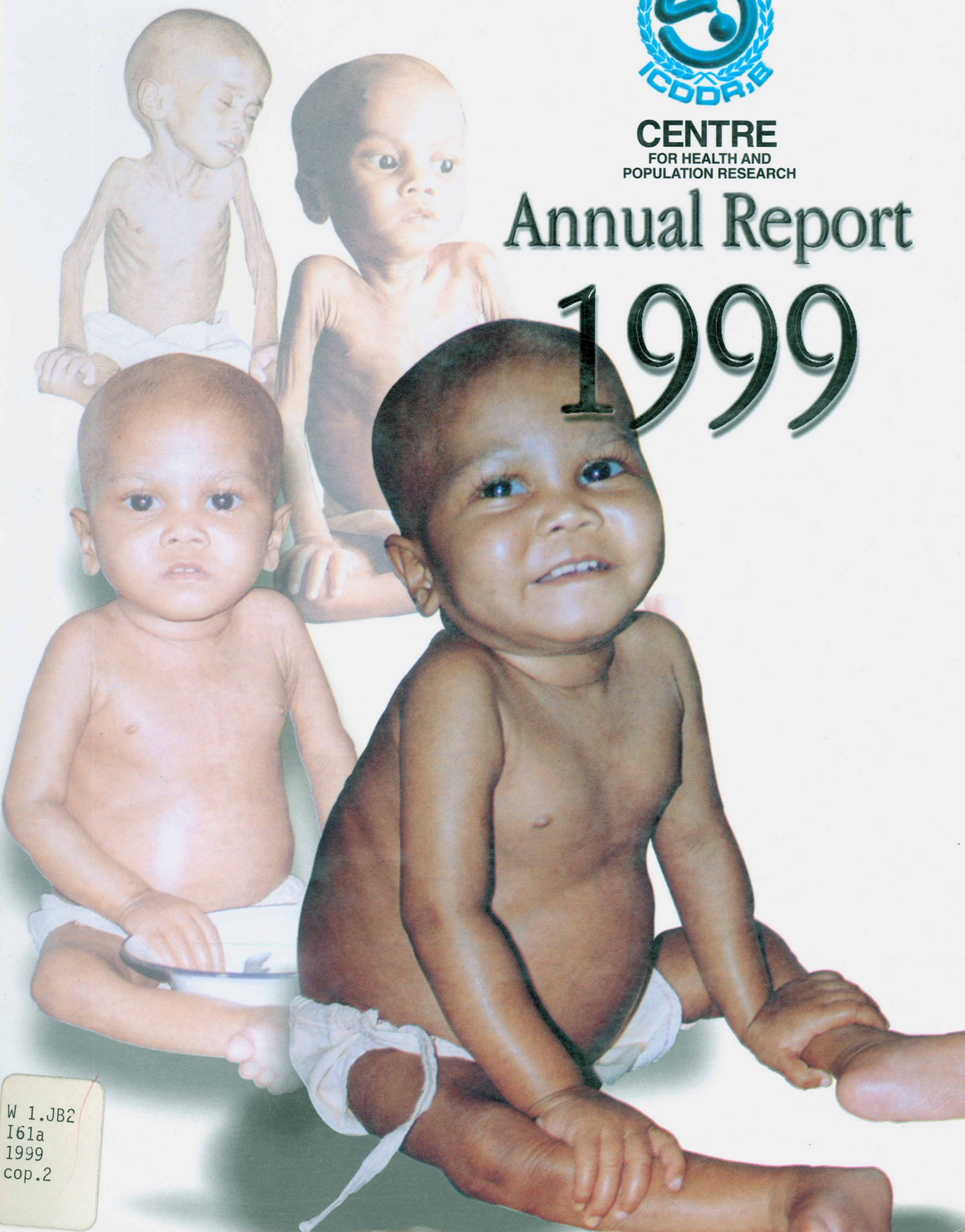




CENTRE
FOR HEALTH AND
POPULATION RESEARCH

Annual Report 1999



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ICDDR,B: Centre for Health and Population Research (the Centre) is a large, non-profit international health research organization with headquarters in Dhaka, Bangladesh. It conducts research and provides service and training in a variety of the most important health problems, which the developing countries face. Initially focused on cholera and diarrhoeal diseases, the mandate of the Centre has broadened considerably, and the Centre is a world leader in studies of and solutions for common conditions prevalent in the developing nations and associated with poverty, including infectious diseases, malnutrition, high fertility, microbial and chemical contamination of the environment and need for better health services.

- ICDDR,B recruits international staff, including public health scientists, laboratory scientists, clinicians, nutritionists, epidemiologists, demographers, social and behavioural scientists, from academic and research institutions, and United Nations (UN) organizations. Approximately, 95% of the staff, including scientific researchers, medical officers, health workers, and administrators, are Bangladeshi nationals.
- ICDDR,B provides training to health professionals attending courses funded by USAID, UNICEF, the Government of Japan, and other donor organizations. Trainees are invited by their governments, academic institutions, and donor agencies.
- The Centre's activities are supported by donors, including governments, UN specialized agencies, non-government organizations, foundations, research institutes, and private sector organizations and companies, and governed by an international Board of Trustees.

The Centre is expanding its mandate to address some of the most critical global health needs facing humanity as we enter into the 21st century, and is composed of four scientific divisions, training, and administrative offices.

The **Clinical Sciences Division (CSD)** provides clinical services and undertake clinical and community research in diarrhoeal diseases, respiratory tract infections, and nutrition. The CSD also provides preventive strategies, such as immunizations for mothers and children, education for mothers on the management of diarrhoeal diseases, nutrition, and other childhood illnesses, with special emphasis on children aged less than five years. The Clinical Research and Service Centre of the Dhaka hospital provides treatment to 120,000-140,000 patients annually, of whom 80% are children, aged less than five years, suffering from diarrhoea, malnutrition, and pneumonia.

The **Health and Population Extension Division (HPED)** conducts operations research in rural and urban areas in collaboration with the Government of Bangladesh and NGOs. The scientific work of the Division aims to enhance efficiency, effectiveness, cost-effectiveness, and sustainability of the health and population sector programmes through the design, field-testing and replication of appropriate strategies and technologies. A major focus is on advocacy and the application of research findings in policy formulation, as well as the provision of technical assistance in scaling-up results from successful interventions. The Division has four experimental sites in Abhoynagar (Jessore), Mirsarai and Patiya (Chittagong), and Dhaka city. Its surveillance system covers a population of 126,747 and 23,624 households at these sites.

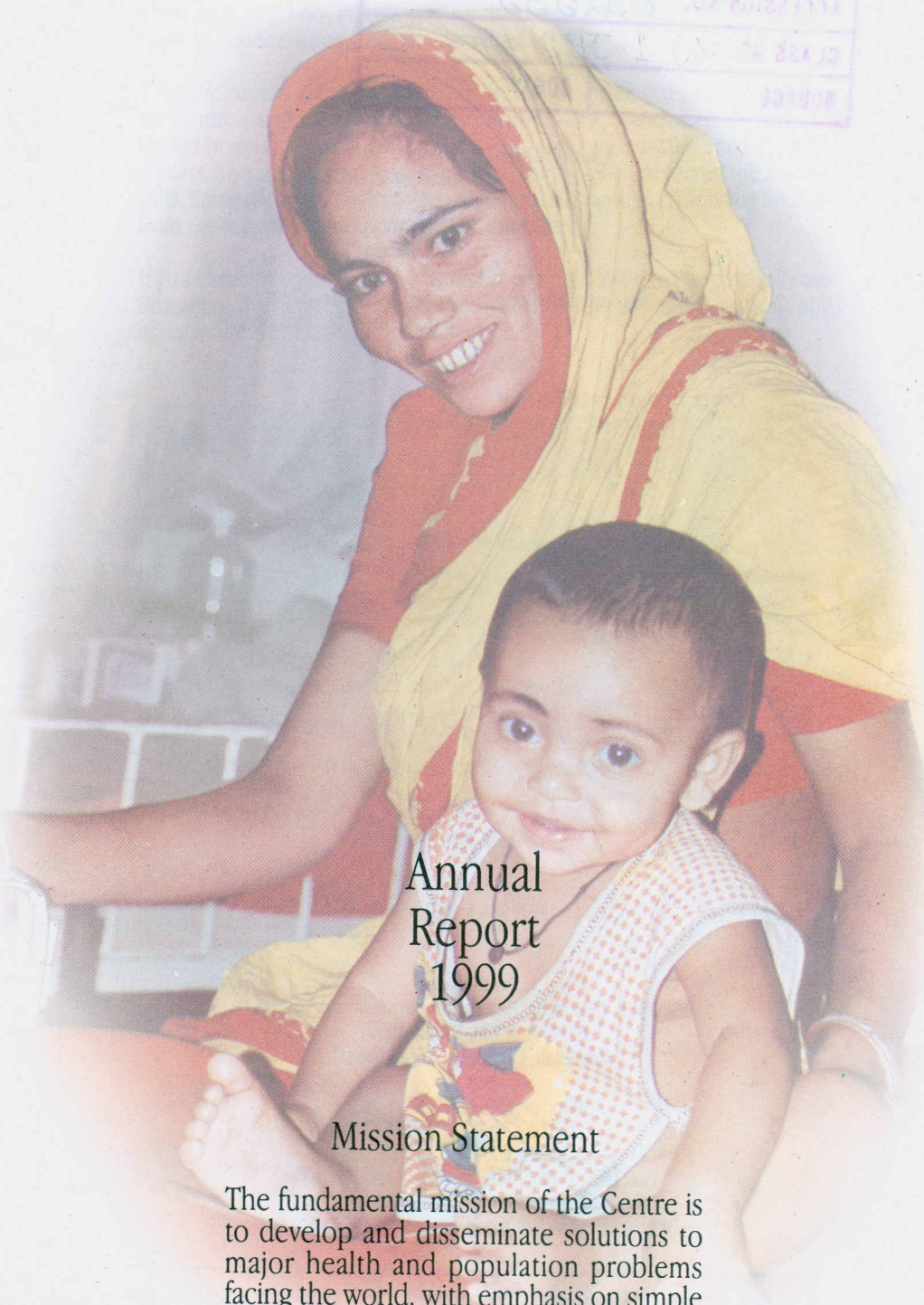
The **Laboratory Sciences Division (LSD)** conducts laboratory-based research in diarrhoeal diseases, acute respiratory infections, reproductive tract infections, HIV, other infectious diseases, environmental health, and nutrition. It has seven state-of-the-art laboratories for bacteriology, virology, immunology, nutritional biochemistry, parasitology, environmental microbiology, and pathology research.

The **Public Health Sciences Division (PHSD)** brings the population perspective to the Centre's mission. It searches for simple, cost-effective approaches that could be widely applied and increase the absolute level, as well as an equitable distribution of health between groups. The Division has a strong research infrastructure, including provision of primary healthcare services in rural Matlab where about 215,000 people are under the Matlab Health and Demographic Surveillance System. Besides the Matlab Health Research Programme and Health and Demographic Surveillance System, the Division has research programmes for Reproductive Health, Child Health, Social and Behavioural Sciences, Epidemic Control Preparedness, and Health Economics. Projects address epidemiological patterns of ill health, transmission of infections, public health nutrition, delivery of healthcare, prevention of illness through education, modification of risk behaviours, vaccine trials, and community development.

The **Director's Division** provides support to the scientific divisions and interfaces with the donor community. The Division is composed of the Director's Office, External Relations and Institutional Development Office, Finance Department, Personnel Department, Training and Education Department, Staff Development, Dissemination and Information Services Centre (Library, Publications, and Audiovisual Unit), Computer Information Services, and Administrative Services.

Training: The Centre has two training facilities: the Sasakawa Training Centre on the Dhaka campus of the ICDDR,B and the International Training Facility in Matlab. Courses are conducted on epidemiology, family planning and reproductive health, child health and survival strategies, research methodology, clinical management, laboratory diagnosis, clinical economics, emerging and re-emerging pathogens, and nutrition. These courses have attracted more than 18,000 participants from 77 countries among both developing and industrialized nations.

(See inside of the back cover...)



Annual Report 1999

Mission Statement

The fundamental mission of the Centre is to develop and disseminate solutions to major health and population problems facing the world, with emphasis on simple and cost-effective methods of prevention and management

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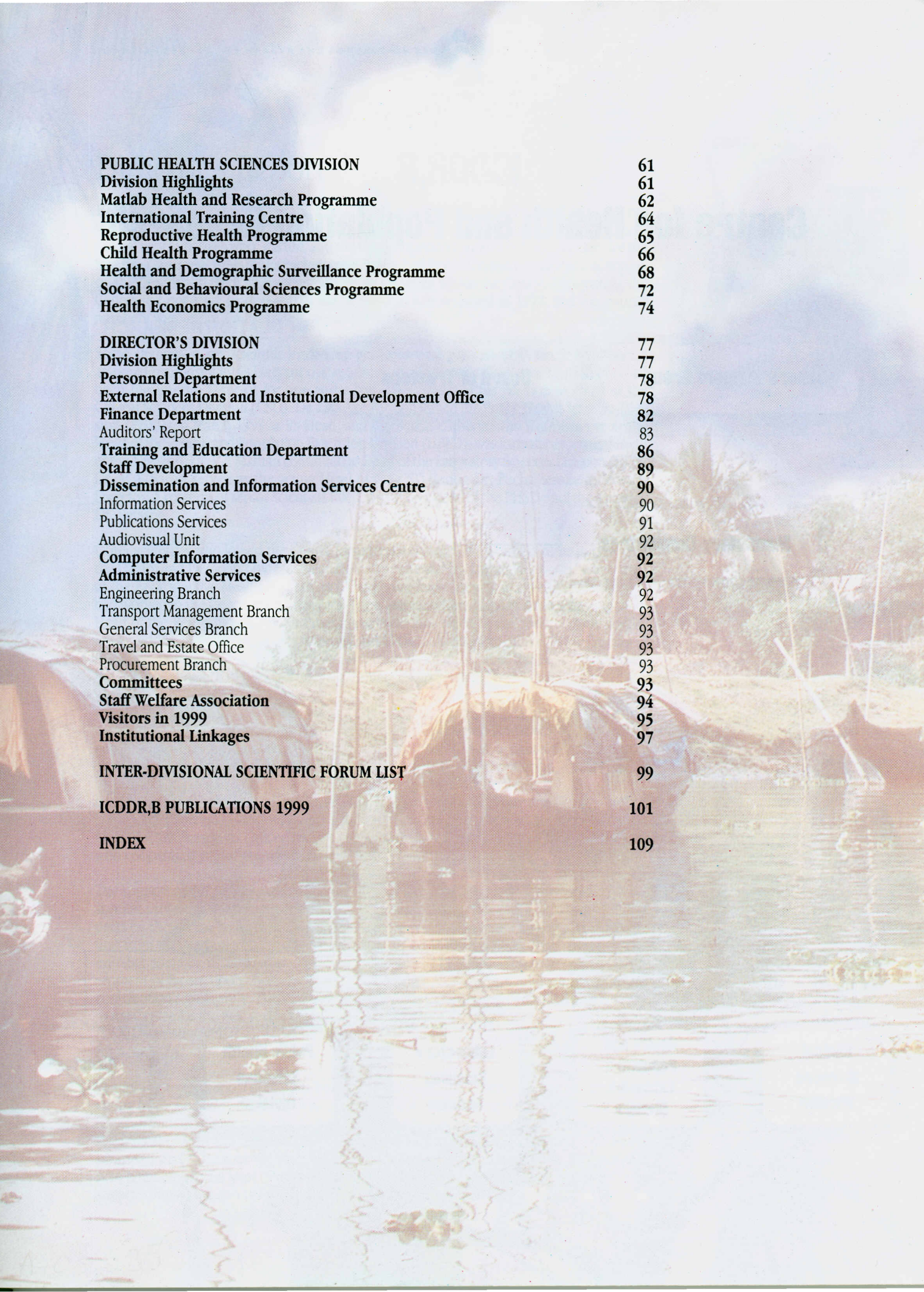
Websites: www.icddrb.org and www.icddrb.org.sg

ICDDR,B: Centre for Health and Population Research publishes a journal, two newsletters, one bilingual staff news bulletin, scientific reports, monographs, working papers, and special publications on subjects relating to diarrhoeal diseases, population and reproductive health, and on nutrition. Details of some of these publications may be found in the section ICDDR,B Publications 1999 of this report.

Cover

Sheema, one of the many patients at the Clinical Research and Service Centre of ICDDR,B, recovering from severe malnutrition that resulted from diarrhoea and pneumonia. During her five-week stay under ICDDR,B care, she gained a total of 2.4 kg weight under standardized management.

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ICDDR,B Centre for Health and Population Research

CENTRE
FOR HEALTH AND
POPULATION RESEARCH

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Division

1999 was a year of many accomplishments and some stabilization for the Centre. All the scientific division head positions were filled up with international staff, a new director joined, several new initiatives were started, and the Centre operated under a balanced budget for the first time in several years. These achievements resulted from increased confidence of donors on the Centre and from improved management systems within the Centre. Fortunately, the Centre did not have to deal with a major flood as had occurred in 1998, and the number of patients was more similar to the overall patterns.



Some changes in key scientific leadership positions took place in 1999. On 01 October, I assumed responsibility as Director of the Centre, at which point Dr. George Fuchs, who had been the Interim Director for one and a half years, resumed his position as Head of the Clinical Sciences Division (CSD). Dr. Lars Åke Persson joined the Public Health Sciences Division (PHSD) in March 1999 as its Head, and Dr. Barkat-e-Khuda, who had been the acting Head of the Health and Population Extension Division (HPED), was formally appointed Head of the Division. Dr. V.I. Mathan continued as Head of the Laboratory Sciences Division (LSD). Dr. M.A. Salam served as the Acting Head of the CSD during Dr. Fuchs' tenure as Interim Director. A rotation of senior scientists filled in as Acting Head of the PHSD until the arrival of Dr. Persson.

Other scientists who joined the Centre included Dr. Peter Kim Streatfield to be in charge of the Health and Demographic Surveillance Programme and Dr. Japhet Killewo to be in charge of the Reproductive Health Programme. The Centre bade farewell to several scientists who had worked in the Centre for many years. They included Dr. Andres de Francisco, Head of the Reproductive Health Programme, who joined the Global Health Forum in Geneva, and Dr. John Albert, Senior Scientist and Microbiologist, who joined the University of Kuwait as Professor of Microbiology. Dr. M. Mahmud Khan, Head of the Health Economics Programme, who left in July, has been continuing as a consultant to the Programme.

In 1998, the Centre made some significant and needed changes in its administrative mechanisms in response to major financial shortfalls during the previous few years. There was a need to improve the Centre's efficiency and productivity. Thus, a right-sizing of the staff occurred, primarily in 1998, with an overall reduction of about 200 positions. The benefits of the right-sizing began to be seen in 1999 with an improved financial situation. Fortunately, most Centre staff, who left the Centre, found excellent positions in other organizations. Much credit for the success of this major restructuring goes to Dr. George Fuchs, Mr. Wahabuzzaman Ahmed, Chief Personnel Officer, Mr. John F. Winkelmann, Chief Finance Officer, and the staff who cooperated with the programme.

The support of the donors was most gratifying. The donors continued to provide support for specific projects rather than providing unrestricted funding; this had several negative impacts on the overall stability of the Centre. We were very encouraged however by the donation from the Netherlands who returned as a donor. Their donation was an unrestricted one that could be used as needed by the Centre. An external evaluation team from the Government of Japan, upon completion of its visit to the Centre, recommended increasing Japan's contribution significantly. The Kingdom of Saudi Arabia has pledged continued core support to the Centre for the next five years. The United States Agency for International Development (USAID) assisted with regard to clinical care by facilitating a productive collaboration with the John Snow Incl.

In addition to the annual donations from specific donors, the Centre's programmes are benefiting from the endowment that was created and enhanced during the last nine years. With the endowment, we are now able to start using a portion of the earnings to support the costs for clinical care in the hospital. The contributors to the Hospital Endowment Fund were promised that a donation would provide care for patients in the future, and this promise is now being kept. The endowment will still have to grow at much higher levels to support the overall costs of the clinical care that the Centre provides.

Because of the increased support from the donor community, the revenue from the endowment, the right-sizing, and strict financial controls, the Centre's operating budget showed a small surplus for the year. Unfortunately, the Centre's accumulated deficit that developed over several years remains a handicap. This deficit will take up to ten years to erase under the Centre's current financial plan.

The administrative and logistics infrastructure of the Centre will benefit from the development of a comprehensive Policies and Procedures Manual that was completed in 1999. This five-volume set includes working documents for all the administrative activities of the Centre and will be the basis for further improvements in its administration. The need for improved administrative and financial information led to development of a new financial reporting system that assists the staff in financial planning and management. Upgrading and standardization of the computer system allow scientists to avail of full email and Internet services. The Centre is also planning for installing a V-SAT satellite link for our computer network, and this will allow fast Internet access.

The Centre has many resources that are administered through the scientific divisions, and these are described below. It has also been discussing how best to address the scientific needs for defining the cross-cutting issues to which each of the scientific divisions can participate. Often through such inter-departmental synergy, major advances occur. Thus, the Centre is defining its cross-cutting themes, which help communicate its goals and promises. These themes, as currently being considered, include: child health, nutrition, reproductive health, infectious diseases, vaccine sciences, health systems, and population sciences. Each of these themes uses the resources of the scientific divisions to formulate the priorities for their topical area, and the discussions among the divisions stimulate innovative projects. These themes inevitably overlap since one cannot talk about child health without discussing infections and nutrition and reproductive health of the parents. There is still value in recognizing the overlapping interests and attempting to deal with children's health as a discrete goal. In Bangladesh, 368,000 children die before they reach their fifth birthday, making this country the eighth highest country in the world for childhood deaths. Although this situation is discouraging, the number is decreasing and is actually decreasing at rates similar to those of India, in spite of its fewer resources. The Centre plays an important role in assisting with this mission of saving children's lives.

Among the important missions of the Centre is that of training and information sciences. Nearly every week, the Training and Education Department is conducting either a national or an international training course. This provides the trainees with improved knowledge, but also provides them with a network of resources. Similarly, the Centre's library is a resource to scientists at the Centre and a resource for the country.

The Clinical Research and Service Centre (Dhaka hospital) continues to serve the large numbers of patients with diarrhoea and diarrhoea-related conditions. During 1999, the number of patient visits (117,365) was lower than that in 1998, the year of unprecedented floods, but it was higher, by 2,378, than that in 1997. This suggests that the trend of increasing numbers of patients would continue. The 2% sample surveillance system (one of every 50 patients) provides information regarding the patients being treated and the aetiology of their diarrhoeal diseases. Based on the surveillance system, the most common agents include rotavirus, *Vibrio cholerae*, *Shigella* spp., and enterotoxigenic *Escherichia coli*.

The Dhaka hospital is not simply a centre for conducting research, it is also an important part of the healthcare system of Dhaka. The Centre is working with partners, such as John Snow Inc.'s Urban Family Health Partnership (JSI/UFHP), to support child-survival activities, and we realize that the services that are currently provided by the ICDDR,B should be provided closer to home. Thus, the Centre is working with its partners to franchise the diarrhoea-treatment services and to more fully integrate them into an overall primary care system.

There were several important findings from the nutrition research at the Centre. For example, in an important study published in the Lancet in June, a protocolized treatment of children with severe malnutrition was shown to significantly decrease the case-fatality rates (by 47%) compared to standard treatment. This observation was highlighted in a follow-up editorial in October in the same journal. Based on the findings of the protocolized management, a training module was developed, and several training workshops, both national and international, were conducted at the Centre. Participants of these workshops came from many countries, including Bangladesh, Bhutan, and North Korea. The Centre is exploring the possibility of becoming the WHO regional training site for the management of severe malnutrition that would include follow-up-effectiveness studies and operations research.

Several studies are evaluating the efficacy of zinc in the treatment and prevention of certain conditions. The goal of these studies is to understand the most appropriate role for zinc as a public health tool during healthy periods, as well as during illness. The series of studies at the Centre will help clarify this role in the near future. It does seem that the studies on zinc demonstrate that zinc supplements need to be considered in combination with other micronutrients, such as vitamin A, to maximize benefits from each.

Studies on the clinical management of diarrhoea were also conducted at the Centre. One study examined the fluid composition in treatment of children with persistent diarrhoea. It was already known that these children benefit from oral rehydration solution (ORS) to compensate for their fluid loss, but the optimal formulation for the ORS needed further validation. Results of studies showed that children who received a reduced-osmolality ORS (either glucose- or rice-based) had decreased stool output compared to the standard WHO-ORS.

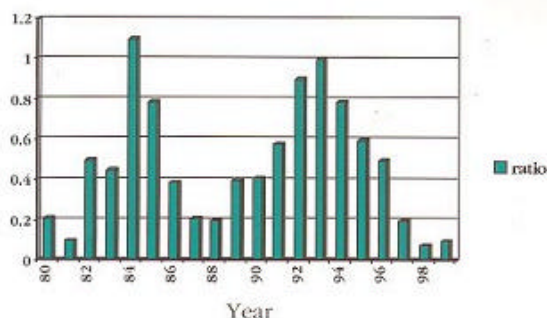
Preliminary data from another study that examined the pathophysiology of *Helicobacter pylori* showed that *H. pylori* infection decreased the amount of gastric acid produced by infected children. Since gastric acid is an important protective mechanism against other intestinal pathogens, the finding suggests that infection with *H. pylori* might make infected children more susceptible to other infections. Another study further demonstrates a role for *H. pylori* infection as one part of the problem of iron deficiency that is so common in the developing countries.

Several studies are examining the potential for change for certain pharmacological agents in the treatment of diarrhoeal diseases. In a rabbit model of shigellosis for example, histidine was shown to markedly decrease the extent of inflammation, thereby setting up the rationale for a clinical trial in patients with shigellosis. Similarly, other agents are also to be tested for their efficacy in specific infections.

Trends with regard to infectious diseases in Bangladesh show some remarkable features. For example, an analysis of shigellosis-related long-term data demonstrates a periodic epidemic due to *Shigella dysenteriae* type 1 (Shiga bacillus). This is shown through monitoring the rates of infection from surveillance areas and hospitals, but it is also dramatically seen when expressing the ratio of isolates of *S. dysenteriae* 1 to *S. flexneri* (Fig. 1). The reason for this ten-year cycle is not known, but the cycle appears to be repeating itself for at least the last forty years. Although there are inadequate data from Central and Southern Africa, similar cycles also appear to occur there. If the cycle continues, we may expect an upsurge in cases by the year 2003, and we should be able to detect this upsurge by monitoring the ratio. Unfortunately, the most of the previous epidemics have occurred with strains that have developed new antibiotic resistance; thus, we might expect that the next epidemic will be one that is resistant to fluoroquinolones. If this occurs, the case fatality rate may be very high, unless appropriate interventions can be developed.

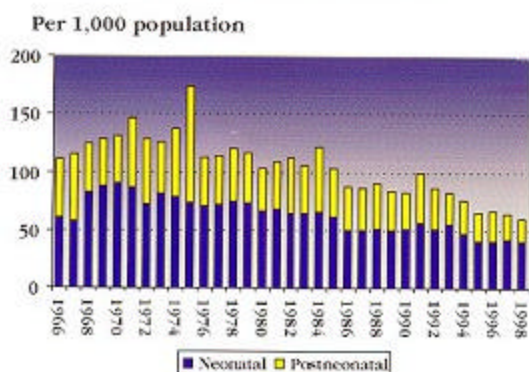
The surveillance system for cholera shows marked differences in the seasonality and incidence among different areas in Bangladesh. Factors that influence the seasonality are being studied. Importantly, the "genetic fingerprints" of the strain of cholera that appeared in Bangladesh in 1992 (*V. cholerae* O139) are being monitored. These studies demonstrate that the new strain is undergoing rapid genetic changes. It is also more widely distributed throughout the country compared to previous years. Taken together, it seems likely that strain O139 will continue to evolve and spread outside South Asia at some point soon.

Fig. 1. Ratio of *S. dysenteriae* to *S. flexneri* in Dhaka since 1980



The Centre is undertaking some ambitious new projects in the area of emerging infectious diseases, including projects in tuberculosis and dengue fever. In studies already underway, the antibiotic resistance patterns of some of the most common bacterial causes of pneumonia are of concern. A large proportion of the *Haemophilus influenzae* type b strains, isolated from children with invasive disease, are resistant to co-trimoxazole, the most commonly-used antibiotic for this illness. Also alarming is the high proportion of *Neisseria gonorrhoeae* organisms, resistant to ciprofloxacin, generally considered to be a first-line antibiotic for this infection. In the past, there was a hypothesis that *in vitro* resistance did not necessarily correlate with clinical failure, but studies at the ICDDR,B have clearly shown that patients infected with these resistant organisms failed to respond to treatment with ciprofloxacin. Fortunately, the surveillance for HIV infection shows that the rate of infection due to this virus is still very low, even in high-risk groups; however, the conditions for its rapid spread exist in Bangladesh. The high-risk groups do have high-infection rates with other sexually transmitted infections, suggesting that HIV will certainly infect Bangladesh as it has so many other countries, unless steps are taken now to limit its spread.

Fig. 2. Neonatal and postneonatal mortality rates, Matlab, Bangladesh, 1966-1998

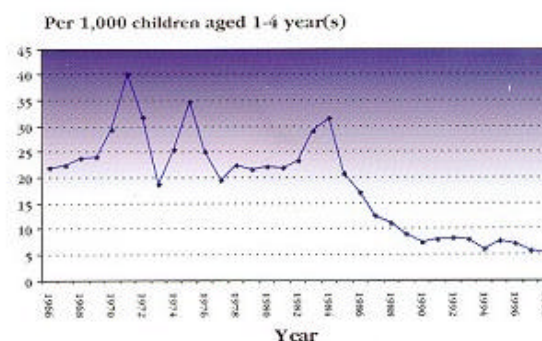


Studies on vaccines for rotavirus, Shigella, pneumococcus, and enterotoxigenic *E. coli* have been underway at the Centre. Zinc supplements were evaluated as a potential way to improve the serological response to rotavirus vaccine in Bangladeshi children, many of whom are zinc-deficient. Children who were given the supplements did show some improvement in antibody titres following vaccine, but the overall results suggest that the rotavirus vaccine is highly immunogenic in these children even without zinc supplements. In another study, pneumococcal vaccine, when administered to pregnant mothers, was

shown earlier to stimulate antibodies that are passed on to their infants. Plans are underway to follow this study with additional studies testing this strategy as a way to prevent pneumococcal pneumonia of infants. Additional studies are also being planned for several new vaccines to be tested in the future.

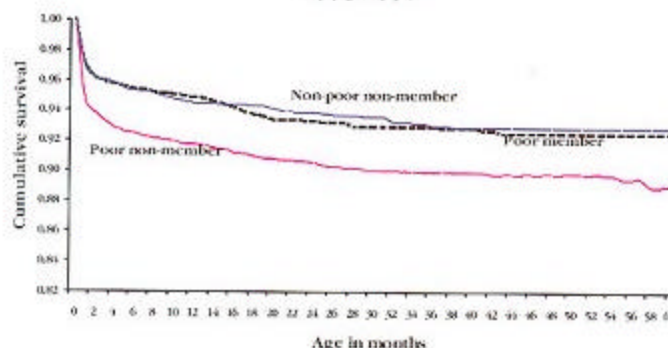
The area of reproductive health has been identified as one of the major priority areas for the Centre. The increased emphasis on this area is the result of a large body of evidence, suggesting that maternal, especially obstetric, health has long been neglected with a high cost in terms of high rates of maternal mortality. This also contributes to the high rates of neonatal mortality. Both PHSD and HPED have major projects to address the needs of obstetric care.

