: Moni Nag (Population Council), M Badrud Duza and M Koenig)

The study was undertaken by the ICDDR,B in collaboration with the Population Council, New York. It was based on 58 group interviews in 23 villages of the Matlab treatment and comparison areas during the latter half of 1986. Among the issues addressed were the size of families, attitudes to family planning and the use of health and family planning services.

A major report entitled "Explaining Fertility Transition in Matlab, Bangladesh: A Qualitative Study," was completed in December 1986. Several papers covering other important topics and a monograph are planned for 1987. This research is intended to complement the numerous quantitative studies of survey research which have been conducted in Matlab on these issues.

In 1982 the Planning Commission of the Government of Bangladesh requested the ICDDR,B to collaborate with the Ministry of Health and Population Control to identify barriers to providing an effective maternal, child health and family planning service, to finds ways to overcome them and to put into practice new interventions. This request came after the Centre had been testing parts of the successful Matlab MCH-FP which had been transferred to the Government health system. The MCH-FP Extension Project has since developed to become a means to test alternative MCH-FP services and to conduct research on the way those services are provided.

The MCH-FP Extension Project
(Marjorie Koblinsky and MA Koenig)

Working in close collaboration with Government officials in two upazilas in the Districts of Jessore and Sirajgonj, the Extension Project has carried out studies to identify the reasons why health services are not delivered effectively, to identify ways to overcome any difficulties and barriers, and to test the modified and improved health services given the constraints and limitations of the Government health care system. In 1986 work focused on three main issues:

- improving human resources, including training and retraining health and family planning workers;
- improving techniques, including evaluating a programme of domiciliary visits to provide injectable contraceptives and alternative ways to deliver vaccinations;
- improved management, including a better record keeping system, better supervision and a more efficient flow of supplies.

Family Welfare Assistants

A major objective during 1986 was an evaluation of increasing the density of Family Welfare Assistants (FWA) from one to every 7500 people in the community to 1:4000. This experiment is a precursor to the Government's plan to hire another 10,000 FWAs and it provided valuable insights into how these health workers could be most effectively recruited, trained and deployed on a national scale. The initial observations in the areas served by the Extension project suggest that the additional FWAs may bring about major improvements in the delivery and quality of maternal, child health and family planning services.

This work has resulted in a greater collaboration between the Extension Project and the Ministry of Health and Family Planning to improve MCH-FP services at the national level. Technical assistance was provided during the year to NIPORT to develop an improved training curriculum for FWA's and the Project also assisted the Government in its plan to recruit the additional FWAs during its third Five Year Plan.

Two important parts of the MCH-FP Extension Project are the Sample Registration System, information recorded by interviews with villagers in the Project areas at intervals of 90 days, and the Record Keeping System, a system to record the services provided by the Community Health Workers in the Matlab MCH-FP Programme (see p 50).

The Sample Registration System (SRS)

The aim of the Sample Registration System is to be able to assess rapidly the impact of the services provided by the MCH-FP Extension Project on the use of contraceptives and on behaviour relating to health. The information is derived from interviews held every 90 days with a sample of villagers in 9,828 households. The SRS produces regular reports on the methods and use of contraceptive, on contacts between village women and health and family planning workers, the topics discussed and services provided during those contacts, and on vital events.

The introduction of personal computers has allowed data to be entered directly from registers used in the field thus eliminating the need for reporting forms, and data is now more readily available. The System allows new information to be collected at any time and linked to that already in the archives.

In collaboration with the Population Council the SRS is being adapted to create an easily used system based on microcomputers. The data will be entered into the microcomputer directly from registers used in the field, thus eliminating the need for report forms, reducing the possibility for errors and increasing the speed of data collection.

The Record Keeping System (RKS) in Matlab

One of the components of the Matlab MCH-FP Programme is to collect data on the family planning and health services which are provided to over 15,000 women. The Community Health Workers who deliver the services record information on the dates of menstruation and onset of pregnancy, on the outcome of pregnancies, and on the use of contraceptives, their side effects and the reasons for stopping contraception.

In 1986 about 15,000 children were also included in the RKS and information was collected about immunization, vitamin A capsules received and about treatment for diarrhoea.

Research

During 1986 the Extension Project continued active research on aspects of the services provided in both Matlab and the Extension Project areas and major concerns during the year were operational and policy lessons learned from the Matlab MCH-FP Programme.

Using time series data a new review was completed of the effect of providing additional maternal and child health services on the number of people using contraceptives. The study demonstrated the need to introduce new services carefully and gradually in order not to interfere with existing services.

Another study carried out during the year explored factors behind the sharp rise between 1977 and 1984 in the number of people in the Matlab

treatment area practising contraception. The results indicate that the increased reliance upon contraception to control birth spacing was the most important factor and accounted for almost 60% of the increase.

A separate paper provided a review of the Matlab MCH and family planning services, factors underlying their success in family planning, and the implications for the success of other programmes in settings such as rural Bangladesh.

A collaborative study with the DSS on the effects of birth spacing on infant and child mortality was completed and found that a short interval between births was associated with a higher risk of dying. At the same time it was found that because many women breast-feed their children for a long period and so do not conceive because of lactational amenorrhoea only a few children were at particular risk.

During the cholera vaccine trial conducted in Matlab in 1974 immunization against tetanus was provided as a placebo for the injected cholera vaccine. In another collaborative study with the DSS, the effects on subsequent neonatal mortality of having provided tetanus toxoid to women was studied in comparison with women who did not receive the tetanus toxoid. It indicated that two doses of tetanus toxoid resulted in a 16% reduction in neonatal mortality with the greatest reduction, of 50%, occurring between 4 and 14 days post partum. An important conclusion of this study was that while the reduced mortality was significant it was considerably less than that suggested by previous studies of neonatal tetanus in Bangladesh. This suggests that there may be fewer deaths from tetanus than actually reported.

A collaborative study with members of the Community Medicine Division examined maternal mortality in Matlab between 1976 and 1985. The average number of deaths which occurred during pregnancy and for 3 months after birth was 5.5 per 1000 live births. Some reduction of this high rate was observed during the period under study in the Treatment area (see Matlab MCH-FP Programme report on p 49 for explanation), apparently a result of the successful family planning programme and fewer pregnancies. The findings of this study indicate that while family planning programmes can reduce maternal mortality, on their own they are insufficient so intensive services must be provided to reduce death before, during and after birth.

The other major component of the Extension Project research during the year was a series of operational studies of the nature, quality and quantity of Government health and family planning services, and in particular the staff who provide those services to rural people.

A series of papers was published which compared and contrasted the Government health and family planning services delivery system with that in Matlab, and identified operational barriers to improving services within the Government system. A review of the study of exchanges in South Asia between people who provide services and their clients was also published during the year.

Other completed studies in operations research included:

- a qualitative study of the use of time by Family Welfare Assistants,

the basic female health and family planning outreach worker in the Government system;

- a quantitative study of the frequency of household visits, topics discussed and services provided by male and female Government workers to rural Bangladeshi women and their children;

- a study of the nature and quality of the services provided by female paramedical workers working for the Government;

- a study of the field supervision of the Government family planning programme;

- an analysis of the effect of household visits by FWAs on subsequently using contraception;

- a study of the feasibility of a domiciliary injectable contraceptive programme in Bangladesh.

In all these studies the objective was to obtain a detailed and realistic understanding of conditions in the field and in the light of any findings, to make recommendations to policy makers about improving the delivery of services.

Maternal, child health and family planning services may be effective, but in poor countries where money for health care is limited they must also be cost-effective.

A cost-effectiveness analysis of the MCH-FP Programmes.
(Principal Investigators: Deborah Balk and Marjorie Koblinsky)

The first aim of this study was to identify and calculate the costs incurred in conducting the MCH-FP Project in Matlab. The second aim was then to compare a ratio of the costs and effects of the MCH-FP Project with other similar interventions in the area of Matlab being used as a control for the Project. In addition, data from nationally organised health and family planning services have been collected to provide another comparison. This cost-effectiveness analysis concerns the costs of all aspects of the Matlab MCH-FP Programme from 1978 to 1985 including services, supervision, administration, data management and research, and concerns both the immediate and delayed effects of the interventions.

This analysis of costs and effects has been now been extended to the MCH-FP Extension Project (see p 50). As a part of the operations research of the Extension Project it is possible to determine the costs and effects of other similar interventions to improve health, such as primary medical care, providing more FWAs, an injectable contraceptive programme and the Expanded Programme for Immunization.

Using micro-economic analyses of the components of the Matlab and MCH-FP Extension projects, lessons may be learned which may be applied to the health and family planning programme of the Government of Bangladesh.

OTHER ACTIVITIES

The interests of the Centre are evident to all who read its name. But although research is a large part of the work of the ICDDR,B, the Centre is also involved in many other activities including training, publishing and providing health care.

For example the ICDDR,B runs hospitals in Dhaka, Matlab and Teknaf which provide anyone with free treatment for diarrhoeal diseases; it runs a large programme delivering free health care in the urban slums of Dhaka, a model of its kind; and it provides maternal, child health and family planning services in Matlab involving free vaccinations, contraceptives and treatment for diarrhoeal diseases.

The Centre also provides expertise for the Government of Bangladesh. A programme to improve the Government's readiness to treat and control epidemics of diarrhoea has been developed, while the Centre is involved in testing many aspects of MCH-FP programmes (see section "Providing Health Care").

In addition to this, many research projects provide facilities or services for the people involved in their studies. For example, tube-wells and pit latrines have been provided in a large area of Mirzapur (see p 8) and most projects involing rural people such as those which have been undertaken over the years in Nandipara, just outside Dhaka (see p 34), provide free treatment at clinics.

The Centre's Library has an extensive and probably unique collection of literature on diarrhoeal diseases available for anyone to consult. The Centre's Publication Unit utilises many of the experts in the Centre to help them prepare specialised Bibliographies on diarrhoeal diseases as well as an international journal and a newsletter.

The Training Branch organises many courses each year on aspects of diarrhoeal diseases such as treatment, diagnosis and epidemiology, using the experts with the Centre as lecturers. These courses are attended by many hundreds of people both from within Bangladesh and abroad.

Finally there needs to be laboratory support for research and routine clinical diagnosis within the Centre's facilities, support which is sometimes made available for outside users.

Some of these other aspects of the Centre's work are described in the next four sections.

PROVIDING HEALTH CARE

The ICDDR,B runs three main hospitals which provide free treatment for diarrhoeal diseases for anyone who needs it. Two of the Treatment Centres also have Nutrition Rehabilitation Units for severely malnourished children.

Each treatment centre has facilities for diagnosing the main pathogens responsible for diarrhoea. At the Dhaka Treatment Centre the diagnosis of pathogens from patients with severe illness continues side by side with a scientific process of sampling so that faeces from one in every twenty five patients is cultured and microscopically examined. The results of this surveillance provide useful information about trends in diarrhoeal diseases. A report of this work can be found in the section on Morbidity and Mortality (see p 10).

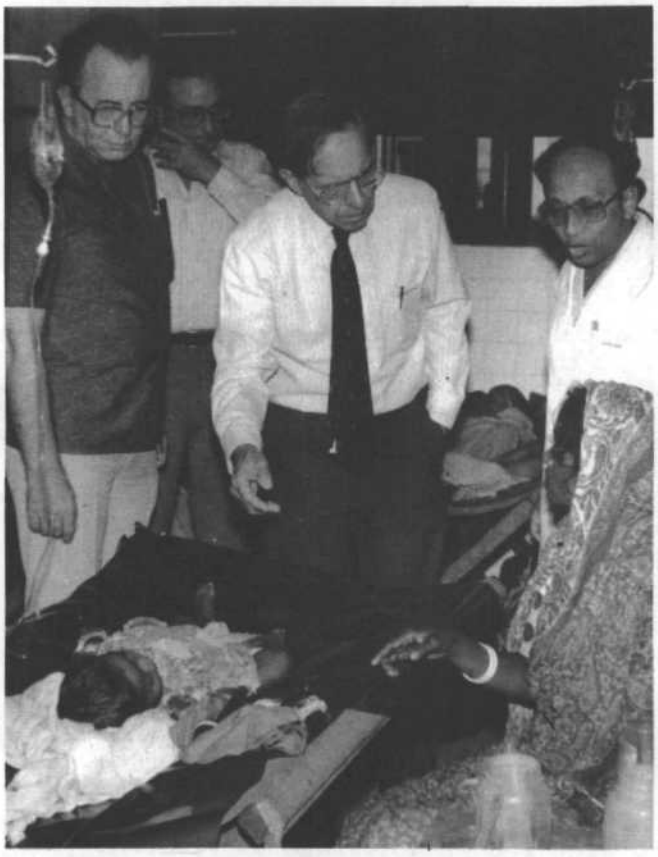
Dhaka Treatment Centre
(AN Alam)

During the year 64,140 people came to the hospital for treatment and 5,712 (8.9%) were actually admitted to the general wards, to the nutrition rehabilitation unit or to the intensive care ward. The average stay was 5.5 days. Only 1.4% of all people who visited the Treatment Centre during 1986 actually took part in research studies.

Cholera and shigellosis were the most common reasons for people to be admitted to the ward and occurred in 15.9% and 19.9% of patients respectively. A prolonged and severe epidemic of cholera during the year resulted in a marked increased in the use of intravenous rehydration fluid, and cholera caused almost 5% of the 365 deaths which occurred during the year. However the most significant cause of death was still shigellosis -- it caused 25% of all deaths in the hospital during 1986. The total death rate about was 1% higher than in 1985 at 6.4% of patients admitted, which is 0.6% of the total number of patients who came to the Treatment Centre. Unfortunately 66 people were brought to the hospital too late and were dead on arrival.

Reorganisation.

In February 1986 five groups were created within the Hospital with specific responsibilities for (1) Watery diarrhoea, (2) Chronic diarrhoea, (3) Invasive diarrhoea, (4) the Research ward and (5) the Outpatient Unit. Each group has a Senior Medical Officer (SMO) who is the leader of the "firm" for 9 months. Under the SMO are several Medical Officers who spend 4 months in each group and then move on. This system is designed to allow physicians to gain some intensive and specialised experience in different aspects of the work of the hospital. In addition, the patients also benefit by becoming the responsibility of a small group of physicians who can deal more personally with their illness.



The US Ambassador to Bangladesh, Mr Howard B Schaffer (centre) seen talking to the mother of a child with diarrhoea at the Dhaka Treatment Centre. On the left is the Director of the Centre, Dr Roger Eeckels and on the right Dr AN Alam, Head of Hospital.

Child Stimulation Programme
(Monique Sternin)

The general objective of this programme is to accelerate and improve the recovery of malnourished children in the Nutrition Rehabilitation Unit of the Dhaka Treatment Centre. The specific aims are as follows: to enhance the awareness and interest of children in their general environment and so stimulate an interest in eating; to improve the relationship between mothers and their children by introducing play and by encouraging feeding; to train the staff of the NRU in basic techniques to stimulate children; finally, to prepare a booklet for staff on stimulating children.

The introduction of child development assessment tests and the use of an adapted version of the scale to assess mother-infant sensitivity (AMIS) will help in measuring the impact of stimulating children.

The overall responsibility for the ICDDR,B field stations in Matlab and Teknaf lies with the Associate Director of the Community Medicine Division. In addition to the Treatment Centres described below, demographic surveillance is carried out in both areas by the DSS (see p 36) and a large MCH-FP Programme is operated in part of the Matlab area. During 1986 the Matlab Field Station was also heavily involved in the Oral Cholera Vaccine Trial.

Matlab Station
(M Yunus)

During 1986 nearly 9,000 patients were provided with free treatment for diarrhoea at the Treatment Centre, 70% of whom came from outside the area of the Demographic Surveillance System. The case fatality rate was 0.5%. An additional 4,500 people were treated at three Community Operated Treatment Centres (COTCs) run by volunteers trained by the Centre. There were only three deaths at the COTCs, a case fatality rate of less than 0.1%.

In addition to the huge amount of work for the Cholera Vaccine Trial, the Microbiology Laboratory cultured stools from patients with diarrhoea who came from within the DSS area and isolated three main pathogens: Vibrio cholerae (30%), non-cholera vibrios (31%) and Shigella spp. (6%). The Clinical Pathology Laboratory performed microscopical examinations on 6,562 faecal samples, 1,093 urine specimens and over 3,000 blood samples.