Fig. 3. Child mortality, Matlab, Bangladesh, 1966-1998



The Demographic Surveillance System (DSS) in Matlab has now been converted into a Health and Demographic Surveillance System (HDSS) by integrating the record-keeping system (RKS) with the DSS. This system continues to provide high-quality data on demographic trends, illustrating some important features. For example, the rates of infant mortality and mortality of children aged less than five years have been steadily declining in Matlab, yet the rates of neonatal mortality have been relatively resistant to change. This is illustrated by Fig. 2 by showing neonatal (0 to 1 month) and postneonatal (1 to 11 month[s]) mortality over time. The contrast with lower rates of childhood mortality is even more dramatic (Fig. 3). Of interest in Fig. 3 are the peaks in childhood mortality related to Liberation War in 1971, the famine of 1974-1975, and the Shigella-associated epidemic of 1984-1985.

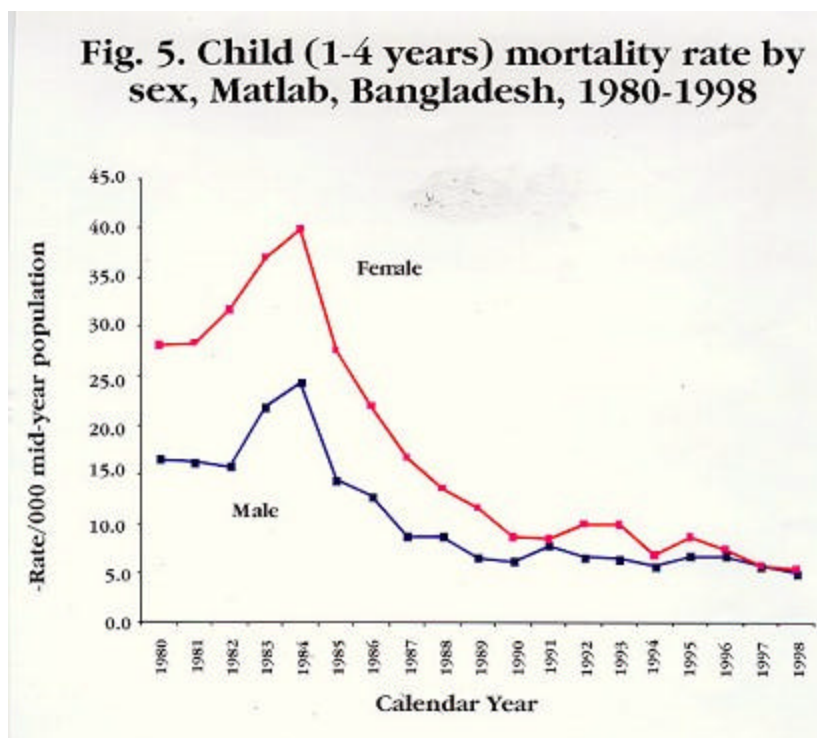
Fig. 4. Child survival function, Matlab, Bangladesh 1993-1997



Issues of equity are also receiving an increased attention at the Centre. For example, results of studies, conducted in Matlab in collaboration with BRAC, show the combined effect of the poverty-alleviation programmes when coordinated with health programmes. As shown in Fig. 4, there are marked differences in survival curves between (a) poor households who did not participate in the poverty-alleviation programmes, (b) poor households who participated in the poverty-alleviation programmes, and (c) economically better-off households who were not eligible to participate in the poverty alleviation programme. The effect of the poverty alleviation programmes in reducing the gaps between the rich and the poor who participated in the programme was quite dramatic. Results of additional studies in equity show a diminution in the difference in gender-specific mortality in Matlab (Fig. 5). Our Matlab primary healthcare programme is clearly finding a way to provide healthcare in an equitable manner and the lessons from this programme need to be translated to other areas.

One innovative field project in Chakaria (in southern Bangladesh) is built around the concept of improving community health through promotion of preventive measures and other health initiatives by indigenous village-based self-help organizations. The major activities during the year included the development of a community financing system for curative services. Currently, there are eight village health posts that provide a platform for health activities. A landmark in this project this year was the completion of a project building, thus increasing the resources for new activities in the area.

The Centre sees itself as an important partner with the Ministry of Health and Family Welfare (MOHFW) of the Government of Bangladesh. The MOHFW is undergoing significant changes in the delivery of its services, and the Centre is playing an active role in assisting in the implementation of these changes and in evaluating their impacts. Through the Operations Research Project (ORP), the Centre provided technical assistance in operationalizing the Community Clinics strategy within the MOHFW and in designing, pilot-testing, and in the nationwide implementation of a unified management information system. The shift in service delivery to a clinic-based programme is a major change for



the Ministry, and the ORP is dedicated to making this shift a success, in terms of improving the quality and cost-effectiveness without jeopardizing the successes of the previous programmes.

The Centre has undergone many changes in recent years as reflected in the expanded range of activities and the different scientific approaches being used. It has not, however, changed its mission "to develop and disseminate solutions to major health problems facing the world, with emphasis on simple and cost-effective methods of prevention and management." We look forward to the coming years with a renewed sense of optimism. The successes of the past provide confidence that health problems of developing countries may be difficult, but changes and improvements can and do occur. While the successes found in an annual report tend to reflect short-term and specific achievements, more gratifying is the long-term progress in lowering the infant and childhood mortality rates and in seeing oral rehydration solution save the lives of over one million children each year. It is the long-term impact of lowering the fertility rates, as well as assisting families to gain control over the health of their households which gives the most satisfaction from working at the ICDDR,B: Centre for Health and Population Research. I trust you will enjoy reading the Centre's Annual Report. We appreciate inquiries about our programmes, and welcome your support as we attempt to fulfill our mission.

David A. Sack, M.D.
Director

The Centre over the years...

Since 1960, the Cholera Research Laboratory (CRL) and its successor ICDDR,B has been recognized as the leading international health research centre located in a developing country. The CRL conducted research that now forms the core of the world's knowledge of diarrhoeal diseases, and led to the development of Oral Rehydration Solution (ORS). The CRL was internationalized and renamed ICDDR,B in 1978 to become one of the most important and influential health research institutions in the world. The work of CRL/ICDDR,B is often cited as the authority for important health and population-related decisions taken by multilateral bodies, governments, and development agencies throughout the world, and many of the Centre's alumni have indeed, become the influential policy-makers in these agencies.

- 1960 Pakistan-SEATO Cholera Research Laboratory established
- 1963 Matlab field station started First of a series of cholera vaccine trials launched
- 1966 Demographic Surveillance System established
- 1968 First successful clinical trials of Oral Rehydration Solution (ORS) conducted
- 1969 Relationship between stopping breast-feeding and resumption of menstruation demonstrated
- 1971 Independence of Bangladesh
- 1973 Shift from classical to El Tor cholera identified
- 1977 Maternal-child health and family planning interventions began in Matlab
- 1978 Government of Bangladesh Ordinance establishing ICDDR,B signed
- 1982 Classical cholera returned Field-testing of cereal-based ORS began MCH-FP Extension Project began
- 1984 ICDDR,B received UNICEF's Maurice Pate Award
- 1985 Full Expanded Programme on Immunization activities tested in Matlab Oral cholera vaccine trial launched and vaccine found effective
- 1987 ICDDR,B received USAID's Science and Technology for Development Award
- 1988 Treatment of and research on acute respiratory infection began
- 1989 The Matlab record-keeping system, specially adapted for government use, extended to the national family planning programme
- 1991 ICDDR,B scientists assisted in response to the diarrhoeal disease epidemics after the cyclone in southern Bangladesh, and the cholera epidemic in South America
- 1992 Joint projects of ICDDR,B and Bangladesh Rural Advancement Committee (BRAC)

commenced

- 1993 New *Vibrio cholerae* O139 Bengal identified and characterized
- 1994 ICDDR,B celebrates the 25th anniversary of the first successful clinical trial of ORS
ICDDR,B team helped slash mortality in Rwandan refugee camps in Goma, Zaire
- 1995 Maternal immunization with a pneumococcal polysaccharide vaccine shown to protect infants up to 22 weeks Visit by the U.S. First Lady Hillary Clinton who praises the Centre as a world resource, and she initiates Lessons without Border
- 1996 First official visit to the Centre by a Prime Minister of the host country
- 1998 ICDDR,B celebrates its 20th anniversary as an international institution The Dhaka Hospital of ICDDR,B treated a record number of 157,446 patients due to the unprecedented flood while maintaining a survival rate of over 99.5% for patients admitted to the Hospital
- 1999 The Centre launched its research programmes within several themes Protocolized management of severe malnutrition is shown to reduce mortality significantly Matlab training centre completed Chakaria centre completed

CLINICAL SCIENCES DIVISION

The Clinical Sciences Division (CSD) continued its research, patient care, and training activities in 1999 with the support of 186 fixed-term employees (120 core and 66 project staff). Another 71 health workers, 127 staff on contractual service agreement, 13 trainee doctors, 15 trainee nurses, a nurse manager, and an international child survival fellow significantly contributed to fulfil the mandate of the Division. Two paediatricians and a consultant radiologist continued to facilitate training of the staff and clinical fellows.



*M.A. Salam
Interim Head
(till 30 September)*

Division Highlights

- Reduced osmolality oral rehydration solutions (RORS) (either glucose- or rice-based) improved clinical outcome of children with persistent diarrhoea compared to standard WHO-ORS. Since over-hydration and electrolyte disturbances are major causes of death among children with severe malnutrition, a modified ORS (less sodium, more potassium, added micronutrients) vs WHO-ORS was tested in severely malnourished children with diarrhoea. The modified ORS resulted in less over-hydration and better potassium status, including less hypokalaemia compared to the standard ORS.
- Protocolized dietary management of severely malnourished children in the rehabilitation phase, using locally available, culturally acceptable, inexpensive foods (vegetables were the primary source of protein), resulted in a greater energy intake and 50% weight gain compared to children who received the same diet *ad libitum*.
- Asymptomatic *Helicobacter pylori*-infected children had higher rates of iron depletion, anaemia, and impaired gastric acid secretion (reversed with treatment of *H. pylori*) compared to non-infected children. This has implications for children in developing countries who are frequently infected with *H. pylori*, with up to 80% of Bangladeshi infants infected in the first year of life. Studies to further define these relationships and their implications are in progress.
- Zinc supplementation to pregnant women had no effect on birth-weight, but reduced the rates of acute diarrhoea, dysentery, and impetigo in the first six months of life in their infants. Benefits of zinc were observed only in infants born with low birth-weight. These results also emphasize the importance of birth-weight as an indicator rather than only an outcome in strategies to influence the consequences of low birth-weight.
- Zinc supplementation had some detrimental effect on cognitive development scores of infants born to mothers who received zinc during



*George J. Fuchs
Division Director*

pregnancy and of infants who received zinc from one to six month(s) of age. Caution should be exercised when supplementing undernourished infants with a single micronutrient.

- Zinc and vitamin A supplementation to young children synergistically improved vitamin A status (retinol and RBP) in vitamin A-deficient children. Zinc alone, vitamin A alone, and zinc plus vitamin A reduced the risk of diarrhoeal disease, and zinc plus vitamin A reduced the rates of persistent diarrhoea and dysentery. Unexpectedly, zinc alone resulted in increased acute lower respiratory infection (ALRI). No differences in growth were observed among any of the groups.
- A collaboration began with the John Snow Inc.'s Urban Family Health Partnership (JSI/UFHP) to support child-survival activities in the Centre's Dhaka hospital, including improved hospital-based educational programmes, development of a referral network with the UFHP's urban clinics to improve follow-up, and to identify the means of self-sustainability of hospital services. An initiative with the UFHP and the Progoti Samaj Kallyan Protishthan (PSKP) to "franchise" the ICDDR,B Hospital was also agreed upon. This initiative is expected to reduce the patient load and the financial pressure on the Centre's Dhaka hospital, improve healthcare delivery (decentralization, improved case management of diarrhoeal disease, and malnutrition within a package of comprehensive healthcare services), and provide a new infrastructure for the ICDDR,B for its operations research and surveillance.
- A training module was developed based on the clinical validation of a standardized protocol for the management of severe malnutrition (Lancet 1999;353:1919-22). Several training workshops were conducted by the CSD, together with the Training and Education Department of the Centre, for national and international healthcare providers (Bangladesh, Bhutan, and North Korea). The Centre is exploring the possibility of becoming the WHO regional training site for the management of severe malnutrition that would include follow-up effectiveness studies and operations research.
- The diarrhoea surveillance of the ICDDR,B's Dhaka hospital ongoing for 20 years was expanded with the collaboration of the Public Health Sciences Division (PHSD) and the Laboratory Sciences Division (LSD) to include the Matlab hospital and community. The CSD, together with the LSD and the PHSD, has also started a surveillance of invasive *Haemophilus influenzae* and *Streptococcus pneumoniae*-associated diseases and their antimicrobial resistance patterns in children. In addition to the ICDDR,B sites, the Dhaka Medical College Hospital and the Dhaka Shishu (Children's) Hospital have been included as two sampling sites.
- The ICDDR,B's Nutrition Centre (housed in the CSD) held a retreat to define its five-year strategic plan and two-year work plan. The Nutrition Centre, through the CSD and the PHSD, also organized an International Symposium and Workshop on Low Birth-weight in 1999, convening a group of international experts.

CASE MANAGEMENT RESEARCH Nutritional Therapy

Soluble fibre (Benefiber)-supplemented comminuted chicken diet in treatment of persistent diarrhoea in children

Investigators: N.H. Alam, S.A. Sarker, R. Meier, H. Schneider, K. Gyr, and G.J. Fuchs

Funded by: Novartis Nutrition, Switzerland

Persistent diarrhoea is associated with a disproportionately higher number of deaths. This double-blind, randomized, controlled clinical trial has been undertaken to compare the effects of a soluble fibre (partially hydrolyzed guar gum called Benefiber)-supplemented comminuted chicken diet in the treatment of children with persistent diarrhoea. Stool output and the duration of diarrhoea are being compared between the groups. Ninety male children, aged 5-18 months, will be enrolled and assigned either to study diet or to control diet (without fibre). Till date, 70 children have been enrolled in the study.

Zinc supplementation in treatment of young infants with acute watery diarrhoea

Investigators: W.A. Brooks, G.J. Fuchs, S.K. Roy, M. Santosham, R.E. Black, M. Hashem, and M.A. Wahed

Funded by: USAID (ICDDR,B + JHU C.A.'s)

Collaborating institute: Johns Hopkins University

Previous studies have demonstrated the efficacy of zinc supplementation to older infants and children with acute watery diarrhoea, while the efficacy in younger infants was uncertain. The aim of this study is to compare the efficacy of 5 vs 20 mg zinc in reducing the duration and severity of acute watery diarrhoea in infants aged less than 6 months in a double-blind, randomized, placebo-controlled clinical trial. To date, the study has enrolled 160 of 292 infants.

Zinc in treatment of severe pneumonia in hospitalized children aged less than 2 years

Investigators: W.A. Brooks, M. Yunus, A.S.G. Faruque, M. Santosham, R.E. Black, M.A. Wahed, and G.J. Fuchs

Funded by: JHU (USAID)

This study aims at determining the efficacy of 20 mg zinc to reduce the duration and severity of pneumonia in hospitalized children aged less than two years in a double-blind, placebo-controlled trial. To date, 76 of 270 children (36.8%) have been studied. If proven effective, zinc might improve the management of severe pneumonia in this population, irrespective of aetiology of the disease and antimicrobial sensitivity.

Efficacy of L-glutamine in persistent diarrhoea in children

Investigators: I. Kabir, G.J. Fuchs, R. Haider, I. Hussain, and M. Islam

Funded by: USAID

Glutamine, an essential nutrient for enterocytes, plays an important role in the maintenance of intestinal integrity, metabolism, and function. It was, therefore, hypothesized that supplementation of glutamine in diet would enhance small intestinal mucosal repair, regeneration, and an early recovery from persistent diarrhoea in children. Ninety children with persistent diarrhoea (≥ 14 days) were assigned either to a rice-based diet containing L-glutamine or to a rice-based diet without glutamine for 7 days. Absorption of carbohydrate, fat, and protein was determined by a metabolic balance study. Small bowel permeability is being estimated by lactulose and mannitol ratio. Data analysis is in progress.

Effect of zinc supplementation in children with shigellosis on immune and inflammatory responses, clinical outcome, and growth

Investigators: R. Raqib, S.K. Roy, T. Azim, N.H. Alam, M.A. Wahed, M.J. Albert, M. Mathan, J. Andersson, and G.J. Fuchs

Funded by: USAID/W

This is a double-blind, placebo-controlled trial to determine the effect of zinc supplementation to moderately malnourished children aged 1-5 year(s) with *Shigella flexneri*-associated dysentery on the inflammatory and immunological responses and severity of acute illness, and on growth following recovery. Nine of 76 subjects have so far been recruited. Microbiological and immunological tests and rectal biopsies have been completed.

Fluid Therapy

Use of a modified oral rehydration solution (ReSoMaL) in treatment of severely malnourished children with diarrhoea

Investigators: N.H. Alam, J.D. Hamadani, N. Dewan, and G.J. Fuchs

Funded by: WHO, Geneva

Severely malnourished children have excess total body sodium and potassium depletion, and are at risk of death due to over-hydration and electrolyte disturbances. This double-blind, randomized, controlled clinical trial compared the efficacy and safety of modified ORS, ReSoMaL (Na^+ 45, K^+ 40, Cl^- 76, glucose 125, citrate 7, Mg 6 mmol/L, Zn 300 $\mu\text{mol/L}$ and Cu 45 $\mu\text{mol/L}$), or standard WHO-ORS (Na^+ 90, Cl^- 80, K^+ 20, glucose 111, citrate 10 mmol/L) in the treatment of severely malnourished children, aged 6-36 months, with acute diarrhoea. Of the 130 patients, 65 received ReSoMaL and 65 WHO-ORS. The study demonstrated the similar efficacy of the two ORSs in rehydration of severely malnourished children, but the children receiving ReSoMaL had the reduced frequency of over-hydration as well as significantly better potassium status.



After instruction from CRSC health personnel, a mother is administering oral rehydration solution to her infant

Efficacy and safety of reduced-osmolarity ORS with lower sodium concentration in treatment of neonates and young infants with acute dehydrating diarrhoea

Investigators: A.M. Khan and G.J. Fuchs

Funded by: USAID/W

This double-blind, randomized, controlled clinical study compares the efficacy and safety of WHO-ORS and hypotonic ORS in the treatment of acute dehydrating diarrhoea in neonates and young infants aged up to two months. The osmolality of the hypotonic solution is 245 mOsmol/L where both sodium and glucose concentrations are each 75 mmol/L. Study of targeted 96 subjects has been completed. Stool output, intake of ORS, unscheduled intravenous (IV) fluid, duration of diarrhoea, and the incidence of hypernatraemia are being compared. Data analysis is in progress.

Reduced-osmolarity oral rehydration solution in treatment of severe persistent diarrhoea in children

Investigator: S.A. Sarker

Funded by: USAID/W

The objective of the study was to compare the efficacy of WHO-ORS, a rice-based ORS osmolality, a glucose-based low-sodium (75 mmol/L) reduced osmolality (137 mOsmol/L) ORS, and a rice-based low-sodium (75 mmol/L), low osmolality (218 mOsmol/L) ORS in the management of persistent diarrhoea in young children. Two hundred forty male children, aged 4-24 months, with persistent diarrhoea were randomly assigned to receive one of the four ORSs up to 7 days. Children receiving the reduced-osmolarity ORS (RORS) (either glucose- or rice-based) had a decreased stool output compared to the standard WHO-ORS. More children (68%) in the

rice-based RORS ($p=0.05$) achieved clinical cure within a week compared to the glucose-based RORS (50%) or standard ORS (44%). None of the children who received the reduced osmolarity ORS developed hyponatraemia.

Studies of L-histidine in human cholera and experimental shigellosis in rabbits

Investigators: G.H. Rabbani, D.A. Sack, and J. Peterson

Funded by: Cytos Pharmaceuticals, USA

In a double-blind, randomized study, the therapeutic effects of L-histidine-supplemented CeraLyte 90 on 130 adult cholera patients will be evaluated. L-histidine will be given orally, mixed with CeraLyte-90, a rice-based ORS. The clinical outcome will be assessed, including stool volume, duration of illness, and requirements for ORS, and intravenous fluids. Twenty cholera patients have so far been enrolled. The effects of L-histidine will also be explored in a rabbit model of acute colitis induced by intracolonic administration of *S. flexneri* 2a. Preliminary observations showed that L-histidine significantly ($p<0.05$) reduced faecal blood and mucus. The study is in progress.

Pharmacologic Therapy

Hyperimmunized egg-yolk immunoglobulin in rotavirus diarrhoea

Investigator: S.A. Sarker

Funded by: SAREC/Karolinska Institute, Sweden

A pharmacological agent for the treatment of diarrhoea due to rotavirus is not available. This study was, therefore, performed to test the effectiveness of an orally administered hyperimmune, anti-rotavirus egg yolk immunoglobulin (HEY) in the treatment of diarrhoea due to rotavirus in children. Seventy-nine children with diarrhoea due to rotavirus were assigned either to HEY or to a placebo for 4 days. In the HEY-treated group, there was a significant reduction in stool output and ORS intake on day 1 and faecal clearance of virus on day 4. No differences in the duration of diarrhoea were observed between the two groups. These early observations indicate that treatment with anti-rotavirus HEY results in modest improvement of diarrhoea due to rotavirus.

Effect of zinc supplementation during pregnancy on mental development of infants, and effect of zinc supplementation during infancy on mental development of infants

Investigators: J.D. Hamadani, G.J. Fuchs, S. Osendarp, S.N. Huda, and S.M.G. McGregor (Institute of Child Health, LSHTM, UK)

Funded by: UNICEF

Limited data are available to suggest that zinc deficiency might detrimentally affect child development. Two double-blind, randomized, placebo-controlled trials were conducted with infants supplemented with zinc beginning at one month of age and with infants whose mothers received zinc during pregnancy. The infants in the zinc groups in both the studies scored worse on the mental development index of the Bayley scale ($B=3.7$, $p<0.005$). No other differences between the groups were observed. This effect remained significant when the nutritional status and social background were controlled. The results suggest that zinc supplementation has some detrimental effect on infant development possibly due to a micronutrient imbalance. Caution should, therefore, be exercised when supplementing undernourished infants with a single micronutrient.

Effects of iron supplementation on growth and intestinal permeability of iron-replete and iron-deplete children

Investigators: G.J. Fuchs, T. Ahmed, and M.A. Wahed

Funded by: USAID/W

Iron supplementation promotes growth among iron-deficient children. However, growth retardation has been observed when iron is supplemented to children who are not iron-deficient. This community-based study compares the effects of iron supplementation on growth and intestinal permeability of children with and without iron deficiency. On the basis of haemoglobin, serum ferritin, and serum transferrin receptor concentration of 315 non-severely malnourished children aged less than 5 years, 60 eligible children (30 in each group) were enrolled. Seventy-eight of the 315 children (25%) had normal levels of all three markers, while 57 (18%) had levels suggestive of severe iron depletion. The remaining children had abnormal levels of at least one marker, indicating a substantial burden of iron-deficiency anaemia even among children with mild malnutrition living in peri-urban communities. Intestinal permeability, physical growth, and endocrine and bone metabolism markers of growth of these children were determined before and after one month of iron supplementation. Data analysis is in progress.

Parenteral gentamicin in a single dose versus conventional three divided doses in malnourished children with infection

Investigators: A.M. Khan and G.J. Fuchs

Funded by: USAID/W

This prospective, open, and randomized clinical study aims to compare the efficacy and safety of once daily parenteral gentamicin compared to conventional three divided doses in malnourished children. Effects of malnutrition on the pharmacokinetics of gentamicin (one dose daily) will also be evaluated. In total, 156 malnourished and 20 healthy children are being enrolled for study. So far, 112 patients have been studied.

Parenteral magnesium in management of diarrhoea-associated abdominal distension in severely malnourished children

Investigators: T. Ahmed, M.A. Salam, and G.J. Fuchs

Funded by: USAID, Government of Japan, and ICDDR,B

Abdominal distension, which interferes with feeding, is a frequent complication in severely malnourished children. In this study, severely malnourished children with diarrhoea and abdominal distension are randomized to receive a single-dose intramuscular injection of either 0.3 mL/kg (maximum 2.0 mL) magnesium sulphate or normal saline. Abdominal distension, persisting beyond 24 hours of treatment with failure to tolerate oral feeds, constitutes treatment failure. If magnesium therapy, along with potassium supplementation, is effective in resolving abdominal distension, feeding can be initiated without further compromising the nutritional status. This will minimize the need of intravenous infusions and the risks associated with it, such as infection. Of the 60 estimated cases, 32 have so far been enrolled.

A multicentre study of short course ciprofloxacin therapy in children with dysentery due to *S. dysenteriae* type 1

Investigators: M.A. Salam and W.A. Khan

Funded by: New England Medical Center, USA

This multicentre clinical trial will compare the efficacy of 3-day vs standard 5-day course of ciprofloxacin in the treatment of children with dysentery due to *Shigella dysenteriae* type 1. Sixty-seven children, aged 1-12 year(s), with culture-proven *S. dysenteriae* type 1 infection will be randomly assigned to the study interventions, hospitalized for 6 days, and followed up for 2 weeks after discharge. The rate of clinical cure and the duration of faecal excretion of *S. dysenteriae* type 1 will be the primary and the major secondary outcome measures respectively. To date, 60 children have been enrolled.

Single-dose azithromycin suspension in children infected with *V. cholerae* O1 or O139

Investigators: W.A. Khan and M.A. Salam

Funded by: New England Medical Center, USA

The objective of this randomized, double-blind, clinical trial is to compare the clinical and bacteriologic effects of a single dose (200 mg/kg) of azithromycin with a 3-day, 6-hourly dose (12.5 mg/kg) of erythromycin. A total of 118 children of either sex, aged 1-15 year(s), with dehydrating diarrhoea due to *Vibrio cholerae* O1 or O139 is being studied. Daily clinical and bacteriologic responses will be assessed during 5 days of hospitalization and during revisit 5-9 days after discharge. Seventy patients in Dhaka and 25 patients at Matlab have so far been studied.

PATHOPHYSIOLOGY RESEARCH Factors associated with severity of measles and of delayed complications of measles

Investigators: S.M. Akramuzzaman, F.T. Cutts, T. Azim, M.J. Hossain, J. Wheeler, S. Alam, and R. Weir

Funded by: European Economic Community

A case-control study was conducted to determine complications-associated factors in the acute and post-convalescence phases of measles. One hundred thirty-nine measles cases and 137 acute measles cases were recruited, respectively, from the hospital and the community during 1995-1996. Cytokines in the whole blood were measured using assays established in Bangladesh. Levels of IL-5, IL-10 and IFN-gama were low at recruitment, and their levels increased at week 6 after recruitment. Lower levels of cytokines were associated with the increased incidence of symptoms of acute lower respiratory infections, referral to hospitals, and with lower weight gain. Lower levels of cytokines were generally associated with an increased risk of complications in the first two weeks after the occurrence of measles.

Zinc balance and bioavailability from two different dietary regimes for children with persistent diarrhoea syndrome

Investigators: S.K. Roy, S.F. Tait, and A.M. Tomkins

Funded by: USAID/W

Although a significant amount of zinc is lost in stools of patients with persistent diarrhoea, absorption efficiency of dietary and supplemental zinc in persistent diarrhoea is still not known. To measure the efficiency of intestinal absorption of zinc from chicken-based and rice-based diet and from supplemental zinc, a metabolic balance study with stable isotope (^{70}Zn and ^{67}Zn) in children with persistent diarrhoea is being conducted. Forty-five of 47 patients have been recruited, and 736 stool and urine samples have been sent to the UK for isotope estimation. The results will help develop and further define an effective dietary and micronutrient management of persistent diarrhoea in children.

***Helicobacter pylori* infection and iron-deficiency anaemia in children**

Investigators: S.A. Sarker and G.J. Fuchs

Funded by: NIH, USA

This combined community- and facility-based study assesses the role of infection due to *H. pylori* as a cause of impaired iron absorption and iron-deficiency anaemia through gastritis and reduced gastric acid output, and examine if it is a cause for failure of iron therapy among children with iron-deficiency anaemia. Three hundred twenty-five children, aged 2-5 years, with iron-deficiency anaemia have been assigned to one of five groups (65 in each)--four groups with infection and one

group without *H. pylori* infection. *H. pylori*-infected children with iron-deficiency anaemia are being assigned to one of the four treatments: anti-*H. pylori* therapy alone, anti-*H. pylori* therapy plus iron supplementation, iron supplementation alone, or placebo. Non-*H. pylori*-infected children with iron-deficiency anaemia are being treated with iron supplementation only. Haemoglobin, serum ferritin, and transferrin receptor concentrations are being determined before the intervention and after one and three months of starting treatment. Gastric acid output and iron absorption are also being determined in a subset of the *H. pylori*-infected children and *H. pylori*-negative children. One hundred twenty-five children have so far been enrolled, and iron absorption and gastric acid output have been assessed in 12 infected and 9 non-infected children. Preliminary analyses indicate that the *H. pylori*-infected children had the greater rates of anaemia and significantly reduced basal (BAO) and stimulated gastric acid output (SAO) compared to the non-*H. pylori*-infected children. Anti-*H. pylori* therapy resulted in a significant rise in both BAO and SAO. These preliminary findings indicate impaired acid secretion relating to *H. pylori* infection in young children.

Carotenoid bioavailability from plant sources

Investigators: K.M.A. Jamil, K.H. Brown, and G.J. Fuchs

Funded by: USDA and Micronutrient Initiative (Canada)

Collaborating institute: University of California-Davis, USA

This study is designed to assess the bioavailability of vitamin A from different dietary sources, using the novel deuterated-retinol dilution technique. Vitamin A reserve was assessed before and after a 60-day period of daily supplementation with an equivalent amount of one of the following four forms of vitamin A: *pui shak* (a green leafy vegetable), sweet potato, retinol, and β -carotene. A control group, not supplemented with any form of vitamin A, was also included. The study will additionally assess vitamin A reserve in these subjects by another abbreviated method, using octa-deuterated retinyl acetate (d-8R). Thirty-eight subjects have completed the study, and another 32 will be enrolled soon.

Diagnosis of pneumonia in children with dehydrating diarrhoea

Investigators: M.A. Salam, A. Ronan, D.Saha, W.A. Khan

Funded by: USAID/W

Questions exist about the sensitivity and specificity of the WHO algorithm for diagnosis of pneumonia in children with dehydrating diarrhoea. This study will assess predictors of pneumonia and the value of pulse oximetry in diagnosing pneumonia in 100 severely malnourished children with diarrhoea and cough. Pneumonia will be diagnosed before and after rehydration, and 48 hours later using the WHO algorithm, pulse oximetry, and chest x-rays, and by a combination of these methods (reference standard). The sensitivity, specificity, and positive and negative predictive values of the WHO algorithm are being compared with the "reference standard." The combination of clinical signs that best predict pneumonia and are easily recognized by mothers/health workers and which improve accuracy of the WHO algorithm in children with diarrhoea will be defined. To date, 123 patients have been enrolled.