The Matlab Field Station was involved in at least 8 training courses during the year including trips from Dhaka by several participants on international courses, as well as many other less formal visits. Finally, 1986 saw the introduction of training courses for ICDDR,B field staff and local Government officials in subjects such as epidemiology, demography and statistics, as well as a workshop on the Expanded Programme of Immunization which provided a forum for the Centre's staff to meet and discuss issues with local and central Government authorities. These activities were highly successful and will be developed further in the coming years.

Teknaf Station
(MH Munshi)

Two treatment centres are operated in Teknaf supported by a small laboratory; services are provided free of charge. During 1986 there were simultaneous epidemics of cholera and of shigellosis due to Shigella dysenteriae type 1. As a result the attendance at the outpatient centre increased by 50% to more than 5,000 patients and a higher proportion were admitted to hospital (Table 5).

A total of 5310 faecal samples were examined microscopically and were cultured for species of Shigella, Salmonella and Vibrio. The strains of S.dysenteriae type 1 isolated were resistant to most of the commonly used antibiotics so nalidixic acid was introduced to treat infections in the middle of 1986. However, resistance to nalidixic acid was found in over 25% of cases.

Table 6

Teknaf: a comparison of clinical service statistics between 1985 and 1986

	1985	1986
Total number of patients	3,631	5,565
Watery diarrhoea	1,152	1,780
Dysentery	2,253	3,572
All others	226	213
Deaths in treatment centres (TCs)	1	9
Patient stayed at TC > 12 hours	36	252
Total number of stools cultured	3,405	5,310
V.cholerae isolated	24	201
Shigella spp isolated	833	1,724
Total ORS used (litres)	6,915	12,550
Total IV fluid used (litres)	557	823

Nandipara Clinic
(Asma Islam)

The Centre has been conducting research in a small area around Nandipara village, just outside Dhaka, for the last 9 years. One such research study is described in the Nutrition section on p 34. As part of this work a free clinic is provide for the mothers and children of Nandipara. In 1986 1,840 patients attended the clinic, most of whom were less than 5 years old. The most commonly provided treatments were for diarrhoea, dysentery, acute respiratory tract infections, pulmonary tuberculosis, skin infections and malnutrition. The mothers of malnourished children were given nutritional advice or were referred to the Nutrition Rehabilitation Unit of the Dhaka Treatment Centre. Mothers were also given health education, with the emphasis on breast feeding and preparing ORS, and traditional birth attendants were trained in aseptic measures and given safe birth kits.

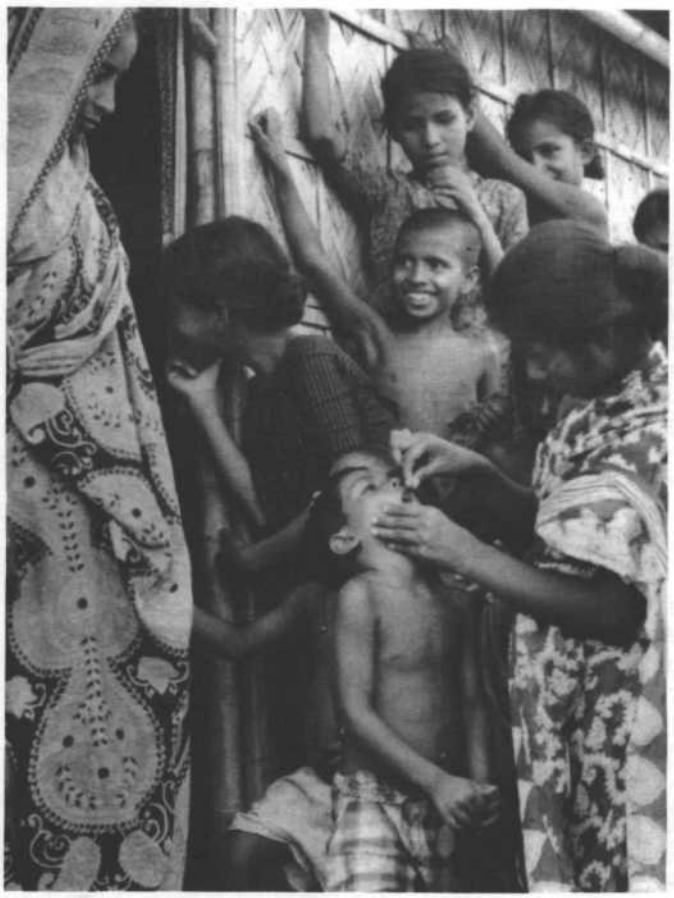
A programme of immunization was begun during the year and 207 children were vaccinated against diphtheria, pertussis, tetanus (DPT vaccine) tuberculosis and polio; 80% received all three doses of the DPT vaccine. In addition, 140 children received vaccination against measles and pregnant women and women of child bearing age were vaccinated against tetanus.

Acute watery diarrhoea should not kill anyone as long as fluids and electrolytes lost in the stools are promptly replaced. The word "prompt" is to be stressed -- treatment for diarrhoea must begin at home, as soon as diarrhoea starts, if a life threatening dehydration is to be avoided. In 1981 a programme began to teach illiterate and semi-literate women from the slums of urban Dhaka how to make ORS to treat people with diarrhoea and, most importantly, to teach people how to make and use ORS themselves. In

this way mild to moderate diarrhoea could be treated in the home and the chances of it developing into serious dehydration requiring medical attention could be reduced. From these beginnings the Urban Volunteer Programme as it is called, has developed into a large and successful way to provide health care to the urban poor of Dhaka.

The Urban Volunteer Programme (UVP)
(Bonita Stanton)

In 1986 approximately 1,500 women volunteers from the slums of Dhaka delivered primary health care to households and at two clinics within the slums. From 60 to 200 volunteers worked in each of Dhaka's 18 districts, which have an average population of 250,000.



An Urban Volunteer administering vitamin A capsules to children with xerophthalmia in the urban slums of Dhaka.

The scope and magnitude of the services provided by the Urban Volunteers increased during the year:

- 78,687 people were treated for dehydration due to diarrhoea and 244,590 packets of ORS were used

- over 6,000 moderately and severely dehydrated patients were successfully treated for their diarrhoea at a clinic staffed continuously by volunteers

- children with xerophthalmia were detected and treated with oral vitamin A

- nutrition education was augmented by distributing two thousand packets of vegetable seeds to encourage people to grow green leafy vegetables in gardens and on roofs during the winter

- the volunteers actively motivated and organised women to have their children immunised, and as a result over 12,500 children were vaccinated between January and September

- two clinics established in 1985 in cooperation with local municipal officers continued to function

- a study of scabies indicated a prevalence of 30% with a cumulative annual incidence of 70%, so 30,532 bars of Neem soap were distributed.

Nutritional rehabilitation

A day-care nutrition education and rehabilitation centre staffed by Urban Volunteers treated malnourished children who received 4 meals each day. The mothers of children being fed were active participants in comprehensive nutrition education, including demonstrations of food preparation, and were themselves given one meal a day. The children who were treated showed a significantly improved nutritional status with a median gain of 7% in weight for height 5 weeks after admission. This improvement in the treated children was shown to be sustained 6 months later and their nutritional status was significantly better than that of other children of the same age 9 months later. The success of this nutritional rehabilitation unit has led to the establishment of two more.

Since 1977 a comprehensive programme of health services has been provided to a population of about 96,000 in Matlab with the aim of reducing maternal, infant and child mortality and obtaining a sustained increase in the number of couples practising family planning.

The design, implementation and monitoring of MCH-FP services in Matlab
(MGM Rowland & V Fauveau)

The Demographic Surveillance System (see p 36) in Matlab makes it possible to assess the impact of more intensive health care and family planning services on one half of the population in the DSS area (the MCH-FP Project) by comparison with the population of the other part, which receives the normal government services. Health care is delivered in fortnightly visits to homes by 80 Community Health Workers (CHW) who provide advice on family planning, a wide range of contraceptive methods, vaccinations, safe birth kits, vitamin A capsules and nutritional education. Mothers and children can also receive treatment for diarrhoea

and other illnesses at the Matlab Treatment Centre or at four smaller clinics. The CHW's are supervised by male Senior Health Assistants who counsel husbands when needed and by female Family Welfare Visitors who can treat women for family planning related infections and can insert intra-uterine devices.

The development of the project began with services considered to be most important for the health of mothers and children: the means for planning a family, treatment for diarrhoea and vaccination against tetanus. Later on services were provided to train traditional birth attendants, to provide antenatal care and to vaccinate against measles.

Immunisations

All children aged from 9 to 60 months in the population of 96,000 are offered immunisation against common diseases. Vaccination against measles was completed just before the annual epidemic between January and March. In April immunisation began against diphtheria, pertussis and tetanus, given as a combined vaccination (DPT), and against tuberculosis (BCG) and polio. As this is a new service there were considerable numbers of children to be vaccinated during the year. Once all have been immunised then newly eligible children will be vaccinated at home.

Tetanus toxoid was offered in early 1986 to all married women of child-bearing age whether pregnant or not, so that nearly 90% of pregnancies were protected by two doses of toxoid.

In order to provide these vaccinations an excellent relationship has been established with the Bangladesh Expanded Programme of Immunization and an efficient cold chain has been maintained.

Oral rehydration, diarrhoea and dysentery

The mainstay of treatment for watery diarrhoea continues to be oral rehydration. However, a survey conducted in 1986 showed growing evidence of an increase in the number of deaths in childhood due to chronic dysentery, and particularly among malnourished children (see p 25). This appears to be part of a increase in dysentery throughout south-east Asia and which oral rehydration does not seem to be able to prevent. For this reason surveillance has been improved in order to try and develop new ways to counter this worrying trend.

Safe birth practices

Neonatal and maternal death rates are still unacceptably high and have shown little improvement, mainly because of poor hygiene during delivery in the home and because mothers at risk of complications are not detected. A programme to train 500 birth attendants got underway at the end of 1986 and safe delivery kits have also been distributed to all pregnant women. Ways to overcome the reluctance of mothers to have trained health personnel on hand during delivery are being studied.

Nutrition

In April a Nutrition Rehabilitation Unit was opened at the Matlab Treatment Centre. This unit will enable severely malnourished children to receive treatment in isolation from people with possibly infectious diarrhoeal diseases. A systematic screening and referral system has been established in the community and research is underway concerning the best

indicator of a need for nutritional support (see p 34).

During its first 9 months of operation 98 children with a mid-upper arm circumference of less than 100 mm were admitted. The children stayed in the Unit with their mothers for an average of 20 days and there were six deaths, mostly as a result of infections complications or due to congenital abnormalities. Once children are well enough to leave the Unit they will be weighed and measured during regular home visits in order to evaluate their subsequent health and growth.

Capsules providing 200,000 units of vitamin A were distributed to children twice in the year during home visits. The impact of providing vitamin A every six months is being evaluated (see p 33).

Family planning activities

The domiciliary contraceptive service was maintained throughout 1986 and clients were offered a wide range of methods from intra-uterine devices to condoms. The acceptance rate of 46% is twice the national average.

Other maternal and child health services

General health services were provided as usual at the Matlab Treatment Centre and at the 4 clinics, but special attention was paid to detecting and treating acute respiratory tract infections, the second most common cause of death during childhood.

To improve the training of all paramedical staff an analysis of tasks concerned with all aspects of health care was undertaken. New roles and expertise needed to provide appropriate services have been defined and further is planned.

An alarming increase in the incidence of diarrhoeal disease during 1982 led the Ministry of Health of the Government of Bangladesh to seek the help of the ICDDR,B to set up an Epidemic Control Preparedness Programme (ECPP). This initiative will eventually form the basis of a National Diarrhoeal Disease Control Programme.

Epidemic Control Preparedness Programme (ECPP)
(AKM Siddique)

The general objective of the ECPP is to provide the Government of Bangladesh with the expertise to control epidemics of diarrhoea by training Government health staff in its diagnosis, management and prevention. The project began in July 1983 with a grant from the Ford Foundation and following its initial success has expanded with the collaboration of the Ford Foundation, UNICEF and the Government of Bangladesh.

The specific aim of the Programme is to train health personnel from all 460 upazilas of Bangladesh to control and prevent epidemics of diarrhoea and so to reduce the case fatality rate from 10% to 1%. After 2 years experience of 174 outbreaks of diarrhoea, the ECPP had made significant progress towards these aims by the end of 1986. The ECPP has been able to identify factors associated with the high case fatality rate due to cholera in rural areas, and has identified cheap and effective measures to prevent epidemics.

The success of the ECPP was confirmed in May 1986 during a joint review of the programme by the Government of Bangladesh and officials from the WHO and UNICEF. The reviewers acknowledged that an effective administration has been developed and that the ability to detect and respond to epidemics has been improved appreciably. However, due to a lack of money, medical staff from only 327 of the 460 upazilas in Bangladesh have received training so far. Nevertheless during 1986 the Programme has trained 17 more Government medical officers to increase the total trained so far to 37, and 111 other government health officials received training during the year.

The Government of Bangladesh is now seeking further assistance from the ICDDR,B to train health workers, to improve its surveillance for outbreaks of diarrhoea and to improve its interventions to control epidemics. In response the Centre plans to train health officials from the remaining 133 upazilas, to review the current surveillance for outbreaks of diarrhoea, to review the reporting of morbidity and mortality due to diarrhoeal diseases, and to develop in two upazilas a model information gathering system. In addition the Centre will continue to provide technical assistance to control and prevent epidemics of diarrhoea. Ultimately the National Control of Diarrhoeal Disease Programme will merge with the Centre's Epidemic Control Preparedness Programme, though the Centre will still offer technical assistance to the Government of Bangladesh.

TRAINING, THE LIBRARY AND PUBLISHING

Training Branch
(Branch Head: R Wroot)

During 1986 981 scientists, physicians and health personnel from 16 countries received training in the Centre. Although the total number decreased by 48% compared with 1985 because of a reduced demand for short visits to see the Centre's facilities, there were nine international training courses during the year attended by 102 students, an increase of 76%, and 5 national courses attended by 75 people.

International Training Courses

Seventy-five physicians and nurses from Nepal (39), Somalia (4), Tonga (1), Botswana (2), Zimbabwe (4), Indonesia (22), and Bangladesh (3) attended six courses on clinical aspects of diarrhoeal diseases, including diagnosis and treatment in both hospitals and the community.

Eleven doctors and nurses from Egypt and the Yemen attended a course on field practices in "Maternal, child health and family planning with special emphasis on diarrhoeal diseases". The aim of the course was to improve the participants' ability to identify risks for mothers and children, particularly from diarrhoeal diseases, and to provide appropriate care.

Eight participants from the People's Republic of China attended a course called "Epidemiological aspects of diarrhoeal disease". This included how to conduct surveys and to evaluate methods to control and prevent the transmission of diarrhoeal diseases.

A course on "Laboratory diagnosis of common diarrhoeal diseases" was attended by eight participants from China, Sri Lanka, Thailand and Nepal.

The fees, travel and living expenses of the participants at these courses were funded by CIDA, USAID and Japan.

National Training Courses

In 1986 the Centre organised four five-day training courses for 70 staff of the Bangladesh Rural Advancement Committee (BRAC). These courses provided training for supervisors of health workers on the causes, management and prevention of diarrhoeal diseases, with special emphasis on nutrition and child survival.

One five-day course was arranged for five participants from the Armed Forces Medical Institute who were trained to treat diarrhoea.

Short-term Training

During the year, a series of one day sessions were provided to 789 people from medical colleges and non-governmental organisations on treating diarrhoea using ORS, while laboratory technicians were trained in the

microscopical diagnosis of common causes of diarrhoea.

The Fellowship Programme

Through this programme 15 students, researchers and health professionals from 9 countries including Bangladesh were trained during 1986 in different aspects of diarrhoeal disease under the supervision of assigned preceptors.

The objective of this training, which varied in duration from one week to one year, was to provide for specialised study and the opportunity to develop skills in research.

Seminars

To provide opportunities for an exchange of information and views, 24 seminars were organised by the Training Branch in which both resident and visiting scientists presented talks on diarrhoea and other related topics. The Dhaka Hospital also organised 49 clinical seminars and case studies, many of which involved eminent visiting physicians.

Collaboration

The Centre continued its collaboration with government and non-government institutions to assist them to improve their services and research. A number of institutions including the Directorate General of Health Services, NIPORT, Dhaka University, Jahangir Nagar University, the Bangladesh Agricultural University, the Bangladesh University of Engineering and Technology, medical colleges and BRAC. This collaboration was not only to provide training, services, materials and experimental animals, but also to initiate research, prepare research proposals and provide facilities for research. Eight collaborative research projects on aspects of diarrhoeal disease were also started during the year.

Recognition for training

A period of six months training at the Dhaka Treatment Centre of the ICDDR,B is now being recognised by the College of Physicians and Surgeons, Bangladesh for their postgraduate studies in medicine. In addition an agreement has been made between the ICDDR,B and Dhaka Shishu (Children's) Hospital for an exchange training programme to last for 6 months. This is due to begin in January 1987.

Developing training materials

Work during the year concentrated on producing audio-visual training materials. This involved putting to full use new equipment provided as part of a project with UNICEF — video cameras, editors, and players, and slide-tape projectors.

Six slide and tape presentations were completed on the following subjects: the work of the ICDDR,B, the Epidemic Control Preparedness Programme (see p 52), the MCH-FP Project in Matlab (see p 50), the use of ORS, the use of rice ORS, and the clinical management of diarrhoeal disease (in two parts).

Three video programmes were also prepared on the ICDDR,B Treatment Centre, treating diarrhoea with rice ORS, and the MCH-FP Extension Project (see p 40).

Library, Publications and Communications
(Branch Head: SI Khan)

The Library and Publication Branch continued to play an important role in the work of the Centre during 1986 by acquiring, organising and disseminating information and materials on diarrhoeal diseases, nutrition and fertility. These efforts have supported both the research activities of the Centre and those of other scientists and physicians, in Bangladesh and Asia in general. During the year the Branch also met specific requests from individuals and organisations at home and abroad by supplying through subscriptions and direct sales, bibliographies, photocopies, reprints and publications of the Centre. Many Bangladeshi organisations, libraries and individuals have been supplied with items free of charge.

The Library

The Library received 5,325 visitors other than members of staff during the year, 14,913 books and journals were loaned and 261 books were bought (31%) or obtained as gifts or by exchange (69%). Although subscriptions to 89 journals were discontinued during the year after conducting a survey to find out what journals were rarely consulted, the Library continued to subscribe to 228 periodicals and received a further 198 as gifts or by exchange: the Library now receives 426 journals, still a considerable number. As part of the inter-library loan system the Centre's library lent 725 books and journals, borrowed 22 and provided photocopies of 8,086 items totalling 130,596 pages. The Library received 7 MEDLARS and 18 POPLINE literature searches in addition to the monthly MEDLARS searches on diarrhoeal diseases provided by the National Library of Australia.

As a part of the ICDDR,B's collaboration with national institutions, the Library donated 451 duplicate books, journals, and other reading materials to institutions and libraries in Bangladesh.

To keep scientists at the Centre, in Bangladesh and abroad aware of recent publications on diarrhoeal diseases and related subjects, the library published 22 issues of the **Current Awareness Service Bulletin.** The organisation of the Bulletin was changed during the year to conform with international standards, and an annual charge was introduced to recover production costs. In 1986, the Library received 35 subscriptions for this Bulletin which has been highly acclaimed by its users.

Publications

During 1986 the Publications Unit produced the 1985 Annual Report (3,000 copies), 2 scientific reports (500 copies each), 1 special publication (100 copies), a 242-page monograph entitled "Life stages, gender and fertility in Bangladesh" (1,000 copies), and 7 issues of the bimonthly newsletter **Glimpse** (41,000 copies). The Unit also assisted in the publication of 2 issues of the **Journal of Diarrhoeal Disease Research** (1,000 copies each) and 4 annotated bibliographies (1,000 copies each).

Publications and brochures were sent to scientists, libraries, and organisations throughout the world as follows: 38,204 copies of Glimpse, 2,492 copies of the 1985 Annual Report, 3,156 copies of the JDDR, 1,400 copies of other scientific publications, 1,363 copies of specialized bibliographies, 4,000 copies of brochures about DISC (see below), the JDDR, ICDDR,B and other publications, and 285 reprints of ICDDR,B external

publications. A survey was conducted to update the mailing list for Glimpse. In 1986, 593 individual copies of the JDDR, annotated bibliographies, directory of Asian scientists, and other internal publications were sold. Details of some of these publications may be found at the end of this report.

The DISC Project

Three and a half years after the start of the International Diarrhoeal Disease Information Service and Documentation Centre (DISC), the first phase ended in January 1986 and the second phase began. The International Development Research Centre (IDRC), Canada has acknowledged its success by agreeing to continue supporting it until the end of 1987. DISC is the first and only clearing house devoted to diarrhoeal disease research and as a measure of its success it enrolled 93 individuals, libraries and organisations as members during the year. In addition DISC received 161 subscriptions for the **Journal of Diarrhoeal Diseases Research** (JDDR). During the year two issues of the JDDR were published and which included two issues of the Annotated Bibliography of Asian Literature on Diarrhoeal Diseases. Abstracts of 143 papers were published in the two issues of the bibliography, and another 144 abstracts were prepared for the next two issues. The JDDR is now indexed by most international indexing journals including Index Medicus, Current Contents: Life Sciences (Clinical Practice), Excerpta Medica and Current Awareness in Biological Sciences.

The DISC Project provided answers to questions for 12 clients in 7 countries during the year, providing photocopies of papers when necessary. To supplement the Centre's library the DISC Project collected 57 reprints and papers on diarrhoeal diseases from authors and other libraries.

The bimonthly newsletter, **Glimpse**, continued to highlight research in progress at the ICDDR,B, and provided abstracts of ICDDR,B publications, news on forthcoming meetings and conferences, and information on diarrhoeal disease research projects in Asian countries, as well as information on the programmes and activities of the DISC project.

Four issues of the **Specialized Bibliography Series** were produced in 1986. The topics covered were: dietary management of diarrhoeal diseases; enterotoxigenic Aeromonas; antisecretory agents in the treatment of diarrhoeal diseases; and chronic diarrhoeal diseases. These bibliographies cited 921 papers and provided abstracts of 524. Another bibliography entitled "Water, sanitation and diarrhoeal diseases: roles and relationships" was completed during 1986 and sent to the press.

Two IBM Personal Computer XTs were installed with word processing and bibliographic software. The computers are being used to prepare all DISC publications and to store details of all papers published by scientists at the Centre. A database of references on diarrhoeal diseases is being planned. In addition during the year the equipment for a complete microfiche laboratory was procured and will be installed in 1987.

Surveys were carried out for the Programme Coordination Committee (see p 76) of current or completed research projects in Bangladesh on diarrhoeal diseases, nutrition and fertility. This was done in addition to the regular survey of current research projects on diarrhoeal diseases in Asia, some of which were reported in Glimpse.

SUPPORT FOR SERVICES AND RESEARCH

The reorganisation of the Centre into four Divisions in 1986 also allowed the structure and administration to be improved of the branches which provide support for services and research.

A Department of Laboratory Services was created within the new Division of Laboratory Sciences and Epidemiology. This new department has drawn together several formerly independent laboratory activities so that equipment can be shared, supplies can be ordered efficiently and labour can be used to the best advantage.

Because much of the work of the Computer Information Services and the Data Management Branch is concerned with the demographic work of the Centre, they were assigned during the reorganisation to the new division of Population Science and Extension and were joined by the Biostatistics Cell.

The Department of Laboratory Services

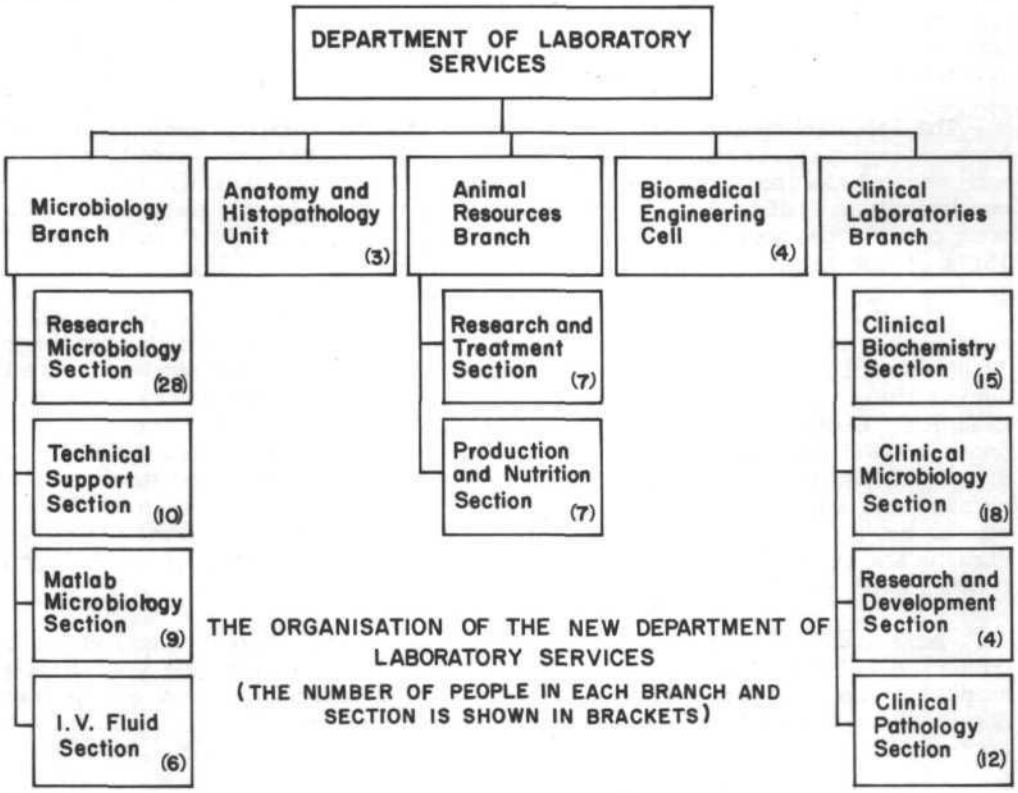
(Head of Department: BA Kay)

Reorganisation during 1986

The administrative structure of the new Department of Laboratory Services, which contains about 110 employees, is shown on p 59. Within the new Department a Clinical Laboratories Branch has been established to meet the needs for tests on hospital patients. The Branch will be situated within the Dhaka Treatment Centre and a new laboratory is currently being built with a central reception desk to receive samples for testing and to give the results. The new facilities will provide on one site all the diagnostic tests that formerly were available at several places within the Centre: microbiological, parasitological, biochemical and haematological. When the new laboratory is occupied in early 1987 it will contain personnel from the former Diagnostic Microbiology Section, the Clinical Pathology Branch and from the Biochemistry Branch. In order that important diagnostic tests can be performed 24 hours a day some members of staff are being trained in all aspects of the work of the new Branch. Several items of equipment have been ordered for the new laboratories including an automated electrolyte analyser which can measure sodium, potassium, chloride and total carbon dioxide in less than 100 microlitres of blood.

After finishing the refurbishment of the old microbiology laboratories in 1985, the new Microbiology Branch has continued to streamline its work and review its laboratory procedures. As part of a long term plan to reduce paperwork and enable statistics to be generated and analysed easily, a single form has been designed for use when submitting specimens for bacteriological tests and to provide the results. A computer database to store the results of tests on the Centre's mainframe computer (see p 60) has been written and will come into operation in 1987. Using a dictionary of codes for the tests performed, the organisms detected and the costs of tests, detailed reports and statistics will become easily available for both scientists and administrators in the Centre.

Three other sections of the Centre concerned with support for laboratory work were brought into the new Department of Laboratory Services during the reorganisation: the Animal Resources Branch, the Bioengineering Cell and the Anatomy and Histopathology Unit.



THE ORGANISATION OF THE NEW DEPARTMENT OF LABORATORY SERVICES

(THE NUMBER OF PEOPLE IN EACH BRANCH AND SECTION IS SHOWN IN BRACKETS)

The Animal Resources Branch provides the Centre and many scientific organisations in Bangladesh with experimental animals for use in research and diagnostic tests. In 1986 it was reorganised into two parts: the Animal Research and Treatment Section and the Animal Production and Nutrition Section. The second addition to the new Department, the Bioengineering Cell, is responsible for repairing and maintaining all electronic and mechanical instruments used in the Centre. The final part of the Laboratory Services Department is the Anatomy and Histopathology Unit. This Unit will move into a new laboratory in 1987 where recently acquired equipment for dehydrating and fixing tissues will be brought into use for both clinical and research purposes.

Routine work during the year.

While the administration of the Centre was being reorganised and new facilities were being planned and built, work continued on testing and analysing samples submitted by the Centre's physicians and research scientists.

The former **Biochemistry Branch** performed 56,306 tests on 27,256 specimens of blood, urine, faeces, cerebrospinal fluid, intravenous fluid,

diets and ORS during the year. The laboratory provided support for 15 research studies and collaborated with 10 institutions and organisations in Bangladesh including the Dhaka Shishu Hospital, the IPH and the Children's Nutrition Unit of the Save the Children Fund (UK). As well as running its own internal quality control scheme using commercially prepared samples, the laboratory continued to take part in a WHO sponsored quality control scheme run by the Queen Elizabeth Medical Centre, UK. During the year the laboratory had a performance rated as excellent.

The laboratory in Dhaka of the former **Microbiology Branch** performed bacteriological culture on 21,045 samples in 1986: 65% were stool samples and rectal swabs while the remainder included urine, blood and cerebrospinal fluid. Vibrio cholerae 01 and Shigella spp were still the most common pathogens isolated from faeces and were found in 13.5% and 15.7% of the samples tested respectively.

The Microbiology Laboratory in Matlab also had an extremely busy year, mainly as a result of work for the Oral Cholera Vaccine Trial, and over 72,000 samples including faeces, water, urine and blood were cultured during 1986. There were 1,774 cases of cholera diagnosed: 60% were the Classical biotype of V.cholerae 01 and 40% were the El Tor biotype. Another 4,875 samples yielded other members of the family Vibrionaceae. As a part of the surveillance for diarrhoea after the oral vaccination, three strains and a pool of 10 strains of E.coli was isolated from each of 27,942 stools or rectal swabs, a total of 111,768 strains and pools. These strains and pools were stored and are now being tested for the ability to produce heat stable and heat labile toxins.

As a part of the vaccine trial, finger-prick blood samples were collected before, during and after vaccination. During the year blood samples were collected from 43,625 people and their blood group was determined. Frozen samples of the blood are being tested for vibriocidal activity and for antibodies to cholera toxin using an ELISA.

The **Animal Resources Branch** had another busy year and provided support to 30 research projects. It's work also included 28,313 tests for the heat stable toxin of Escherichia coli, and it provided over 60,000 mice to the ICDDR,B, to the Institute of Public Health and to other institutions and commercial organisations in Bangladesh.

Computer Information Services (CIS)
(Branch Head: RP Ghosh)

During 1986 the CIS further improved its computer hardware, installed more software and added to the services it offers to scientists and physicians at the Centre. In April the IBM 4331-L02 mainframe computer was upgraded to become an IBM 4361-L05. In May a direct access storage device with a capacity of 730 megabytes was installed, and in June seven more terminals were added to the computer to increase the total to 11. To allow IBM personal computers in other parts of the Centre outside the CIS offices to be used as terminals to the mainframe, a cluster controller, modems and emulator cards were installed so that by the end of the year 7 IBM PC's had direct access to the IBM 4361. Two other terminals were also installed: one in CIS itself and one, by a direct connection, to the Personnel Management

Branch. Finally, the network of linked computers was improved by a direct connection between the old mainframe, the IBM System 34, and the IBM 4361.

A major addition to the software available on the IBM 4361 during 1986 was the Statistical Analysis System (SAS). This programme was installed in addition to Sort/Merge, a programme to sort large files of data; RPG-II, a programme to enable Report Programme Generator software to be transferred from the IBM System 34 to the IBM 4361; and software on the System 34 to allow its terminals to act as extra terminals to the IBM 4361.

A major part of developing the computer systems during the year concerned taking full advantage of the power of the IBM 4361 and transferring data-processing systems from the System 34. Most of the third phase of editing the DSS database was completed and technical assistance was provided to the MCH-FP Extension Project for their sample registration and record keeping systems (see p 41). An on-line personnel management system was developed for the Personnel Management Branch and a new payroll system was designed to replace the existing one on the IBM System 34.