Apple polyphenol (Applephenon™) to reduce cholera toxin-induced intestinal secretion in rabbit

Investigators: G.H. Rabbani, M. Noda (Chiba University, Japan), and M.J. Albert

Funded by: Tomen Corporation, Japan

Apple contains a large amount of polyphenols, including tannin, catechin, and epicatechin, which occur naturally as intermediate metabolites during flavonoid biosynthesis. The apple polyphenol, particularly the condensed tannin (ACT), purified from unripe fruit, inhibits cholera toxin-induced

fluid accumulation in a rabbit ileal assay. This study aims to evaluate the cholera toxin-inhibitory actions of Applephenon and characterize its antisecretory effects in a rabbit model of secretory diarrhoea by the steady-state perfusion technique in cholera toxin-stimulated rabbit small intestine, using a non-absorbable marker (PEG 4000). Treatment effects are being evaluated by comparing the intestinal transport rates of water, sodium, potassium, chloride, and bicarbonate ions across the mucosa between the treatment and the control groups. The early experiments have just been started.

PREVENTIVE/MATERNAL AND CHILD HEALTH RESEARCH

Promotion and support of exclusive breast-feeding and lactational amenorrhoea method by peer counsellors in rural Bangladesh

Investigators: I. Kabir, R. Haider, T. Faruque, and S. Banu

Funded by: World Bank (NCOE) and SDC, Switzerland

Peer counselling is effective in promoting exclusive breast-feeding under very controlled situations, but it has never been brought to scale up anywhere in the developing world. This study will evaluate the effectiveness of peer counsellors on breast-feeding and contraceptive practices in rural Bangladesh using local women as peer counsellors. Pregnant mothers in their third trimester and lactating mothers will be randomized by union. In one union, mothers will receive individual counselling at home. In another union, mothers will receive counselling in groups, with additional individual counselling at home for the first month of pregnancy and after child birth. The third union will serve as control, where counselling will not be provided to mothers. To date, 230 pregnant women have been enrolled.

Effective means to address moderately malnourished children within Bangladesh Integrated Nutrition Project communities

Investigators: S.K. Roy, G.J. Fuchs, J. Mahmood, T. Sharmeen, and S.S. Akhtar

Funded by: Bangladesh Integrated Nutrition Programme, Government of Bangladesh and World Bank

Of all children with malnutrition, those with moderate malnutrition constitute the largest proportion. This group also increases in number with the success of programmes to address severe malnutrition, such as BINP. In total, 282 children, aged 6-24 months and with weight-for-age between 61% and 75% of the NCHS, were divided into 3 groups: (a) intensive nutrition education, (b) supplementary feeding plus intensive nutrition education, and (c) control [supplementary feeding plus less-intensive education (standard BINP practice)]. At the end of the intervention, a significantly greater number of children of Group A and Group B (37% and 47% respectively) improved their nutritional status compared to those of the control group (18%). Weight gain (g/kg) was significantly higher in both the intervention groups (mean \pm SD, 154 \pm 88 in Group A, 182 \pm 117 in Group B) compared to the control group (104 \pm 90, $p < 0.0001$). A significant change in the mother's behaviour about child feeding and diversion of existing household resources toward the moderately malnourished child was achieved.

Effect of psychosocial stimulation on mental development of malnourished children in BINP nutrition centres

Investigators: J.D. Hamadani, G.J. Fuchs, R. Haider, S.N. Huda, and S.M.G. McGregor

Funded by: Government of Bangladesh and World Bank

Malnourished children exhibit deficits in psychomotor development despite nutritional rehabilitation. This randomized controlled trial will include a group of malnourished children and their mothers who will be attending the BINP feeding centres. This group of children will

participate in an intervention on child-development activities, and will be compared with a control group of malnourished children who will be attending other feeding centres. Site selection, staff training, and focus-group discussions have already been completed.

A dietary treatment algorithm as a home-based management of children with persistent diarrhoea: a community-based study

Investigators: N.H. Alam, J.D. Hamadani, A.S.G. Faruque, and G.J. Fuchs

Funded by: SDC

This randomized controlled study is to evaluate the efficacy of a dietary treatment algorithm as home-based management of 320 moderately ill children with persistent diarrhoea. The dietary treatment algorithm is based on a successful hospital-tested treatment plan, consisting of a milk-based diet (cow's milk, rice powder, and sugar--Diet A) as the initial diet. Diet B (containing rice powder, vegetable oil, egg white, and sugar) will be fed if there is no improvement with Diet A within 7 days. The control group will receive usual home diet. The success rates with Diet A and Diet B will be compared with that of the control group. So far, 115 patients have been studied.

Evaluation of the impact of a large home-gardening programme in rural Bangladesh

Investigators: G.J. Fuchs, M. Khan, and A.S.G. Faruque

Funded by: USAID/W (Office of Nutrition)

Vitamin A deficiency, a major public health problem, carries long-term health and social consequences. The Helen Keller International (HKI) initiated a home-gardening programme to promote production and consumption of vegetables, increase income, improve quantity and quality of food consumed, and reduce vitamin A deficiency among rural population of Bangladesh. Results of an evaluation of 600 mothers and 800 children in five randomly selected rural communities of Bangladesh showed that vitamin A status (retinol) was not better in children and women of the gardening households compared to the control households. However, women in the programme households had a better vitamin A status when gardening was performed according to the HKI guidelines. Further data analyses are in progress. It is expected that the results of this evaluation will have important implications for gardening programmes in Bangladesh and elsewhere in the world aimed at improving the vitamin A status.

Impact of zinc on birth-weight and early infant growth and morbidity

Investigators: S. Osendarp, G. Darmstedt, and G.J. Fuchs

Funded by: The Royal Netherlands Government and USAID

Effects of zinc supplementation during pregnancy on subsequent infant growth, morbidity, and immune response were investigated in two cohorts in the slums of Dhaka city. In total, 559 infants whose mothers were supplemented with either 30 mg zinc/day or placebo during pregnancy were followed up postnatally, and received three doses of vaccination with tetramune (DTP-Hib). Another cohort of 301 infants was supplemented with 5 mg elemental zinc/day or placebo from 4 to 24 weeks of age, and was assessed for morbidity. These infants received three doses of tetramune and three doses of the 7-valent pneumococcal conjugate vaccine. Infants of mothers who received zinc during pregnancy showed significantly reduced risks of the incidence of acute diarrhoea (RR: 0.84; 95% CI: 0.72,0.98), dysentery (RR: 0.36; 95% CI: 0.25,0.84), and impetigo (RR: 0.53; 95% CI: 0.34,0.82). Reduced risks were observed among the low birth-weight infants, whereas no significant differences were observed in the normal birth-weight infants. No significant differences in infant growth were observed between the treatment groups.

Impact of zinc on infant immune response

Investigators: S. Osendarp, M. Santosham, and G.J. Fuchs
Funded by: USAID

Effects of zinc supplementation during pregnancy on the subsequent immune response were investigated in the same two cohorts described above. A total of 559 infants whose mothers were supplemented with either 30 mg zinc/day or placebo during pregnancy received three doses of vaccination with tetramune (DTP-Hib). Another cohort of 301 infants, e supplemented with 5 mg elemental zinc/day or placebo from 4 to 24 weeks of age, received three doses of tetramune and three doses of the 7-valent pneumococcal conjugate vaccine. Analysis of morbidity data from the infant cohort and of immune response from both the cohorts is in progress.

Single-dose vitamin A to prevent shigellosis in family-contact children

Investigators: A.S.G. Faruque and G.J. Fuchs
Funded by: SDC

Shigellosis is associated with childhood malnutrition in many developing countries, including Bangladesh. Because of a very small infective dose, the infection can easily transmit from one family member to another. In an earlier study, vitamin A was shown to improve clinical outcome of children with acute shigellosis. This randomized, double-blind, placebo-controlled intervention trial aims to determine if a single large dose of vitamin A can reduce the secondary case rates of shigellosis among family members who have exposure to documented cases of shigellosis. Forty of 900 children have been enrolled for the study.

Prevention of acute lower respiratory tract infection and diarrhoea with zinc supplementation in children aged less than two years

Investigators: W.A. Brooks, A.S.G. Faruque, R.E. Black, M. Santosham, G.J. Fuchs, and M.A. Wahed
Funded by: SDC, CHR (USAID), and JHU (USAID)

This study aims to determine the efficacy of 70 mg/week of zinc vs placebo to reduce the incidence of pneumonia in 1,614 children, aged less than two years, supplemented for one year. It is a community-based double-blind, placebo-controlled trial employing weekly home surveillance. If effective, zinc might be a strategy to reduce morbidity and mortality attributable to pneumonia, irrespective of aetiology, in the most vulnerable age group.

Evaluation of osmotic sachets to prepare ORS, therapeutic milk, infant formulae, and potable water

Investigators: S.K. Roy, M.S. Islam, A. Seal, T. Ahmed, and A.M. Tomkins
Funded by: UCB Osmotics Limited, U.K.

A modified, semi-permeable, cellulose membrane sachet, developed by UCB Osmotics Ltd., U.K., has been tested in the ICDDR,B laboratory. Sachets for preparation of ORS, therapeutic milk, infant formulae, and potable water produced 100%, 93%, 96%, and 100% uncontaminated solutions respectively from heavily contaminated water. The osmotic sachet has a significant potential for preparing safe-drinking water and feeds in heavily contaminated and/or crisis environment. This device is also currently being evaluated in the slums of Dhaka city to determine the impact on safety and convenience of preparing therapeutic and supplementary food for malnourished children at home.

CLINICAL RESEARCH AND SERVICE CENTRE

Chief Physician: M.A. Salam

Funded by: ICDDR,B The number of patient visits (117,365) was lower (40,076; 25.5%) in 1999

than that in 1998, the year of the unprecedented flood. However, it was higher (2,378; 2.1%) than that in 1997. Fifty-three percent (62,114) of the patients were admitted to the Short Stay Ward (SSW), 47% of whom were discharged within 24 hours. Eleven percent (6,520) required admission for a longer stay at the General Ward (GW), Special Care Unit (SCU), and Nutritional Rehabilitation Unit (NRU). Eight hundred thirty-two patients were admitted either to the Clinical Study Ward (CSW) or to the Metabolic Study Ward (MSW) under 19 different research protocols conducted by the CSD alone or jointly with the LSD. Of the 6,520 patients admitted to the GW and to the SCU, 380 (6%) died despite best possible efforts. Nineteen (0.03%) of the 62,114 patients admitted to the SSW died, while another 13 patients were dead upon arrival at the Clinical Research and Service Centre (CRSC). Thus, there was a total mortality rate of 0.3% in 1999. In total, 83,268.4 litres of intravenous (IV) fluids and 634,274.0 litres of oral rehydration fluids (ratio of ORS to IV: 1:8) were used at the CRSC during 1999.



At the Short Stay Ward of the CRSC, an attendant is administering rice-ORS solution to her patient who is still on intravenous rehydration fluid for management of severe dehydration

With funding from a consortium of energy companies, installation of a deep tubewell was started to solve the water supply problem during the summer months and epidemic periods. Establishment of the Centre's wastewater treatment facility was also in progress.

NURSING PROGRAMME Nurse Manager: Mohammad Ullah

Funded by: ICDDR,B

The nursing staff of the CRSC provide clinical care to patients who seek treatment at the CRSC, and also render support services for clinical management of patients admitted to various research protocols. The CRSC has a total staff of 47 nurses, comprising a nurse manager, 4 nursing officers, 32 senior staff nurses, 5 assistant nurses, and 5 aid nurses. Fifteen trainee nurses, in addition to receiving hands-on-training on diarrhoeal case management, significantly contributed to patient care services of the hospital. In addition to their normal duties, all trainee nurses underwent, after meeting the challenge of growing demand on the nurses, 2,088 hours of training on management of diarrhoeal diseases. Two nurses participated at a training course on HIV/AIDS counselling organized by the Voluntary Health Services Society, Dhaka. Another 5 nurses participated at a peer-education course on HIV/AIDS and Training of Trainers course on HIV/AIDS. Twenty-five B.Sc. nursing students from the College of Nursing, Dhaka, underwent clinical training at the CRSC. The Hogeschool Nijmegen, The Netherlands, seconded a graduate nursing student for a four-month practicum on nursing in developing countries.

CHILD HEALTH PROGRAMME Coordinator: T. Ahmed

Funded by: World Bank and John Snow Inc. (JSI), USA

Since 1988, the Child Health Programme (CHP) has been managing the nutritional rehabilitation and follow-up of severely malnourished children, health education, immunization, and family planning within the operations of the CRSC. Most children and their mothers who visit the CRSC for treatment of diarrhoeal diseases do not receive any prior preventive health services. The CHP offers these services, based on the concept of "missed opportunities." Training of healthcare providers and operations research in these areas are additional activities of the CHP.

During 1999, 262 very severely malnourished children were treated in the in-patient NRU where a standardized feeding programme has been tested, using inexpensive, locally available foods. A total of 1,669 severely malnourished children in the community came for a revisit for nutritional assessment and advice at the out-patient unit of the CHP. In total, 26,431 focus-group discussions with mothers and female caretakers of children were conducted by the health workers, covering an estimated 158,586 individuals. They provided health education on prevention and home management of diarrhoea, prevention of malnutrition using appropriate complementary diets, and on the importance of immunization and family planning. Immunizations against six vaccine-preventable diseases were provided to 6,222 (98% of the eligible) children, making it the largest fixed-site immunization centre in Bangladesh. In addition, 16,689 women of child-bearing age received tetanus toxoid. Vitamin A capsules were also administered to all children who did not receive it during the previous 6 months. The CHP provided family-planning services to 252 parents of children attending the hospital.



A doctor is examining a child in the Nutrition Rehabilitation Ward, admitted with severe malnutrition after his diarrhoea and associated problems have been successfully managed in other ward(s)

The success of the CHP as a model programme for dissemination of knowledge and practice of healthcare in the community has made its activities and role a part of the clinical training courses for national and international participants. Based on the success of the CHP in the management of severe childhood malnutrition, a comprehensive training course on the management of severely malnourished children has been developed in collaboration with the Training and Education Department of the Centre. The first course, conducted in March 1999, was participated by health workers from Bangladesh and Bhutan.

PHYSIOLOGY LABORATORY Coordinator: G.H. Rabbani

Funded by: USAID, Cytos Pharmaceuticals, USA, Government of France, and Tomen Corporation, Japan

The Physiology Laboratory, established in 1995, is equipped for clinical and animal experimentation, and provides opportunities to the CSD and LSD scientists to conduct basic studies in selected fields with direct relevance to the Centre's overall research objectives. Currently, there are seven scientific investigators, including doctoral students and trainees, working in the following pathophysiologic studies of diarrhoeal diseases: (a) Development and use of animal models of shigellosis and malnutrition; (b) Studies on intestinal ion transport, involving Ussing chamber and perfusion techniques; (c) Evaluation of nitric oxide and oxidative stress in experimental shigellosis; (d) Evaluation of antidiarrhoeal agents in experimental cholera (plant polyphenols) and shigellosis (L-histidine); (e) Role of trace elements (copper) in the pathogenesis of experimental diarrhoea; and

(f) Studies on body composition, using Bioelectric Impedance Analysis (BIA) technique.

OPERATIONS RESEARCH COMPONENT OF THE BANGLADESH INTEGRATED NUTRITION PROJECT

Programme Director: G.J. Fuchs

Funded by: Government of Bangladesh The Government of Bangladesh initiated the Bangladesh Integrated Nutrition Project (BINP) four years ago through a World Bank loan. The objectives of this comprehensive, nationwide project are to reduce malnutrition among children aged less than two years and pregnant/lactating women through community-based nutrition interventions, including growth monitoring and selective food supplementation. The ICDDR,B coordinates and conducts the operations research component of the BINP through the ICDDR,B-BINP Operations Research Project (ORP). A BINP Steering Committee, consisting of scientists from all ICDDR,B's scientific divisions, monitors and assists in the scientific activities. The daily management is under the responsibility of the BINP/ORP Secretariat consisting of Prof. George Fuchs, Dr. S.K. Roy, and Ms Saskia Osendarp.

During 1999, 14 research projects have been implemented under this programme by scientists from 8 different national and international research organizations or NGOs and by the ICDDR,B. By the end of 1999, fieldwork of three projects was still ongoing, while 11 projects had completed data collection with their final reports in various stages of completion. During the course of the BINP-ORP, research capacity-building and quality assurance were major activities for the ICDDR,B. The review procedure of the research proposals and interactions with investigators and members of the ICDDR,B's Final Award Committee ensured the quality of the research proposals. An ICDDR,B monitor was assigned to provide technical assistance to the investigators during the implementation of each study project, and during the dissemination phase with an extensive review of the draft reports and separate discussion meetings with the ICDDR,B monitor/coordinator and investigators, if required, to ensure the quality of the reports. The ICDDR,B is assisting the Research Advisory Committee (RAC) in disseminating the results of the studies and is, in this capacity, producing a series of dissemination reports. These reports compile the findings of several BINP operations-research studies, and present some general conclusions and recommendations for the programme. A first dissemination report, containing the findings of the first three studies, was presented in a one-day dissemination seminar, held at the ICDDR,B, in December 1999.

NUTRITION CENTRE OF EXCELLENCE

Programme Head: G.J. Fuchs

Funded by: World Bank The Nutrition Centre of Excellence (NCOE), established in 1998 as a Centrewide, cross-divisional activity and housed in the CSD, continued to strengthen the Centre's activities during 1999 in nutrition research. The NCOE enabled the Centre to expand its existing nutrition agenda. The existing initiatives, enhanced by the infusion of nutrition funding, included: (a) work conducted under the BINP-ORP, (b) standardized management of severely malnourished children in a hospital-based setting, (c) maintenance of the Nutritional Rehabilitation Unit, ICDDR,B and Nutrition Follow-up Clinic of the Dhaka Hospital, and (d) development of a course and training programme on the treatment of severely malnourished children in the hospital setting. Twelve research projects were also awarded funds through an internal competition. The NCOE conducted a retreat in September 1999 to define its five-year strategic plan and two-year work plan. It organized an International Symposium and Workshop on Low Birth-Weight, convening a group of international experts. The meeting was co-sponsored by UNICEF, the CHR Project of USAID, and the BINP. Proceedings of the symposium and workshop will be published as an ACC/SCN monograph.

HOSPITAL SURVEILLANCE PROGRAMME

Diarrhoeal disease and enteric infection

Investigators: G.J. Fuchs and A.S.G. Faruque

Funded by: USAID/W

Each year, thousands of patients attend the CRSC, Dhaka and Matlab hospital for the treatment of diarrhoeal illness and associated problems. The Hospital Surveillance Programme collects information on clinical, epidemiological and demographic characteristics of these patients. The programme provides key information to the Government of Bangladesh for the development of health policies; enables the Centre to monitor the emergence of new enteric pathogens, changes in the population and disease patterns, and drug sensitivity; provides database to conduct epidemiological studies; assists in the identification and development of new research areas; and helps define improved patient-care strategies and introduce preventive programmes.



CRSC staff busy providing care to diarrhoeal patients in the outdoor pavilion during an early seasonal epidemic of diarrhoeal diseases

A systematic 2% sub-sample of the patients attending the CRSC, Dhaka and a 10% sub-sample of the patients attending the Matlab hospital are enrolled into this surveillance. Trained personnel interview the patients and/or their attendants to obtain information on their socioeconomic and demographic characteristics, housing and environmental conditions, feeding practices (particularly of infants and young children), and use of drugs and fluid therapy at home. Extensive microbiological assessments of faecal samples (microscopy, culture, and ELISA) of patients are performed to identify diarrhoeal pathogens, and to determine antimicrobial susceptibility of bacterial pathogens.

The clinical characteristics, anthropometric measurements, treatments received at the facility, and outcomes of the patients are also recorded.

In Dhaka, *V. cholerae* O1 and *Shigella* (*S. flexneri* species accounting for 55% of the total) were isolated from 17% and 5% respectively of the 2,348 patients under the surveillance (Table). Routine screening of enterotoxigenic *Escherichia coli*, enteropathogenic *E. coli*, and enteroaggregative *E. coli*, using gene probes, in the Dhaka surveillance between July 1998 and June 1999 accounted, respectively, for 10%, 5%, and 7% of the enteric pathogens isolated. In Matlab, *V. cholerae* O1 and *Shigella* (*S. flexneri* species accounting for 61% of the total) were isolated from 16% and 5% respectively of the 895 patients under the surveillance (Table).

Table. Aetiological agents isolated from patients in the Surveillance Programme in Dhaka and Matlab in 1999

Month	Location	No. of patients	V. cholerae O1	V. cholerae O139	Shigella	Salmonella	Rotavirus	Other vibrios	ETEC
January	Dhaka	214	41	5	17	3	90	36	16
	Matlab	90	20	3	7	-	38	12	3
February	Dhaka	144	13	1	3	2	75	26	9
	Matlab	75	2	-	7	-	44	8	5
March	Dhaka	212	22	3	5	1	64	36	27
	Matlab	70	5	-	2	2	21	12	7
April	Dhaka	287	59	16	11	3	51	57	42
	Matlab	125	19	2	7	1	15	5	29
May	Dhaka	266	50	13	12	5	70	41	44
	Matlab	100	23	4	2	2	20	7	21
June	Dhaka	178	20	6	10	3	42	41	22
	Matlab	98	21	1	3	3	20	9	16
July	Dhaka	175	21	3	9	4	51	39	23
	Matlab	79	17	-	3	4	20	2	8
August	Dhaka	157	18	2	8	8	46	51	17
	Matlab	42	3	-	3	-	18	-	9
September	Dhaka	174	40	4	6	1	44	42	26
	Matlab	49	4	-	5	3	17	-	5
October	Dhaka	219	58	15	14	4	43	33	19
	Matlab	55	10	-	2	2	21	2	2
November	Dhaka	158	27	10	6	3	40	30	15
	Matlab	58	10	6	-	-	23	5	3
December	Dhaka	164	20	3	9	2	67	36	18
	Matlab	54	7	6	-	-	25	1	4

Total	Dhaka	2348	389	81	110	39	683	468	278
	Matlab	895	141	22	41	17	282	63	112
%	Dhaka	-	16.6	3.4	4.7	1.7	29.1	19.9	11.8
	Matlab	-	15.8	2.5	4.6	1.9	31.5	7.0	12.5
Estimated*	Dhaka	117400	19450	4050	5500	1950	34150	23400	13900
	Matlab	8950	1410	220	410	170	2820	630	1120

*Extrapolated to the total of patients attending the CRSC, Dhaka from the 2% sub-sample and the Matlab hospital from the 10% sub-sample.

Invasive *Streptococcus pneumoniae* and *Haemophilus influenzae* diseases and antimicrobial resistance

Investigators: S. Hossain, M. Rahman, A.H. Baqui, N. Nahar, V.I. Mathan, and G.J. Fuchs

Funded by: USAID/W

A hospital-based surveillance has been established at the ICDDR,B and at the Dhaka Medical College Hospital to determine the prevalence of *S. pneumoniae* and *H. influenzae* type b and their resistance to antimicrobials in children suffering from pneumonia and meningitis. So far, 272 bronchopneumonia and 49 meningitis cases have been enrolled. The overall yield of cultures from blood was 15.8%, of which 2% and 2.5% were *S. pneumoniae* and *H. influenzae* type b respectively. The overall yield of cultures from cerebrospinal fluid was 32.6% of which 10% and 16.3% were *S. pneumoniae* and *H. influenzae* type b respectively. About 75% (9/12) of *S. pneumoniae* and 81% (13/16) of *H. influenzae* type b strains were resistant to trimethoprim-sulphamethoxazole; about 8% (1/12) of *S. pneumoniae* and 50% (8/16) of *H. influenzae* type b strains were resistant to penicillin and ampicillin respectively; and 37% (6/16) of *H. influenzae* type b strains were resistant to chloramphenicol.

AWARDS

Dr. Tahmeed Ahmed was awarded the 1999 International Health Research Award by the Ambulatory Pediatric Association (USA) for his work on the reduction of mortality in severely malnourished children with acute illnesses by following a standardized management protocol. Dr. Syed Samiul Hoque received the Auxillary Award of the American College of Gastroenterology as best scientific paper submitted by a fellow-in-training.

Health and Population Extension Division

Division Director
Prof. Barkat-e-Khuda



Barkat-e-Khuda
Division Director

The Health and Population Extension Division (HPED) has collaborative projects with the host government and with national and international agencies working in the health, population and environmental health sectors. The key tasks of the Division are to: (a) conduct operations research on public health issues, primarily health systems research, reproductive health, child survival, epidemic control, and environmental health; (b) disseminate research findings through publications, seminars, and conferences; and (c) provide technical assistance to the Government of Bangladesh (GoB) and to non-government organizations (NGOs) in the application and replication of lessons learned from successful interventions.

The HPED is composed of Operations Research Project (ORP), Epidemic Control Preparedness Programme (ECP), and Environmental Health Programme (EHP). At the end of 1999, the Division had a staff of 268 personnel (5 international-level scientists, 49 national officers, and 214 general services and field-level staff). Dr. Bilqis Amin Hoque, Head, EHP, left after over 13 years of valuable contributions to the Centre. In September 1999, a key staff member of the ORP Dr. Shameem Ahmed passed away. She made significant contributions to the work of the Division and to the activities of the research partners of the Centre.

Division Highlights

- Provided technical assistance to the Ministry of Health and Family Welfare (MOHFW), GoB, in operationalizing the Community Clinics strategy using the experience of interventions gained from the ORP sites and in designing, pilot-testing, and nationwide implementation of a unified management information system (UMIS).
- Completed studies on indicators likely to be affected by the current interventions with the GoB and the partners of the National Integrated Population and Health Programme (NIPHP) on reproductive health needs of adolescents and on willingness-to-pay for essential health and family-planning services.
- Continued the cholera surveillance activities in the five sentinel sites as a collaborative research project with the University of Maryland and the Johns Hopkins University, USA.
- Assisted the GoB in the management of diarrhoea epidemics and in strengthening the local epidemic control capacity.
- Published journal articles and technical reports on reproductive tract infections (RTIs), clinical contraception, effects of pricing on contraceptive use, reproductive health needs of adolescents, essential obstetric care (EOC), infant feeding, and knowledge and practices of men on reproductive health issues and services.
- Formalized collaborative links with the Partners in Population and Development (PPD): a South to South Initiative. Organized an International Expert Group Meeting on Reproductive Health Research Capacity Development, jointly with the PPD as part of a memorandum of understanding to develop joint international initiatives on reproductive health research.

- Provided technical assistance to the GoB and other stakeholders in formulating the Bangladesh vision statement and broad strategies for future water supply and sanitation activities (Vision 21).

The Division plans to:

- Co-host a seminar on Family Planning Programmes in the 21st Century in January 2000 in Dhaka, jointly with the International Union for the Scientific Study of Population (IUSSP), Brussels.
- Continue the current interventions with the GoB and the NIPHP partners.
- Incorporate additional components to the current interventions on reproductive tract infections/sexually transmitted infections (RTIs/STIs) and human immunodeficiency virus (HIV), i.e. conduct a validity assessment of the syndromic management of vaginal discharge, and also conduct baseline surveys on knowledge about RTIs/sexually transmitted diseases (STDs)/HIV/acquired immunodeficiency syndrome (AIDS).
- Field-test interventions to improve reproductive health services for adolescents, and initiate studies on cost and cost-effectiveness analyses of delivery of the essential services package (ESP) and on enhanced involvement of commercial providers in the delivery of the ESP.
- Conduct collaborative studies with the Johns Hopkins University on key areas identified in the ORP work plan for 1999-2000.
- Initiate a surveillance of dengue viral fever in Bangladeshi children.
- Initiate an effectiveness trial of cholera vaccine.
- Continue research on arsenic challenges.
- Continue to collaborate with other scientific divisions of the Centre in organizing the Working Groups, particularly on Health Systems Research, Reproductive Health, Environmental Health, and Nutrition.

Operations Research Project

Chief of Party: Barkat-e-Khuda

Funded by: USAID The ORP, begun in July 1997 as a follow-on project to the former MCH-FP Extension Projects, represents the Centre's principal contribution to a broad partnership, involving the MOHFW, GoB and other service-delivery organizations under the USAID-funded NIPHP.

The focus of the ORP reflects the Centre's emphasis on finding solutions to problems in reproductive health and child survival and on promoting the wider availability and use of the services included in the national ESP. The key indicators of the project effectiveness directly relate to programmatic and policy improvements in the health and population sector. These include the number of operations-research studies conducted to support the service-delivery activities of the GoB and the NIPHP partners, and the application of research findings for the required programmatic and policy changes. Within these contexts, the ORP designs and field-tests interventions jointly with the government agencies and NGOs in the rural and urban areas.

The Project maintains four field sites located in Abhoynagar thana (sub-district) of Jessore district, Mirsarai and Patiya thanas of Chittagong district, and in Dhaka city (thana now renamed as Upazilla). In addition, during 1999, the ORP conducted research and carried out technical assistance-related activities in 28 thanas in 13 districts and in two city corporations of the country. Technical assistance was also provided to conduct Training of Trainers course on unified MIS of the national health and family-planning programme.

The Project has been organized into 3 teams, covering the areas of integrated family-health services; sustainable service-delivery systems and health financing; and management support systems and innovative programmes. A Field Support and Surveillance Team and an Administrative Unit assist these teams. At the end of 1999, the ORP had 2 international-level staff members, 41 national officers, and 201 general services and field support staff.

In 1999, the ORP continued the following operations-research activities with the GoB and the NIPHP partners:

1. Operationalization of a cost-effective-tiered system for delivering the Essential Services Package in the public sector.
2. Operationalization of a cost-effective-tiered system for delivering the Essential Services Package in rural areas by the NIPHP NGOs.
3. Strategies to improve prevention and management of reproductive tract infections and sexually transmitted diseases (jointly with the Centre's Laboratory Sciences Division).
4. Modified strategies for ensuring referral and linkage for essential obstetric care.
5. Strategies for improving quality and performance of clinical contraceptive services.
6. Technical assistance to strengthen management support systems for effective delivery of the Essential Services Package.
7. Cost-recovery of ESP delivery through systematic pricing and revenue management in the public sector and NIPHP NGO programmes.

Research Highlights

The ORP scientists were involved in several national policy advisory bodies. These include: (a) National Technical Committee on Cost Recovery and Financial Sustainability in the Health and Population Sector, (b) National Essential Obstetric Care Core Group, (c) National Committee for the Development of an Integrated Behaviour Change Communication Strategy, (d) National Unified MIS Implementation Task Force. The Project extended substantial assistance in organizing the 7th International Workshop on "Improving Effectiveness, Quality of Services and Sustainability in Reproductive Health Programmes through Operations Research", held at the Centre. It organized two meetings of the Urban Health Forum to promote sharing of research findings and lessons learned among agencies working to improve urban health, particularly in slum areas.



Prof. Dr. M Amanullah, Hon'ble State Minister for Health and Family Welfare, addressing a workshop on community clinics, organized by ORP as part of

Operations research on operationalizing a cost-effective tiered system for delivering the essential services package in the public sector

Research Team: S. Routh, S. Sarker, Z. Islam, S. Alamgir, M.A. Bhuiyan, S. Begum, A. Shahriar, R. Khanam, and Barkat-e-Khuda

Funded by: USAID In July 1998, the GoB initiated the current five-year health programme, namely the Health and Population Sector Programme. The USAID-supported NIPHP began in July 1997. The central theme of the HPSP and the NIPHP is to provide a package of essential health and family-planning services (ESP) to the population, especially to women, children, and the poor, through a tiered system of fixed-site clinics. The conventional home-visit approach is being gradually replaced by the community-level health centres (Community Clinics for rural areas) to offer selected ESP services jointly by the health and family planning field workers and referrals for other ESP services to the higher-level facilities. The objectives of this study were to operationalize, monitor, and evaluate the new service-delivery strategies in the rural and urban areas, and to recommend measures for their effective and efficient implementation. The study design entails documentation, monitoring, and evaluation of the ESP operationalization process through field interventions at the rural (Abhoynagar thana of Jessore district, and Mirsarai and Patiya thanas of Chittagong district) and urban (Sher-e-Bangla Nagar in Dhaka city) sites of the ORP.

The findings of the study were shared with the senior government policy-makers and programme managers, and donors that led to modifications in the national guidelines for establishing Community Clinics. The ORP assisted the MOHFW in preparing manuals to facilitate and monitor the implementation of the strategy. As part of the urban intervention, the Sher-e-Bangla Nagar Model ESP Clinic has been reorganized, and new services, such as counselling and health education, antenatal screening for syphilis, have been introduced. An algorithm-based client-screening approach as a means to tap the missed opportunities has also been developed. To assist in the development of a behaviour change communication (BCC) programme for the new strategy, a needs assessment study was completed in the rural sites of the ORP, and an in-depth analysis of the information needs of the urban poor is underway. The operations research, conducted in close collaboration with the MOHFW and its two directorates (Directorate General of Health Services and Directorate of Family Planning) and with the Dhaka City Corporation (DCC), has been contributing to the nationwide implementation of the ESP-delivery strategies in the rural and urban settings through sharing of the study findings and recommendations with the policy-makers and programme managers.

Operationalizing a cost-effective-tiered system for delivering the essential services package in rural areas by NIPHP NGOs

Research Team: R. Gazi, M. Alauddin (Pathfinder International), N. Uddin, Y. Hassan, and M. Rahman
Funded by: USAID

The service-delivery strategy of NGOs, supported by the Rural Service Delivery Partnership (RSDP), comprises a fixed clinic, a number of satellite clinics, and limited provision of services at the community level through their depot-holders. This study, a rapid appraisal of the community perceptions about the depot-holders and their current activities, was conducted in five thanas, and included in-depth interviews, focus-group discussions, observations, and participatory learning action (PLA) techniques.



As part of its current interventions, ORP developed communication materials for use by field staff to inform rural women about services included in ESP

The results of the study indicated that the community women preferred to receive additional services from the depot-holders, including the delivery of contraceptives at home. The depot-holders were important sources of family-planning methods, and there were considerable variations in the size of their catchment areas. The findings of the study suggest to simplify the record-keeping system used by the depot-holders. They also need support to target non-users of family-planning methods, newly-weds, pregnant women, and households with infants.

Strategies to improve prevention and management of reproductive tract infections and sexually transmitted diseases (jointly with the Centre's Laboratory Sciences Division)

Research Team: S. Rahman, J. Bogaerts, A.I. Khan, I. Shams, P.A. Khanam, M.A. Quaiyum, Barkat-e-Khuda, and R. Khanam

Funded by: USAID

Both HPSP and NIPHP have provisions of services for the prevention and management of RTIs/STDs and HIV/AIDS within the package of reproductive health services. This intervention assesses the feasibility of syndromic management of RTIs/STDs and antenatal (ANC) screening for syphilis as part of ANC services at the primary healthcare (PHC) level. It also assesses the feasibility of strengthening the capacity of pharmacies to provide STD/AIDS-prevention services. The first two components of the intervention are being tested in the government and non-government clinics in the urban and rural areas, in collaboration with the GoB, Urban Family Health Partnership (UFHP), RSDP, and the Laboratory Sciences Division (LSD) of the Centre. The clinics are: Sher-e-Bangla Nagar Government Outdoor Dispensary, Mirpur Paribarik Shasthya Clinic of Progoti Samaj Kallyan Protisthan (PSKP), and Shibalaya Paribarik Shasthya Seba Clinic of Jatiya Tarun Sangha (JTS). Two surveys were conducted, in collaboration



ORP, jointly with LSD, imparted training to staff at Mirpur PSKP-UFHP clinic as part of operations-research study to assess the feasibility of introducing syphilis screening in ANC services

with the Social Marketing Company (SMC), in Tongi municipality as part of the implementation of pharmacy component. The findings of the surveys indicate that drug-sellers of the pharmacies provide services to RTI/STD clients, but they do not have skill to provide treatment. However, they could be trained to be used as a source of information and referral.

Improving reproductive health services for adolescents

Research Team: Q. Nahar, C. Tuñón, M.A. Quaiyum, Barkat-e-Khuda, R. Gazi, M. Islam, and F. Ahmed

Funded by: USAID

In 1999, the ORP began to collaborate with the UFHP, Population Council, and other local NGOs to develop a baseline study for their interventions to improve health services for adolescents.

As part of designing interventions to provide improved reproductive health services to adolescents, a needs assessment study, using both survey and qualitative data-collection techniques, was completed in 1999. The results of the study indicated that lack of correct information on issues, such as fertility, family planning, STDs, and HIV/AIDS, was a major problem. The adolescents perceived that the existing reproductive health services were not accessible to them. In the urban areas, a large proportion of adolescents living in slums dropped out from schools and joined the labour market.

The results were disseminated locally and also presented at two international workshops organized by the Population Council in Washington, D.C. and by the Division of Reproductive Health of the Centres for Disease Control and Prevention in Atlanta, Georgia. In September 1999, a presentation was made on the study at USAID, Washington. The study findings have been used for developing an operations-research proposal to be implemented in 2000.

As part of this activity, the ORP provided technical inputs to assess the family-planning activities for the newly-wed couples within the RSDP of the NIPHP (Pathfinder International) and also to assess the BRAC's programme for Adolescent Family Life Education.

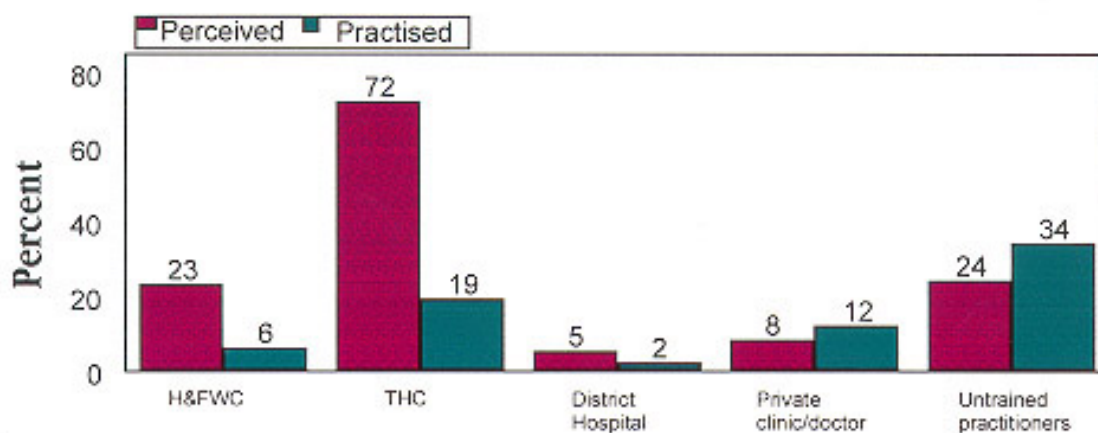
Modified strategies for ensuring referral and linkage for essential obstetric care

Research Team: M.A. Quaiyum, P.A. Khanum, A. Islam, I. Shams, and R. Razzak

Funded by: USAID

The results of a recent baseline study, conducted in the ORP sites, showed that a persistent wide gap existed between awareness and actual use of facilities for the management of obstetric complications (Fig. 1). This intervention tested a strategy to increase the use of EOC facilities for the management of obstetric complications; increase the number of deliveries by trained personnel; and increase awareness among women and in the community about complications of pregnancy and childbirth.

Fig. 1. Knowledge and practices of women regarding source of care for complications of pregnancy and childbirth



The ORP has started activities to raise community awareness. This has been done using pictorial cards and posters about complications of pregnancy and childbirth and timely care-seeking from appropriate sources by involving formal and informal community leaders, imams, leaders of organized groups, and pregnant women. The linkages between different types of service providers have been strengthened, involving the village practitioners and traditional birth attendants (TBAs) in the referral process.

As part of this intervention, the ORP scientists, along with the GoB and UNICEF, participated in the development of a communication and social mobilization plan to support the national programme for reducing maternal mortality. The service-delivery manuals and protocols for EOC have been finalized and submitted to the Line Director, Training, MOHFW, for his approval.

Strategies for improving quality and performance of clinical contraceptive services

Research Team: F. Sobhan, A.I. Khan, A. Ashraf, R. Khatun, A. Islam, M. Islam, and Z. Haider
Funded by: USAID

The ORP is testing strategies to reduce barriers to clinical methods, to reduce contraceptive discontinuation, and to strengthen referral and linkages as part of an intervention to improve the quality and performance of clinical contraceptive services.

The findings of a recent baseline survey indicated that more than half of the women surveyed had misconceptions regarding the disadvantages of clinical contraceptives. For example, two-thirds of them had misconceptions about intrauterine devices (IUDs) and female sterilization, and about 60%

had misconceptions about injectables, male sterilization, and Norplant. The findings of the survey also showed that fear of side-effects, social barriers, and health concerns were important reasons for non-use of contraception. Materials to provide accurate information have been designed in collaboration with the Behaviour Change Communication Unit of the MOHFW, and are being field-tested. Activities to raise awareness of the providers on these issues and to orient them to the use of BCC materials have been completed. Refreshers' training sessions for the field-workers and paramedics in compliance with protocols were also conducted as part of this intervention.



Activities of GoB-ORP interventions include organization of orientation workshop with community leaders and village doctors on clinical contraception and EOC

Technical assistance to strengthen management support systems for effective delivery of the Essential Services Package

The new service-delivery strategies on ESP delivery within the government and NGO programmes demand changes in the support systems, especially with regard to the management information systems (MIS) and mechanisms for local-level planning, and coordination among the various service providers.

Management information systems

Research Team: S.M.T. Azim, C. Tuñón, J. Uddin, N. Uddin, and Barkat-e-Khuda
Funded by: USAID

Technical assistance was provided to develop and pilot-test and for nationwide implementation of a system to record and report the performance of staff providing the ESP at the thana level and below from the clinics jointly managed by the MOHFW and the NIPHP NGOs.

As part of a special task force established by the MOHFW, the ORP helped develop record-keeping and reporting formats for the UMIS for use of the health and family planning staff. The UMIS was subsequently pilot-tested in the rural ORP sites. The research team also designed training manuals, users' guidelines, and a methodology for monitoring the experience in implementing the new system nationwide, based on the results from the pilot-testing phase. The ORP helped the government develop a training methodology for staff at the thana-level and below, and assisted in organizing the training activities for the UMIS in 18 districts.

The government formally launched the new MIS in October 1999, and the MOHFW sought the

assistance of the ORP to monitor its implementation process in all 22 thanas of Jessore and Chittagong districts over the next 12 months.

In February 1999, the Project, jointly with the UFHP of the NIPHP, conducted a mid-term assessment of the record-keeping and performance-reporting system used in the UFHP clinics and in the service-delivery points.



A new UMIS has been launched nationwide. ORP assisted the government in its development and pilot-testing, and training of staff. Its implementation is being monitored by ORP in all thanas of Jessore and Chittagong districts

Local-level planning in rural areas

Research Team: J. Uddin, M. Alauddin (Pathfinder International), A.K.M. Sirajuddin, and C. Tuñón
Funded by: USAID

In 1998, the Pathfinder International organized a management-training course for teams of thana managers from the MOHFW and from the RSDP NGOs. These teams developed action plans to improve the ESP coverage, quality of care, and team work in their respective areas. The ORP evaluated the performance of the trained managers. During February-June 1999, data were collected from five thanas through in-depth interviews, observations of field activities and meetings, focus-group discussions, and reviews of records.

The results of the evaluation showed that all the trained managers introduced immunization services at the satellite clinics for family planning. The number of acceptors of clinical method increased by 1-2 percentage point(s) and the immunization coverage (TT2 and measles) by 6-8 percentage points in all thanas. The action plans helped focus attention on targets, increased supervision and referrals, and improved recording and reporting. Meetings were also better organized after the training. Several constraints to the effective implementation of the action plans were identified. For example, transfer of staff hampered the formation of effective teams. Lack of funds and insufficient support from supervisors affected the implementation of the action plans. The results suggest that post-training interventions are needed at the central and field level to support the trained managers.

The ORP, in collaboration with the UFHP, Population Services and Training Centre, and the Immunization and Other Child Health Project, also designed and evaluated interventions to improve services in smaller municipalities through improved coordination among the service-delivery agencies in the health and population sector.

Planning and coordination among service providers in urban areas

Research Team: J. Khatun, J. Uddin, A.K.M. Sirajuddin, and C. Tuñón

Funded by: USAID

The Zonal Committees were introduced in 1995 to promote planning and coordination of health and family-planning services between the government and non-government service-delivery agencies in the DCC. In June 1998, the intervention was modified to respond to a change in the service-delivery strategy of the NIPHP NGOs. The Committees organized meetings of the local elected leaders and the representatives of the government and NGOs to formulate annual plans to improve the availability of the ESP in Zone 3, 4, 6, and 7 of the DCC, and met regularly to monitor the implementation of these action plans. The ORP also prepared an inventory of the government and NGO clinics providing the ESP in Dhaka city as part of this intervention.

In September 1999, a study was conducted in all 10 zones of the DCC to assess the perceptions of the local stakeholders about the activities and roles of the Zonal Committees in the delivery of ESP services in their respective areas. Structured interviews were conducted with a random sample of the service providers and local leaders at the zone and ward level. The committee meetings were observed, and the meeting records were reviewed. The study found that only those zones that were receiving the ORP inputs had work plans for the July 1998-June 1999 period. In other zones, the stakeholders reported that the committee activities discontinued due to lack of support from the ORP. The respondents mentioned the necessity of the Zonal Committees to improve coordination in the organization of local health-promotion campaigns and to address the common health issues. The intervention showed that the committees did not function without external facilitation and that the health departments of large municipalities needed to be strengthened to improve the coordination of the ESP delivery-related activities.

Cost-recovery of ESP delivery through systematic pricing and revenue management in the public sector and NIPHP NGO programmes

Research Team: S. Routh, M.A. Mozumder, Z. Quayyum, S.A. Jahan, Z. Islam, and Barkat-e-Khuda

Funded by: USAID

This operations research seeks to improve cost-recovery strategies to deliver the ESP by charging user fees and by revenue management. The study follows a quasi-experimental design with a non-equivalent control group and with pre- and post-test measurements.

As part of the operations research, a survey of 2,400 households in Abhoynagar and Mirsarai, using the 'contingent valuation method' and 'bidding techniques', was completed in March 1999 to assess willingness-and ability-to-pay and demand for healthcare from the public-sector facilities. The results of the survey showed that the average household expenditures during the quarter preceding the survey were Tk 60.00 (US\$ 1= Tk 50.00) for ANC, Tk 12.00 for tetanus toxoid (TT) immunization, Tk 90.00 for sick mother care, including drug costs, Tk 10.00 for child immunization, and Tk 100.00 for sick child care, including drug costs. Seventy percent of the respondents were willing to pay for family-planning methods and 70-80% for maternal and child healthcare. The majority of those who were willing and able to pay for the services opted to pay Tk 4.00-7.00 for the specified maternal and child-health services (ANC, TT immunization, sick mother care, child immunization, and sick child care). It was as well evident from the survey that a considerable number of clients were willing to pay at the government facilities. Interestingly, the socioeconomic variables had shown no statistically significant influence on the payment decision-making process. In July 1999, qualitative studies were conducted to understand the perspectives of the providers and users on pricing. The results of these studies showed that improvements, such as better staff behaviour, availability of medicines, and less-waiting time, were perceived by the respondents as factors critical to introduce fees for services.

Cost and cost-effectiveness analysis of ESP delivery

Research Team: S. Routh, Z. Islam, S.A. Jahan, M.A. Mozumder, and Barkat-e-Khuda

Funded by: USAID

One of the major activities of the ORP in the area of health financing and sustainability relates to analysis of costs and cost-effectiveness of ESP delivery at various tiers. To this end, tools for analyzing cost of services

have been developed, and cost analyses have been initiated in collaboration with the Partnerships for Health Reforms, Abt Associates, Maryland, USA.

Strategies for involvement of the commercial sector in ESP delivery

Research Team: S. Routh, S. Sarker, Z. Islam, R. Khanam, and Barkat-e-Khuda

Funded by: USAID

To encourage the participation of the commercial sector in the delivery of ESP commodities and services, the ORP worked with the Social Marketing Company to test-market injectable contraceptives through commercial outlets, such as doctor-attended pharmacies, and to market progestin-only pills (PoPs) among lactating mothers. A number of activities to strengthen the private sector further for delivering ESP-related services and commodities are currently being pursued. The aim of these activities is to enhance the financial sustainability of the programme by decreasing client dependence on the highly-subsidized public sector and NGO facilities.

Survey and field research activities Routine surveillance and monitoring of the intervention activities were carried out in the rural and Dhaka city field sites of the ORP. It covered 23,624 households and a population of 126,747. The ORP surveillance system reported the rates of contraceptive prevalence (CPR), crude birth (CBR), general fertility (GFR), total fertility (TFR), crude death (CDR), infant mortality (IMR), 1-4-year mortality, and full-immunization coverage (FIC) at the ORP field sites for 1999 (Table).

Table. Contraceptive prevalence, fertility, mortality, and immunization rates in the ORP field sites in 1999

Type of area	Thana	CPR	Fertility			Mortality			FIC*
			CBR	GFR	TFR	CDR	IMR	1-4	
Rural intervention	Mirsarai	42.8	24.0	92.0	2.8	7.9	71.0	7.2	75.0
Rural comparison	Satkania	29.5	28.7	118.3	3.9	6.6	50.4	6.5	67.5
Rural intervention	Abhoynagar	59.0	22.6	82.9	2.4	6.5	57.8	2.7	82.9
Rural comparison	Keshobpur	52.1	20.5	78.9	2.2	8.2	65.7	3.5	73.3
Rural intervention	Patiya	47.7	23.9	98.5	3.0	6.3	50.7	3.2	73.8
Rural comparison	Lohagara	34.1	24.9	105.4	3.4	5.1	39.5	7.6	66.7
Urban intervention	S.B. Nagar	52.6	30.7	105.5	3.1	7.9	113.6	6.9	N/A
Urban comparison	Lalbagh	51.9	26.7	98.1	2.8	5.8	72.9	7.6	N/A

*FIC: Full-immunization coverage includes BCG, measles, and three doses of DPT and polio.

Three special surveys--Combined Baseline Survey (CBS) for the ORP interventions; Reproductive Health Survey on Adolescents; and Ability and Willingness to Pay and Health Care Demand for GoB Services in rural areas--have been conducted at the field level. A baseline survey on clinical contraceptives and EOC interventions at the RSDP sites (Chagolnaiya and Chandina) has also been conducted.

Epidemic Control Preparedness Programme

Head: A.K. Siddique

Funded by: The Royal Norwegian Government The overall objectives of the Epidemic Control Preparedness

Programme (ECP) are to (a) improve the understanding of epidemiology of cholera; (b) develop models for the prediction of outbreaks; (c) and improve the methods of intervention. Specifically, the ECP studies the epidemiology and ecology of *Vibrio cholerae* in five sentinel sites in Bangladesh to test the hypothesis that "plankton are the reservoir for *V. cholerae*. Their growth and life cycle(s) control the vibrio population in the surface waters which determines the periodicity of cholera in endemic regions and spread of cholera in pandemic form." The Programme also conducts epidemiological investigations of cholera outbreaks in Bangladesh, and provides technical assistance nationally and internationally in the management and control of cholera epidemics.

Diarrhoea epidemics in Bangladesh in 1999: investigations by ECP

The magnitude of diarrhoea epidemics was less pronounced in 1999 (Fig. 2). In 1998, 1.7 million cases of watery diarrhoea were reported by the government epidemic surveillance, whereas, during January-November 1999, 478,809 cases and 593 deaths due to acute watery diarrhoea were reported. Over 21% of the cases and 55% of the deaths were reported from eight southern districts (Faridpur, Jessore, Pirojpur, Jhalokathi, Barisal, Patuakhali, Borguna, and Noakhali). The wet-season epidemics affected the north central and north-western districts. However, the onset of wet-season epidemics, which usually begins by August, was delayed.

During the dry-season epidemics (January-April), the ECP conducted rapid assessment in 35 thanas of the eight southern districts. During the wet-season epidemics, the ECP conducted investigations in 26 thanas of 4 districts (Kurigram, Kishoreganj, Netrokona, and Mymensingh). Cholera epidemic was confirmed in 13 thanas (51%). Five hundred forty-seven patients with acute diarrhoea were identified and treated by the ECP team during the field investigations. About 70% of them suffered from acute watery diarrhoea. Samples of 253 specimens were collected and cultured at the Centre's laboratory in Dhaka. *V. cholerae* was isolated from 29% of the specimens. *V. cholerae* O1 (mostly Ogawa) accounted for 79% of the isolates, and the rest were *V. cholerae* O139.

V. cholerae O139 was isolated relatively at a higher rate from all four districts during the wet-season epidemics compared to any other year in the recent past; the overall proportion of O139 isolates was 47%. All *V. cholerae* isolates were sensitive to tetracycline and erythromycin, but were resistant to co-trimoxazole. Re-emergence of biotype El Tor Inaba in the northern areas has also been noted.

Epidemic Management Training for GoB Mid-level Health Managers

The ECP provided technical assistance to the Control of Diarrhoeal Diseases (CDD) Programme of the GoB in training the mid-level managers to improve their capabilities to manage diarrhoea epidemics. In 1999, two training sessions were conducted in Rajshahi and Khulna divisions. Forty-two mid-level managers from 37 thana health facilities of five districts participated in these sessions. All these contributed to enhance the skills of 418 mid-level managers from 352 thanas in the management of diarrhoea epidemics. The trained managers are expected to play a vital role in organizing an early response to diarrhoea epidemics in rural Bangladesh.

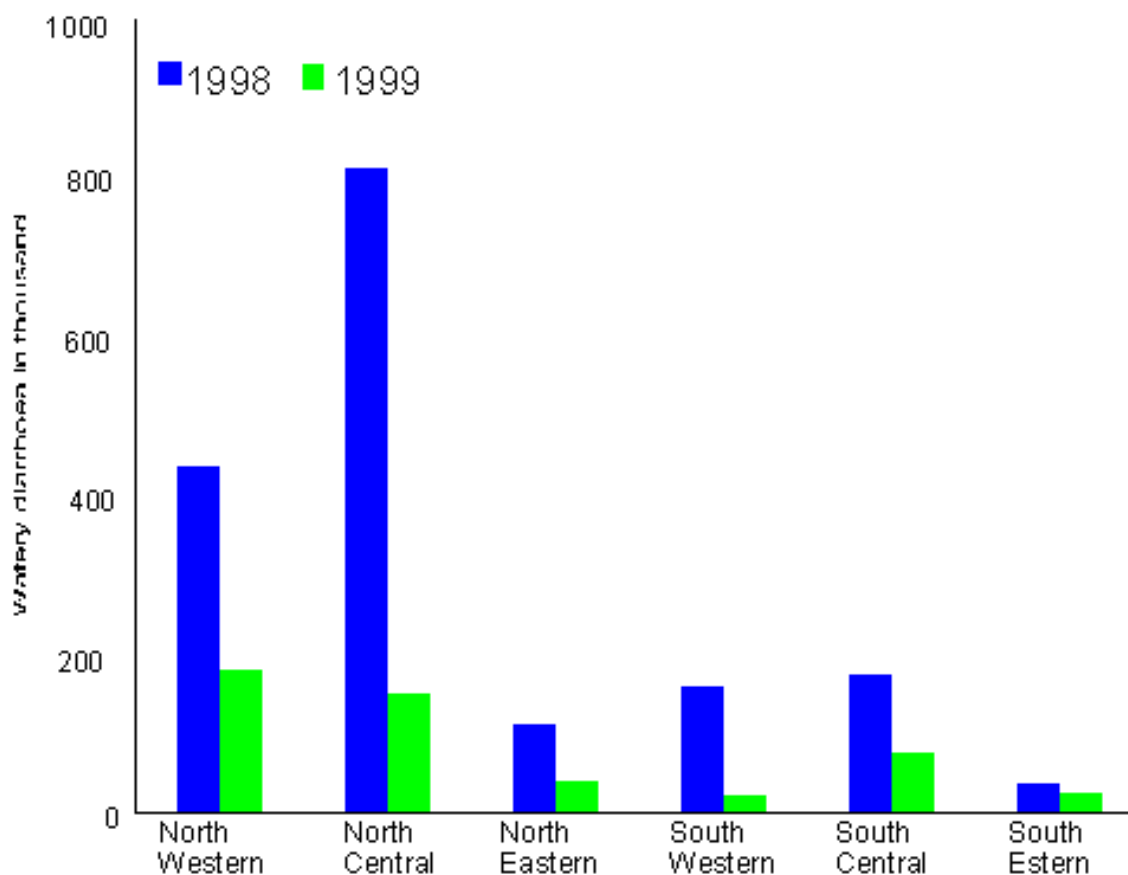
Clinical surveillance for "ecology and epidemiology of cholera in Bangladesh" at the sentinel sites

PI: A.K. Siddique

Funded by: NIH, USA

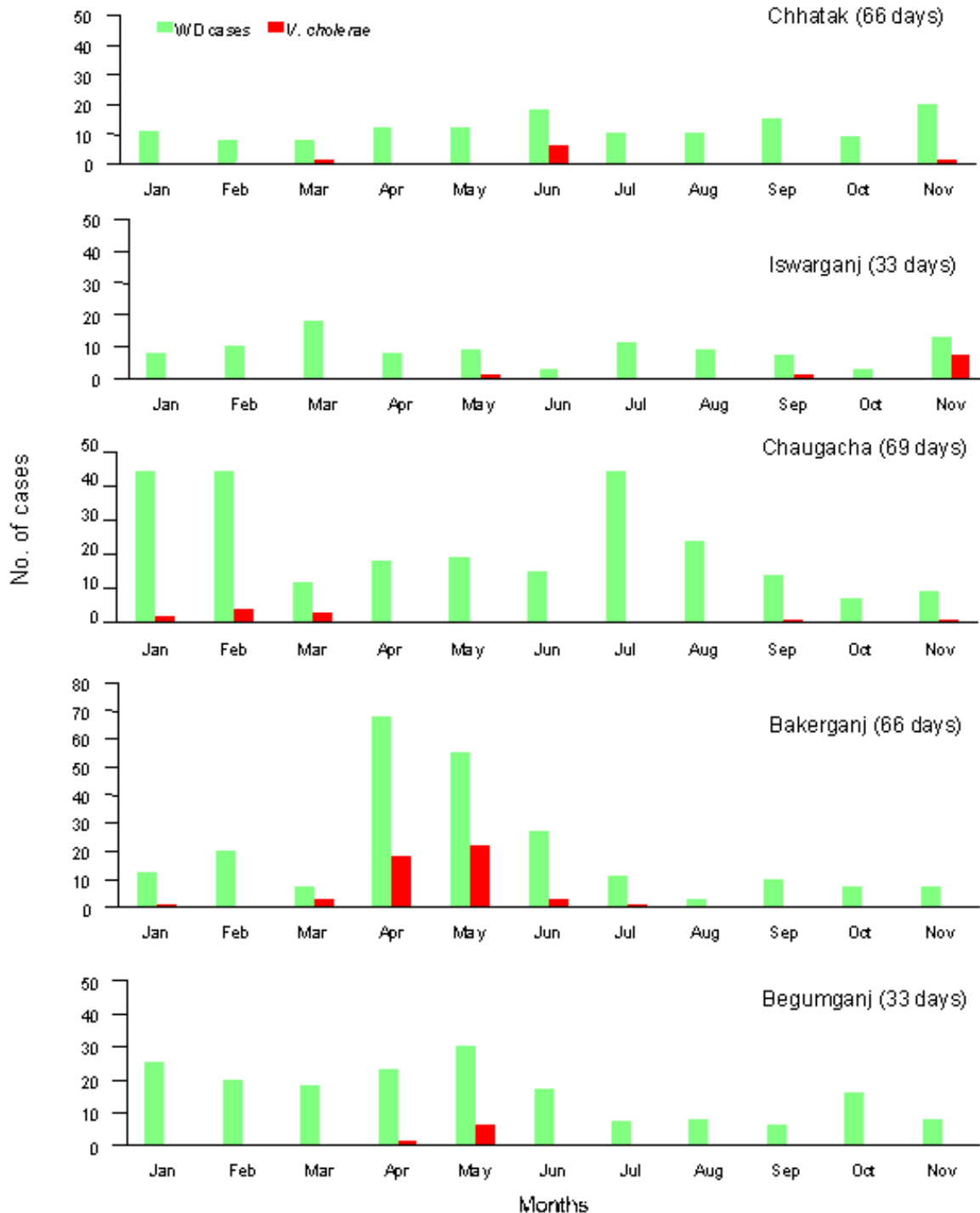
The ECPP continued the cholera surveillance at the sentinel sites. During January-November 1999, 978 diarrhoea patients were identified, of whom 93% suffered from acute watery diarrhoea (Fig. 3). Of the 746 specimens (82% of watery diarrhoea patients) cultured for *V. cholerae* O1 and *V. cholerae* O139, over 11% were positive for *V. cholerae* (91/1,000 watery diarrhoea cases seen). *V. cholerae* O139 accounted for 34.9% of *V. cholerae* isolated compared to 3.1% in 1997, and the strain was isolated from all the sites. In two of the five sites, *V. cholerae* O139 accounted for over 50% of *V. cholerae* isolated. The above results suggest a change in patterns of cholera epidemiology in Bangladesh.

Fig. 2: Watery diarrhoea cases reported* during epidemics in Bangladesh, 1998-1999



* GoB surveillance report

Fig. 3: Isolation of *V. cholerae* at five sentinel sites in Bangladesh in 1999 (267 days of surveillance)



Environmental Health Programme

Programme Head: B.A. Hoque

Funded by: Multi-donors The Environmental Health Programme (EHP) conducts and supports environmental health research on the control of diarrhoeal diseases and on other public health issues. The Programme also conducts basic and applied research in rural and urban areas during both normal and disaster periods. Its key strategy is to involve the community and other agencies at all stages of implementation. The EHP provides technical assistance to the government and non-government agencies, and disseminates findings of research

locally and internationally.

The EHP laboratory conducted physical, biochemical, biological and chemical tests of water, soil, food (limited) and urine (limited) samples for research projects at the Centre and for external agencies. Laboratory models for water-supply options by treating arsenic and coliform bacteria at the community and at the household levels were developed and tested at the EHP laboratory.

Arsenic challenge in action research

Research Team: B.A. Hoque, M.R. Munshi, F. Khan, G. Morshed, and H.I. Hossain

Funded by: SDC, Switzerland and EHP-ICDDR,B

This study was conducted to: (a) develop/field-test appropriate field kit(s) for screening of arsenic-contaminated tubewells; (b) develop appropriate water-supply options; and (c) study ways to involve the community in arsenic mitigation.

Four locally available kits and 11 different water-supply and/or water-treatment options were studied under laboratory conditions during 1998-1999. The five options, found to be satisfactory/promising, were tested at the field level under controlled conditions over a period of about three months to one year. Of these options, rainwater harvesting, pond sand filters and home-made filter (developed by the EHP) showed encouraging results, but they still need further testing under different field conditions.

Of the four kits studied, the modified E-Merck kit was found to be the most reliable kit. It was modified by the EHP to indicate arsenic concentration at the local required level. It was also observed that cost-sharing among the stakeholders, including users, for tubewell screening and in distribution of water-supply options was possible. The community volunteers, government health workers, school teachers, and leaders also participated efficiently in screening tubewells and creating awareness about the arsenic problem and its immediate mitigation strategies.