During the year the CIS also organised 6 internal and 2 external courses and trained four junior programmers. Expert services were provided to many researchers within the Centre as well as to 7 external organisations such as UNICEF and BRAC.

The Data Management Branch
(Branch Head: K Sheikh)

The Branch provided assistance to 18 scientific projects during the year by designing questionnaires, preparing graphs and charts, and by coding and editing data and performing cross-tabulations. In addition it developed a comprehensive archiving system to improve access to existing sources of data for research. The Branch is also responsible for keeping medical records and provided many of the statistics which appear in this report on the three Treatment Centres, in Dhaka, Matlab and Teknaf.

The Branch was also consulted on techniques for data analysis many times during the year by scientists, teachers and physicians from several national institutions such as the National Institute of Preventive Medicine and the Fisheries Research Institution.

The Biostatistics Cell
(Head of Cell: M Rahman)

In addition to providing statistical expertise for scientists at the Centre and reviewing research proposals and scientific papers, several courses on aspects of statistics and statistical analysis were given during 1986. A training course on "Introductory epidemiology, biostatistics and demography" was arranged for project managers, senior field officers and medical officers at the Matlab Field Station. A course on statistical methods was provided to participants in a course arranged by the Training Branch on "Epidemiological aspects of diarrhoeal diseases". Finally, in collaboration with the Computer Information Services an informal training course on statistical aspects of the SAS software was provided.

ADMINISTRATION

Finance Office
(HAN Janssen)

An increase in contributions from donors and a sharp reduction in expenditure led to a small operating fund surplus during 1986, before providing for depreciation. The Centre's total income increased by 5 percent to US$ 7.9 million during the year while expenditure dropped by 11 percent to US$ 7.7 million.

Contributions from donors and other receipts increased by US$ 406,000 and US$ 221,000 respectively, while the exchange gain was lower by US$ 275,000 when compared with 1985. Expenditure in all forms was lower than in 1985. The cost of personnel, which accounted for two-thirds of expenditure in 1986, was 9% lower when compared with 1985, even though local staff were given an increase in salary averaging just over 10 percent and effective from January 1st, 1986.

The reduced expenditure resulted primarily from action taken towards the end of 1985 to reduce costs sharply in 1986 and included:

- stopping centrally funded research
- reducing the number of international staff and cutting salaries by 10%
- suspending the hiring of centrally funded local staff and delaying a recommended wage rise
- stopping centrally funded travel except for fund raising purposes.

Most of the decrease in expenditure during the year was concentrated in management and central services costs.

Cash flow

The bank overdraft decreased by US$ 1.9 million during 1986 to stand by the end of the year at US$ 927,000, primarily as a result of having received substantial contributions from donors in advance of their being spent. By the end of 1986 the ICDDR,B had obligations to complete projects for which funds equivalent to US$ 2.1 million had been received. In addition US$ 576,000 was due to the Centre for work already completed.

A major change in accounting procedures

In 1985 a decision was made to change at the beginning of 1986 to the accrual method of accounting for income. The reason for the change was to match more accurately sources of income with expenditure. This change was necessitated by the increased reliance on project rather than central funding and its impact on the 1986 statement of accounts is rather complex. However, the major impact is as follows: if the Centre had continued accounting for income on a cash basis, the income reported in 1986 would have been US$ 1.5 million higher. This amount represents a net future obligation and will not be recorded as income until the expenses are incurred for which the contributions from donors were provided.

Table 7

Contributions to the ICDDR,B during the last 3 years on the basis of cash received in US$. In 1986 the accrual method of accounting for receipts was adopted (see above and Appendix A: Auditors report)

		1986	1985	1984
Central Funds:				
Australia		123,237	143,365	161,078
Bangladesh		59,311	0	32,760
China		10,000	0	0
Saudi Arabia		70,000	100,000	100,000
Sweden		117,810	0	207,280
Switzerland		780,309	310,813	324,271
UNICEF		500,000	250,000	0
United Kingdom		206,448	171,741	168,516
United States - AID		500,000	0	1,898,000
Others		0	139	0
Total		2,367,115	976,058	2,891,905
Project Funds:				
Aga Khan Foundation		17,951	52,260	0
Arab Gulf Fund		0	485,440	280,000
Australia		2,224	0	0
Australian National University		5,773	0	0
Belgium		114,739	68,115	7,906
BOSTID		22,170	13,312	0
Canada - CIDA		1,021,677	807,806	1,407,016
Case Western Reserve University		12,782	0	0
FAO		37,987	0	0
Ford Foundation		68,349	354,544	256,900
France		0	12,600	49,220
Germany, Federal Republic		0	13,671	0
IDRC		93,796	85,468	58,610
IBRD		78,863	85,986	41,162
Japan		320,000	260,000	240,000
Johns Hopkins University		0	11,141	9,224
Management Science for Health		4,500	0	0
Medecins Sans Frontieres		24,063	0	0
Miles Pharmaceuticals		47,399	0	0
Nestle		9,205	0	0
Norway - NORAD		427,827	228,837	0
Norwich Eaton Pharmaceuticals		22,500	10,500	0
OPEC		30,000	0	0
Population Council		5,352	32,474	27,167
Rockefeller Foundation		6,164	5,380	0
Saudi Arabia		536,596	275,053	485,614
Sweden - SAREC		0	0	36,579
UNDP/UNROB		43,571	43,570	0
UNDP - UVP		103,154	96,470	0
UNDP/WHO		388,000	187,000	349,567
UNFPA		0	75,375	42,400
UNICEF		335,480	253,645	451,244
United States - AID		3,167,627	2,980,682	743,333
WHO		88,104	57,762	4,510
Others		0	14,248	16,280
Total project funds		7,035,853	6,511,339	4,506,732
GRAND TOTAL	US $	9,402,968	7,487,397	7,398,637

Resources Development Office
(MR Bashir)

In 1985 it became apparent that donors to the Centre were preferring to support specific projects rather than provide central funds for general use. For this reason during 1986 the Resources Development Office has sought to obtain new commitments and has emphasised the importance of supporting the Centre's general funds while still maintaining current contributions. By the end of 1986 pragmatic planning and successful negotiations had contributed to a clear improvement in the Centre's financial state.

Donors

A new donor to the Centre is the **Danish** aid agency **DANIDA,** which agreed to provide major support for the Dhaka Treatment Centre for 3 years, beginning in 1987. DANIDA also have agreed to support two Danish nurses for the Traveller's Clinic in the Dhaka Treatment Centre.

More support from Scandinavia came during the year from the **Swedish** aid agency **SAREC,** which announced a new grant for the Centre's general funds — support which is likely to be continued.

The **Arab Gulf Fund** also agreed during 1986 to provide more support to the Centre. This will be used for applied research, services and training.

The **United States Agency for International Development, USAID,** remains a generous and steady supporter of the Centre. The ICDDR,B has entered into a four-year cooperative agreement with USAID in Washington which provides some limited central support, a grant to cover administrative costs and a discretionary fund to develop new ideas for research. In addition, the Dhaka mission of USAID agreed to help support the Urban Volunteer Programme (see p 49) for 5 years from October 1986.

The **Canadian International Development Agency (CIDA)** continued to be a major donor during 1986 and funded the Demographic Surveillance Systems in Matlab and Teknaf (see p 36) as well as providing support to the Training Branch for international courses on managing and preventing diarrhoea (see p 54).

The Government of Bangladesh remains a generous supporter of the Centre and has provided central funds as well as practical support and assistance to implement projects.

UNICEF continued to provide general support to the ICDDR,B in 1986 as well as funding several research projects. **The Ford Foundation** remained a supportive donor with a grant to the Epidemic Control Preparedness Programme (see p 52). **NORAD,** the Norwegian agency for development, which became a new donor in 1985, continued its support of the MCH-FP services during 1986. The **UNDP** maintained its support for clinical research and for the Urban Volunteer Programme, which has also received further support during 1986 from the Belgian aid agency **BADC.** Aid from **Japan** has provided valuable assistance for the Centre's research and training activities, and the African Training Programme in particular.

Contributions to the Centre's central funds were received during the year from **Australia, Saudi Arabia, Switzerland** and the **United Kingdom.** Funds were also provided for specific projects by the **World Bank,** the **World Health Organization** and the **International Development Research Centre.**

The **World University Service of Canada** (WUSC), **ORSTOM** (France), **BADC** (Belgium), the **Population Council,** and the **London School of Hygiene and Tropical Medicine** continued to support personnel at the Centre.

Collaborative activities

During 1986 the ICDDR,B continued to develop links with organisations outside Bangladesh in an effort to provide services and skills in the field of diarrhoeal diseases. In accordance with the terms of a collaborative agreement signed in 1985 between the ICDDR,B and the Ministry of Public Health of the **People's Republic of China,** there has been an exchange of scientists and several training courses for Chinese participants.

The Centre's collaborative agreement to provide technical assistance for the Diarrhoeal Disease Treatment Centres in Dammam and Riyadh, **Saudi Arabia,** continued throughout 1986.

The **2nd African Conference on Diarrhoeal Diseases** sponsored by the ICDDR,B was held in Harare, Zimbabwe in November 1986. It was attended by scientists and health personnel from 18 African countries and generated a keen interest in diarrhoeal disease research and management.

The Reserve Fund

The Resources Development Office continued to seek further contributions to the Reserve Fund during 1986. By strengthening the Centre's financial base for its services and research the Reserve Fund is crucial for providing enduring stability to the ICDDR,B.

A Donor's Consortium

Instead of holding consultative meetings of donors, the Centre's Board of Trustees has decided to hold a meeting in Dhaka to allow donors to become acquainted at first hand with the work of the Centre. This should enable donors to examine specific services and research they might wish to support and will allow the Centre to explain in detail its short and long term requirements. The first Donors Consortium is to be held in Dhaka in March 1987.

Capital development

The **United Nations Capital Development Fund (UNCDF)** has agreed to fund the Centre's new buildings in Matlab. This major development — on the Centre's own land — will provide new facilities for research, training and services in Matlab, and should be completed by 1989.

Personnel Management Branch
(R Dery)

Because of the financial problems the Centre faced during 1986 every effort was made during the year to reassign staff paid from central funds to specific, funded projects or to recruit from within the Centre. Very

few staff were hired unless they were to be paid from project grants and several positions were left vacant.

In early 1986 the Centre's Staff Rules were thoroughly revised and then approved by the Board of Trustees during their meeting in March. Two Personnel Management consultants from the UNDP visited the Centre in May to review the personnel system in general and the job classification system in particular. Their recommendations are being implemented gradually.

At the request of the Board of Trustees a review of the policy of ranking scientific and clinical staff was undertaken by the Council of Associate Directors and the Personnel Office. The report of this review will be used as the basis for a study of the prospects for promotion and career development within the Centre.

As already reported in the CIS report on p 60, a computer database of the Centre's personnel is being created. When it comes into operation in early 1987 it will allow speedy access to information about all employees as well as summary statistics which are not currently available. The hardware for this system was installed during the year: an IBM Personal Computer XT which will be linked directly to the IBM 4361 for direct access to the personnel database.

PEOPLE

At the end of 1986 there were 1364 members of staff of the ICDDR,B: 1333 National Staff, a fall of about 5% since the end of 1985, and 31 International Staff, a fall of almost 40%.

The reorganisation of the ICDDR,B into four Divisions to replace the five working groups has also spread the numbers of staff more evenly between its scientific and administrative parts. At the end of the year there were 142 (10.6%) staff in the Clinical Sciences Division, 378 (28.4%) in the Community Medicine Division, 221 (16.6%) in the Epidemiology and Laboratory Sciences Division, 314 (23.6%) in the Population Sciences and Extension Division, and 224 (16.8%) involved in the administration of the Centre. Another 33 staff were either in the Training Branch, Library and publications Branch or Resources Development Office. Finally, 21 people are attached to the Director's office and include staff working on the Epidemic Control Preparedness Programme and those working in Saudi Arabia.

Staff development

Improving the skills, knowledge and productivity of staff members is an important part of the development of the Centre. At the begining of the year 10 members of staff were out of Bangladesh on degree courses or for periods of training, while during the year 8 more left the Centre to begin degrees or to go on courses. Meanwhile in Bangladesh, a total of 18 people were sent to institutions within the country for short courses of training in fields such as computer programming and office management.

Here are details of some of the people who have returned or left the Centre during the year to give an idea of the growing expertise of the ICDDR,B.

AH Baqui returned from the Johns Hopkins University, Baltimore, USA in November having completed the course work for his Ph.D. He is now working on his dissertation on persistent diarrhoea in rural Bangladeshi children.

PK Bardhan, a Senior Medical Officer, returned after two years spent being trained in Clinical Gastroenterology by Prof Klaus Gyr at the University Hospital, Basle, Switzerland. His training was sponsored jointly by the Centre and Ciba-Geigy of Switzerland.

A Bari spent 4 months at the Australian National University as a Visiting Fellow sponsored by the Ford Foundation. While there he analysed data from the trial of rice ORS in Chandpur (see p 28).

A Bhuiya, a coinvestigator in the Matlab DSS project (see p 36), began his field research as part of a Ph.D. at the Australian National University. The subject of his dissertation will be factors affecting child survival in Matlab.

A Hossain, a Medical Officer at Teknaf Station, returned in August from Belgium where he had been receiving training in Clinical Microbiology and Clinical Pathology in the laboratory of Prof. JP Butzler at the St. Pierre Hospital, Free University of Brussels.

I Kabir, a Senior Medical Officer, rejoined the Centre in September after spending two years being trained in Gastroenterology at the Case Western Reserve University, Cleveland, Ohio, USA. His training was sponsored jointly by the ICDDR,B and the Rockefeller Foundation.

SK Nath, a Senior Medical Officer, left to work in the laboratory of Dr JF Desjeux at INSERM in Paris, France, where he will receive three-years training in gut pathophysiology.

GH Rabbani left for two-years training in gastroenterology with Dr Emmanual Lebenthal at the Childrens' Hospital in Buffalo, New York, USA.

M Rahman, a coinvestigator of the Teknaf DSS project, left Dhaka in September to begin studying for the Sc.D. degree at the Johns Hopkins Unversity, Baltimore, USA. His research dissertation will be concerned with the effects of breast feeding and the environment on child survival in Teknaf.

New staff and consultants

Dr Vincent Fauveau (France) joined the International Staff of the Centre at the beginning of the year from the School of Public Health at Johns Hopkins University, Baltimore, USA. Dr. Fauveau, a Paediatrician, is responsible for the MCH-FP Programme in Matlab.

Two consultant joined the Urban Volunteer Programme during the year. **Ms Claire Fauveau** (France) as a local Consultant Nutrition Coordinator and **Ms Nancy Hughart** as an EPI Consultant.

The Danish aid agency DANIDA has agreed to support two nurses for the Traveller's Clinic and **Ms Ruth Petersen** and **Ms Karin Jenssen**, both Danish, were recruited locally to run the clinic on alternate weeks. DANIDA are also supporting a Consultant for the Child Stimulation Programme in the Nutrition Rehabilitation Unit, **Ms Monique Sternin** (France).

The Dhaka Treatment Centre gained an experienced nurse, **Mrs Rahima Khatun**, as its new Nursing Manager. Mrs Khatun was formerly the Director of Nursing Services for the Government of Bangaldesh.

Ms Reba Som (India) joined the Resources Development Office as a Consultant Programme Officer.

Mr J Charles Simons (USA) and **Mr MR Rao** (India) both joined the Cholera Vaccine Trial as Computer Consultants to help analyse the huge amount of information generated by the trial. Mr Simons taught Computer Sciences in California before joining the Centre.

Dr KA Chowdhury (USA) joined the Centre as a Consultant Pathologist to the Laboratory Sciences and Epidemiology Division. Dr Chowdhury worked for

the US Food and Drug Administration in Washington, DC before joining the ICDDR,B.

Two consultants joined the MCH-FP Extension Project during the year. **Mr Alan Lindquist** (USA) has been seconded from the Population Council, New York and **Dr Khodezatul Kobra** (Bangladesh) joined as a Consultant Economist. **Ms Caroline Smith** (UK) also joined the Project as part of the British Overseas Development Administration Postgraduate Training Scheme.

Dr Firdausi Qadri (Bangladesh) joined the Department of Immunology and Bacterial Genetics as a Post Doctoral Fellow. Dr Qadri, who obtained her Ph.D. in Biochemistry at the University of Liverpool, UK, also holds an appointment as Assistant Professor of Biochemistry at the University of Dhaka.

Ms Willy van der Voet-de Boer (Holland) has been recruited as a local part-time consultant to the Department of Laboratory Services. She is a haematologist.

New appointments

Dr AN Alam (Bangladesh) was appointed as Head of Hospital in the Dhaka Treatment Centre from 1st July 1986.

Awards

Dr **MU Khan** (Bangladesh) was presented by the Bangladesh Academy of Sciences with the 1986 Sonali Bank Award for Science and Technology.

Elevations

Dr KA Monsur (Bangladesh), who left the staff of the Centre during the year, was invited to join the Board of Trustees of the ICDDR,B.

Departures

Two long serving Bangladeshi members of staff, both Associate Directors, left the Centre during 1986.

Dr. M Mujibur Rahaman had been with the Centre since it was formed in 1978 and with the former Cholera Research Laboratory (CRL) before that. He helped to steer the CRL through the difficult times which saw the birth of Bangladesh and was deeply involved in setting up the field station in Teknaf. A highly qualified physician and scientist with research interests in the field of nutrition, Dr Rahaman was the Associate Director in charge of the Nutrition Working Group. He has now joined the FAO as their Nutrition Advisor in Baghdad, Iraq.

Dr KMS Aziz had also been with the ICDDR,B since its formation. A microbiologist by training Dr Aziz was the Associate Director in charge of the Training, Extension and Communications Division and was the Chairman of the Ethical Review Committee for several years. Dr Aziz continued to serve

the Centre as Member Secretary of the Programme Coordination Committee and has now joined the Ministry of Health of the Kingdom of Saudia Arabia as a Microbiologist.

Dr M Mujibur Rahaman

Dr KMS Aziz

Dr AM Molla (Bangladesh), a Senior Scientist in the Clinical Sciences Division, left the Centre to take up a new post as Professor and Chairman of the Department of Paediatrics at the Aga Khan University Hospital in Karachi, Pakistan. His wife, **Dr. Ayesha Molla**, an International Research Associate at the ICDDR,B, has joined him there as an Assistant Professor in the Department of Biochemistry.

Dr. Judith Wasserheit (USA), a Research Physician in a study of infections related to family planning (see p 12) returned to the USA to take up an appointment as Assistant Professor in the School of Medicine at Johns Hopkins University, Baltimore.

Dr JR Harris an Epidemiologist from the Centers for Disease Control and a coinvestigator on the Oral Cholera Vaccine Trial Project left the Centre in 1986 to join the Office of Health in US AID in Washington, DC.

Dr Nazma Rizvi (USA) a Nutritional Anthropologist and **Dr AKMA Chowdhury** (Bangladesh) both left the Centre during the year. Dr Chowdhury has joined Johns Hopkins University, Baltimore, USA. **Dr. Shushum Bhatia** (India) left early in the year to take up an appointment with the World Bank at their Headquarters in Washington, DC, USA.

Dr Marjorie Koblinsky (USA) left the MCH-FP Extension Project after the birth of a son having been with the Project for over 2 years. She is now a Program Officer with the Ford Foundation in New York. Another American who joined at the same time, **Dr Bonita Stanton,** also left the Centre during in June. Dr Stanton had been running the Urban Volunteer Programme (see p 49) and has now joined the Bangladesh Mission of the World Bank where she has become their MCH-FP Specialist.

Several staff provided by the World University Service of Canada (WUSC) finished their contracts during the year. **Mr M Chibba,** a Health Economist, **Ms Marilyn Hurrel** and **Ms Brenda Wroot,** both Health Educators, and **Mr R Banerjee,** a Systems Advisor for the Computer Information Services. Another member of CIS, the Computer Operations Manager **Mr AH Mustafa,** also left during the year.

Two Belgian members of staff left the Centre during 1986. Dr **Francoise Moonens,** a Research Physician, and **Ms Isabella Vesters** who had been the Nurse in the Traveller's Clinic for almost 5 years.

Dr D Anand (India) left the Centre in December after over 2 years as a Consultant involved in developing training materials in the Training Branch. Another consultant in the same field, **Ms Molly Reed** also left the Training Branch during the year.

Mr T Le Grand (USA) returned to the Department of Economics at the University of Michigan, Ann Arbor, USA to complete his PhD after working in the MCH-FP Extension Project for almost a year as a consultant. Another consultant to the Project, **Ms Parvin Pasha** (Bangladesh) left after one year as a Programmer as did **Ms Susan Brechin** (USA) a consultant in Training.

Retirements

Three members of staff retired during 1986, all having served the ICDDR,B or its predecessor the Cholera Hospital for a considerable length of time. **Mr Md Shahidullah,** a Field Research Officer retired after 23 years employment, **Mrs Basanti Devi,** an Assistant Staff Nurse in the Dhaka Treatment Centre retired after 20 years, and **Mr Fazlur Rahman,** a clerk retired after 11 years.

Obituaries

It is sad to record the deaths of four members of staff during the year, three of whom worked in the Dhaka Hospital. **Wendy Hussain,** the Matron and nurse trainer, died tragically after a very sudden illness. Mrs Hussain was born in Britain where she trained as a nurse and had worked as a consultant to the Centre before being appointed as Matron. She was married and had three young daughters. To commemorate her life an award for the Best Ward Employee of the Year has been instituted in the Dhaka Treatment Centre.

The hospital also lost another experienced nurse, **Mrs Zinnatun Nessa.** She had worked for the Centre for 12 years and died after a long illess. **Mr MR Bhuiyan,** a cleaner in the hospital for the past 9 years, also died

during the year and **Mr M Noman,** an attendant for 6 years in the staff canteen, was killed in a road accident.

Long service

During 1986 139 members of staff had completed 20 or more years service with the ICDRR,B and its predecessor. The seven listed here had completed more than 25 years service during the year. They are:

Waseque U Ahmed	Senior Research Officer
Nirmal C Das	Security Guard
Delwar Hossain	Laboratory Technician
Zahidul Huq	Laboratory Technician
AKM Nurul Islam	Supervisor, Technical Support
MA Salek Miah	Senior Research Officer
Md Shahabuddin	Special Assistant to the Director

Visitors during 1986

The ICDDR,B had many visitors during the year: eminent visitors to Bangladesh who had heard of the Centre's reputation, current or future donors to the Centre's services and research, scientists interested in seeing the Centre's facilities or setting up research, scientists to review the Centre's work and representatives of international health projects. Some of them, but not all, are mentioned here, in no particular order.

The Ambassadors to Bangladesh of Switzerland, France and the United States and the High Commissioner for Canada all visited the Centre in 1986: their Excellencies **M Jean Cuendet, M Stanislas Filliol, Mr Howard B Schaffer** and **Mr Anthony G Vincent.** Mr Vincent accompanied **Mrs M Catley-Carlson,** the President of **CIDA,** on a visit to the Matlab Field Station.

The head of the **DANIDA** mission in Bangladesh, **Mr Paul Nyborg** and two consultants, **Dr B Sommers** and **Mr T Bellers,** also visited Matlab. The head of the Asia Mission of **DANIDA, Mr Ole Molgaard-Anderson** and **Mr Peter Mark** the Head of the Bangladesh Section of DANIDA also visited the Centre. There were also several visitors from the Norwegian aid agency **NORAD:** the local head of mission **Mr. Bjorn Johannessen** and **Ms Aina Bergstrom** from Oslo.

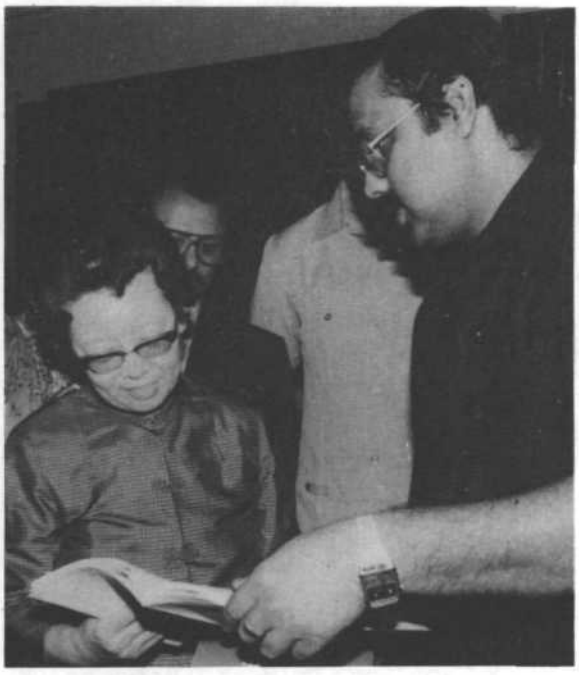
CIDA sent two people to review the work of the Population Science and Extension Division: **Professor Richard Osborne** from the Department of Epidemiology at the University of Toronto and **Ms Helen Morres** from Ottawa. In addition **Ms Ann Thomson,** WUSC Coordinator, also visited the Centre.

Five reviewers from US AID in Washington, DC, USA visted the Centre last year: **Drs Gerald Keusch, Peter Kunstadter, James Heiby, Robert Black** and **Myron Levine.**

In November there was an external review of the work of both the Community Medicine and Population Science and Extension Divisions by **Dr John Ross** from the Center for Population and Family Health, Columbia University, New York, and **Dr. Shanti Ghosh** an MCH-FP expert from India.

Dr George Rubin and **Charles Bailey** of the Ford Foundation visited Matlab and two consultants from **CIDA, Alan Sunter** and **Detlaf Pieper** came to review the DSS Project.

In August the Nigerian Minister of Health, **Professor O Ransome-Kuti,** visited the Centre to see its work in Dhaka and Matlab, and in December the WHO Regional Director for south east Asia, **Dr U Ko Ko,** came to Dhaka to discuss the Centre's work and see its facilities.



Madam Li Xiannian, (seen left with Mr MSI Khan,Head of the Library Branch), the wife of the President of the Peoples' Republic of China and herself a physician, was shown around the Centre's facilities while in Dhaka during the state visit of her husband.

The Population Science and Extension Division had many visitors during the year. **Dr Moni Nag** came from the Population Council in New York to conduct a collaborative field research project. A regular visitor, **Dr Jane Menken,** from the Office of Population Research at Princeton University, came to set up a DSS workshop. **Dr George Simmons,** Professor in the Department of Population Planning, School of Public Health, University of Ann Arbor, Michigan, USA, and **Dr Ruth Simmons,** Associate Professor in the Department of Health Planning and Administration of the same university, both visited the MCH-FP Extension Project as consultants as part of a long term collaboration. Other visitor during the year included: **Dr Henry Mosley,** a former Director of the Cholera Research Laboratory and now at Johns Hopkins University; **Dr Sharon Epstein** from US AID, **Drs R and D Freedman** from the World Bank; **Dr George Brown,** Vice-Predisident of the Population Council; and **Dr Barnett Barron,** the Senior Representative of the Population Council in south east Asia.

Several scientists and physicians visited the Centre to plan or begin collaborative research: **Dr J-F Desjeux** from INSERM, Paris, France; **Dr Michael Gracey** from the Princess Margaret Children's Medical Research Foundation in Perth, Australia; **Dr. Beth Henning** from the Department of International Studies at the Johns Hopkins Univesity, Baltimore, USA; **Dr. Mark Steinhoff** also from Johns Hopkins; **Dr Ron Behrens** from the Department of Human Nutrition at the London School of Hygiene and Tropical Medicine; and **Dr E Lebenthal** from the Children's Hospital, Buffalo, New York, USA. **Dr Tom Butler**, a former Associate Director of the ICDDR,B and now back at Case Western Reserve University, returned for a few weeks in December to collaborate in writing papers.

Four scientists from Sweden, France and the USA came to see the Immunology and Microbiology laboratories and to discuss cooperation with the ICDDR,B: **Dr Torkel Wadstrom** and **Dr Asa Ljungh** from the University of Agricultural Sciences in Uppsala, **Dr PJ Sansonetti** from the Institut Pasteur in Paris, and **Dr MM Levine** from the Center for Vaccine Development, at the University of Maryland.

Dr Brendan Collins, a gastroenterologist from the City Hospital, Belfast, Northern Ireland spent 3 months in the Centre working on a study of gastric emptying and writing a research proposal.

Dr. John Spika from the Centers for Disease Control in Atlanta, USA, visited the Centre for two months as a consultant epidemiologist for a study of respiratory tract infections in Teknaf.

Dr Charles Stephenson visited the Centre to establish a test to measure breath hydrogen as part of research on hypochlorhydria (see p 18).

Dr Stephen Walter, Professor in the Department of Clinical Epidemiology and Statistics at McMaster University, Hamilton, Ontario, Canada, was a Consultant statistician to the Cholera Vaccine Trial.

Three microbiologists from the University of Maryland came to the Centre to work on identifying Vibrio cholerae from the environment. They were **Professor Rita Colwell, Dr Mark Tampling, Dr Mark O'Brien** and **Ms Phyliss Brayton.**

In October **Ambassador Nancy Ostrader,** Co-ordinator of Population Affairs, US Department of State visited the Centre to see its facilities and discuss its activities.

In November **Mr Masamitu Yomaguchi** and **Ms Yoko Oshima** from the Japanese Organisation for International Cooperation in Family Planning (JOICFP) came to discuss the Centre's activities.

Two consultants on personnel management systems from the **UNDP, Mr Gary Rahn** and **Mr Reginald Hiscock,** visited the Personnel Management Branch to review the Centre's job classification system.

STATUTORY COMMITTEES

Board of Trustees

The Director of the Centre answers to the Board of Trustees of the ICDDR,B -- representatives of the Government of Bangladesh and eminent national and international scientists. The Board meets twice a year in Dhaka, usually in June and November, and are the final arbiters of the Centre's policy, administration and scientific direction. The Director of the Centre is both a member and the Secretary of the Board.

Professor David Bell (Chairman)
Dept. of Population Sciences
School of Public Health
Harvard University, Boston
Massachusetts, USA.

Dr Abdul Rahman Al-Swailem
Deputy Minister of Health
Government of the Kingdom of
Saudi Arabia
Riyadh, Saudi Arabia.

Dr Immita Cornaz
Swiss Development Cooperation
and Humanitarian Aid
Berne, Switzerland.

* Dr D. Habte,
Dept. of Paediatrics & Child
Health, Faculty of Medicine,
Addis Ababa University,
Addis Ababa, Ethiopia.

Professor Leonardo Mata
Director, Instituto de
Investigaciones en Salud (INISA)
Universidad de Costa Rica,
Costa Rica.

* Dr K.A. Monsur,
House No. 58, Road No. 15A
Dhanmondi R/A,
Dhaka '5, Bangladesh.

* Mr Syed Aminur Rahman
Joint Secretary (Admin.),
Ministry of Health & Family
Planning, Govt. of the People's
Republic of Bangladesh
Bangladesh Secretariat
Dhaka, Bangladesh.

Mr M.K. Anwar
Secretary, External Resources
Division, Ministry of Finance
Govt. of the People's Republic
of Bangladesh, Dhaka.

Professor Richard G. Feachem
Head, Dept. of Tropical Hygiene
London School of Hygiene and
Tropical Medicine
Keppel St., London, UK.

Professor J. Kostrzewski,
Polska Akademia Nauk, Palac
Kultury i Nauki,
Skrytka Pocztowa,
Warszawa, Poland.

Dr M.H. Merson
Director,Diarrhoeal Disease
Control Programme,
World Health Organization,
Geneva, Switzerland.

* Dr Nyi Nyi
Director, Programme Division,
UNICEF, United Nations
New York, NY, USA.

Dr V. Ramalingaswami
Director-General,Indian Council
of Medical Research
Ansari Nagar, New Delhi, India.

(* Appointed in 1986)

Professor Derrick Rowley
Dept. of Microbiology & Immunology, University of Adelaide, Australia.

Dr PP Sumbung
Vice-Chairman
National Family Planning Board
Jakarta, Indonesia.

Programme Coordination Committee (PCC)

At a meeting in 1982 the Board of Trustees of the ICDDR,B established a Programme Coordination Committee (PCC) to coordinate research at the Centre with the work of national institutes in Bangladesh. In 1986 the Committee had 46 members: 6 from the ICDDR,B and the remainder from government departments, universities and non-governmental organisations concerned with health, development, education and population studies. The Committee has an executive body or standing committee of 20 members. The mandate of the PCC was reconfirmed for another 3 years on July 1st 1986.