Environmental health intervention in selected slums of Dhaka city

Research Team: B.A. Hoque, G. Morshed, S.M. Kabir, A. Rahman, and F. Khan

Funded by: Ministry of Health and Family Welfare (GoB)-World Bank and EHP-ICDDR,B

This study is a part of an integrated water, sanitation, hygiene, and solid waste-disposal (WSHS) improvement initiative at Mirpur and Agargaon, the two poor urban settlements in Dhaka city. The Project is involved in three phases: (a) hygiene promotion; (b) development of appropriate WSHS options/systems; and (c) community-centred integrated promotion and installation of options depending on the availability of funds and resources.

The findings of the first phase of the study indicated that the intervention led to a significant improvement in knowledge on the modes and prevention and transmission of diarrhoea, hand-washing, water and food handling, and benefits of proper WSHS practices. However, WSHS behaviours/practices remained similar in both the areas, before and after the intervention. The results of the first phase of the study on community perspectives showed that there was no improvement in practices due to the absence of: (a) appropriate WSHS provisions and services; (b) coordination among the stakeholders; (c) knowledge on appropriate WSHS technology; and (d) community involvement. Willingness-to-share cost for improving and/or installing new provisions for water and latrines remained similar as was observed in the baseline survey, i.e. US\$ 1.00 and US\$ 0.10 per family for water and latrine respectively.

Various options for sanitary disposal of faeces and water supply were studied, developed, and promoted during the second and third phases. Biogas plants for sewage treatment, developed by the EHP in collaboration with the Local Government Engineering Department (GoB) and the Plan International, were observed to be the most appropriate and acceptable option. After the promotion of the alternative appropriate options, the willingness-to-share cost increased significantly (US\$ 5.00 per family and US\$ 20.00 per family for latrine and water supply respectively). The users have been covering 100% of the operating and maintenance costs. The WSHS behaviours studied also improved significantly.

Vision 21: a shared vision for water supply, sanitation and hygiene

PI: B.A. Hoque

Funded by: Water Supply and Sanitation Collaboration Council-WHO, Switzerland

The objectives of the Vision 21 were to formulate a vision statement and to outline broad strategies for future water and sanitation activities in Bangladesh. The EHP, in collaboration with the Department of Public Health Engineering (GoB), WHO, UNICEF, and selected NGOs, coordinated a series of consultations and focus-group discussions with women, men, professionals, social and political leaders, and other community groups at various local and national levels to develop the Bangladesh Vision 2025. The exercise raised awareness about the needs for meeting the demand of water supply and sanitation in the new millennium.

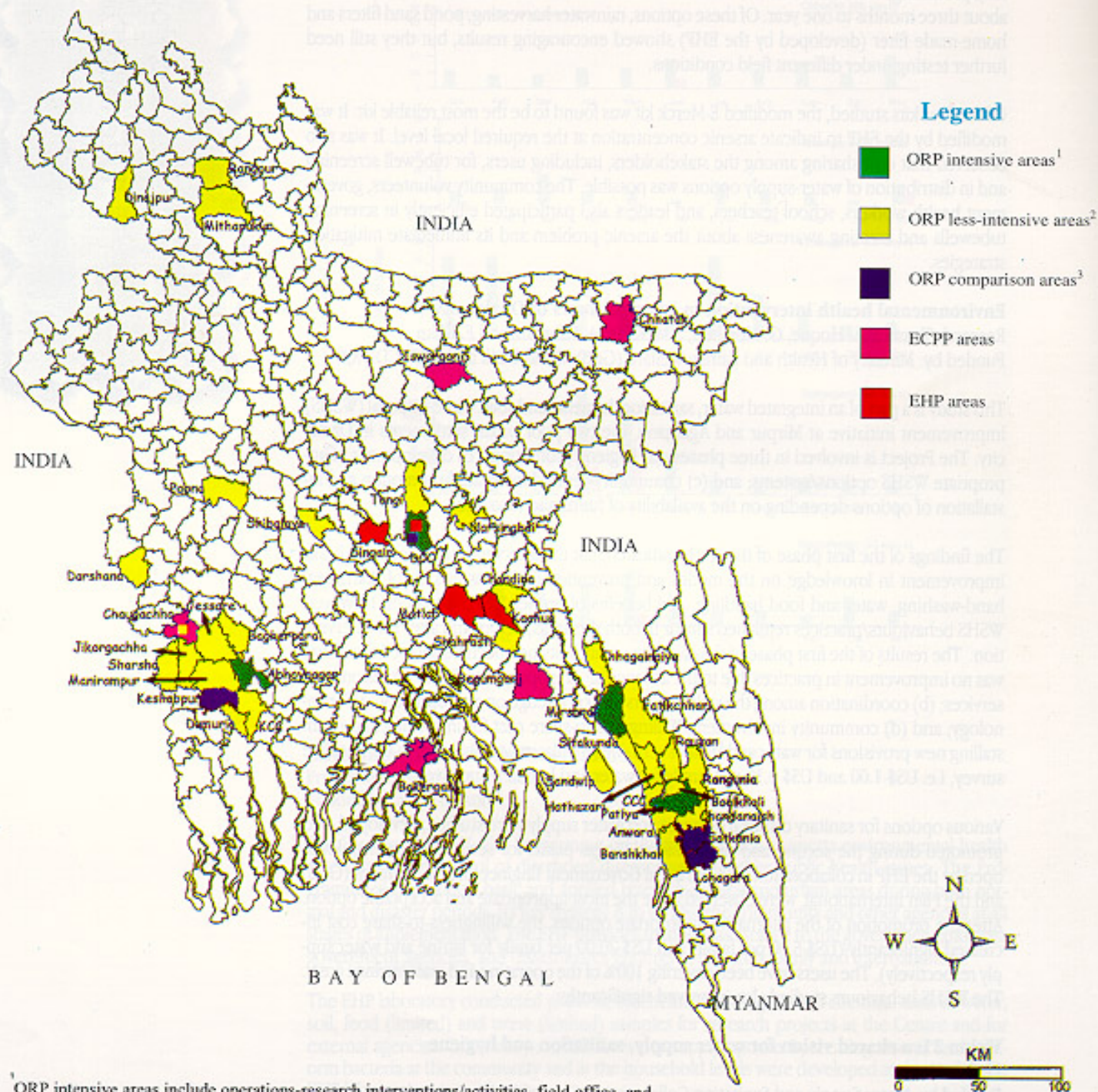
Hygiene practices in Bangladesh: situation analysis

Research Team: B.A. Hoque and G. Morshed

Funded by: The Royal Danish Embassy

Recent evaluations of the rural water supply and sanitation (WS) programme indicated that most efforts were dedicated to promote the use of clean water and less to strengthen activities to change other hygiene practices. A situation analysis, conducted by the EHP through an extensive review of literature and selected field visits, revealed that almost all the stakeholders recognized the importance of hygiene. A clear definition of hygiene and the need to create an enabling environment for the targeted people/community were often neglected. Factors, such as lack of a priority-based definition, planning and methodology for hygiene interventions, absence of integrated approaches, and insufficient coordination and collaboration among the stakeholders, contributed negatively to an effective and sustainable improvement in the hygiene practices.

Field Sites of Health and Population Extension Division



¹ ORP intensive areas include operations-research interventions/activities, field office, and surveillance system at 3 rural thanas(sub-districts) in 2 districts and 1 urban thana in Dhaka city

² ORP less-intensive areas include operations-research interventions/activities, but no field office and surveillance system at 28 rural thanas in 13 districts and selected areas in 2 city corporations

³ ORP comparison areas include no operations-research intervention, but field office and surveillance system only at 3 rural thanas in 2 districts and 1 urban thana in Dhaka city

LABORATORY SCIENCES DIVISION

Division Director

V.I. Mathan



V.I. Mathan
Division Director

The mission of the Laboratory Sciences Division is to adopt, develop, and use the best scientific technology to address the infectious diseases and related nutritional problems of disadvantaged populations, in partnership with the other divisions of the Centre and with national, regional and international partners that share our commitment to maintain healthy populations. The mandate of the Division is to apply science to alleviate diseases. The Division has 23 scientists, 59 technologists, and 68 support staff. Dr. M. John Albert, Senior Research Microbiologist, left the Centre after over 10 years of valuable contributions.

Division Highlights

- *Vibrio mimicus* and some strains of *Vibrio cholerae* non-O1 were found to act as aquatic environmental reservoirs of the cholera toxin bacteriophage (CTX ϕ).
- Longus, a type IV pilus antigen (CS20), was expressed by 8.5% of 662 enterotoxigenic *Escherichia coli* (ETEC) isolates from patients. This antigen was immunogenic in patients with IgA antibodies in the gut and systemically.
- Tnp ϕ A mutagenesis of *Providencia alcalifaciens* resulted in invasion-deficient mutants that were unable to secrete a 47-KDa protein.
- Diarrhoeagenic *E. coli* and *Shigellae* were detected in the aquatic environment by multiplex PCRs developed in the Division.
- The *V. cholerae* O139 serogroup is undergoing rapid genetic reassortment. Non-toxigenic *V. cholerae* O139 strains were derived from several environmental strains of *V. cholerae* non-O1.
- Analysis of epidemiological data of *Shigella dysenteriae* serotype 1 from South Asia suggested that the next epidemic outbreak due to this pathogen is likely to occur between 2002 and 2004.
- Extensive production of neuropeptides and neuroproliferation in the rectal mucosa of patients with shigellosis confirmed the hypothesis that the enteric nervous system is involved in the mucosal inflammatory response.
- The antimicrobial peptide LL-37 and superoxide dismutase, a zinc-dependent enzyme protecting against oxygen-free radical damage, were downregulated in the rectal mucosa in patients with shigellosis.
- 9.4% of children aged \leq 60 months with *S. dysenteriae* infection developed the haemolytic-uraemic syndrome (HUS), and 56% of children with HUS did not survive.
- The predominant strain of rotavirus during 1996-1997 was G9 (39.1%), of which the majority were P[6]. In 1997-1998, the predominant strain was G1 (31.5%), followed by G non-typable.
- In 1999, 37% of *Neisseria gonorrhoeae* strains were resistant to

ciprofloxacin in contrast to only 11% isolates during 1998.

- An evaluation of the syndromic management of reproductive tract infection in the primary healthcare setting showed that treatment was given inappropriately in 95% of instances.
- The National Sentinel Surveillance for HIV and syphilis showed that, in 1998 in high-risk groups, the prevalence of syphilis was 22.6%, while the prevalence of HIV was only 0.4%. The highest prevalence (2.5%) of HIV was found among injecting drug-users.

ence to alleviate diseases. The Division has 23 scientists, 59 technologists, and 68 support staff. Dr. John Albert, Senior Microbiologist, Left the Centre after over 10 years of valuable contributions.

Major infrastructural changes

An image analysis system, two autoanalyzers, and a haematology autoanalyzer were obtained through grants from the World Bank and the USAID.

Audit of divisional work and plan of action

The active research work of the Division is evidenced by the scope and variety of the projects, the extent of inter-divisional, national and international collaborations, and the publications.

Major projects planned for 2000

The Division plans to:

- expand the work on aquatic environmental pathogens of diarrhoea, using molecular techniques.
- forecast and prevent the next epidemic outbreak due to *S. dysenteriae* type 1.
- undertake a detailed study of immunology and pathogenesis of diarrhoea due to *V. cholerae* and enterotoxigenic *E. coli*.
- undertake a prospective study of reproductive tract infections.
- characterize antimicrobial resistance patterns of *Mycobacterium tuberculosis*.
- undertake studies in preparation for and evaluation of efficacy of a variety of enteric and respiratory vaccines.
- initiate phase-II safety and immunogenicity studies of the oral enterotoxigenic *Escherichia coli* vaccine in children, aged 6 months to 3 years, in the urban slums of Dhaka city.

INFECTIOUS DISEASE PROGRAMME ENTERIC INFECTIONS

CHOLERA AND OTHER WATERY DIARRHOEAS

Epidemiology and ecology of *Vibrio cholerae* in Bangladesh

Investigators: M.S. Islam, S.M. Faruque, F. Qadri, M.J. Albert, A.K. Siddique, M. Yunus, D.A. Sack, R.B. Sack, R.R. Colwell, A. Huq, G. Morris, and I. Longini

Funded by: NIAID, NIH, USA

The following three aspects of this major ongoing study were carried out in the Division: Water, zooplankton, aquatic plants, phytoplankton, and sediment, collected from four monitoring sites at 15-day intervals, were examined by enrichment culture, fluorescent antibody technique (FA), colony-blot hybridization, and polymerase chain reaction (PCR) to detect *V.*

cholerae O1 and O139. *V. cholerae* O1 El Tor, Inaba, and Ogawa were isolated from zooplankton, water hyacinth, and phytoplankton in samples collected during June, September, and November. Viable but non-culturable *V. cholerae* O1 and O139 were detected by the FA technique throughout the year. Molecular characterization of toxigenic and non-toxigenic *V. cholerae* O1 and O139, isolated from patients and environmental samples, identified new clones. Two monoclonal antibodies with the potential for use in rapid diagnosis of *V. cholerae* O1 have been identified, and are being characterized further.

Characterization of epidemic strains of *Vibrio cholerae* O1 and non-O1 based on genetic and phenotypic traits

Investigator: S.M. Faruque

Funded by: USAID

Molecular epidemiological surveillance of *V. cholerae* strains, by restriction fragment length polymorphism of rRNA genes (ribotypes) and genes involved in virulence, showed a continual emergence of new clones characterized by changes in ribotypes, CTX genotypes and antimicrobial susceptibility. Seven different ribotypes have been recognized in the O139 serogroup during the last 7 years, while in the O1 serogroup, only 12 ribotypes have emerged over a 30-year period. This suggests that the O139 serogroup is undergoing rapid genetic reassortment. Non-toxigenic O139 strains were derived from environmental strains of *V. cholerae* non-O1. Thus, the O139 antigen is present in different lineages, and does not identify a unique cluster. The transmission of bacteriophage-encoding cholera toxin (CTX ϕ) to non-toxigenic strains of *V. cholerae* is one mechanism for the emergence of new toxigenic clones. *V. mimicus* strains in the environment can act as a reservoir of CTX ϕ .

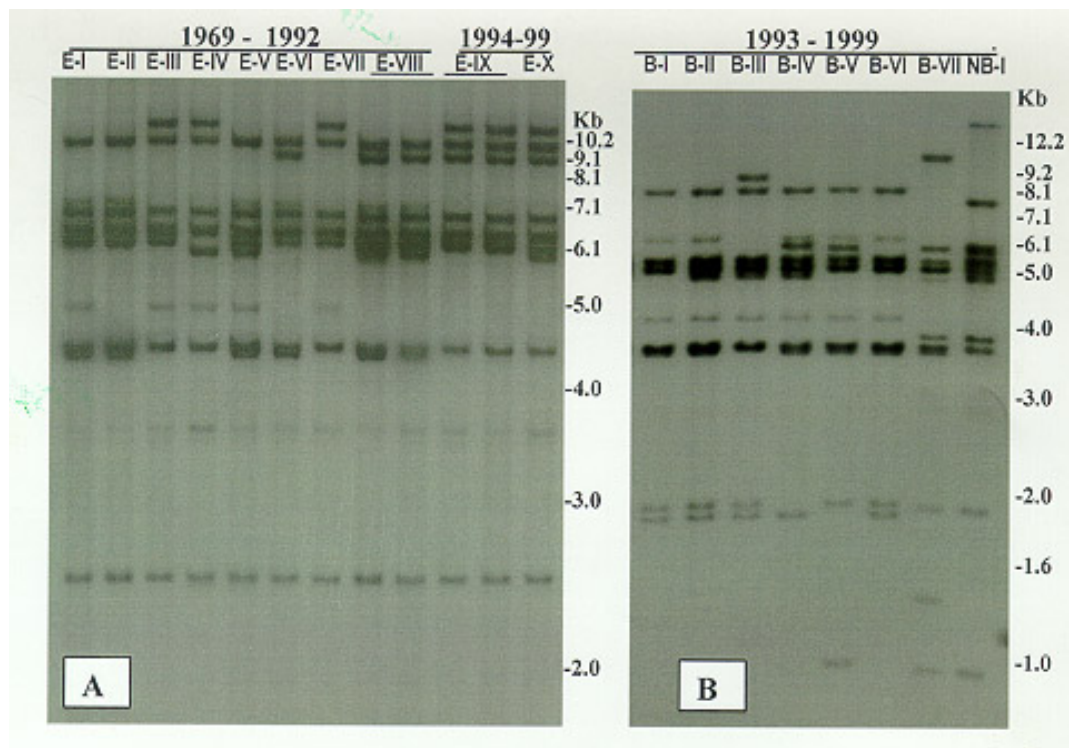


Fig.1. Ribotypes of toxigenic *V. cholerae* strains: (A) *V. cholerae* O1 El Tor
(B) *V. cholerae* O139 Bengal

Are waste stabilization ponds barriers to, or reservoirs of, cholera? How much *V. cholerae* is there in wastewater?

Investigators: M.S. Islam, T. Curtis, and M. Barer

Funded by: DfID, UK

To determine the *V. cholerae* load in wastewater, several techniques, such as most probable number (MPN), FA, PCR, ELISA, and colony-blot hybridization, were applied to wastewater from Pagla (the major sewage outflow point of Dhaka) and Matlab. In the FA test, the count of non-culturable *V. cholerae* O1 and O139 in wastewater from both the sources was 3×10^4 /mL.

Studies on virulence of *V. cholerae* O139 Bengal

Investigators: M.J. Albert, M. Ansaruzzaman, A. Weintraub, F. Qadri, Motiur Rahman, and M. Mathan

Funded by: SIDA/SAREC

Recent isolates of *V. cholerae* O139 were found to be CAMP haemolysin-negative compared to earlier isolates, which were positive. Comparison of clinical data of patients suggested that those infected with CAMP haemolysin-positive isolates had more severe disease compared to those infected with CAMP-negative isolates. Capsulated, serum-resistant strains of *V. cholerae* O139 were translocated across polarized Caco-2 monolayers, but not non-capsulated serum-sensitive strains. Live bacteria elicited TNF α and IL-1 β in the supernatant of the monolayers, but purified capsular polysaccharide or lipopolysaccharide did not.

Role of specific and innate mechanisms of immune response in acute watery diarrhoea due to *Vibrio cholerae* and enterotoxigenic *Escherichia coli*: studies in patients and vaccinees

Investigators: F. Qadri, A.-M. Svennerholm, D. Islam, R. Raqib, N.H. Alam, M.A. Salam, and M. Mathan

Funding: SIDA-SAREC

Cholera: 12 patients with *V. cholerae* O1 and 7 with O139 have been recruited so far. The mediators of the innate defence system, such as lactoferrin, myeloperoxidase, nitric oxide metabolites, prostaglandin E $_2$, and leukotriene B $_4$, were upregulated at the acute stage of infection. The regulation of inflammatory cells is being studied by histochemical, immunohistochemical and electron-microscopic techniques.

Enterotoxigenic *E. coli* (ETEC): The peak antibody-secreting cell response to colonization factors and heat-labile toxin occurs within 48-72 hours of infection in contrast to children with cholera, where it occurs later on day 7. This suggests a secondary response. A monoclonal antibody ICA39 was developed against type IV pilus antigen, longus (CS20). The pilus was found in 8.5% of 662 ETEC isolates from the hospital surveillance. It was found with similar frequency in children and adults, and was commonly co-expressed with CFA/II (61%) or CFA/I (21%). Longus was expressed alone in 18% only. Detailed investigations of patients detected specific IgA antibody to longus in the serum and in the gut.

Phase-I safety and immunogenicity studies have been completed on an oral, killed ETEC plus cholera toxin B-subunit vaccine. Two doses of the vaccine were well-tolerated by the adults (n=38) and children (n=21). Antibody-secreting cell responses to both the vaccine components were higher seven days after the intake of the first dose than after the second dose of the vaccine. Significant increases in plasma and intestinal antibodies were observed to the vaccine components. A positive correlation was found between the antibody-secreting cell and the plasma antibody responses making the latter a useful marker for field-based vaccine studies. These results suggest that a single dose of the ETEC vaccine may elicit significant mucosal immune responses in both children and adults residing in an ETEC-endemic country, such as Bangladesh.

Ecological and epidemiological studies of *Aeromonas* spp. in

Bangladesh with special emphasis on their spread in the environment and humans

Investigators: M.J. Albert, M. Ansaruzzaman, A.S.G. Faruque, M.S. Islam, A.K. Siddique, R. Möllby, I. Kühn, and R.B. Sack

Funded by: SIDA/SAREC

The toxin genes, *act*, *alt*, and *ast*, were tested in 115 isolates of *Aeromonas* from 1,440 children with diarrhoea, 27 isolates from 830 matched controls, and in randomly selected 120 of 600 isolates obtained from 1,200 surface water samples. *Alt* and *ast*-positive organisms were found to be significantly higher in children with diarrhoea and in environmental isolates. The prevalence of *act* was insignificant. These findings suggest that *alt* and *ast* may contribute to the pathogenesis of diarrhoea in children, and *Aeromonas* spp. may be yet another environmental pathogen of diarrhoea.

Molecular characterization of invasion-associated gene(s) in *Providencia alcalifaciens* by *TnphoA* mutagenesis

Investigators: Motiur Rahman and M.J. Albert

Funded by: ICDDR,B

P. alcalifaciens produced diarrhoea in the RITARD assay, and was invasive in gentamicin-Hep-2 cell assay. Random transposon mutagenesis and subsequent screening showed that 4 transconjugates were invasion-deficient, and were unable to stimulate host cell actin condensation. Southern blot hybridization showed that the transposon is located in 4.9, 5.2 and 11.1 kb DNA fragments. Immunoblot experiments, using rabbit polyclonal antibody, showed that invasion-deficient mutants failed to secrete a 47-kDa protein in culture supernatant. The flanking region of the transposon in one of the mutants is currently being cloned.

Simple water filtration for cholera intervention

Investigators: M.S. Islam, M. Yunus, J. Chakraborty, K.M.A. Aziz, A. Huq, E. Russek-Cohen, and R.R. Colwell

Funded by: National Institute of Nursing Research, NIH, USA

Filtration of surface water through eight folds of sari cloth significantly reduces the plankton content. A field trial of the feasibility, acceptability, and efficacy of filtration of water for household use in the Matlab field area, using eight folds of sari cloth and nylon material, has been initiated, aiming at reducing the severity of diarrhoea, number of cases, or both. Biweekly monitoring of the use of filtration, weekly sampling of surface and household water, and monitoring for cases of diarrhoea have been planned as follow-up. The first-phase data showed that both the devices were acceptable.

Effect of vitamin A and zinc supplementation on immune response to oral cholera vaccination

Investigators: M.J. Albert, F. Qadri, A.H. Baqui, M.A. Wahed, G.J. Fuchs, J. Clemens, and R.E. Black

Funded by: Thrasher Research Fund, USA

A four-cell placebo-controlled double-blind field trial to assess the effect of supplementation with vitamin A and zinc on the immune response of children to oral cholera vaccine has completed recruitment and sampling. In total, 673 children in the 2-5-year age group were screened, and 268 of them deficient for vitamin A were enrolled in the study. Post-immunization sampling and laboratory analysis have been completed.

SHIGELLOSIS

Development and application of multiplex diagnostic PCR assays as an aid to clinical and environmental studies

Investigator: S.M. Faruque

Funded by: USAID Multiplex PCR assays for detecting pathogens causing watery diarrhoea and pathogens involved in invasive diarrhoea, developed previously,

were used for examining environmental water samples. These assays detected ETEC and enteropathogenic *E. coli* in the environment. The multiplex PCR analysis of the environmental water samples also revealed the presence of bacteria carrying the genes for enteroinvasiveness as well as Shiga-like toxins, normally produced by strains of *S. dysenteriae* type 1 or *S. flexneri*. Further studies are underway to examine the possible presence of culturable *Shigella* species in environmental water samples.

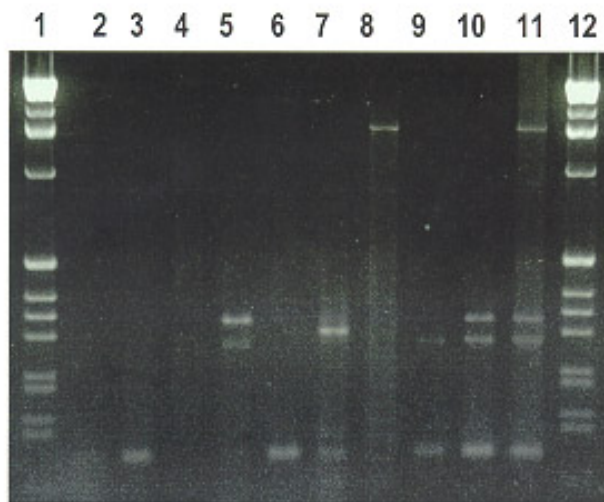


Fig.2. Multiplex PCR assay for ETEC, EPEC, and toxigenic *Vibrio cholerae*: Lanes 1 and 12: marker (1+kb DNA ladder), Lane 2: negative control, Lane 3 through 8: environmental water samples, Lane 9: positive control -ST and LT positive, Lane 10: positive control-LT, ST and BFP positive, Lane 11: positive control -CT, LT, ST and BFP positive

Serological and molecular epidemiology of *Shigella flexneri* isolated in Bangladesh

Investigators: K.A. Talukder and V.I. Mathan
Funded by: ICDDR,B

Twenty percent of clinical isolates of *S. flexneri* during January-December 1999 were untypable by a panel of commercially available antisera for type and group factor antigens compared to only 1.8% of such isolates during 1978-1984. Serotype 2a, the dominant serotype during 1978-1984, was no longer the major serotype. The plasmid profile of the untypable strains was different from that of the typable strains.

Molecular epidemiology of *Shigella dysenteriae* type 1 strains associated with haemolytic-uraemic syndrome and other complications

Investigators: K.A. Talukder, K.A. Jamil, W.A. Khan, M.J. Albert, and V.I. Mathan
Funded by: USAID

In this newly initiated protocol, isolates of *S. dysenteriae* type 1 from patients are being characterized by pulse-field gel electrophoresis, plasmid analysis, and hybridization. The molecular characteristics are being correlated to clinical outcome.

Identification of risk factors and study of the outcome of *Shigella*-associated haemolytic-uraemic syndrome

Investigators: T. Azim, M.A. Salam, T. Ahmed, N.H. Alam, R. Raqib, M. Hanif,

S. Yamasaki, and Y. Takeda

Funded by: Government of Japan through UNOPS and USAID

The study was undertaken to compare the history of antibiotic intake, clinical features, and immune response between children with and without haemolytic-uraemic syndrome (HUS) associated with *S. dysenteriae* type 1 infection to identify risk factors. Children, aged 7-60 months, with confirmed *S. dysenteriae* type 1 infection were enrolled. So far, 33 of the 85 children with dysentery screened had either *S. dysenteriae* type 1 or *stx* in their stools. Sixteen children developed HUS, of whom 9 died. These represent 9.4% of all children diagnosed as having *S. dysenteriae* type 1 infection. The protocol will continue till 30 children with HUS are recruited.

Influence of innate immune mechanisms on stimulation of T cells in shigellosis

Investigators: D. Islam, B. Christensson, N.H. Alam, and M. Mathan

Funded by: SIDA/SAREC

Ten adult males with shigellosis, 10 adult males with acute watery diarrhoea (controls), and 4 healthy adult volunteer controls have so far been recruited for this study. Blood and rectal mucosal biopsies are obtained on day of enrollment and on day 11, 30, and 60 thereafter. *Shigella* antigen-specific antibody-secreting cells were higher in rectal biopsies of shigellosis patients on entry to the study, suggesting secondary stimulation. Total plasma cells were higher in acute watery diarrhoea patients.

Further studies of immunoprotective and immunopathogenic mechanisms in shigellosis

Investigators: R. Raqib, J.A. Andersson, F. Qadri, D. Islam, N.H. Alam, and M. Mathan

Funded by: SIDA/SAREC

The hypothesis to be tested was that the enteric nervous system interacts with the immune system in the gut, and influences the local inflammatory and immunoregulatory functions in acute shigellosis. An extensive production of neuropeptides and neurotransmitters, substance P, vasoactive intestinal peptide, bradykinin, histamine, and serotonin by various types of inflammatory cells was observed in the rectal tissues in the acute stage of shigellosis. This correlated to the severity of inflammation in the rectum. Extensive neuroproliferation was also evident in the rectal mucosa during the acute stage of the disease.

Detailed study of humoral and cellular immune responses in children with primary infection due to *Shigella* species

Investigators: R. Raqib, D. Islam, M.J. Albert, and N.H. Alam

Funded by: WHO

Children, aged 2-10 years, infected with *Shigella* species had a significantly lower concentration of antigen-specific immunoglobulin G and A subclasses in serum compared to adults aged 18-45 years, although the kinetics were similar. Frequencies of antigen-specific antibody-secreting cells in the children were 6% of the total antibody-secreting cells, whereas in adults the specific response was 15% of the total responses. The study will continue to elucidate the differences in the response between children and adults with shigellosis.

Can the next epidemic outbreak due to *Shigella dysenteriae* serotype 1 be predicted?

Investigators: V.I. Mathan, A. Hossain, and S.M. Faruque

Funded by: ICDDR,B

An analysis of the available data from the Indian subcontinent on *S. dysenteriae* type 1 infections showed that there were three different periods of epidemic outbreaks, such as 1972-1973, 1983-1984, and 1993-1994. The epidemiological evidence suggests that the outbreaks were water-borne. Each outbreak was preceded by the ratio of *S. dysenteriae* type 1 to *S. flexneri* in

clinical isolates in hospitals gradually approaching one and the emergence of new plasmid-mediated antimicrobial resistance in *Shigellae*. Based on this, the next epidemic can be predicted to occur between 2002 and 2004.

VIRAL DIARRHOEAS

Studies in preparation for introduction of rotavirus vaccines for routine childhood immunization in Bangladesh

Investigators: T. Azim, L. Unicomb, G. Podder, M.A. Salam, J. Gentsch, and R.I. Glass

Funded by: USAID Significantly more children, aged 7-24 months, with diarrhoea due to rotavirus have ³ 4-fold rise to rotavirus-specific IgA1 and IgG3 titres in blood than children with watery diarrhoea due to other causes. Hospitalized children with diarrhoea due to rotavirus were found to be better nourished when compared to hospitalized children with diarrhoea due to other causes. A total of 1,534 rotavirus strains, circulating in Bangladesh from 1992 to 1998, were characterized. G9 strains emerged in 1995. In 1996 and 1997, G9P[6] was the predominant strain, whereas in 1997-1998, the predominant strain was G1 (31.5%), followed by G non-typable. In 1998, a large proportion of the strains were G non-typable.

Cellular and humoral immune responses to rotavirus infection in Bangladeshi infants and relevance to rotavirus vaccine studies

Investigators: T. Azim, M.A. Salam, G. Podder, M.A. Wahed, and S.M. Faruque
Funded by: USAID

This study is aimed at describing the immune response of Bangladeshi children with natural rotavirus infection and the relationship between malnutrition, clinical progress, rotavirus excretion, and specific immune responses. For this purpose, children with rotavirus infection are being enrolled and followed up for 3 weeks. Follow-ups on 56 children >75% and 16 children \leq 75% of weight-for-age have so far been completed.