During 1986 the PCC met twice and redefined its duties, responsibilities and powers -- changes which were confirmed by the Board of Trustees. The following terms of reference were drawn up.

1. To ensure that the Centre offers facilities for training and research to Bangladeshis in collaboration with national and international organisations, but not to confer academic degrees.

2. To ensure that the Centre establishes and maintains contact with Bangladeshi institutions by collaborative research, seminars and an exchange of scientists and physicians.

3. To offer fellowships for a period of study at the Centre.

4. To ensure that the Centre will avoid actions which might prejudice research carried out by other Bangladeshi organisations in similar fields.

5. To assist in securing funds for collaborative research between institutions in Bangladesh and the ICDDR,B.

During the year a Scientific Review Sub-committee was formed to review research proposals from national institutions and if suitable to recommend them to the Standing Committee of the PCC. This sub-committee contains 5 members of the PCC who represent the ICDDR,B and the BMRC.

Another sub-committee, a Management Sub-committee, was established to manage and administer the programmes undertaken by the PCC. Dr. AN Alam of the ICDDR,B was co-opted onto this sub-committee.

The Chairman of the PCC during the year was Professor MA Matin, the Vice-Chairman was Professor K Ahmad and the Member Secretary, Dr KMS Aziz.

Members of the PCC

1 * Prof MA Matin
Honourable Deputy Prime Minister, Government of Bangladesh

2 *+ Prof Kamaluddin Ahmad
Chairman, Standing Technical Committee, National Nutrition Council, Mohakhali, Dhaka-12

3 *	Dr KMS Aziz Associate Director (till 30.6.86) ICDDR,B (House C-109, Road 13A Banani, Dhaka-13)	4	Honourable Minister Ministry of Health & Family Planning Government of Bangladesh Dhaka
5	The Secretary Ministry of Health & Family Planning Government of Bangladesh Dhaka	6	The Secretary External Resources Division Ministry of Finance Government of Bangladesh Dhaka
7 *	Vice Chancellor Bangladesh Agricultural University, Mymensingh	8 *	Vice Chancellor Dhaka University Dhaka
9	Vice Chancellor Bangladesh University of Engineering & Technology Dhaka	10	Vice Chancellor Chittagong University Chittagong
11	Vice Chancellor Rajshahi University Rajshahi	12	Vice Chancellor Jahangir Nagar University Savar
13	Chairman Bangladesh Agricultural Research Council, Dhaka	14	Chairman BCSIR Laboratories Dhaka
15 *	Research Director Bangladesh Institute of Development Studies (BIDS) Dhaka	16 *+#	Prof Nurul Islam Director & Professor of Medicine, IPGM&R Dhaka
17 *+	Maj Gen Dr MR Chowdhury Commandant AFIP&T, Dhaka Cantonment Dhaka	18	Dr Hajera Mahtab Medical Director BIRDEM (Diabetic Hospital) Shahbagh, Dhaka
19 *	Director General Health Services Govt of Bangladesh, Dhaka	20 *	Prof TA Chowdhury Professor of Gynaecology and Obstetrics, IPGM&R, Dhaka
21 *+	Dr KA Monsur Member, Board of Trustees ICDDR,B, Mohakhali, Dhaka-12	22 *	Director General Family Planning Implementation Govt of Bangladesh, Dhaka
23 *	Director General National Institute of Population Research & Training (NIPORT), Azimpur, Dhaka	24	Director National Institute of Preventive & Social Medicine (NIPSOM), Mohakhali, Dhaka

* Members of the Standing Committee
\+ Members of the Scientific Review Sub-committee
\# Members of the Management Sub-committee

25 * Director
Institute of Public Health
Govt of Bangladesh
Mohakhali, Dhaka-12

26 Director
Institute of Public Health
Nutrition, Govt of Bangladesh
Mohakhali, Dhaka-12

27 Director
Bangladesh Fertility Research
Programme (BFRP), Govt of
Bangladesh, Mohammadpur
Dhaka-7

28 Programme Coordinator
Bangladesh Rural Advancement
Committee (BRAC),Mohakhali
Dhaka-12

29 Director, MIS Unit
Directorate of Family
Planning, Govt of Bangladesh
Dhaka

30 Prof MS Akbar
Consultant Paediatrician
Dhaka Shishu Hospital, Dhaka

31 Director
Institute of Bangladesh
Studies, Rajshahi University
Rajshahi

32 *+# Director
Bangladesh Medical Research
Council, Mohakhali, Dhaka-12

33 Project Director
National Oral Rehydration
Programme, Govt of Bangladesh
Dhaka

34 Director
Institute of Nutrition and
Food Science, Dhaka University
Dhaka

35 * Dr Zafrullah Chowdhury
Project Coordinator
Gonoshayastha Kendra
Dhamrai, Dhaka

36 * Dr Humayun K M A Hye
Director, Drug Administration
Govt of Bangladesh, Dhaka

37 Dr AK Khan
353 Elephant Road, Dhaka-5

38 Dr Mobarak Hossain
4/2, Block A, Lalmatia, Dhaka-7

39 Brig M Hedayetullah
232 New DOHS, Mohakhali
Dhaka-12

40 * Dr Sultana Khanum
Medical Director
Children's Nutrition Unit(CNU)
91 New Eskaton Road, Dhaka

41 * Prof Roger Eeckels
Director, ICDDR,B
Dhaka

42 *# Mr MR Bashir
Associate Director, Resources
Development, ICDDR,B, Dhaka

43 Dr David A Sack
Associate Director, LSED
ICDDR,B, Dhaka

44 Dr Ivan Ciznar
Associate Director,
ICDDR,B, Dhaka

45 Dr MGM Rowland
Associate Director, CMD
ICDDR,B, Dhaka

46 Dr M Badrud Duza
Associate Director, PS&ED
ICDDR,B, Dhaka

The Ethical Review Committee (ERC)

The ERC meets regularly to examine and monitor ethical issues in research involving human subjects at the ICDDR,B. It has 13 members: three from the ICDDR,B, one from PCC's Standing Committee, one representative from Bangladesh Medical Research Council, one representative from the WHO office in Bangladesh, and seven people representing other interests.

The ERC has a five member sub-committee to ensure that research studies are being conducted ethically and according to the approved proposal, and makes certain that patients know that the quality of medical care would be unaffected if they do not agree to participate in a study or decide to withdraw.

In 1986 the ERC met 14 times to consider 38 research proposals, approving 28. In addition 4 special meetings were held to review draft new recommendations on the powers, functions and duties of the Ethical Review Committee. These new proposals were approved by the Board of Trustees at their meeting in November.

The ERC Members in 1986 were:

Dr KMS Aziz (Chairman until 30.6.86)	: Microbiologist
Dr MM Rahaman (Relieving Chairman until 30.6.86)	: Physician and Nutritionist
Dr Andre Briend	: Physician and Nutritionist
Dr KA Monsur (from 1.7.86)	: Scientist (replacement for Dr KMS Aziz)
Dr AN Alam (from 1.7.86)	: Physician (replacement for Dr. MM Rahaman)
Prof Kamaluddin Ahmad (Representing PCC Standing Committee)	: Biochemist/Nutritionist (Acting Chairman from 1.9.86)
Prof TA Chowdhury (Representing the BMRC)	: Gynaecologist
Dr ANA Abeyesundere	: WHO Representative,
Dr Humayun KMA Hye	: Pharmacologist
Dr Khaleda Banu	: Paediatrician
Dr Jamal Ara Rahman	: Non-Scientific Member
Mr Md Mofazzal Hossain Khan	: Religious Representative
Mr KZ Alam	: Representative of Legal Profession
Mrs Husnara Kamal	: Behavioural Scientist
Mrs Taherunnessa Abdullah	: Behavioural Scientist

Research Review Committee (RRC)

The RRC is composed of scientists and physicians from the ICDDR,B and one representative from the PCC Standing Committee. The RRC reviews research proposals to evaluate their value, significance and feasibility given the Centre's objectives and financial means. During 1986 the RRC met 13 times to consider 32 research proposals, approving 24.

The RRC members in 1986 were:

Dr KMS Aziz (Chairman until 30.6.86)
Professor Roger Eeckels (Chairman from 01.07.86)
Dr MM Rahaman (until 30.6.86)
Dr Ivan Ciznar
Dr David A Sack
Dr MGM Rowland
Maj Gen Dr M R Chowdhury (Member of PCC Standing Committee)
Dr MU Khan (until 30.9.86)
Dr M Yunus
Dr M Badrud Duza
Dr AN Alam (from 1.7.86)
Dr Andre Briend (from 1.5.86)
Dr PK Bardhan (from 1.11.86)
Dr AKM Siddique (from 1.11.86)
Professor Kamaluddin Ahmad (Acting Chairman ERC, from 1.9.86)

The following people from outside the Centre kindly reviewed research proposals during the year: Prof TA Chowdhury, Dr Humayun KMA Hye, Prof MS Akbar, Prof MQ-K Talukdar, Dr Khaleda Banu, Prof Kamaluddin Ahmad, Prof Nurul Islam, Dr Benedict Gomes, Dr Sultana Khanum, Dr Farida Huq, Dr Shafiqur Rahman, Prof MR Khan, Col Dr ASMM Rahman and Prof A K Azad Khan.

ICDDR,B PUBLICATIONS 1986

(* Indicates not listed in earlier annual reports)

A INTERNAL PUBLICATION SERIES:

A.1 ICDDR,B Annual Report 1985. September 1986. 92 p.

A.2 Rahman M, Chowdhury SA, Patwari Y, Saha SK, Wojtyniak B, Rahaman MM. Demographic surveillance system - Teknaf. Vital events and migration, 1982. Aug 1986. 48 p. (Scientific report no. 65)

A.3 Rahman M, Chowdhury SA, Patwari Y, Saha SK, Wojtyniak B, Rahaman MM. Demographic surveillance system - Teknaf. Vital events and migration, 1983. Aug 1986. 49 p. (Scientific report no. 66)

A.4 Use of mass media in the epidemic control and management of diarrhoeal diseases; proceedings of a workshop, Dhaka, 6 Oct 1985. Jun 1986. 72 p. (Special publication no. 25)

A.5 Annotated bibliography on enterotoxigenic Aeromonas, compiled by M Shamsul Islam Khan, Abdul Matin and M M Hassan. Abstractors: Zeaur Rahim, Mahua Khair and Iftekharul Islam. Scientific Editor: Arifuzzaman Khan. Editors-in-Chief: Zeaur Rahim and K M S Aziz. Jan 1986. iii, 59 p. (Specialized Bibliography Series no. 9)

A.6 Annotated bibliography on antisecretory agents in the treatment of diarrhoeal diseases, compiled by M Shamsul Islam Khan, Abdul Matin and M Mahfuzul Hassan. Abstractors: Mahua Khair and Ramendra N Mazumder. Scientific Editor: Arifuzzaman Khan. Editor-in-Chief: G H Rabbani. Feb 1986. ii, 86 p. (Specialized Bibliography Series no. 10)

A.7 Annotated bibliography on chronic diarrhoeal diseases, compiled by M Shamsul Islam Khan, Abdul Matin and M Mahfuzul Hassan. Abstractors: Iftekharul Islam and Mahua Khair. Scientific Editor: Arifuzzaman Khan. Editor-in-Chief: A M Molla. Oct 1986. ii, 140 p. (Specialized Bibliography Series no. 11)

A.8 Annotated bibliography on water, sanitation and diarrhoeal diseases: roles and relationships, compiled by M Shamsul Islam Khan, Abdul Matin, M Mahfuzul Hassan, and Malik M Abdul Quader. Abstractors: Mahua Khair and Iftekharul Islam. Scientific Editor: Arifuzzaman Khan. Editor-in-Chief: K M A Aziz. Dec 1986. iii, 186 p. (Specialized Bibliography Series no. 12)

A.9 Journal of Diarrhoeal Diseases Research (also includes: Annotated Bibliography of Asian Literature on Diarrhoeal Diseases). v. 4, no. 1, 1986.

A.10 Glimpse. v. 8, nos. 1-4, 1986.

B ORIGINAL SCIENTIFIC PAPERS (Including Short Communications):

B.1 Ahmed SM, Islam MR, Butler T. Effective treatment of diarrhoeal dehydration with an oral rehydration solution containing citrate. Scand J Infect Dis 1986;18(1):65-70

B.2 Ahren CM, Gothefors L, Stoll BJ, Salek MA, Svennerholm A-M. Comparison of methods for detection of colonization factor antigens on enterotoxigenic Escherichia coli. J Clin Microbiol 1986 Mar;23(3):586-91

B.3 Akhtar SQ. Application of Biken test (modified Elek test) for sampling of heat-stable enterotoxin of Escherichia coli isolated in Bangladesh [short communication]. Biken J 1986;29:73-5

B.4 Azad MAK, Islam M, Butler T. Colonic perforation in Shigella dysenteriae 1 infection [brief report]. Pediatr Infect Dis 1986 Jan;5(1):103-4

B.5 Aziz KMS, Rahim Z, Faruque ASG, Huq S, Eusof A. Aeromonas hydrophila: its isolation from acute diarrhoeal illness in rural Bangladesh. Bangladesh Med Res Counc Bull 1986 Dec;12(2):49-58

B.6 Aziz KMS, Morshed MG, Chowdhury MAR, Islam MS. Isolation of enterotoxigenic Escherichia coli from the Buriganga river. Bangladesh J Microbiol 1986;3(2):1-5

B.7 Becker S, Black RE, Brown KH, Nahar S. Relations between socioeconomic status and morbidity, food intake and growth in young children in two villages in Bangladesh. Ecol Food Nutr 1986;18(4):251-64

B.8 Becker S, Chowdhury A, Leridon H. Seasonal patterns of reproduction in Matlab, Bangladesh. Pop Stud 1986 Nov;40(3):457-72

B.9 Bhuiya A, Zimicki S, D'Souza S. Socioeconomic differentials in child nutrition and morbidity in a rural area of Bangladesh. J Trop Pediatr 1986 Feb;32(1): 17-23

B.10 Bhuiya A, Wojtyniak B, D'Souza S, Zimicki S. Socio-economic determinants of child nutritional status: boys versus girls. Food Nutr Bull 1986 Sep;8(3):3-7

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B.13 Brown KH, Robertson AD, Akhtar NA. Lactational capacity of marginally nourished mothers: infants' milk nutrient consumption and patterns of growth. Pediatrics 1986 Nov;78(5):920-6

B.14 Brown KH, Akhtar NA, Robertson AD, Ahmed MG. Lactational capacity of marginally nourished mothers: relationships between maternal nutritional status and quantity and proximate composition of milk. Pediatrics 1986 Nov;78(5):909-19

B.15 Butler T, Speelman P, Kabir I, Banwell JG. Colonic dysfunction during shigellosis. J Infect Dis 1986 Nov;154(5):817-24

B.16 Carniel E, Butler T, Hossain S, Alam NH, Mazigh D. Infrequent detection of Yersinia enterocolitica in childhood diarrhea in Bangladesh. Am J Trop Med Hyg 1986 Mar;35(2):370-1

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B.18 Chowdhury AKMA. Infant mortality in relation to internal migration in rural Bangladesh. J Biosoc Sci 1986 Oct;18(4):449-56

B.19 Chowdhury MAR, Aziz KMS, Rahim Z, Kay BA. Antibiotic resistance patterns of Vibrio mimicus isolated from human and environmental sources in Bangladesh. Antimicrob Agents Chemother 1986 Oct;30(4):622-3

B.20 Chowdhury MAR, Aziz KMS, Rahim Z, Kay BA. Vibrio mimicus in gastroenteritis: a case report. Bangladesh J Microbiol 1986;3(1):25-7

B.21 Clemens JD, Stanton B, Stoll B, Shahid NS, Banu H, Chowdhury AKMA. Breast feeding as a determinant of severity in shigellosis: evidence for protection throughout the first three years of life in Bangladesh children. Am J Epidemiol 1986 Apr;123(4):710-20

B.22 Clemens JD, Jertborn M, Sack D, Stanton B, Holmgren J, Khan MR, Huda S. Effect of neutralization of gastric acid on immune responses to an oral B subunit, killed whole-cell cholera vaccine. J Infect Dis 1986 Jul;154(1):175-8

B.23 Clemens JD, Sack DA, Harris JR, Chakraborty J, Khan MR, Stanton BF, Kay BA, Khan MU, Yunus M, Atkinson W, Svennerholm A-M, Holmgren J. Field trial of oral cholera vaccines in Bangladesh. Lancet 1986 Jul 19;2(8499):124-6

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B.26 Faruque ASG, Eusof A. Medical care utilization: prior to death in cholera outbreaks in rural Bangladesh. Trop Doct 1986 Apr;16(2):87-9

B.27 Feachem RG, Koblinsky MA. Interventions for the control of diarrhoeal diseases among young children: promotion of breast-feeding. Bull WHO

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B.28 Glass RI, Stoll BJ, Wyatt RG, Hoshino Y, Banu H, Kapikian AZ. Observations questioning a protective role for breast-feeding in severe rotavirus diarrhea. Acta Paediatr Scand 1986 Sep;75(5):713-8

B.29 Haider K, Huq MI. A transferable resistance plasmid in Vibrio cholerae and Escherichia coli isolated from the same patient [short communication]. J Diarrhoeal Dis Res 1986 Jun;4(2):91-3

B.30 Henry FJ, Cooper ES. Failure of a supplementary feeding programme to improve the health of young children. Ecol Food Nutr 1986;18(4):287-95

B.31 Huq MI, Shahid NS, Ahmed WU. Bacteremia due to Gram-negative organisms during diarrhoea. Indian J Med Microbiol 1986 Jan;4:59-63

B.32 Huq MI, Rahman ASMM, Al Sadiq A, Munshi MH, Ahmed MU. Clinical and pathological features of Schistosoma mansoni infection in the Eastern Province of Saudi Arabia. Indian J Pathol Microbiol 1986 Jul;29(3):219-26

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B.35 Islam MS, Shahid NS, Haque ME, Mostafa G. Characteristics and practices of traditional birth attendants in Matlab, Bangladesh. J Prev Soc Med 1984 Dec;3(2):23-31*

B.36 Islam MS, Bhuiya A, Yunus M. Socioeconomic differentials of diarrhoea morbidity and mortality in selected villages of Bangladesh. J Diarrhoeal Dis Res 1984 Dec;2(4):232-7*

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B.38 Islam SS, Khan MU. Risk factors for diarrhoeal deaths: a case-control study at a diarrhoeal disease hospital in Bangladesh. Int J Epidemiol 1986 Mar;15(1): 116-21

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B.42 Kamal M, Islam KMN, Sanyal SC. Pathogenesis of Aeromonas hydrophila induced diarrhoea. Bangladesh Med Res Counc Bull 1986 Jun;12(1):9-17

B.43 Khan MU, Shahidullah M, Barua DK, Begum T. Efficacy of periodic deworming in an urban slum population for parasite control. Indian J Med Res 1986 Jan;83:82-8

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B.50 Nag M, Duza MB, Koenig M. Explaining fertility transition in Matlab, Bangladesh: a qualitative study. New York: Population Council, 1986. 131 p.

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APPENDIX A

AUDITORS' REPORT
TO THE BOARD OF TRUSTEES OF
INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

We report that we have audited the Balance Sheet of International Centre for Diarrhoeal Disease Research, Bangladesh as at 31st December, 1986, signed by us under reference to this report, and the relative Income and Expenditure Account for the year ended on that date which are in agreement with the books of account maintained by the Centre and produced to us. Our examination was made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion and to the best of our information and according to the explanations given to us, the Balance Sheet and Income and Expenditure Account together with the Notes attached thereto, give respectively a true and fair view of the state of affairs of the Centre as at 31st December, 1986 and its deficit for the year ended on that date.

RAHMAN RAHMAN HUQ & CO.
Chartered Accountants

PRICE WATERHOUSE
(formerly Price Waterhouse & Co.)
Chartered Accountants

Dhaka, 24 March, 1987

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH
BALANCE SHEET AS AT DECEMBER 31, 1986

	Schedule	1986	1985
Fixed Assets: Cost less depreciation	1	4,291,600	4,290,652
Employees' Retirement Fund Deposits		1,757,013	1,415,650
Current Assets			
Stock of stores and spares	2	432,089	579,067
Contributions receivable from donors		575,682	
Advances, deposits and prepayments	3	382,862	567,720
Cash and bank balances	4	1,828,251	1,613,345
		3,218,884	2,760,132
Less:			
Current Liabilities			
Bank overdraft	5	927,313	2,820,314
Interest free loan		1,186,080	1,186,080
Contributions paid in advance by donors		2,085,959	
Other current liabilities	6	328,857	295,413
		4,528,209	4,301,807
Net Current Assets		(1,309,325)	(1,541,675)
	US $	4,739,288	4,164,627
Represented By:			
Capital Development Fund	7	5,692,533	5,216,813
Operating Fund	8	(4,181,449)	(3,868,786)
Reserve Fund	9	1,471,191	1,400,950
Employees' Retirement Fund		1,757,013	1,415,650
	US $	4,739,288	4,164,627

NOTES FORM PART OF THE ACCOUNTS

Director
ICDDR,B

Member
Board of Trustees

This is the Balance Sheet referred to in our report of same date

Price Waterhouse
(formerly Price Waterhouse & Co.)
Chartered Accountants

Rahman Rahman Huq & Co.
Chartered Accountants

Dhaka, March 24, 1987

INCOME AND EXPENDITURE ACCOUNT (OPERATING FUND)
FOR THE YEAR ENDED DECEMBER 31,1986

	Schedule	1986	1985
Income			
Contributions	10	7,892,691	7,487,397
Other receipts		430,458	208,932
		8,323,149	7,696,329
Less:			
Transferred to Capital Development Fund to the extent of capital expenditure/contribution		475,720	547,410
		7,847,429	7,148,919
Exchange gain		31,449	306,083
		7,878,878	7,455,002
Expenditure			
Personnel services and benefits		5,181,005	5,678,716
Supplies and materials		1,112,985	1,288,644
Travel expenses		436,664	473,369
Transportation of materials		83,525	163,028
Rent,communication and utilities		184,150	200,653
Printing and reproduction		111,603	166,759
Other contractual services		619,318	706,313
Depreciation		462,291	416,122
		8,191,541	9,093,604
Surplus/(Deficit)	US $	(312,663)	(1,638,602)

SOURCE AND APPLICATION OF FUNDS FOR THE YEAR ENDED DECEMBER 31, 1986

		1986	1985
Source			
Capital Development Fund receipts		475,720	547,410
Reserve Fund receipts		70,241	559,321
Decrease in net current assets			946,772
Retirement Fund receipts (net)		341,363	450,746
Sale of assets		8,686	1,019
Cash surplus from operation		153,423	
	US$	1,049,433	2,505,268
Application			
Addition to fixed assets		475,720	848,290
Increase in net current assets		232,350	
Cash deficit in operation			1,206,232
Investment in Retirement Fund (net)		341,363	450,746
	US$	1,049,433	2,505,268

SCHEDULE 1

FIXED ASSETS

Description	COST				DEPRECIATION					BALANCE
	Opening balance on 1.1.1986	Additions this year	Sales/ Adjust-ments	Total	Rate	As at 1.1. 1986	Charge for the year	Adjust-ments	Total	As at 31.12.1986
Land	71,362			71,362						71,362
Buildings	1,800,241	34,458		1,834,699	2%	102,648	36,694		139,342	1,695,357
Vehicles	444,322	34,544	1,923	476,943	20%	222,002	95,389	1,154	316,237	160,706
Furniture	374,845	14,526	16,731	372,640	10%	100,584	37,264	5,019	132,829	239,811
Equipment	2,478,100	391,334		2,869,434	10%	580,119	286,943		867,062	2,002,372
Others	119,168	858		120,026	5%	16,959	6,001		22,960	97,066
Work in progress	24,926			24,926						24,926
US$	5,312,964	475,720	18,654	5,770,030		1,022,312	462,291	6,173	1,478,430	4,291,600

SCHEDULE 2

		1986	1985
STOCK OF STORES AND SPARES			
Capital Development Fund:			
Capital assets		54,452	42,446
Operating Fund:			
Supply stores		255,770	394,690
Maintenance stores		121,867	141,931
		377,637	536,621
	US $	432,089	579,067

SCHEDULE 3

ADVANCES, DEPOSITS AND PREPAYMENTS			
Capital Development Fund:			
Advance against capital expenditure			147,780
Operating Fund:			
Advance against supplies and services		209,935	164,299
Advance against expenses		144,213	230,433
Other advances		24,936	20,012
Deposits		3,778	5,196
		382,862	419,940
	US $	382,862	567,720

SCHEDULE 4

CASH AND BANK BALANCES	1986	1985
US $ Account		
American Express Bank Ltd.,New York (Reserve Account)	38,372	20,820
American Express Bank Ltd.,Switzerland	7,935	7,969
American Express Bank Ltd.,Dhaka	131,084	63,252
American Express Bank Ltd.,Dhaka (Reserve Account)	21,819	29,131
American Express Bank Ltd.,Call Deposit (Reserve Account)	1,411,000	1,351,000
American Express Bank Ltd.,BOSTID Account	524	6,212
American Express Bank Ltd.,MSF Account	0	16,063
American Express Bank Ltd.,US AID - MCH	526	8,536
Janata Bank, Dhaka	1,274	1,274
Bank of Credit and Commerce International (Overseas) Ltd.	0	228
US $	1,612,534	1,504,485
Taka Account		
Bank of Credit and Commerce International (Overseas) Ltd.	0	44,727
Janata Bank, Dhaka	1,369	1,373
Agrani Bank,Dhaka BAF	36,300	20,874
Agrani Bank,Dhaka Head Office	25	26
Agrani Bank,Matlab	3,177	3,349
Agrani Bank,Teknaf	1,076	317
Agrani Bank,Sirajgonj	1,173	1,353
Agrani Bank,Noapara	926	269
Agrani Bank,Chandpur	356	346
Agrani Bank,Mirjapur	3,544	4,646
American Express Bank Ltd.,Dhaka	25,643	5,578
American Express Bank Ltd.,Dhaka(NORAD)	6,555	0
American Express Bank Ltd.,Dhaka(Call Deposit)	116,764	0
US $	196,908	82,858
UK £ Account		
American Express Bank Ltd.,London	8,478	15,634
SFR Account		
American Express Bank Ltd.,Switzerland	7,394	6,594
SR Account		
Saudi American Bank,Dammam	1,468	1,510
Cash in hand	1,469	2,264
US $	1,828,251	1,613,345

SCHEDULE 5

		1986	1985
BANK OVERDRAFT			
US $ Account			
American Express Bank Ltd.,New York		367,596	1,075,620
Taka Account			
American Express Bank Ltd.,Dhaka		559,717	1,744,694
	US $	927,313	2,820,314

SCHEDULE 6

OTHER CURRENT LIABILITIES			
For supplies and materials		83,526	86,399
For expenses		211,869	171,792
Security and other deposits		33,462	37,222
	US $	328,857	295,413

SCHEDULE 7

CAPITAL DEVELOPMENT FUND			
Balance as at January 1		5,216,813	4,669,403
Add: Transferred during the year from Income and Expenditure Account		475,720	547,410
	US $	5,692,533	5,216,813

SCHEDULE 8

OPERATING FUND			
Balance as at January 1		(3,868,786)	(2,230,184)
Deficit for the year ended December 31		(312,663)	(1,638,602)
	US $	(4,181,449)	(3,868,786)

SCHEDULE 9

RESERVE FUND			
Balance as at January 1		1,400,950	841,629
Add: Received during the year		0	500,000
Interest earned on deposits		70,241	59,321
	US $	1,471,191	1,400,950

SCHEDULE 10

CONTRIBUTIONS	1986				1985
	Received in 1986	Receivable	Carried forward	Total for 1986	Received in 1985
Central Funds:					
Australia	123,237		61,619	61,618	143,365
Bangladesh	59,311		15,627	43,684	0
China	10,000			10,000	0
Saudi Arabia	70,000			70,000	100,000
Sweden	117,810			117,810	0
United States - AID	500,000			500,000	0
Switzerland	780,309		648,203	132,106	310,813
United Kingdom	206,448		103,224	103,224	171,741
UNICEF	500,000			500,000	250,000
Others	0			0	139
Total Central Funds	2,367,115	0	828,673	1,538,442	976,058
Project Funds:					
Aga Khan Foundation	17,951		16,886	1,065	52,260
Arab Gulf Fund	0			0	485,440
Australia (Nandipara)	2,224		1,122	1,102	0
Australian National Univ y	5,773		2,397	3,376	0
Belgium	114,739	74,113		188,852	68,115
BOSTID	22,170	5,443		27,613	13,312
Canada - CIDA (Training)	254,637	3,585	76,247	181,975	0
- CIDA (DSS)	767,040		200,318	566,722	807,806
- IDRC (DISC)	83,141		6,712	76,429	85,468
- IDRC(Infant Mort´y)	9,393		2,202	7,191	0
- IDRC(Video)	1,262			1,262	0
Case Western Reserve Univ´ty	12,782		3,101	9,681	0
FAO	37,987		37,129	858	0
France	0	13,873		13,873	12,600

(Continued on next page)

CONTRIBUTIONS

	1986				1985
	Received in 1986	Receivable	Carried forward	Total for 1986	Received in 1985
Ford Foundation	68,349	405	86,519	(17,765)	354,544
Germany, Federal Republic	0			0	13,671
IBRD	78,863	99,078		177,941	85,986
Japan	320,000		18,501	301,499	260,000
Johns Hopkins University	0			0	11,141
Manage't Science for Health	4,500			4,500	0
Medecins Sans Frontieres	24,063			24,063	0
Miles Pharmaceuticals	47,399	28,633		76,032	0
Nestle	9,205		3,379	5,826	0
Norway - NORAD	427,827		101,920	325,907	228,837
Norwich Eaton Pharmaceutical	22,500		3,924	18,576	10,500
OPEC	30,000			30,000	0
Population Council	5,352	13,438		18,790	32,474
Princeton University	0			0	3,748
PRITEC	0			0	10,500
Rockefeller Foundation	6,164		3,414	2,750	5,380
Saudi Arabia (DCC)	536,596	88,500		625,096	275,053
UNDP/UNROB	43,571			43,571	43,570
UNDP - UVP	103,154			103,154	96,470
UNDP/WHO	388,000		147,982	240,018	187,000
UNFPA	0			0	75,375
UNICEF (ORT,Training)	335,480	88,518		423,998	253,645
UNITED STATES - AID :					
- Cholera Vaccine Trial	380,000			380,000	2,300,000
- Cooperative Agreement	1,700,000		497,571	1,202,429	0
- Urban Volunteer Programme	0	77,994		77,994	0
- Dhaka,MCH FP& others	983,812	72,945		1,056,757	663,033
- Jakarta,Training	33,440			33,440	3,755
- Nepal,Training	40,644			40,644	0
- Cairo,Training	15,000			15,000	0
- NIROG	14,731			14,731	13,894
WHO	88,104	9,157	47,962	49,299	57,762
Total Project Funds	7,035,853	575,682	1,257,286	6,354,249	6,511,339
Grand Total US$	9,402,968	575,682	2,085,959	7,892,691	7,487,397

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH,BANGLADESH
NOTES TO ACCOUNTS FOR THE YEAR ENDED DECEMBER 31,1986

1. ACCOUNTING POLICIES

(i) Income and Expenditure Account and Balance Sheet of the Centre are prepared in the manner as prescribed and approved by the Board of Trustees.

(ii) Fixed assets have been brought to account at material cost up to August 1981. Subsequent to that date incidental expenses such as labour, freight, insurance etc. (excluding clearing charges) have also been included in arriving at the cost of fixed assets.

(iii) Stock of stores and spares are valued at material cost only.

(iv) During the year there has been a change in the basis of accounting for contributions. Up to the period ended 31st December, 1985, all receipts by way of contributions were considered to be the income of the year of receipt whereas for 1986, contributions have been taken as income on the following basis:

(a) Those pertaining to Central Funds have been carried forward to the extent they relate to future periods.

(b) As regards Project Funds, the unexpended contributions received in 1986, and earlier, have been carried forward. Correspondingly amounts equal to the expenses incurred but not yet reimbursed by donors have been treated as contributions receivable.

Had the past practice been followed, contributions for the year would have been higher by $ 1,510,277.