Entamoeba histolytica

Intraspecies variation in *Entamoeba histolytica* and protective immunity with *E. histolytica* infection

Investigators: R. Haque and W.A. Petri, Jr.
Funded by: University of Virginia, USA and USAID

The study was undertaken to analyze the genetic heterogeneity of *E. histolytica* isolates by isoenzyme classification, DNA polymorphism of two single copy genes, and/or polymerase chain reaction ribotyping and to determine if any association exists between the clinical manifestations of amoebiasis and protective immunity. Size and restriction site polymorphism in the repetitive regions in two *E. histolytica* genes, the "serine-rich antigen gene" (SREHP), and the "strain-specific gene" (SSG) are being studied. Distinct differences between the axenic-HM1 isolate of *E. histolytica* and the clinical isolates obtained from Bangladesh were found. It was not possible to amplify the SREHP gene in all clinical isolates.

Field studies of human immunity to amoebiasis in Bangladesh

Investigators: R. Haque and W.A. Petri, Jr.
Funded by: NIH, USA

In an urban slum area of Dhaka, 1,164 children, aged 2-5 years, have been examined for *E. histolytica* infection by testing stools and blood. Of these children, 50 excreted *E. histolytica* cysts in stool samples, and 171 were positive for anti-*E. histolytica* antibody in blood. Two cohorts of 140 children matched for age, sex, and residential area are being monitored for *E. histolytica* infection, invasion, and immune response. The first cohort will comprise 140 children with serologic evidence of prior *E. histolytica* infection with or without *E. histolytica* cysts in stool, and the second cohort will also comprise 140 children without serologic evidence of prior *E.*

histolytica infection and without any *E. histolytica* cysts in stool. These children are being monitored for the next 3 years to determine the role of acquired immunity to *E. histolytica* in human infection.

RESPIRATORY TRACT INFECTION

Surveillance of invasive *Streptococcus pneumoniae* (Spn) and *Haemophilus influenzae* (Hi) diseases in Bangladeshi children and antimicrobial resistance and serotype patterns of Hi and Spn isolates in Bangladesh

Investigators: Mahbubur Rahman, A.H. Baqui, and S. Hossain

Funded by: USAID So far, 261 pneumonia cases and 51 meningitis cases have been enrolled. A bacterial pathogen was detected in 38 of the 261 (14.56%) pneumonia cases by blood culture. *S. pneumoniae* and *Haemophilus* were detected in 6 and 4 pneumonia cases respectively. *Acinetobacter* and *Moraxella* were also detected in 8 and 2 cases respectively. A bacterial pathogen was isolated in 15 (29.4%) of the 51 meningitis cases. *H. influenzae* type b, *S. pneumoniae*, and *Neisseria meningitis* were detected in 8, 4, and 1 meningitis case(s) respectively. Twelve isolates of *H. influenzae* type b were resistant to ampicillin, cotrimoxazole, and chloramphenicol, whereas all *H. influenzae* type b isolates were susceptible to ceftriaxone. All *S. pneumoniae* isolates were susceptible to penicillin.

Immune responses in children with both acute lower respiratory tract infection and diarrhoea

Investigators: D. Islam, A. Brooks, R. Raqib, M.A. Salam, and Nazmunahar
Funded by: USAID

Twenty-one children, aged 2-36 months, with clinical evidence of pneumonia and diarrhoea, 21 matched children with only diarrhoea, 11 children with only pneumonia, and 15 apparently healthy children have so far been recruited. In children with pneumonia, only 4 pathogens were isolated in blood culture, but various pathogens were cultured from nasopharyngeal aspirates. Clinically, children with pneumonia were prone to repeated episodes with 25% of the same children having pneumonia two months after the initial diagnosis. The majority of the children were malnourished.

Detection of *Streptococcus pneumoniae* and *Haemophilus influenzae* type b directly from blood and cerebrospinal fluid by multiplex polymerase chain reaction

Investigators: Mahbubur Rahman, S.S. Mohsin, and M. Yeasmin
Funded by: ICDDR,B

A multiplex PCR, based on amplification of the pneumolysin gene of *S. pneumoniae* and *bexA* gene of *H. influenzae* type b, was compared with blood culture. In 160 samples from patients with pneumonia, PCR was positive for *S. pneumoniae* in 11 of the 12 culture-positive samples and detected a further 3 cases that were culture-negative.



*Automated Hematology analysis in the
Clinical Pathology laboratory*

Ten of the 10 culture-positive *H. influenzae* and a further 4 culture-negative cases were also detected by PCR. In 90 patients with meningitis, PCR of cerebrospinal fluid samples identified all 9 *H. influenzae* type b culture-positive samples and a further 5 culture-negative samples. PCR also detected 3 *S. pneumoniae* infections that were culture-positive.

REPRODUCTIVE TRACT INFECTION

Sexually transmitted infections/reproductive tract infections in a basic healthcare clinic in Dhaka (1996-1998)

Investigators: J. Bogaerts, J. Ahmed, N. Akhter, N. Begum, M. van Ranst, and J. Verhaegen

Funded by: BADC

A total of 1,879 consecutive married women, who attended a basic healthcare clinic for a variety of services, were examined for vaginal discharge.



*Computerized image analysis in the
Immunology laboratory*

The overall prevalence of *N. gonorrhoeae*, *Chlamydia trachomatis*, and *Trichomonas vaginalis* infection was 0.5%, 1.9%, and 2.0% respectively. Eight percent of the women showed yeast cells in the vaginal fluid, and 20% had Gram-staining compatible with bacterial vaginosis. *T. vaginalis* (7% vs 1%), yeast cells (21% vs 6%), and bacterial vaginosis (29% vs 19%) were more frequently observed among women with, than without, vaginal discharge on speculum examination, whereas no difference was observed for gonococcal/chlamydial infection (2.6% vs 2.1%). The positive predictive value of the WHO algorithm for gonococcal/chlamydial infection was very low, and resulted in a 95% over-treatment for cervicitis. Incorporating indicators of infection did not improve the performance of the algorithm.

Aetiology of male genital ulceration

Investigators: J. Bogaerts, M. Hoque, T. Azim, M.S. Khan, Motiur Rahman, E. van Dyck, and J. Verhaegen
Funded by: BADC

One hundred three consecutive men attending the Dhaka Medical College Hospital STD clinic with history of genital ulcers were included in this study. Clinical diagnoses were: scabies (n=49), chancroid (n=30), syphilis (n=12), genital herpes (n=8), donovanosis (n=1), and undetermined (n=3). Laboratory diagnoses were: chancroid (n=59), syphilis (n=7), genital herpes (n=2), chancroid+syphilis (n=4), chancroid+herpes (n=4), and no diagnosis (n=27). Thirty (61%) of the 49 patients clinically diagnosed as having genital scabies had a laboratory diagnosis of chancroid. A detailed prospective study is being initiated.

Prevalence of ciprofloxacin resistance in *N. gonorrhoeae* isolated from female sex workers in Bangladesh

Investigators: Motiur Rahman, S.A. Khan, and M.J. Albert
Funded by: ICDDR,B

Antimicrobial susceptibility to ciprofloxacin of *N. gonorrhoeae* isolates from street-based female sex workers during 1997 was compared with isolates from 1998-1999. Of the 153 isolates from 1998-1999, 37% were resistant, and 7% had reduced susceptibility to ciprofloxacin compared to 11% resistant and 26% with reduced susceptibility among isolates from 1997 (n=94). Of the isolates (n=29) collected from female sex workers residing in organized brothels outside Dhaka during 1999 (kindly provided by Prof. Nazrul Islam), only 24% were resistant to ciprofloxacin.

Prevalence of treatment failure due to ciprofloxacin and ceftriaxone in gonorrhoea among Bangladeshi female sex workers

Investigators: Motiur Rahman and S.A. Khan
Funded by: SDC

Recent data from the Centre's laboratory indicate that about 37% of the *N. gonorrhoeae* isolates from female sex workers in Dhaka are resistant to ciprofloxacin, and may account for treatment failure. The prevalence of treatment failure to ciprofloxacin is being compared with ceftriaxone among female sex workers.

Field evaluation of multiplex PCR-based diagnosis for control and prevention of sexually transmitted infection/reproductive tract infection among female sex workers

Investigators: Motiur Rahman, M.A. Quaiyum, and A. Hossain
Funded by: Government of Bangladesh and USAID

Diagnosis of sexually transmitted infections (STIs) and reproductive tract infections (RTIs) is a major problem in STI/RTI and HIV/AIDS intervention programmes. Two sets of multiplex PCR are currently in the process of development for diagnosis of genital ulcer diseases, such as *Treponema pallidum*, *Haemophilus ducreyi*, and herpes simplex virus, and urethral and

genital discharge (*N. gonorrhoeae*, *C. trachomatis*, and *T. vaginalis*).

OTHER PROTOCOLS

Molecular characterization of *Helicobacter pylori* strains isolated from patients with duodenal ulcer and gastric cancer and from asymptomatic carriers

Investigators: Motiur Rahman, M.J. Albert, S. Sarker, F. Qadri, S. Normark, and L. Engstrand

Funded by: SIDA-SAREC Thirty-one *H. pylori* strains, isolated from patients with duodenal ulcer, gastric cancer, and non-ulcer dyspepsia, were characterized for virulence factors by studying *cagA* and *geno*-typing of *vac* gene. Seventy percent (17/24), 80% (4/5), and 50% (1/2) of the isolates from duodenal ulcer, non-ulcer dyspepsia, and gastric cancer patients respectively were *cagA*-positive. *mls*vac allele was expressed in 40% (10/24) and *m2s2* in 30% (7/24) of the isolates from duodenal ulcer patients, and 30% (7/24) had mixed infection expressing both *mls1* and *mls2* allele. *mls*vac allele was expressed in 20% (1/5), *m2s1* in 40% (2/5), *mls2* in 20% (1/5), and *m2s2* in 20% (1/5) of the isolates from non-ulcer dyspepsia patients.

Energy-dense supplementary food for malnourished children

Investigators: M.A. Wahed, I. Hosain, and S. Ahmed

Funded by: BINP-ORP and World Bank

The effect on energy intake of the addition of amylase-rich flour (ARF) to liquefy the energy-dense food supplement (SF), used at the Community Nutrition Centres (CNCs) under the BINP, was studied in Narshingdi thana. Each of the 9 CNCs was randomly allocated to study diet (SF+ARF), control diet I (usual SF), and control diet II (usual SF with additional water to make it liquid). The total intake was significantly higher in children receiving the amylase-rich flour (33.9 ± 8.2 g) compared to the control diet I (25.6 ± 6.7 g) and



Scientists from laboratories in Nepal participating in antimicrobial resistance programme during their hands on training at ICDDR,B

control diet II (30.2 ± 8.3 g). Ninety-five percent of the mothers felt that the trial diet with ARF was better. The additional cost of ARF is only Tk 0.25 per feed.

EMERGING AND RE-EMERGING INFECTIONS The Division provides necessary laboratory facilities for the ongoing surveillance of enteric pathogens (by the Clinical Sciences Division) and for respiratory pathogens. Reports of the prevalence patterns of enteric pathogens are regularly submitted to the Director General of Health Services and to other health authorities in Bangladesh.

Tuberculosis surveillance

Investigators: Z. Rahim and V.I. Mathan

Funded by: USAID

The laboratory at the Government of Bangladesh Tuberculosis Clinic at Shyamoli, Dhaka is being upgraded with technical inputs. The surveillance of antimicrobial resistance in *M. tuberculosis* is likely to start by mid-2000.

Nepal antimicrobial resistance surveillance: a technical cooperation project

Investigators: M.J. Albert, V.I. Mathan, A. Hossain, Motiur Rahman, and A. Ansaruzzaman

Funded by: USAID



Scientists at work in the Molecular Genetics laboratory

Thirteen clinical laboratories were selected for enhancing their capabilities to culture *V. cholerae*, *S. pneumoniae*, *H. influenzae* type b, and *N. gonorrhoeae*. A consensus workshop was held in Kathmandu in early April 1999 with participation from the Ministry of Health of His Majesty's Government of Nepal, 13 laboratories, Environmental Health Project, USA, and ICDDR,B scientists. A draft manual for laboratory work, prepared by the ICDDR,B, was reviewed. One Microbiologist/Technologist from each of the 13 laboratories took part in a 3-week hands-on training workshop at the ICDDR,B held in May and June 1999. By December 1999, about 70 isolates from 4 participating laboratories have been transported to Dhaka for confirmatory tests.

National sentinel surveillance for HIV and syphilis

Investigators: T. Azim, J. Bogaerts, C. Jenkins, and A.M.Z. Hossain

Funded by: UNAIDS, Geneva and DfID, Dhaka

The first year (1998-1999) of the National Sentinel Surveillance for HIV and syphilis tested 3,871 and 3,886 serum samples respectively. The risk-behaviour groups tested included samples from brothel-based sex workers, street-based sex workers, truckers, injecting drug-users (IDUs), men having sex with men, and STD clinic patients. Of them, 22.6% and 0.4% were,

respectively, syphilis- and HIV-positive. The prevalence of HIV was highest among the IDUs (2.5%), whereas syphilis (56.8%) was highly prevalent among the street-based sex workers. A total of 1,000 consecutive patients under therapy for pulmonary tuberculosis were also tested for HIV, and a prevalence of 0.1% was found. The second year of surveillance has commenced.

THEMATIC WORKING GROUPS AND INTER-DIVISIONAL COLLABORATION

The major research focus of the Division is on a variety of infectious diseases of primary importance to disadvantaged populations. Fifteen of the 34 projects reported here have only an infectious diseases focus and one nutrition. The other 20 projects are infectious disease projects with a major component in one of the other working group themes (case management 4, environmental health 2, health systems research 2, reproductive health 6, vaccine evaluation 6). The Division has been collaborating actively with other scientific divisions of the Centre in carrying out these 34 protocols (CSD 16, HPED 5, PHSD 7), and in addition, the Division scientists are co-investigators in 7 other protocols primarily housed in other divisions.

CLINICAL LABORATORY SERVICE PROGRAMME The Clinical Microbiology, Clinical Pathology, and Clinical Biochemistry Laboratories in Dhaka and the Matlab Clinical Laboratory provided diagnostic help for patients at the Dhaka and Matlab hospitals, for referred patients, and for several research protocols. There is an active in-service training programme and a provision for training individuals sent by others organizations. The table summarizes the work output of this programme. The outpatient service facility continued to earn a significant amount, and is valued by the public because of the quality-assured results provided. During the year, 230 bags of blood were purchased, and 96 bags were used in the two hospitals. On screening, 78 bags were found to be unsuitable for use.

Clinical Pathology Laboratory

The laboratory carried out 130,359 tests on 62,678 specimens. The newly-acquired Haematology analyser will facilitate the work in this area. The laboratory continued to be assessed as excellent by the external quality-assurance programme.

Clinical Microbiology Laboratory

A total of 31,356 specimens were processed for identifying pathogens. The most common isolate from blood culture continued to be *Salmonella typhi* (176 of 4,867 cultures). The laboratory was assessed as being within the 95% confidence interval by the WHO external quality-assurance scheme.



Autoanalyzers improve efficiency and accuracy in the Nutritional Biochemistry Laboratory

Clinical Biochemistry Laboratory

In total, 121,093 assays were done on 32,669 specimens. The internal quality-assurance programme ensured that the laboratory is assessed as in the grade-1 standard by the WHO external quality-assurance scheme.

Matlab Clinical Laboratory

A total of 15,397 tests were done on 12,356 specimens, of which microbiological cultures were done on 4,772 specimens. *V. cholerae* and other vibrios continued to be the major isolates.

Table. Activities of Dhaka clinical laboratories in 1999

Activity	Clinical Pathology	Clinical Biochemistry	Clinical Microbiology
No. of total specimens processed	62,628	32,665	31,356
No. of specimens from paying cases	39,754	18,437	16,624
No. of specimens from internal cases	22,874	14,228	14,732
Total no. of tests	130,359	121,093	-
Total workload units	1,099,059	1,043,963	1,361,702
Total work-hours	19,319	18,357	26,136
Workload units per person-hour	56.89	56.87	52.10
No. of research protocols supported	20	20	21
No. of trainees	25	15	33
Total manpower	09	09	13
Scientists and technologists	07	08	09

ADMINISTRATIVE SUPPORT SERVICES PROGRAMME

Logistic Support In total, 3,920 litres of semi-solid culture media, 780 litres of culture broth, 127 litres of carbohydrate fermentation broth, and 35 litres of amino acid broth were supplied to research projects and service laboratories in Dhaka and Matlab. A total of 3,174 samples were lyophilized, and stock cultures were maintained.

Animal Resources

The animal house provided support for research protocols and to a number of national institutions. It has also been used for training visits by other institutions. A total of 362 rabbits, 229 guineapigs, 279 rats, 8,905 swiss albino mice, and 107 balb/c mice, and 24.3 litre of sheep blood were supplied.

Biomedical Engineering

The Cell provided support for the installation, maintenance, and repair of the wide variety of instruments. One staff member was trained as a Radiation Control Officer, and was appointed Laboratory Safety Officer.

Public Health Sciences Division

Division Director

Prof. Lars ÅKe Persson



*Lars ÅKe Persson
Division Director*

The Public Health Sciences Division (PHSD) brings the population perspective to the Centre's mission, and focuses on the development and evaluation of population-based interventions to address major health problems. The Division provides a variety of scientific skills and methods, and also shares a set of values and priorities. Its research programme contributes to understanding how health and diseases are generated in the community, with a focus on vulnerable or disadvantaged groups. It searches for simple, cost-effective approaches that could be widely applied and increase the absolute level as well as an equitable distribution of health among groups. The Division has strong research infrastructures, including provision of primary healthcare services in rural Matlab under Chandpur district and in Chakaria under Cox's Bazar district. In Matlab, the Health and Demographic Surveillance System (HDSS) regularly updates demographic information of about 215,000 people. Besides the Matlab Health Research Programme and the HDSS, the Division has research programmes for reproductive health, child health, social and behavioural sciences, and health economics. The broad range of research interests includes projects addressing epidemiological patterns of ill health, transmission of infectious agents (especially for diarrhoeal and acute respiratory illnesses), public health nutrition, delivery of healthcare, prevention of illness through education, modification of risk behaviours, vaccine trials, and community development.

Division Highlights

- A number of changes have taken place in the international positions of the Division. Prof. Lars Åke Persson from Sweden started his work as Division Director in March (replacing Prof. Patrick Vaughan who left in June 1998). Dr. Kim Streatfield from Australia is the new programme head for the Health and Demographic Surveillance System from July (after Dr. Jeroen K. van Ginneken). Prof. Japhet Killewo from Tanzania has replaced Dr. Andres de Francisco as head of the Reproductive Health Programme. Prof. Mahmud Khan of the Health Economics Programme left in July.
- Further steps have been taken to modernize the HDSS in Matlab. This includes improvements in data-collection modules, coverage, fieldwork, data handling and management. In 2000, there will be a full integration of health (earlier Record-Keeping System) and demographic (earlier Demographic Surveillance System) surveillance in the entire 215,000 population in Matlab.
- Dr. Khalequzzaman of the Matlab Health Research Programme successfully defended his

Ph.D. thesis on diarrhoea and fluid intake at the Johns Hopkins University, and joined the Child Health Programme (CHP) as an epidemiologist. The CHP completed fieldwork of zinc and rotavirus vaccine study, *Shigella* vaccine study, pneumococcal vaccine study, and the first year of a zinc effectiveness study. The CHP team assisted in organizing of an international low birth-weight symposium at the Centre in June.

- The impact survey of the long-term BRAC-ICDDR,B project in Matlab was completed. Analysis of synergy effects of combined health and development interventions has already started, using the HDSS databases and additional information collected by the project.
- Integrated interventions and research on essential obstetric care (EOC) and management of childhood diseases are being implemented in Matlab, with financial support from the European Union, Belgian Administration for Development Cooperation, and WHO. These activities are being performed across Matlab thana. An out-patient department building was completed in Matlab, decreasing the load on the wards. Delivery facilities were improved at the third sub-centre.

The scientific staff comprises public health professionals, epidemiologists, social scientists, and health economists. In 1999, seven personnel of international level, 41 national officers, and 447 staff of other categories, including 145 community health workers, worked for the Division.

Matlab Health and Research Programme

Head: Md. Yunus

The Programme has a research infrastructure, including village-based Community Health Workers (CHWs), four sub-centre clinics manned by paramedics at the union level, and a primary care hospital. It is involved in conducting clinical and epidemiological research, provides health services for diarrhoea, acute respiratory infections (ARIs), malnutrition, and other child health and reproductive health problems, and provides maternity services. It also offers medical back-up support for research projects being conducted in Matlab. Services are provided for common reproductive and child health problems both at the community and at the sub-centre clinics.



Prof. David A. Sack, Department of International Health, Johns Hopkins University School of Hygiene and Public Health, visited Matlab to see for himself the community participation in ICDDR,B Research, before he took up his current position of Director, ICDDR,B

In 1999, 8,951 patients (20% admitted, 80% out-patients) with diarrhoea received treatment at the Matlab health facility. The overall case-fatality rate was 0.5%. The case-fatality rate at the in-patient wards was 2.3%. *Vibrio cholerae* O1 and *V. cholerae* O139 were isolated, respectively, from 201 (10%) and 71 (3.6%) of 1,992 patients from the DSS area.

A total of 9,326 women of childbearing age (15-49 years) and children aged less than 5 years attended the Matlab MCH-FP clinic in 1999. Of them, 7,809 (84%) were treated as out-patients and 1,517 (16%) as in-patients. Of the 509 women admitted, 232 were pregnant and delivered at Matlab. A total of 1008 children were admitted; of them, 697 (69%) were treated for acute lower respiratory tract infections (ALRIs); the case-fatality rate was 0.7%.

Family-planning activities, supported by the Government of Japan, were carried out in the MCH-FP intervention area. The CHWs provided family-planning services primarily at the household level to 19,039 eligible couples. The contraceptive-use prevalence rate (CPR) was 70% in 1999. In total, 10,926 women visited the four sub-centre clinics, and 4,422 visited the Matlab Clinical Research Unit for various health problems.

Safe-motherhood activities promoting facility-based delivery at two of the four community-level sub-centres were carried out where standard delivery facilities (with trained nurse-midwife) were in place for providing quality services. Antenatal and postnatal care was provided from other two sub-centres. Promotional activities were carried out by the CHWs through information dissemination, education and communication, and distribution of a pictorial pregnancy card to all pregnant women who attended a sub-centre for antenatal, delivery and postnatal care. Similar delivery facilities in the third sub-centre (Block B, Khadergaon) were established with support from the community and the BADC; this sub-centre will start to function from January 2000. With this, the plans for establishment of delivery facilities at the community level sub-centres are completed.

During the year, 213 deliveries were conducted in the two sub-centres (Block C and D). In addition, 2,336 pregnant women made 3,233 antenatal and 920 postnatal visits to the four sub-centre clinics. The services were registered and assessed by the Record Keeping System (RKS), which is now becoming an integral part of the HDSS. Ninety-six percent of the infants were immunized with BCG, 87% with third dose of DPT and polio; 93% of the children, aged 9-23 months, against measles, and 98% of the women of reproductive age with two doses of tetanus toxoid. In total, 9,314 children, aged 6 months to less than 5 years, were given vitamin A capsule with coverage of about 98%.

Two thousand three hundred twenty-nine cases of ALRIs were detected (active and passive detection) by both CHWs in the community and paramedics at the sub-centre clinics. Home management of ALRI cases with co-trimoxazole by the CHWs was modified as of August 1999 when a community-based ARI surveillance was launched. In Block A and B, the CHWs continued home treatment for non-severe cases with co-trimoxazole as before, and referred severe cases without giving co-trimoxazole to the Matlab Clinical Research Unit (CRU). In Block C and D, the CHWs referred all non-severe ARI cases to the sub-centre clinics without giving co-trimoxazole and severe cases to the Matlab CRU. The CHWs treated 624 ALRI cases, and referred another 1,503 cases either to the sub-centre clinics or to the Matlab CRU.



At Matlab, ICDDR,B Community Health Workers provide health-related information to the rural community members

During the year, 238,402 ORS packets were distributed for management of diarrhoea at home, and 2,286 safe-delivery kits were produced and distributed to pregnant women in the intervention area. In the four sub-centre clinics, 4,213 infants and 6,029 children, aged 1-5 year(s), were given care for various illnesses.

Studies Conducted

Safety and immunogenicity of tetravalent rhesus rotavirus vaccine with or without zinc supplementation

PIs: M. Yunus, J. Bresee (CDC), and S.E. Arifeen

Funded by: USAID/CHR (JHU) and WHO (Vaccines donated by Wyeth-Ayerst International)

Collaborative institutions: CDC, and Johns Hopkins University, USA

The study is designed to assess the safety and serological response of 3 doses of oral tetravalent rhesus rotavirus vaccine (4×10^5 pfu /dose) in Bangladeshi infants given with or without zinc supplementation. It tests the hypothesis that simultaneous daily zinc supplementation will significantly improve the immunogenicity of the RRV-TV rotavirus vaccine in infants. All field and laboratory work has been completed. The preliminary results showed that the vaccine and the supplement were well-tolerated. The vaccine was immunogenic. The zinc supplementation increased the IgA immune response somewhat, but the increase was likely not clinically relevant. Further data analysis is in progress.

Efficacy of bismuth-subsalicylate in preventing acute diarrhoeal episodes from becoming persistent in rural Bangladeshi children

PIs: H.R. Chowdhury and M. Yunus

Funded by: Proctor and Gamble, USA (Child Health Foundation, USA)

A controlled, randomized, double-blind study in children, aged 4-36 months, with acute diarrhoea was done to determine whether bismuth-subsalicylate (BSS) given orally would prevent the development of persistent diarrhoea. In total, 226 children were given oral BSS (as Pepto-Bismol), 100 mg/kg.day, for 5 days, and 225 were given an equal volume of identical placebo. The groups were comparable on admission to the study, both clinically and microbiologically. No significant difference in the development of persistent diarrhoea was observed between the two groups (8% and 10% respectively). However, the children treated with BSS had a statistically less-severe and less-prolonged illness than the children treated with placebo. Unexpectedly, those treated with BSS gained significantly more weight (2.3%) than those treated with placebo (0.5%, $p < 0.001$). No toxicity of BSS was detected.

Children's fluid intake during diarrhoea: a comparison of questionnaire responses with data from observations

PI: K. Zaman

Funded by: WHO

The study, conducted in Matlab, estimated the proportion of young children who were offered/received increased quantities of fluids during diarrhoeal episodes compared to their healthy periods. The study also evaluated the usefulness of a simple questionnaire to detect changes in children's fluid intake during diarrhoea by comparing the responses of caretakers with data obtained by direct observations. The mean numbers of feedings, breast-feeding episodes, breast-feeding duration, and total fluid consumption were higher during diarrhoea compared to those of healthy periods. During 12 hours of observation, the estimated mean (\pm SD) total fluid intake during diarrhoea was 653.9 (\pm 240.4) mL compared to 399.5 (\pm 133.6) mL during healthy periods ($p < 0.000$). Age of children and schooling of caretakers were associated with the differences in fluid intake between the two periods. At the population level, the simple questionnaire administered to caretakers was found to have high agreement between the reported increase in fluid consumption and the actual increase in fluid intake (defined as >100 mL). At the individual level, the questionnaire was found to be highly sensitive (84.3%) for detecting children whose fluid intake had increased, but was not specific (36.4%) in detecting children who did not consume an increased amount of fluid. A poor agreement ($\text{Kappa} = 0.22$) was found between the caretakers' questionnaire responses and the observed fluid intake.

Evaluation of sustainability of education aimed at increased consumption of green-leafy vegetables by young children and mothers in selected poor village communities in Bangladesh

PI: M. Yunus

Funded by: SDC

The study evaluates the sustainability of a nutrition-education intervention aimed at improved preparation and increased consumption of β -carotene-rich vegetables by young children and mothers as a source of vitamin A. The study was carried out in Matlab. It included 120 households with poor socioeconomic conditions having one child, aged 6-59 months, who were previously given an intensive nutrition-education intervention, and 120 households with similar criteria but without intervention served as controls. A knowledge, attitude and practice (KAP) survey, two rounds of dietary recall survey, and one round of in-depth interview were conducted, and one round of 8-hour participant observation was made in all households. Ethnographic interviews on food behaviour were also conducted in a sample of 20 households to understand the reasons for the difference in sustainability. The field data collection has been completed.

International Training Centre With financial support from the Government of Japan, construction of a three-floor training facility at Matlab was completed in 1999 to offer courses and host conferences and workshops in areas where the ICDDR,B has expertise. The Japanese Ambassador in Dhaka, His Excellency Mr. Yoshikazu Kaneko, inaugurated the building on 19 May 1999. The Centre hosted several local and international courses and seminars, including the international low birth-weight workshop.

The complex is also available for rent by other organizations. Accommodations for a maximum of 24 persons are available in air-conditioned double-bed guest rooms. A large seminar room, two smaller rooms, and computer equipment are available.



A view of the newly-built International Training Centre (ITC) with modern facilities at Matlab



The ITC being inaugurated by the Japanese Ambassador H.E.Mr. Yoshikazu Kaneko on 19 May 1999

Reproductive Health Programme

Head: Md. Yunus (till October 1999), Japhet Killewo (from October 1999) The Reproductive Health Programme is currently working on new projects in areas of safe motherhood, family planning, and sexually transmitted diseases. There are plans to undertake research on adolescent reproductive health and also intervention studies on intrauterine growth and neonatal health. The Programme has made major contributions to the work of the Reproductive Health Working Group, which coordinates reproductive health research at the Centre. Prof. Japhet Killewo is the chairman of the Working Group.

Safe motherhood: essential obstetric care

PI: J. Killewo

Funded by: EU

The project will mainly evaluate the impact of providing EOC interventions in a rural area of Bangladesh. The intervention will establish a functional EOC facilities, including those for conducting caesarean sections at a Thana Health Complex (sub-district), and those for providing basic EOC at the Union Health and Family Welfare Centres. The intervention will also develop an information package to increase awareness of obstetric danger signs among women and decision-makers at the community level. The overall goal of the intervention is to reduce maternal morbidity and mortality. All project activities are designed to take place within the government healthcare system.

Male involvement in reproductive health

PI: J. Killewo

Funded by: EU

Male involvement in reproductive health and family planning is dependent upon an active programme targeting adult male populations. This approach is implemented and evaluated in Matlab, and the lessons will be propagated in other areas of Bangladesh. Preparations for quantitative data collection have been completed, and four male clinics have been set up at Matlab. A programme of education and involvement of males in reproductive health started this year with design of IEC materials to be distributed to clients.

Optimal duration of nutritional supplementation to pregnant mothers and its impact on birth-weight

PI: R. Shaheen

Funded by: BINP-ORP

The study was undertaken to estimate an optimal duration of nutritional supplementation to malnourished pregnant women and to assess the impact of different durations of supplementation

on birth-weight and on maternal nutritional status. The study has been conducted in four unions of Shaharasti thana, Chandpur district. In total, 723 mothers had so far completed supplementation for at least 30 days. Results of the analysis showed that babies born to mothers who received supplementation for ≥ 150 days were 178 g heavier than babies born to mothers who received supplementation for less than 90 days ($p < 0.01$). Reduction in the proportion of low birth-weight in this group was also statistically significant with 36% being low birth-weight compared to 53%, 51% and 50% among < 90 , 90-119 and 120-149-day groups respectively (test for trend $p < 0.01$). Supplementation also significantly improved the body mass index (BMI) of mothers who entered into the programme with lower BMIs compared to the mothers who entered with higher BMIs ($p < 0.01$).

Prevalence and risk factors for STDs among residents at the Tejgaon truck stand in Dhaka

PI: N. Alam

Funded by: SDC

The prevalence of and risk factors for sexually transmitted diseases (STDs) among residents and workers at the Tejgaon truck stand, a busy area in Dhaka city, are being estimated. The study will also determine the healthcare-seeking practices for RTIs/STDs of the study population and the antimicrobial susceptibility of bacterial pathogens. Adult population working at the truck stand, excluding the truck drivers and their helpers, are being included in the study. The study will have three components, such as qualitative part, a survey (clinic- and laboratory-based), and a case-referent approach, all preceded by a census to identify and recruit 1,000 participants for the study. The project is being implemented in collaboration with 'Paricharja', a national-level NGO working on STDs/AIDS interventions in a clinic set-up in the Tejgaon truck stand. The preparatory phase and the census have been completed.

Child Health Programme

Head: Abdullah Hel Baqui The Child Health Programme (CHP) successfully raised funds for two large studies. One was a 5-year study to assess the health and economic impact of the IMCI (Integrated Management of Childhood Illness) strategy (funded by WHO). The second one was a 3-year effectiveness study of *Haemophilus influenzae* type b vaccine (funded by Asian Development Bank through the Urban Primary Health Care Project of the Government of Bangladesh and the Pasteur Merieux Connaught). The Programme successfully completed the fieldwork of a number of studies, including phase-I studies of a live-attenuated *Shigella* vaccine and the first phase of a large zinc-effectiveness study. The goal of the CHP is to contribute to the development of cost-effective child health and survival programmes by enhancing the understanding of causes of childhood morbidity and mortality and by testing cost-effective public-health interventions. The programme has identified the following four broad areas of priority research: infectious diseases, vaccine evaluation, nutrition research, and health systems research.

A community-based, randomized, controlled trial to assess effect of zinc supplementation to Bangladeshi children, aged less than 5 years, during diarrhoea on the clinical course of diarrhoea, subsequent diarrhoea and ARI morbidity, and growth

PIs: A.H. Baqui and R.E. Black

Funded by: USAID/CHR (JHU and ICDDR,B)

This community-based, prospective, randomized, controlled trial is aimed at assessing the effect of two-week zinc therapy for all episodes of diarrhoea in children, aged 3-59 months, on the clinical course of diarrhoea, subsequent diarrhoea and ALRI morbidity, and growth. The hypothesis is that if all episodes of diarrhoea are treated with zinc, the severity and duration of the treated episodes will be reduced. In addition, a positive zinc balance will be maintained in most children, which, in turn, will reduce morbidity and improve the growth and survival of children. Service areas of 30 CHWs at Matlab were randomized to intervention and control with all children (aged < 5 years) with diarrhoea in the intervention areas having access to a 14-day zinc therapy, in addition to oral rehydration therapy (ORT), through the established depot-holders of the Centre. A system for surveillance of morbidity and growth was instituted. One year of intervention and data collection

has been completed. Analysis of the first 10 months of data revealed a marked but statistically non-significant reduction in child mortality in the zinc intervention area. For a conclusive result of the effect of zinc therapy on mortality, the intervention and follow-up were extended for the second year.

A community-based, randomized, controlled trial to assess efficacy of iron and/or zinc or a micronutrient mix supplementation to reduce anaemia and morbidity and to improve growth and development in Bangladeshi infants

PI: A.H. Baqui

Funded by: USAID/CHR (ICDDR,B) and Nutricia Foundation, USA

In a community-based, prospective, double-blind, randomized, controlled trial, the efficacy is being assessed of weekly supplementation of iron, and/or zinc or a micronutrient mix in infants for 6 months beginning at 6 months of age. Five groups: (i) 20 mg iron with 1 mg riboflavin, (ii) 20 mg



*Volunteers of Shigella vaccine trial with the investigators
Drs. A.H. Baqui and Mahbubur Rahman*

zinc with 1 mg riboflavin, (iii) both iron and zinc with riboflavin, (iv) a micronutrient mix, and (v) riboflavin only (placebo) will be studied. The study is being carried out in the Matlab surveillance area of ICDDR,B. The following outcome variables are being measured: (a) iron status, (b) zinc status, (c) copper status, (d) diarrhoeal morbidity, (e) growth, and (f) cognitive, psychomotor, and behavioural development. Efficacy of various types of supplementation on the outcomes of interest will be assessed. The potential additive and multiplicative effects of providing zinc, iron, and other micronutrients will also be assessed.

An out-patient study of safety, dose and immunogenicity of an oral live-attenuated *Shigella flexneri* 2a vaccine candidate (SC602) in a rural community setting in Bangladesh

PIs: A.H. Baqui and D. Isenbarger

Funded by: Walter Reed Army Institute of Research, National Vaccine Program Office, USA, and USAID

Collaborative institutions: Walter Reed Army Institute of Research, USA and Armed Forces Research Institute of Medical Sciences, Thailand

In-patient and out-patient trials were conducted in adults and older children in rural Matlab to evaluate the safety, immunogenicity, transmissibility, and appropriate dose levels of an oral live-attenuated *Shigella flexneri* 2a candidate vaccine (SC602). Three different doses (10^4 , 10^5 , and 10^6) were tested. The preliminary findings showed that the vaccine was well-tolerated even at the highest dose. There was no transmission of the vaccine strain to household and neighbourhood contacts of the vaccinees. Similar trials in young children, the target population for this vaccine, are currently being planned.

Surveillance of invasive *Haemophilus influenzae* and *Streptococcus pneumoniae* diseases in

Bangladeshi children and their antimicrobial resistance and serotype patterns (community component)

PI: A.H. Baqui

Funded by: USAID

This three-year study in 12,500 children (aged <5 years) in Matlab aims to study the epidemiology of invasive *Haemophilus influenzae* and *Streptococcus pneumoniae*-associated infections, to determine the prevalence, patterns, and trends in antimicrobial resistance, and to disseminate relevant information for policy decision.

Immunogenicity of conjugate pneumococcal vaccine in infants of mothers vaccinated with the pneumococcal polysaccharide vaccine

PIs: N.S. Shahid and M. Steinhoff

Funded by: Thrasher Research Fund and USAID/CHR, and Wyeth-Lederle Vaccines Clinical Research, USA

The study will start as soon as the vaccines are received from Wyeth. In the meantime, two addenda to the project were approved: (1) Safety and immunogenicity of early neonatal immunization with the 9-valent conjugate vaccine, and (2) Safety of a single dose of the polysaccharide vaccine at 9 months of age of infants whose mothers received the same vaccine during pregnancy. Addendum two was suggested at a WHO meeting on pneumococcal vaccine held in Geneva in 1999. This suggestion was based on the consideration that the conjugate vaccine may not be available to children of developing countries in the very near future and that the 23-valent polysaccharide vaccine may cover a wider range of serotypes than the conjugate vaccines. Accordingly, 110 mother-infant pairs were randomized to receive either the polysaccharide 23-valent pneumococcal vaccine or the control vaccine in the third trimester of pregnancy (with TT) and at 9 months of age of infants (with measles). The fieldwork has been completed, and data analysis is in progress.

An evaluation of the health and economic impact of Integrated Management of Childhood Illness (IMCI) in Matlab, Bangladesh: a randomized experimental study

PI: S.E. Arifeen

Funded by: WHO

This five-year study, being conducted in Matlab thana, in collaboration with the Government of Bangladesh, will evaluate the health impact and cost-effectiveness of Integrated Management of Childhood Illness (IMCI). Selected government and ICDDR,B first-level facilities of the thana, along with their catchment areas, will be randomly selected for IMCI intervention or control. In the intervention facilities, IMCI-related service delivery will be made available, and referral linkages will be established. In the control facilities and their catchment areas, the existing government and ICDDR,B services will continue. IMCI will be introduced in the control facilities at the end of the project. Data-collection instruments have been developed and pilot-tested, and staff recruitment is in progress.

Health and Demographic Surveillance Programme

Head: Radheshyam Bairagi (until July), Peter Kim Streatfield (since July) The Programme, designed to evaluate the impact of different health and socioeconomic interventions, has two functional units: (1) Health and Demographic Surveillance System and (2) Geographic Information System (GIS). The demographic surveillance in Matlab started in 1966; surveillance of health conditions (record-keeping system) was added on in 1978 in half of Matlab; and the GIS started in 1994. The system for collecting demographic data on more than 200,000 population for over 30 years is the longest-running demographic surveillance system in the developing world.

In 1999, the major activity of the Programme was the "Modernization of the Matlab Health and Demographic Surveillance System (1998-2001) Project", funded by DfID, UK, which is integrating the collection and management of all demographic, health and GIS data. The scientists of the Programme have also undertaken other studies on population, reproductive health, including family planning, maternal and child health

All female CHWs have received training to collect all health and demographic data from January 2000. The same data will be collected in both the parts of Matlab, although the ICDDR,B will only provide services in half of the area, while the government provides services in the other half. Improvements have been made in the data entry and database management systems, resulting in much faster data processing.



Mr. William Gates, Sr., visited Matlab and made a tour to a village to see demographic surveillance activities. He was keen to see ICDDR,B research in rural areas

Abortion dynamics in rural Bangladesh: does an MCH-FP project bring about any change?

PIs: R. Bairagi and M.K. Ahmed

Funded by: WHO and EU (partly)

The results of this study showed that the abortion ratio declined over a decade in the MCH-FP project area in Matlab, but increased sharply in the area where the government provides services. It is concluded that an MCH-FP programme can reduce demand for abortion by addressing the unmet contraceptive need. The study findings also suggest that increasing contraceptive use in the MCH-FP area may substitute family-planning use for abortion.

Fertility transition, contraceptive use, and abortion in rural Bangladesh: the case of Matlab

PI: A. Razzaque

Funded by: Futures Group International, USA

The impact of the availability and quality of family planning services on abortion is being assessed.

Issues relating to the availability of services are being considered both from the perspectives of the clients and the programme. The association between the above factors and abortion, and the association between socio-demographic variables and abortion are being examined.

Use of health services for children's acute illness in rural Bangladesh: patterns and correlates

PI: N. Alam

Funded by: Fogarty Fellowship, USA

The Matlab health and socioeconomic survey 1996 collected data on children's acute morbidity in the past month, health actions taken to combat it, household socioeconomic conditions, and women's empowerment. The results of the survey showed that 10% of the children with acute illness were taken to the trained allopaths (6% to doctors and 4% to paramedics). As illness becomes worse, they were more likely to be taken to the trained allopaths. Caregivers very often used home-care and village doctors (44% and 39% respectively) as a conduit to other outside options, perhaps to minimize the cost of care. Favourable household socioeconomic conditions and easy access to the health facility were associated with the increased use of the trained providers. Empowerment of women was not related to health-service use for sick children, but their participation in NGO activities was related to the increased use of medical care.

Effect of divorce on infant mortality in a remote area of Bangladesh

PI: N. Alam

Funded by: ICDDR,B

The study, carried out at Teknaf during 1982-1987, examined the impact of divorce on neonatal and postneonatal mortality of births born before versus conceived before but born after divorce. Comparison of the risk (odds) of infant death within marriages ending in divorce versus the risk within stable marriages showed that neonatal and postneonatal mortality was more than double among births born after divorce, or within 12 months before divorce compared to those born into an intact marriage. Within marriages ending in divorce, postneonatal mortality was double than that in stable marriages in the period more than 12 months before divorce (no difference in neonatal mortality). An increased risk of infant deaths surrounding divorce may reflect an increased vulnerability of women and children in Bangladesh.

Spouse's prior marital status and divorce in rural Bangladesh

PI: N. Alam

Funded by: ICDDR,B

The study examined the effects of prior marital status of spouse on risk of divorce among 1,762 Muslim marriages occurring in 1982-1983 (followed for 5 years) in Teknaf, an area where divorce, remarriage, and polygyny are common. The risk of divorce was 2.5 times higher for groom's polygynous marriages and 1.6 times higher for brides' remarriages compared to their peer's first marriages. The risk of divorce decreased with the longer duration of marriage. Low-socioeconomic status of groom, illiteracy, early age-at-marriage, and infertility increased the risk of divorce.

Ageing and the aged in Bangladesh: a case of rural Matlab

PI: G. Mostafa (doctoral project)

Funded by: ICDDR,B

Levels of and trends in ageing among the people of Matlab and their living arrangements (1982-1996) were examined. Results of the study showed that proportions of the population, aged 60 years and over, and the old-age dependency ratio are increasing. Co-residence with son and daughter-in-law decreased from 55% in 1982 to 33% in 1996, while living alone or with spouse only increased considerably. Elderly women outnumbered elderly men.

Do daughters also provide old-age security to parents, as do sons?

PI: G. Mostafa

Funded by: ICDDR,B

The aim of the study was to explore whether daughters provided any social security to elderly (60 years and over) parents, particularly women. Analysis of the Matlab data (1982-1992) showed that the beneficial effect of living with a daughter was higher for an elderly woman than for an elderly man. This was viewed as an important potential motivating factor for the preference of daughters.

Desire for children and subsequent abortion in Matlab, Bangladesh

PI: A. Razzaque

Funded by: ICDDR,B

Relationship between desire for children and subsequent abortions in Matlab was investigated. Women, interviewed in the in-depth 1984 and KAP 1990 surveys, were followed for four years to ascertain subsequent pregnancy outcomes. The results showed that the women who did not want any more children had higher odds of abortions than those who wanted more children. The findings suggest that, to reduce abortions and its associated complications, comprehensive family planning need to be targeted for women who want to limit their family size.

Gender and injury-related deaths among population of 10-49 years age group in Matlab: levels, trends, and circumstances

PI: A. Razzaque

Funded by: ICDDR,B

The study reviewed data relating to deaths due to injury in Matlab (1979 to 1998). Injury-related deaths (as % of all deaths) increased significantly in all ages, especially in the 10-49-year age group. In this age group, injury-related deaths increased 2.7 times for males and 3.7 times for females. Of the injury-related deaths, more females than males died of suicide (47% vs 20%), but fewer females than males died from accidents (47% vs 65%), homicide (4% vs 9%), and drowning (3% vs 6%). Circumstances leading to suicide were mainly due to family conflict, and most victims used pesticides that are readily available in the household.

Family size and children's education in Matlab, Bangladesh

PI: A. Razzaque

Funded by: ICDDR,B

Relationship between the family size and the education of children (7-17 years) was examined in the MCH-FP area of Matlab. Education of children was measured in terms of completed years of schooling: class I (aged 7-11 years), class IV (aged 12-17), and class VII (aged 15-17). Unlike in 1982, the relationship between the family size and the children's education was negative in 1996. Boys had more education than girls did in 1982, but this difference disappeared in 1996. The study supports the argument that, with the fertility decline in Bangladesh, children's education would increase, diminishing sex differential in schooling.

Case studies of violent deaths in rural Bangladesh

PI: M.K. Ahmed

Funded by: ICDDR,B

Verbal autopsy data from the demographic surveillance system in Matlab were used for exploring circumstances surrounding female deaths due to domestic violence (1989-1995). Women than men were more likely to commit suicide because of domestic violence.

Risk factors of violent deaths to women of reproductive age in Bangladesh

PI: M.K. Ahmed

Funded by: ICDDR,B.

In this case-control study, women who died due to violence or had other 'natural' deaths were compared with surviving women. Female deaths due to violence decreased with age, and were lower where the age difference of husband and wife was less. There was no relation to marital status. Deaths due to 'natural' causes peaked at the age of 35 years, and were also higher among single women. Female all-cause mortality was higher among women without children.

Defining high-risk areas of endemic cholera with environmental risk factors: implications of GIS

PI: M. Ali (PhD thesis, University of Liege, Belgium)

Funded by: BADC and ICDDR,B

This research aims to identify the high-risk (hot spot) areas of endemic cholera with environmental risk factors. Hospitalized cholera patients from the Matlab research area for the 1983-1987 and 1992-1996 periods, in combination with demographic surveillance and remote-sensing data, were analyzed at spatial scale to identify the risk factors of cholera. Various risk-area models have been tested to suggest a suitable model for an information setting. The research is further extended to understand time geography of cholera and the determinants of cholera-related mortality.

Implications of healthcare provisions on ALRI mortality in Bangladeshi children

PIs: M. Ali, M. Emch, F. Tofail, and A.H. Baqui

Funded by: ICDDR,B

The study evaluated the effects of healthcare provision on mortality due to ALRI in very young children in rural Bangladesh, using GIS. Matlab data (1988-1993) on ALRI-specific mortality for children aged less than two years were used. The focus was on the effectiveness of the community-based ALRI control programme, and on what exogenous factors were working at spatial scales to influence child mortality due to ALRI.

Spatial filtering by a raster GIS: a simplified method for scaling health and environmental data

PI: M. Ali, M. Emch, and J.-P. Donnay

Funded by: ICDDR,B

The aim of this study is to simplify the methodological issues of GIS for scaling health and environmental data. Matlab has been used as an empirical study area, and a raster GIS technology has been pursued to demonstrate the methodological issues.

Social and Behavioural Sciences Programme

Head: Abbas Bhuiya

Funded by: Ford Foundation, USA The programme activities during the year were focused toward achieving the programme mission of institutionalizing social and behavioural science research at the Centre. This was done by carrying out relevant research, providing support to other research activities, staff training, and participating in international activities. In addition to carrying out ongoing research on the impact of poverty-alleviation programme on health and human well-being and community participation in primary healthcare activities, the Programme developed five new research proposals in areas of violence against women, community nutrition, and sexuality; of these, four have been started. The Programme hosted a meeting of the faculty members of the International Course on the Anthropology of Health and Health Care to revise the course curriculum for its 5th course to be organized by the Centre in collaboration with BRAC. Three personnel started their higher studies in London and Amsterdam during the year.

Impact of social and economic development programmes on health and human well-being: the BRAC-ICDDR,B Matlab Joint Project

PIs: A. Bhuiya and A.M. Chowdhury (BRAC)

Funded by: Ford Foundation and International Center for Research on Women, USA

The impact-evaluation survey of the poverty-alleviation programme, which was deferred last year, has been carried out. In total, 12,000 households were visited. Information on economic conditions, morbidity, reproductive and health-seeking behaviours, and nutritional status was collected. Findings of this survey when compared with the baseline survey carried out in 1994 will provide opportunities to assess the impact of the poverty-alleviation programmes on various aspects of human well-being. With the aim to use the BRAC's women groups for the promotion of reproductive, sexual, and family health, an exploratory study on sexual issues and RTIs/STIs were

carried out during 1998. Based on its findings, a training module was developed, and was used for training the healthcare providers and other relevant community members. Its impact on family, sexual and reproductive health was also studied. The study generated important information, and provided insights which will be useful to design and implement reproductive health interventions.



*Newly-constructed office-cum-training building of
Chakaria Community Health Project*

Improvement of health through a community development-oriented programme in rural Bangladesh: the Chakaria Community Health Project

PI: A. Bhuiya; Technical Adviser: A. Beerling

Funded by: Swiss Red Cross and Dutch Red Cross and German Red Cross Societies

The Project is a continuous effort to improve community health through promotion of preventive measures and other health initiatives by indigenous village-based self-help organizations. The major activities during the year included the development of a system of community financing for curative services. Currently, there are eight village health posts providing a platform for health activities. Construction of own office building for the Project was completed in 1999.

Action research into positive deviance in child nutrition in rural Bangladesh

PIs: R.T. Naved and S. Rasheed

Funded by: World Bank

This study has been undertaken to explore the caring practices contributing to the nutritional status of children, aged 24 months or less, to design and implement programmes based on the study findings, and to assess the impact. The study blends quantitative and qualitative research methods.

Situation assessment of male-to-male sex in Chittagong for STD/HIV intervention

PIs: S.I. Khan and A. Bhuiya

Funded by: SDC

The popular notion of "only heterosexual transmission" of STDs/HIV actually overlooks the holistic and critical dynamics of STD/HIV transmission in a society, especially where male-to-male sexual behaviours (MSM) are socio-religiously stigmatized and hence completely denied and hidden. This study aims to analyze the present situation of male-to-male sex in Chittagong city. Both qualitative and quantitative research methods are being applied to gather information on MSMs with an ultimate objective to translate the findings into STD/HIV intervention programmes.

Explanatory model of risk perception: adolescents of Bangladesh

PIs: L. Muna, T. Sharmin, and A. Bhuiya

Funded by: SDC

The aims of this study are to examine adolescent sexuality in the cultural context of Bangladesh and to assess the risk of adolescents in relation to HIV/AIDS. Data are being collected, using in-depth and key-informant interviewing methods from young men and women aged between 14 and 22 years, parents, guardians, and teachers of the adolescent population.

Use of direct recording scale to involve mothers in monitoring growth of children in rural Bangladesh

PIs: A. Bhuiya and S. Rasheed

Funded by: World Bank

The direct recording scale (DRS) is specially designed to enable mothers in weighing their children without having to plot the chart or being literate. The study aims to document the operational aspects of using the DRS at the field site (Chakaria) and its impact on nutrition-related behaviour. The study subjects will comprise children aged less than two years and their mothers.

Health Economics Programme

Acting Head: Abbas Bhuiya The Health Economics Programme (HEP) was established in December 1996. The DfID, UK, BADC (Belgium), IDRC (Canada), and ICDDR,B provided financial support to establish the Programme. Its overall goal is to establish and strengthen a resource unit at the Centre for conducting policy-oriented research and training with emphasis on application of state-of-the-art technical tools and methodology.

Healthcare-seeking behaviour and willingness and ability to pay for health services delivered through NGO-run facilities of Urban Family Health Partnership

PIs: S. Ahmed, M.M. Khan, and Z. Quayyum

Funded by: USAID

The purpose of this research is to assist the UFHP NGOs in developing strategy for pricing policy for the delivery of the ESP. The specific parameter that will be assessed includes the implication of the existing user fees in the UFHP NGOs and its implication on the use and quality of care, healthcare-seeking behaviour of clients, willingness and ability of clients to pay for different components of the ESP services. A household survey has been conducted in the catchment area of the UFHP static clinics served by 10 static clinics and its satellite clinics located in urban areas of Bangladesh. Data collection has been completed.

Healthcare-seeking behaviour and willingness and ability to pay for health services and costing of ESP components delivered through NGO-run facilities of Rural Service Delivery Partnership

PIs: S. Ahmed, M.M. Khan, and Z. Quayyum

Funded by: USAID

The existing user fee system as a cost-recovery measure has been examined, aiming at mobilizing additional resources for the delivery of the ESP by the RSDP NGOs. The study will also focus on efficiency of resource allocation as inputs used for the production and delivery of different components of the ESP. It will particularly assess the implication of pricing policy on the use and quality of care, health-seeking behaviour of clients, willingness and ability of clients to pay, and cost of providing different components of the ESP services. A household survey has been conducted in the areas served by 18 RSDP static clinics and its satellite clinics located in the rural areas of Bangladesh. The study will calculate the overall cost of providing the ESP services at the static clinics (health centres) by analyzing the health centre expenditure data and by observing various aspects of the facility and personnel. It will also examine the time allocation of health personnel to various ESP services in the static and satellite clinics.

Cost analysis of health facilities of Bangladesh Women's Health Coalition

PIs: M.M. Khan, Z. Quayyum, S. Khan, and K.K. Shaha

Funded by: Bangladesh Women's Health Coalition

This study will examine allocation of resources to the health facilities of the Bangladesh Women's

Health Coalition (BWHC). It will also examine the resource use in different activities, and will calculate the overall cost of six health centres by analyzing the expenditure data and by observing the various aspects of the facility. Time allocation study for the use of personnel time has been conducted to assess the personnel time and cost for various health services provided by the BWHC centres. The unit cost of providing the ESP services at the BWHC facilities will be estimated.

Short course on clinical economics

The HEP organized a short course on Clinical Economics during May 1999. Twelve participants attended the course from government organizations in Bangladesh, NGOs, research organizations, universities, and ICDDR,B.

Director's Division

Interim Director: George J. Fuchs (until 30 September)

Director: David A. Sack (from 01 October)

The Director's Division comprises Personnel Department, External Relations and Institutional Development Office, Finance Department, Training and Education Department, Dissemination and Information Services Centre, Computer Information Services, Administrative Services, and Staff Development office. The Division provides support to scientific divisions to carry out research activities effectively. At the end of 1999, the Division had a total staff of 172 personnel (5 international-level staff, 24 national officers, 123 general services staff, and 20 other categories, including trainees and employees under contractual service agreement).



George J. Fuchs
Interim Director
(till 30 September)

Division Highlights

- Prof. David A. Sack joined the Centre in October as its new Director.
- Hon'ble Prime Minister of Bangladesh Sheikh Hasina visited the Centre to address the Inaugural Ceremony of the 8th ASCON and Celebration of Twentieth Anniversary of the Centre. About 300 biomedical and social science researchers, health professionals, policy-makers, and health administrators from national, regional and international institutions attended the 8th Annual Scientific Conference.
- Revenue contributions increased by US\$ 1,875,578 over 1998. Contributions to projects increased by US\$ 1,565,076, and contributions for central activities increased by US\$ 310,502. All these resulted in an operational surplus of US\$ 263,132 (US\$ 817,632 deficit in 1998).
- Considering the role of the Centre during the 1998 floods, the Government of Bangladesh released Tk 1 crore (over US\$ 200,000).
- The Government of the Netherlands returned as a core donor.
- US\$ 2.97 million was spent to procure scientific and other materials from home and abroad.
- 18 national and international training courses were organized. 292 scientists, physicians, health administrators, health personnel, and trainers from 28 countries participated in these courses. Skills of 173 personnel of



David A. Sack
Director
(from 01 October)

various levels were enhanced under the staff development programme.

- The Centre's scientists published 104 original papers, review articles, book chapters, letters, etc., in addition to 36 working papers, scientific reports, and special publications published internally.
- Over 55,000 copies of the Centre's various publications, highlighting the findings of research conducted by the scientists of the Centre, were distributed and/or mailed all over the world. The Journal of Diarrhoeal Diseases Research is being re-launched as the Journal of Health, Population and Nutrition.
- The Centre's library added 1,000 new books, bound journals and reprints, and 349 current periodicals. 14,128 readers availed of the library facilities.
- A V-SAT satellite system is being installed at the Centre's premises to ensure faster access to the international information system.
- At the end of 1999, the Centre had a total staff of 919 personnel, in addition to 137 Community Health Workers and 71 Health Workers. Eight personnel retired from the Centre.

PERSONNEL DEPARTMENT

Chief Personnel Officer: Wahabuzzaman Ahmed At the end of 1999, the Centre had 919 personnel, in addition to 137 Community Health Workers and 71 Health Workers. Of the total 919 personnel, 15 were of international level (3 on secondment), 164 national officers, and 740 in the general services category.

Arrival, Departure, Retirement, and Obituary: Dr. David Allen Sack, Professor, Department of International Health, and Head, Vaccine Testing Unit, Johns Hopkins University, joined the Centre as its new Director on 01 October 1999. Several other key personnel who joined in 1999 included: Prof. Lars Åke Persson, Division Director, PHSD (on 1 March); Dr. Peter Kim Streatfield, Head, Health and Demographic Surveillance Programme (on 18 July); Prof. Japhet Z.J. Killewo, Head, Reproductive Health Programme (on 27 October); and Mrs. Judith G. Bennett Henry, Executive Assistant to Director (on 01 October).

Key personnel who left the Centre in 1999 included: Mr. Ngudup Paljor, Administrative Director, ORP, HPED (on 15 January); Dr. Aye Aye Thwin, Health Policy Analyst, HPED (on 15 January); Dr. L.A. de Francisco, Head, Reproductive Health Programme and MCH-FP Physician, PHSD (on 17 January); Ms Julie A. Banfield, Executive Assistant to Director (on 22 February); Dr. Jeroen J. Van Ginneken, Head, Health and Demographic Surveillance Programme, PHSD (on 31 October); Dr. M. Mahmud Khan, Health Economist, PHSD (on 26 July); Dr. M. John Albert, Research Microbiologist, LSD (on 31 October); and Dr. Bilqis Amin Hoque, Environmental Specialist, HPED (on 31 December). During the year, 8 personnel retired from the Centre. With deep sorrow, we record the deaths of 5 personnel during 1999, who made valuable contributions to the Centre.

Long service award: During 1999, the following four personnel, who completed 30 years of service in the Centre, were awarded a pay increase: Mr. Khorshed Alam, LSD; Mr. Lal Miah, MHRP; Mr. Khalilur Rahman, MHRP; and Mr. Monoranjan Das, CHRU, MHRP. Besides, 17 personnel, who completed 25 years of service in the Centre, were also awarded a pay increase.

Staff Clinic: The Staff Clinic provided improved healthcare services to the staff and their dependants. In 1999, 16,839 patient visits took place in the Staff Clinic; 473 personnel were vaccinated; and 280 were provided with family planning services.



Sheikh Hasina, Hon'ble Prime Minister of the Government of Bangladesh, inaugurating the 8th ASCON and the week-long events of the 20th Anniversary of ICDDR,B

EXTERNAL RELATIONS AND INSTITUTIONAL DEVELOPMENT OFFICE

Technical Cooperation Officer: Ishtiaque Zaman

Grants Administrator: Vanessa Brooks The External Relations and Institutional Development (ER&ID) Office continued to implement the planned activities during 1999 as follows:

Preparation of project proposals: The Office coordinated the preparation and submission of institutional components of proposals seeking 1999 annual contributions from the AusAID, Japan, and the Netherlands, and new project support from the DfID, UK. Project proposals were submitted for Japanese funding through the UNDP.

Four concept papers were submitted to the Government of Japan for additional funding to the annual contribution to the Centre. The Office coordinated the response to a call for proposals on behalf of the Centre, and submitted protocols for funding to the Asian Development Bank for the urban primary healthcare project of the Centre. In response to a proposal for a one-off contribution for the Centre for its role during the 1998 floods, the Government of Bangladesh released Tk one crore (over US\$ 200,000). The successful efforts of the ER&ID Office resulted in the return of the Government of the Netherlands as a core donor after a lapse of two years. A second year's funding was secured from the World Bank for the Nutrition Centre of Excellence.



Dr. Gro Harlem Brundtland, Director General of the World

Health Organization, is shown the ORT Corner of the Dhaka Hospital by the Chief Physician Dr. M.A. Salam during her visit to the Centre.

Grants administration: The ER&ID Office reviewed and drafted, where necessary, the terms and conditions of grants and contracts entered into by the Centre. These included: (1) four sub-agreements with the Karolinska Institute, Sweden, under the ICDDR,B-SIDA 1999-2001 agreement; (2) multiple agreements between individual scientists from national institutions, NGOs, and the ICDDR,B with the Centre as the secretariat for the BINP; (3) agreements between the ICDDR,B and various academic institutions, research organizations, and development partners worldwide; (4) a new collaboration between the ICDDR,B and both the Government of France and the University of Dhaka as partners; (5) a collaborative nutrition survey with CARE-Bangladesh; and (7) a proposal to UNDP Headquarters for a grant financed by the Japanese Women in Development Programme.

The Office coordinated the allocation of the USAID's targeted research funds and the SDC's research funds amongst the scientists of the Centre. This last tranche of research fund allocation completed the total allocation of USAID/W's US\$3 million in Targeted Research Fund, and also completed the allocation of the SDC's research funds for 1999 and 2000.

The technical and financial reports and the annual work plans of the three EU-funded protocols were submitted to the EU for the release of second year's funding. A portfolio review of the USAID/W-funded Child Health Research (CHR) Project was submitted to the USAID/W.

Hospital Endowment Fund: The Annual Fundraising Dinner resulted in earning of over \$32,000 from ticket sales, raffles, and generous contributions.

International Health Solutions Trust: The ER&ID Office coordinated with Mr. Peter McLean, Chairman and Mr. Tony Shillingford, Trustees of the U.K.-based charity, called the International Health Solutions Trust, for mass mailing of an appeal-for-support letter. A write-up was prepared for the IHST Patron H.E. Mr. Mahmood Ali, High Commissioner of Bangladesh to the U.K.