"Expenditures" of the Centre for the year have been accounted for on an "accrual" basis in accordance with past practice.

(v) Depreciation on fixed assets has been charged on a straight line basis.

(vi) The accounts have been prepared on a]historical cost´ basis. For advances , liabilities , cash and bank balances the year end exchange rate was used for converting non-US currencies to US Dollars. For other transactions, average monthly exchange rates were used for conversion purposes.

(vii) All assets costing $ 50 or less are expensed. The Centre maintained a separate register for such assets up to December 31, 1983 which has not been updated since then.

2. FIXED ASSETS

(i) 4.10 and 0.51 acres of land situated at Mohakhali (Dhaka) and Matlab (Comilla) received as donations from the Government of Bangladesh and a private party respectively have not been brought into the books of account.

(ii) Cost of buildings includes an amount of US$ 101,646 spent on the extension of the Institute of Public Health building, owned by the Government of Bangladesh and at present partly accommodating the Centre. The extension was built for use by the ICDDR,B.

(iii) Work in progress $ 24,926 represents the cost of a transformer, installed in 1984, which has not been made operational due to the unavailability of a required chemical.

(iv) No provision for depreciation has been made up to December 31, 1982.

3. EMPLOYEES' RETIREMENT FUND DEPOSITS

These deposits represent employees' and Centre's contributions lodged with American International Re-insurance Company Ltd., Pembroke, Bermuda (AIRCO) under a group annuity contract through the Institute of International Education, New York, to provide for retirement benefits to employees who are in the WHO scale. Since the fund is not maintained by the Centre, these deposits do not form part of its assets but have been incorporated into the books of account by a contra credit to "Employees' Retirement Fund" on the basis of memorandum records maintained by the Centre in this respect. Accretions to the deposits by way of interest as may be allowed by AIRCO are not recognised in the Centre's records.

4. PERSONNEL SERVICES AND BENEFITS

(i) Members of the Board of Trustees waived their entitlement to an honorarium in 1986. In 1985 an amount of US $ 42,909 was paid in this respect.

(ii) Retirement liability to the extent of US $ 39,000 (approx.) has not been provided for in the accounts in respect of ICDDR,B employees not covered by WHO scale.

5. CURRENCY TRANSLATION

Currency	Average monthly exchange rates	Year end exchange rates
	.....US dollars.....	
TK 1.00	0.0333	0.0329
UK£ 1.00	1.4809	1.4604
SFR 1.00	0.5602	0.5448
SR 1.00	0.2703	0.2665
S$ 1.00	0.4602	0.4760

6. OTHERS

Grants by way of various services rendered by the donor agencies to the Centre have not been considered in the accounts.

Previous year's figures have been rearranged and regrouped wherever found necessary.

APPENDIX B

STAFF LIST

This is a partial list of Staff of the ICDDR,B during 1986 and only includes members of General Service Grade 5 and above.

The list was prepared by the Personnel Branch of the ICDDR,B and the Editor of the Annual Report bears no responsibility for any errors or ommisions contained herein.

*** New in 1986, ** Left in 1986, *** Died**

	DIRECTOR		
	R Eeckels MD DTM	Belgium	Director
	ASSOCIATE DIRECTORS		
**	KMS Aziz MSc PhD	Bangladesh	Senior Scientist Training Extension and Communication Working Group (until 30 June 1986)
	MR Bashir BA	Bangladesh	Resources Development Division
	I Ciznar PhD DrSc	Czechoslovakia	Senior Scientist Immunology & Bacteriology Genetics Dept
*	M Badrud Duza MA PhD	Bangladesh	Senior Scientist Population Science and Extension Division
**	MM Rahaman MBBS MSc PhD	Bangladesh	Senior Scientist Nutrition Working Group (until 30 June 1986)
	MGM Rowland MBBS DCH DTM&H FRCP	UK	Senior Scientist Community Medicine Division
	DA Sack MD	USA	Senior Scientist Laboratory Sciences and Epidemiology Division

COMMUNITY MEDICINE DIVISION

*	Dilruba Afroze MBBS	Bangladesh	Medical Officer
	Shahnaz Ahmed MSc	Bangladesh	Field Research Officer
	Dewan S Alam MBBS	Bangladesh	Medical Officer
	K M A Aziz MA MPhil PhD	Bangladesh	Anthropologist
**	R Banerjee MS	Canada	Computer Consultant
**	Laila Baqee MSc MUPR	Bangladesh	Operations Researcher
	Abdullah Hel Baqui MBBS MPH	Bangladesh	Senior Medical Officer
	M Abdul Bari MBBS	Bangladesh	Senior Medical Officer
	Suraiya Begum MA	Bangladesh	Field Research officer
	A Briend MD	France	Nutritionist
	Dibyendu B Chakma BSc	Bangladesh	Field Research Officer
	Jyotsnamoy Chakraborty	Bangladesh	Manager, Health Services
**	M Chibba	Canada	Health Economist
**	A K M A Chowdhury ScD	Bangladesh	Demographer
	Aminul I Chowdhury BA	Bangladesh	Statistical Officer
*	M H Rahman Chowdhury MBBS	Bangladesh	Medical Officer
*	V A Fauveau MD MPH	France	MCH-FP Physician
*	Claire F Fauveau	France	Nutrition Coord Consultant
**	M Giasuddin MBBS	Bangladesh	Medical Officer
	F Henry PhD	Guyana	Nutritionist
	M Emdadul Hoque MA	Bangladesh	Sr Field Research Officer
*	Bilqis A Hoque BSc Eng PhD	Bangladesh	Environmental Engineer
	M Shahadat Hossain MA	Bangladesh	Field Research officer
	M Mokbul Hossain	Bangladesh	Field Research Officer
*	Nancy Hughart RN	USA	Immunization Effort Coord
**	Marilyn Hurrell RN BS	Canada	Health Educator
	M Shafiqul Islam MA	Bangladesh	Assistant Scientist
	M Mofizul Islam	Bangladesh	Research Officer
	M Nazrul Islam BA	Bangladesh	Field Research Officer
*	Rafique-ul Islam MSc	Bangladesh	Junior Programmer
*	N M Jahangir MSc Eng	Bangladesh	Analyst Programmer
	Tajkera Khair MSc MA	Bangladesh	Coordinator, UV Programme
	Shahida Khanam MSc	Bangladesh	Field Research Officer
	Jahanara Khatun MSc	Bangladesh	Field Research Officer
	Khodeza Khatun MA MPH	Bangladesh	Sr Field Research Officer
	M Khaleguzzaman MBBS	Bangladesh	Senior Medical Officer
	Matiur R Khan	Bangladesh	Manager, Special Studies
	S A Khan MBBS	Bangladesh	Medical Officer
	M Eradul H Khan MBBS	Bangladesh	Medical Officer
	A Hamid Khan Dip Eng	Bangladesh	Engineering Supervisor
**	Marjorie Koblinsky PhD	USA	Director MCH-FP Ext Project
	Abdul Matin	Bangladesh	Senior Staff Nurse
	M A Quddus Mondal BA	Bangladesh	Field Research Officer
**	M Golam Morshed MSc	Bangladesh	Research Officer
**	A H Mostafa BSc Dip EDP	Australia	Computer Operations Manager
	M M Hoque Munshi MBBS MPH	Bangladesh	Head, Teknaf Station
	Hazera Nazrul MA	Bangladesh	Field Research Officer
	M Yeakub Patwary MA	Bangladesh	Sr Field Research officer
	A S M M Rahman MBBS MSc	Bangladesh	Associate Scientist
	Loretta Saldanha	India	Executive Secretary
*	Saroj Kumar Saha PhD	Bangladesh	Financial Analyst
	Thomas M Sarker MSc	Bangladesh	Computer Operator
	Jatindra N Sarker BA	Bangladesh	Project Office Manager

	S M Abdus Sattar BA	Bangladesh	Sr Administrative Officer
	M Shahidullah MA	Bangladesh	Sr Field Research officer
**	Bonita Stanton MD	USA	Project Director, UVP
	M Umra BSc	Bangladesh	Field Research Officer
**	Judith N Wasserheit MD	USA	Epidemiologist
*	Brenda Wroot BEd MEd	Canada	Training Consultant
	M Yunus MBBS MSc	Bangladesh	Head, Matlab Station

CLINICAL SCIENCES DIVISION

	Milita G Adhikari	Bangladesh	Senior Staff Nurse
	Tahmeed Ahmed MBBS	Bangladesh	Medical Officer
	Syed M Akramuzzaman MBBS	Bangladesh	Medical Officer
	A Nurul Alam MBBS PhD	Bangladesh	Head, Dhaka Hospital
	M N Hoque Alam MBBS	Bangladesh	Senior Medical Officer
	Kaiser Ali MBBS	Bangladesh	Medical Officer
	M Showkat Ali	Bangladesh	Hospital Services Supvr
	M M Ramzan Ali	Bangladesh	Secretary
**	M Khairul Anam MBBS	Bangladesh	Medical Officer
	Hasan Ashraf MBBS	Bangladesh	Medical Officer
	A Kalam Azad MBBS	Bangladesh	Senior Medical Officer
**	A Aziz	Bangladesh	Assistant Matron
	Anita Baidya	Bangladesh	Senior Staff Nurse
	Pradip K Bardhan MBBS	Bangladesh	Senior Medical Officer
	A Amita Baroi	Bangladesh	Senior Staff Nurse
	Maya R Barua	Bangladesh	Senior Staff Nurse
*	Mohshina Begum	Bangladesh	Senior Staff Nurse
	M L Bennish MD	USA	Int'l Research Associate
	Pankajini Biswas	Bangladesh	Matron
	Golak B Chakma	Bangladesh	Senior Staff Nurse
	Meena Chowdhury MBBS	Bangladesh	Staff Clin Phys'cn Manager
**	G Nandan Chowdhury MBBS	Bangladesh	Medical Officer
	Ignatius Costa	Bangladesh	Senior X-Ray Technician
	Fatema Cruze	Bangladesh	Senior Staff Nurse
	Florence Daring	Bangladesh	Senior Staff Nurse
	Santona D'Cruze	Bangladesh	Senior Staff Nurse
	Ratan C Gomes	Bangladesh	Senior Staff Nurse
	Irene S Gomes	Bangladesh	Senior Staff Nurse
	Bernard Gomes	Bangladesh	Senior Staff Nurse
	Usha E Gomes	Bangladesh	Senior Staff Nurse
	Maloti A Gomes	Bangladesh	Senior Staff Nurse
**	Ratan C Goswami	Bangladesh	Senior Staff Nurse
	Rukhsana Haider MBBS	Bangladesh	Medical Officer
	Magdalena G Halder	Bangladesh	Senior Staff Nurse
	Smriti K Halder	Bangladesh	Senior Staff Nurse
	Sushama S Halder	Bangladesh	Senior Staff Nurse
	Jena D Hamadani MBBS	Iran	Medical Officer
	Tariq Hassan MBBS	Bangladesh	Medical Officer
**	M Amir Hossain	Bangladesh	Infection Control Officer
***	Wendy Hussain SRN RSCN	UK	Nurse Trainer/Matron
	Lily Islam	Bangladesh	Senior Staff Nurse
*	Karin Janssen	Denmark	Nurse/Practitioner
	A K M Iqbal Kabir MBBS MS	Bangladesh	Senior Medical Officer
	Hosna Ara Kabir	Bangladesh	Assistant Matron

	Ali M Khan MBBS	Bangladesh	Medical Officer
**	Masum K Khan MBBS	Bangladesh	Medical Officer
	Rahima Khatun BA SRN SCM	Bangladesh	Nursing Manager
	Makhduma Khatun BSc	Bangladesh	Research Officer
	Nasheha Khatun MSc	Bangladesh	Dietician
	Asma Khanam MBBS MPH	Bangladesh	Senior Medical Officer
	Premlata Kunder	Bangladesh	Senior Staff Nurse
	F P L Van Loon MD	Netherlands	Gastroenterologist
	Abdul Majid	Bangladesh	Pharmacist
	Ramendra N Mazumder MBBS	Bangladesh	Medical Officer
**	AM Molla MBBS PhD DCH	Bangladesh	Paediatric Gastroenterol
	Manakhushi Mondal	Bangladesh	Senior Staff Nurse
	Barlin C Nokrek	Bangladesh	Senior Staff Nurse
*	F C Patra MD	India	Int'l Research Fellow
	A Rahman Patwary	Bangladesh	Secretary
*	Ruth S Petersen	Denmark	Nurse/Practitioner
	Momata H Purification	Bangladesh	Senior Staff Nurse
	Tazia Qamar MA	Bangladesh	Medical Social Worker
	M G M Rabbani MBBS MSc	Bangladesh	Assistant Scientist
	M Matiur Rahman MBBS	Bangladesh	Medical Officer
	Hosneara Rahman	Bangladesh	Senior Staff Nurse
	M Lutfur Rahman	Bangladesh	Senior Staff Nurse
*	T Rautanen	Finland	Research Fellow
**	Najma Rizvi MA PhD	USA	Nutrition Anthropologist
	S K Roy MBBS MS	Bangladesh	Senior Medical Officer
	Mavel V Rozario	Bangladesh	Senior Staff Nurse
	Suratunnessa	Bangladesh	Assistant Matron
	M Abdus Salam MBBS	Bangladesh	Chief Physician
	Jacinta Sarker	Bangladesh	Senior Staff Nurse
	M S Alam Sarker MBBS	Bangladesh	Medical Officer
	M Abdus Sattar	Bangladesh	Senior Staff Nurse
	Mahbooba B Shamsuddin	Bangladesh	Secretary
*	Mamun Shahrier MBBS	Bangladesh	Medical Officer
**	Goutam P Shome MBBS	Bangladesh	Medical Officer
	Anita Stephen	Bangladesh	Assistant Matron
**	Isabella Vesters SRN	Belgium	Nurse/Practitioner

LABORATORY SCIENCES & EPIDEMIOLOGY DIVISION

Q Shafi Ahmad MSc	Bangladesh	Supervisor Research Micro
Ziauddin Ahmed MSc	Bangladesh	Statistical Officer
Ziauddin Ahmed MSc PhD	Bangladesh	Bacterial Geneticist
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APPENDIX C

ACRONYMS AND ABBREVIATIONS

BADC	Belgian Administration for Development Cooperation
BIRDEM	Bangladesh Institute of Research & Rehabilitation in Diabetes, Endocrine & Metabolic Disorders
BOSTID	Board on Science and Technology for International Development
BRAC	Bangladesh Rural Advancement Committee
CIDA	Canadian International Development Agency
CIS	Computer Information Services
CMD	Community Medicine Division
CSD	Clinical Sciences Division
DANIDA	Danish International Development Agency
DMCH	Dhaka Medical College Hospital
DISC	International Diarrhoeal Disease Information Service and Documentation Centre
DMB	Data Management Branch
DPT	Diphtheria, pertussis and tetanus
DSS	Demographic Surveillance System
ELISA	Enzyme-linked immunosorbent assay
EPI	Expanded Programme of Immunization
ERC	Ethical Review Committee
IBRD	International Bank for Reconstruction and Development
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh
IDRC	International Development Research Centre
INSERM	Institut National de la Santé et de la Recherche Médicale
IPH	Institute of Public Health
JDDR	Journal of Diarrhoeal Diseases Research
LSED	Laboratory Sciences and Epidemiology Division
MCH-FP	Maternal and Child Health - Family Planning
MOHPC	Ministry of Health and Population Control
NIPORT	National Institute of Populations Research and Training
NIPSOM	National Institute of Preventive and Social Medicine
NORAD	Norwegian Agency for Development
OMP	Outer Membrane Protein
OPEC	Oil Producing and Exporting Countries
ORS	Oral rehydration salts; oral rehydration solution
ORSTOM	Institut Français de Recherche Scientifique pour le Développement en Coopération
ORT	Oral rehydration therapy
PCC	Programme Coordination Committee
PHC	Primary health care
PSED	Population Science and Extension Division
SAREC	Swedish Agency for Research Cooperation with Developing Countries
RRC	Research Review Committee
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNFPA	United Nations Fund for Population Activities
UNICEF	United Nations Childrens´ Fund
UNROB	United Nations Relief Organisation in Bangladesh
USAID	United States Agency for International Development
UVP	Urban Volunteers Programme
WHO	World Health Organization
WUSC	World University Service of Canada

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