Ms. Trix Heberlein, President of the Swiss Parliament (front row, 2nd from right), beside the wall-mounted Honour Boards that carry the names of donors who contributed to the Centre's Hospital Endowment Fund. SDC tops the list of all donors with a contribution of \$2 million to this Endowment Fund

Hospital Endowment Fund Contributions 1999

Individual donors (in alphabetical order of the last name)

Prof. Barkat-e-Khuda
Dr. Peter V. Barrette
Dr. Butzner
Ms Zeenat Ruzwana Chowdhury
Ms Sarah E. Coghlan
Prof. Rita R. Colwell
Dr. Lena Davidsson
Dr. Mercedes de Onis
Mrs. Diane Fink
Mr. Jurg Frick
Mr. Seth Frisbe
Mr. Richard Greene
Mr. Elthem Kabir
Mrs. Hasina Kibria
Mr. Jacques O. Martin
Prof. Tikki Pang
Dr. Marc Rhoads
Dr. Subrata Routh
Mrs. Jean Sack and Irene Alexander
Mr. Matthias Scherler
Prof. Robert M. Suskind
Dr. Jeroen van Ginneken
Mrs. Lia van Ginneken Noordman
Dr. Cesar Victora
Dr. Yuichiro Yamashiro



Corporate and institutional donors (in alphabetical order)

ACCESS Pvt. Ltd
ACI Ltd.
ACI Pharmaceuticals
Alliance Francaise de Dhaka
American International School, Dhaka
ANZ Grindlays Bank Limited
Bengal Airlift
Bengal Fine Ceramics
British Airways
British American Tobacco Company Limited
Confidence Trade Limited
Crescent Trading Agencies (Pvt) Ltd.
Dacca Warehouse
Delta Airlines
Dhaka Sheraton Hotel
Dragon Air
Eastland Insurance Company Ltd.
Emirates Airlines
Finance Office, ICDDR,B
Fisons (Bangladesh) Ltd.
Foreign Investors' Chamber of Commerce
Ganges Travel Service
Globex Marketing Company Ltd.
Hongkong and Shanghai Banking Corporation Limited (HSBC)
Lemon Grass Restaurant
Mummert & Partners
National Warehouse
Northwest Airlines
Pan Pacific Sonargaon Hotel
Parallel Printers
Partex Group
Radda MCH-FP Centre
Reliance Insurance Ltd.
Rhone-Poulenc Rorer Bangladesh Limited
Salwa Ltd.
The Scobie and Claire Mackinnon Trust
Sheba Printers
Singapore Airlines
Sky Room Restaurant
Standard & Chartered Bank
Tradesworth Ltd.
United Insurance Company Limited



Communication: Press conferences, radio and TV programmes were organized to disseminate the Centre's research findings during the two-day Eighth Annual Scientific Conference (ASCON) held in February. A press conference was also organized prior to holding the International Low Birth-Weight Symposium and Workshop on 14-17 June. A handout on the Centre's ongoing activities was presented at the Global Health Forum Conference held in Geneva, while a new video was produced to promote the Centre. The Office submitted a proposal for the Prince of Asturias Awards, and published a book chapter titled "Oral rehydration: Bangladesh." Ms Vanessa Brooks continued to act as the Editor-in-Chief of the Centre's quarterly newsletter Glimpse.



Hon'ble Minister for Health & Family Welfare Mr. Salahuddin Yusuf is seen presenting a cheque to the Centre's Interim Director Prof. George Fuchs. The contribution was an additional contribution to the Centre from the Government of Bangladesh in recognition of the Centre's role during the 1998 flood

Board of Trustees and Donors Support Group meetings: The ER&ID Office, as usual, assisted the Director's Office to prepare for the June and November BoT meetings. It provided an update on the substantive donor relations that took place between the Centre and its various donors during the year. The Office coordinated the holding of the two-day Board Retreat in November 1999 and the meetings of the Donors Support Group (DSG) of the ICDDR,B.



Ms Meiko Nishimizu, Vice President of the World Bank for South Asia, is enquiring about the well-being of a patient at the short stay Ward of the Centre's Dhaka Hospital. Mr. Fred Temple, the Cheif of Mission of the World Bank in Bangladesh, is also seen

The Office initiated a set of activities that led to signing of an agreement with the USAID for "Multiple Project Assurance (MPA)", which acknowledges the Centre's adherence to the ethical principles regarding all research involving humans as subjects. The Centre also sought a similar MPA with the NIH to abolish duplication in ethical review of research protocols either at the NIH or at the Centre.

FINANCE DEPARTMENT

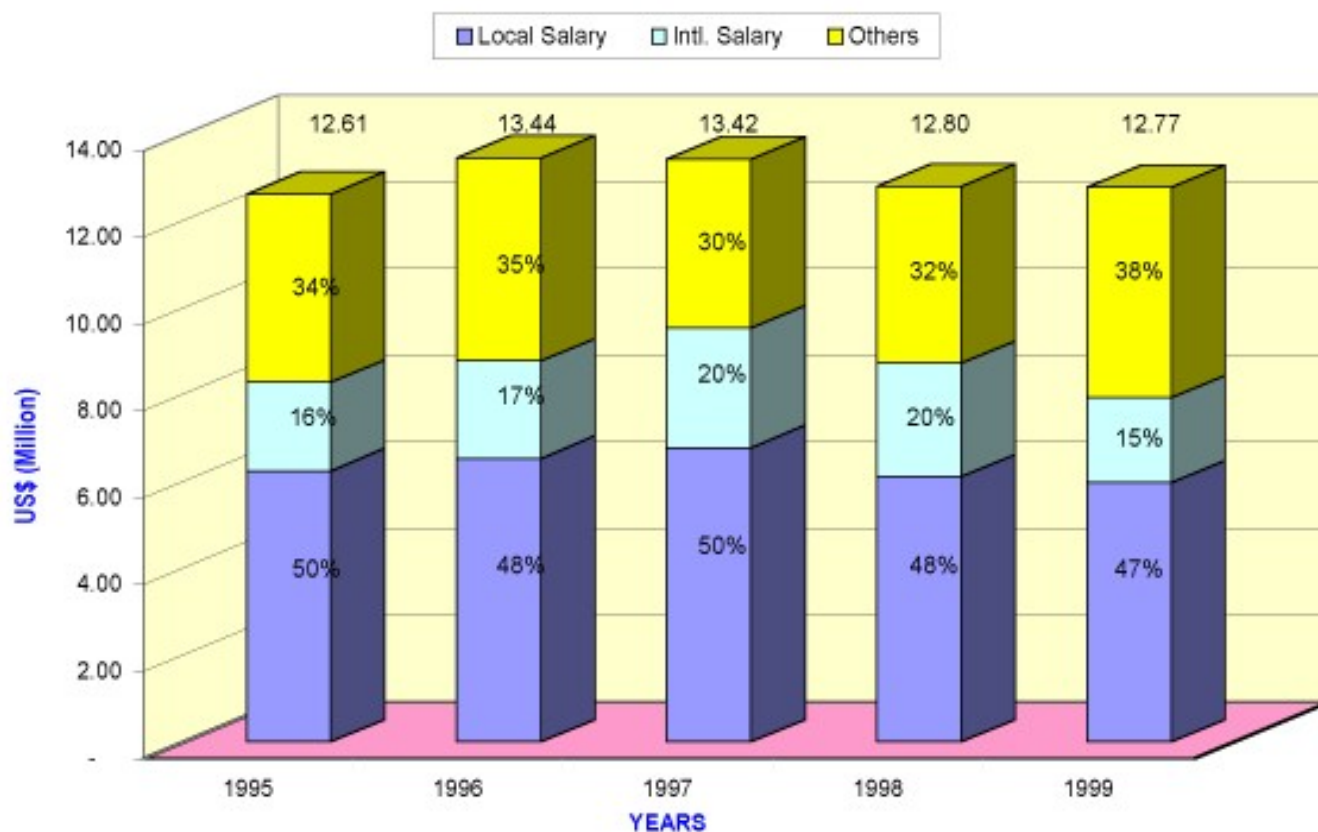
Chief Finance Officer: John F. Winkelmann

The Finance Department has the overall responsibility for financial operations, central stores, and fixed asset management of the Centre, and has a staff of 31. The financial operations include: custodianship of all funds, preparation of the annual budget, recording of all financial transactions, and commitments to prepare accurate and timely financial reports for the Board of Trustees and donors, in addition to preparing monthly and annual reports. The Department is also responsible for facilitating the annual audit and assuring that audits for all necessary donors' contributions are completed in time.

Financial highlights for 1999 are given below:

- Revenue contributions from donors increased by US\$ 1,875,578 over 1998. Contributions to projects increased by US\$ 1,565,076, and contributions for central activities increased by US\$ 310,502.
- ICDDR,B Hospital Endowment Fund contributed US\$ 200,000 (US\$ Nil in 1998) to help defray the costs of patient care in the two hospitals.
- Contributions from donors, after deducting the expenditure for fixed assets of US\$ 1,209,634 (US\$ 495,737 in 1998), increased by 10.7% from US\$ 10,893,724 to US\$ 12,055,405.

TOTAL EXPENDITURE BY CATEGORIES: 1995-99



- Net expenditure, after deducting miscellaneous receipts of US\$ 777,652 (US\$ 1,084,981 in 1998), not including depreciation, increased by 2.4% from US\$ 11,711,356 to US\$ 11,992,273.
- Operating surplus was US\$ 263,132 (US\$ 817,632 deficit in 1998) which, after charging depreciation of US\$ 898,683 (US\$ 894,651 in 1998), resulted in a net deficit of US\$ 635,551 (US\$ 1,712,283 in 1998).
- Net current assets increased by US\$ 1,183,837 over 1998 due to a increase in cash and equivalents of US\$ 1,953,813 and a decrease of US\$ 769,976 in other net current assets.
- There were no receipts on account of capital contributions (US\$ 116,974 in 1998).
- Capital purchases of US\$ 65,254 (US\$ 350,000 in 1998) were funded by a transfer from the Operating Fund to the Fixed Assets Acquisition and Replacement Fund.

With continued strict controls over expenditures and increased contributions for central activities, the Centre achieved a small operating surplus in 1999. This is the first such surplus since 1992.

AUDITORS' REPORT

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

We have audited the financial statements of INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH (ICDDR,B) for the year ended December 31, 1999, from which these abridged financial statements were derived. In our report of same date we expressed an opinion that the financial statements from which these abridged financial statements were derived, present fairly the financial position of the Centre in all material respects, except for (a) non-recognition of "ICDDR,B Employees Separation Payment Fund" balance as at December 31, 1999 of US\$8,365,718 and corresponding investments with Generali Worldwide Insurance Company Limited of Guernsey,

Channel Islands, in these accounts, (b) recoverability of funded support of US\$200,000 from Arab Gulf Fund and (c) treatment of Voluntary Severance Pay of US\$288,019 as Deferred Revenue Expenditure.

In our opinion, the attached abridged financial statements are consistent, in all material respects, with the aforesaid financial statements from which they were derived and on which we issued a qualified report.

For a better understanding of the Centre's financial position and the results of its operations for the year and of the scope of our audit, the abridged financial statements should be read in conjunction with the financial statements from which these abridged financial statements were derived and our report thereon.

Hoda Vasi Chowdhury & Co
Chartered Accountants

Dhaka, March 15, 2000

Price Waterhouse
Chartered Accountants



*Dr. A.K.M Masibur Rahman, Secretary
(ERD), Ministry of
Finance and Member of the Centre's Board
of Trustees, is
seen signing the 1999 Annual Financial
Statements, together
with the Director, Chief Finance Officer,
and the auditors*

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

Statement of Financial Position as of December 31, 1999 (US\$ 000) - Abridged

	<u>1999</u>	<u>1998</u>
Total Assets and Deferred Revenue Expenditure	15,000	13,690
Assets	14,712	13,114
Cash and deposits	3,582	2,867
Accounts receivable	1,721	1,735
Centre Endowment Fund investments	3,842	3,180
Inventories	414	624

Property, plant and equipment	5,153	4,708
Deferred Revenue Expenditure	288	576
Total liabilities and fund balances	15,000	13,690
Current liabilities	7,285	7,316
Fund balances	7,715	6,374
Fixed Asset Fund	5,153	4,708
Fixed Asset Acquisition and Replacement Fund	78	147
Centre Endowment Fund	3,842	3,180
Reserve Fund	2,365	2,260
Operating Fund	(3,723)	(3,921)

Statement of Activities (US\$ 000) - Abridged

Income	13,033	11,979
Donors' contributions	13,265	11,389
Contribution from ICDDR,B Hospital Endowment Fund	200	-
Other items - net	(432)	590
Expenditure	13,669	13,691
Personnel	7,923	8,323
Voluntary Severance Package	288	-
Depreciation	899	895
Other items	4,559	4,473
Operating deficit	636	1,712

Statement of Cash Flows (US\$ 000) - Abridged

Cash flows from operating activities	1,321	(958)
Cash flows from investment activities	(1,239)	(991)
Cash flows from financing activities	633	1,190
Net Increase/(Decrease) in cash and equivalents	715	(759)
Cash and equivalents beginning of year	2,867	3,626
Cash and equivalents end of year	3,582	2,867

Director Member, Board of Trustees

This is the abridged form of the financial statements referred to in our report of same date.

Hoda Vasi Chowdhury & Co

Price

Waterhouse

Chartered Accountants

Chartered

Accountants

Dhaka, March 15, 2000

**INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH
DONORS CONTRIBUTIONS (US\$ 000)**

1999

1998

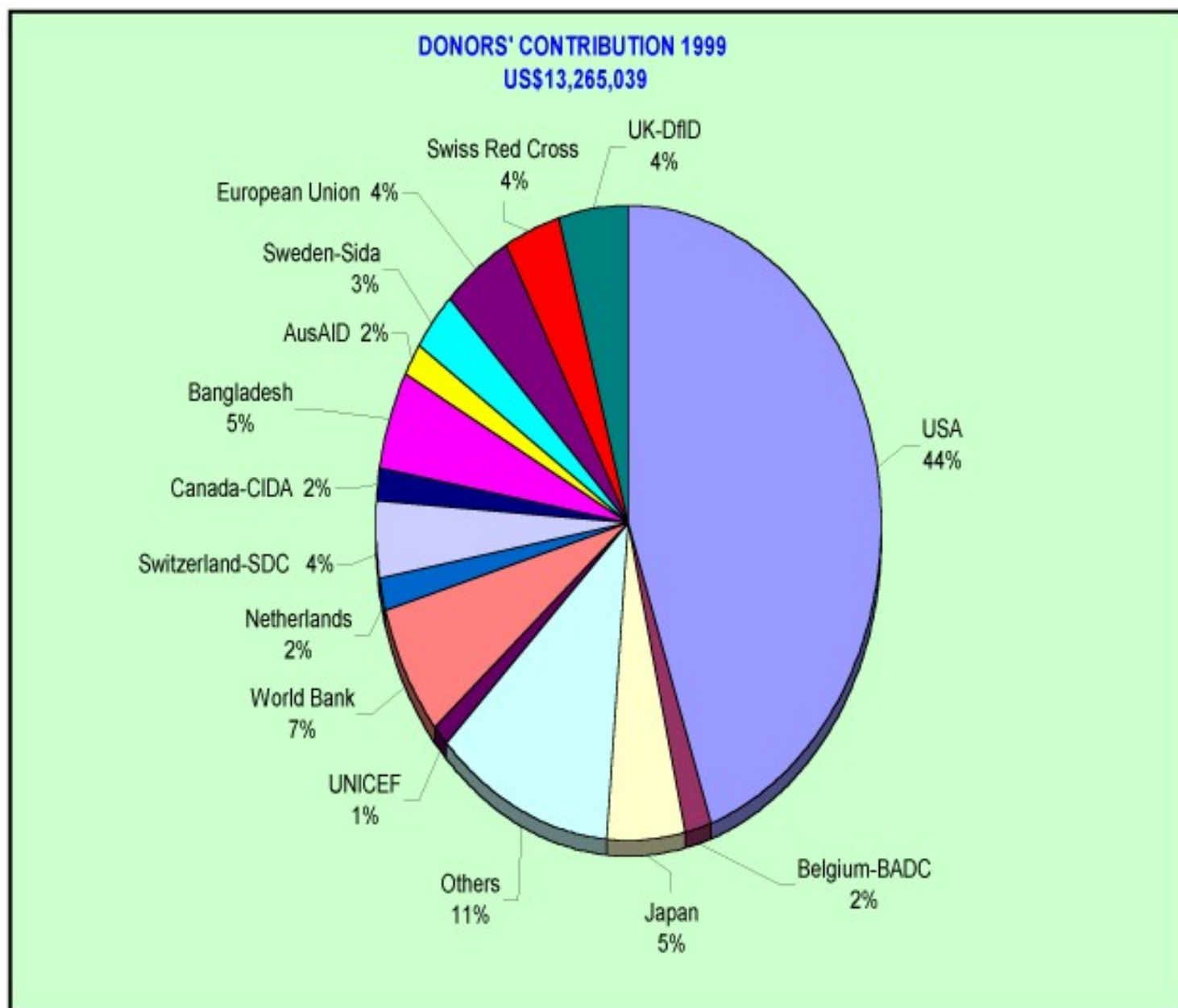
Contributions	13,265	11,389
Australia - AusAID	209	207
Bangladesh- World Bank & BINP	677	435
Belgium - BADC	210	236
Canada - CIDA	205	143
European Union	573	123
Ford Foundation	256	333
Japan	580	580
Johns Hopkins University	126	80
Netherlands	237	40
Norway - NORAD	113	125
Sweden - SIDA/SAREC	425	482
Switzerland - SDC	513	436
Swiss Red Cross	477	292
Thrasher Foundation	84	58
United Kingdom - DfID	594	460
United States - AID etc.	5,946	5,636
United Nations - (UNAIDS)	59	95
UNDP/Japan	78	59
UNICEF	136	113
WHO	128	187
World Bank	885	185
Disaster/Epidemic (a)	257	542
Others (b)	497	542
Fixed Assets Fund	-	117
Bangladesh	-	232
United Kingdom - DfID	-	(115)

a) Contributions in 1999 for Disaster/Epidemic funds were received from USAID/CARE, DfID/Dhaka, AusAID, Cairn Energy PLC., UNOCAL Bangladesh Ltd., Shell Bangladesh Explorations Dev. B.V., Occidental of Bangladesh Ltd.

b) Contributions in 1999 from Others for project funds were received from Canada – IDRC, George Mason Foundation, Future Group Intl. Inc., International Atomic Energy Centre, Medical Research Council, North Field Laboratories, Proctor & Gamble, New England Medical Centre, SAIDNET, Japan/JICWS, Institutional Development for Self Sustaining Area, Cytos Pharmaceuticals Inc., Novartis, British Geological Survey, UCB/Sidac, UFHP, Universities of Alabama, Pennsylvania, New Castle, Loughbourg and Virginia.

Director

Member, Board of Trustees



TRAINING AND EDUCATION DEPARTMENT

Head: A.N. Alam The Department, in collaboration with scientific divisions of the Centre and also with national and international organizations, regularly conducts national and international training programmes. Research findings of the Centre are shared with participants of these courses and workshops. The courses and workshops are designed to provide participants with knowledge and skills applicable to their needs, so that they are able to help develop increased capacity for research, management of the control of diarrhoeal disease (CDD) programmes, and family-planning services.

During 1999, 18 training courses and workshops were organized (Table). Participants in these courses and workshops included 292 scientists, physicians, health administrators, health personnel, and trainers from 28 countries (Asia-15, Africa-8, America-2 and Europe-3). Another 459 persons received orientation training. The training programmes were managed and conducted with 3 trainers of the Department and with faculty support drawn from four scientific divisions of the Centre and sometimes from outside the Centre. The Government of Japan, SIDA, Office of the

Foreign Disaster Assistance (OFDA), USAID/W, and the Ford Foundation provided support to conduct most training programmes.

Table. Training programmes conducted during 1999

Activities	No. of courses (n=18)	No. of participants (n=292)	Countries represented (n=28)
Health Research Training			
Introductory Course on Epidemiology and Biostatistics	2	39	Bangladesh
International Workshop on Research Methodology	1	15	Bangladesh, Indonesia, Kenya, Malaysia, Pakistan, South Africa, and Sri Lanka
Post-graduate fellowships students of universities of Bangladesh	-	10	Bangladesh
International Workshops/Courses			
Course on Emerging and Re-emerging Pathogens	1	06	Japan
Course on Management of Severely Malnourished Children	1	10	Bangladesh and Bhutan
Training Course for AMR Surveillance	1	13	Nepal
Course on Clinical Management of Diarrhoeal Diseases	2	27	Bangladesh, Indonesia, South Korea, Sudan, Sri Lanka, and Uganda
Course on Laboratory Diagnosis of Common Diarrhoeal Disease Agents	1	11	Bangladesh, Indonesia, Pakistan, and Zimbabwe
Workshop on Emergency Response to Cholera and <i>Shigella</i> Epidemics	1	10	Cambodia, Kenya, Netherlands, Rwanda, Tanzania, and USA
Workshop on Improving, Effectiveness, Quality of Services and Sustainability in Reproductive Health Programme through Operations Research	1	12	Bangladesh, Ghana, India, Indonesia, Kenya, Pakistan, Philippines, Tanzania, Mexico, Vietnam, Zambia, and Zimbabwe
National Training Courses/Workshops			
Child Survival Interventions Training Course for Paramedics	1	12	Bangladesh
Training Course for Management of Severely Malnourished Children	3	35	Bangladesh
Training Course on Clinical Economics	1	12	Bangladesh
Clinical Management of Diarrhoeal Diseases for DCH Students	1	10	Bangladesh
Training of Peer Educators: HIV/AIDS Staff Education Programme	1	14	ICDDR,B Staff (Bangladesh only)
Fellowship Programme			
International Fellows (elective training and training for postgraduate degree and diplomas)	-	22	Bangladesh, Japan, Netherlands, Sweden, UK, and USA
Training of fellows from SAARC countries	-	10	Bangladesh, Bhutan, Maldives, Nepal, and Sri Lanka
Clinical Fellowship	-	13	Bangladesh
Nursing Fellowship	-	11	Bangladesh

Health Research Training

The major components of health research training include (a) Research Methodology Workshop, (b) Health Research Training Fellowship, and (c) National Course on Epidemiology and Biostatistics. The Centre's scientists supervise several ongoing research projects of Bangladeshi nationals. In 1999, no health research training fellowships could be offered due to financial constraints. Sixty-four researchers from 7 countries participated in these training programmes which are briefly highlighted below:

Research Methodology Workshop: Eleven participants from Bangladesh, Indonesia, Kenya, Malaysia, Pakistan, South Africa, and Sri Lanka, and four ICDDR,B personnel attended a two-week Research Methodology Workshop. The workshop helped them improve their knowledge in advanced biostatistics and epidemiology used in clinical trials and epidemiological studies. The participants received sufficient opportunities to analyze data using the 'Stata' software. The participants and the faculty members discussed the research design-related problems in a special session.

National Course on Epidemiology and Biostatistics: Thirty-nine participants attended two four-week Introductory Courses on Epidemiology and Biostatistics organized in collaboration with national institutions. They learned how to plan, design, and implement epidemiological studies and to analyze and interpret data.

One M.Phil. and 9 M.Sc. students from the University of Dhaka and the Bangabandhu Sheikh Mujib Medical University carried out research on topics of their dissertations at the research laboratories of the Centre. The scientists of the Centre supervised their research work.

Training of Trainers

The Department organized five international training courses to update knowledge and skills of trainers in prevention, case management and laboratory diagnosis of diarrhoeal diseases and emerging and re-emerging pathogens, so that they can organize appropriate training programmes in their own countries or place of work. Fifty-seven participants from 10 countries attended these courses.

Emerging and Re-emerging Pathogens: Six participants from different hospitals and medical schools of Japan attended a four-week course sponsored by the Japan International Corporation of Welfare Services. The course included a module on hands-on-training at the Centre's Dhaka hospital in the management of patients with cholera and *Shigella*, and another on laboratory training for diagnosis of diarrhoeal pathogens and identifying their sensitivity patterns. Management of severely malnourished children and visit to the Matlab Health Research Programme for gaining practical experience in community management of diarrhoeal diseases were additional components of the course.

Laboratory Course for ARM Surveillance: Thirteen microbiologists and technologists from Nepal attended a 2-week course to upgrade their knowledge and skills on diagnosis of selected pathogens under the Antimicrobial Resistance Surveillance Programme in Nepal. The course was supported by USAID.

Clinical Management of Diarrhoeal Diseases: Twenty-seven physicians, nurses, and diarrhoeal disease control programme managers from Bangladesh, Indonesia, Democratic People's Republic of Korea, Sudan, Sri Lanka, and Uganda attended two two-week courses. The course was designed to provide participants with knowledge on clinical management of diarrhoea with different aetiologies and their complications. In addition, the participants were taught to organize courses for health professionals in their own countries.

Laboratory Diagnosis of Common Diarrhoeal Diseases Agents: Ten participants from Bangladesh, Indonesia, Pakistan, and Zimbabwe attended this two-week course. They learned the principles of laboratory procedures of isolating and identifying diarrhoeal pathogens and preparation of culture media.

Training Workshop on Emergency Response to Cholera and *Shigella* Epidemics

Ten trained healthcare professionals from 6 countries, representing the Medicines Sans Frontiers, International Rescue Committee, OFDA, International Medical Corps, and Catholic Relief Services, attended the workshop. The participants were trained to strengthen their capacity in managing epidemics of cholera and shigellosis effectively to reduce morbidity and mortality, with emphasis on preparedness to handle disaster situations, prevention of diarrhoea, ensuring safe-water supply and addressing sanitation hazards. The participants received hands-on training in Dhaka and in the makeshift treatment centres in the field, and prepared an action plan for use by their organizations during disasters and epidemics.

Reproductive Health Programme through Operations Research

Eleven participants from Bangladesh, Egypt, India, Indonesia, Malaysia, Pakistan, the Philippines, Thailand, and Tanzania attended an International Workshop on "Improving Effectiveness, Quality of Service and Sustainability in Reproductive Health Programme through Operations Research." The participants were familiarized with the operations-research activities and lessons learned in the field of reproductive health by the Centre's scientists. The workshop gave opportunities to share and understand the experiences of linking operations research with the process of policy formulation to improve reproductive health programmes.

Clinical Training Programme

Fifty-six persons received fellowships to develop their clinical skills in diagnosis and treatment of patients with diarrhoea and malnutrition with some insights into research methods. Different fellowship programmes offered in 1999 are highlighted below:

Fellowship for SAARC Countries: Ten fellows from Bangladesh, Bhutan, Maldives, Nepal, and Sri Lanka attended a 6-week training on clinical aspects of diarrhoeal diseases, laboratory diagnosis of common diarrhoeal disease agents, and community health to help strengthen the diarrhoeal disease control programmes in their countries.

Clinical Fellowship: The programme provided an intensive training on different aspects of diarrhoeal diseases to 13 Bangladeshi physicians who have completed at least one year's training either on paediatrics or on internal medicine and are interested to pursue postgraduate studies. Both University of Dhaka and Bangladesh College of Physicians and Surgeons recognize this training for postgraduate diploma/degree in paediatrics or medicine.

Fellowship for Nurses: Eleven fellowships were offered to train nurses in the management of patients with diarrhoeal diseases.

Other Fellowships: Twenty-two health professionals from Bangladesh, Japan, the Netherlands, Sweden, UK, and USA received training on different aspects of diarrhoeal diseases. The large majority came for an elective clinical attachment in the hospital or the community and, in some cases, assisted the Principal Investigators of the ongoing research protocols.

National Training Courses

Seventy-one researchers, students, and paramedics attended 7 training courses organized in 1999.

Management of Severely Malnourished Children: Four courses were, for the first time,

organized for 45 participants from Bangladesh and Kingdom of Bhutan. UNICEF, BHUTAN, and NGOs of Bangladesh sponsored the first course, and three courses were organized with support from the World Bank to the 'Centre of Excellence for Nutrition.' This task-oriented and competency-based course provided the participants with an intensive 'hands-on' training. Practical aspects of the standardized protocol for the management of severely malnourished children, which has been successful in reducing the mortality rates among these children by half, constituted an integral component of the course, with emphasis on the preparation of indigenous low-cost diets for use in community-based nutritional rehabilitation.

Child Survival Interventions Training Course for Paramedics: A one-week course was conducted at the newly-constructed International Training Centre of the Centre's Matlab Health and Research Programme under the USAID-supported NIPHP. Twelve paramedics from NGOs were trained for rendering quality services under the NIPHP.

Clinical Economics: A one-week intensive course on Clinical Economics with focus on developing countries was organized. Twelve participants, including 4 from the Centre, attended it. The course was designed with inputs from faculty members involved in health economics teaching in the USA and the UK universities. The course curriculum covered: (a) demand for healthcare services, (b) behaviour of healthcare providers (physicians and hospitals), (c) economic evaluation of health and family planning projects, (d) critical evaluation of QALYs and DALYs, (e) financing the healthcare sector and mobilizing resources for health, and (f) health insurance in the developing world, private and social insurance.

Clinical Management: Ten DCH students from the Bangladesh Institute of Child Health attended one 5-day training course.

Peer Educators' Training

Under the HIV/AIDS Staff Education Programme, 28 staff members have been trained as Core Trainers by the CARE-Bangladesh and the SDC through organizing 4 courses of Training of Trainers. They subsequently trained 59 peer educators in Dhaka and Matlab.

Other Training Activities

During the year, series of one and two-day sessions were organized for 469 medical students and health professionals from national institutions. The participants of these sessions received training on the management of laboratory animals, clinical management of patients, and computer applications through individually assigned programmes and short-term courses. Four persons from various libraries also received hands-on training (1-3 months) at the Centre's library to gain experience in the management and dissemination of information.

Seminars

Five seminars on various topics were organized during the year to provide opportunities for the exchange of information and views, in addition to 29 inter-divisional scientific forums. Both resident and visiting scientists presented the seminars.

STAFF DEVELOPMENT

Manager: Bejoy R. Saha The Centre has adopted a systematic staff development programme to sustain the ongoing research and training, and to maintain a well-trained staff. To achieve this, the Centre regularly organizes workshops and training courses, and sends personnel to national and overseas institutions for higher studies and training. In 1999, 172 personnel were benefited under these programmes with financial support from the SDC, fellowships from several other agencies, and funding from projects of the Centre.

Overseas Training: Thirty-seven personnel received overseas training in various universities in Belgium, France, Germany, India, Japan, New Zealand, the Netherlands, the Philippines, Singapore, Switzerland, Thailand, UK, and USA. Nineteen personnel completed their study and training, and four, after completing their course work, returned to undertake research at the Centre for their PhD dissertations to be submitted to the London School of Hygiene & Tropical Medicine, UK, International Institute for Population Sciences, India, and University of Liege, Belgium. Of the 15 personnel who completed their studies and training, 4 received PhD degree, 3 obtained masters degree, and 8 completed non-degree programmes in various disciplines. During the year, 20 personnel left to begin their higher studies or training. At the end of the year, 18 (PhD-10, Masters-6, and training-2) were studying abroad.

In-country and In-house Training: During the year, 93 personnel received in-country training in various disciplines. Under the in-house training programme, several workshops and courses were organized. Nineteen staff members attended a training course on Microsoft Visual Basic 6.0 Programming; 5 attended a workshop on Clinical Economics; 9 attended an introductory course on Epidemiology and Biostatistics; 3 attended a course on Management of Malnourished Children; 2 attended an international course on Laboratory Diagnosis of Common Diarrhoeal Agents; and 4 attended an international workshop on Research Methodology.

Seventy-two personnel attended 44 regional and international scientific conferences.

DISSEMINATION AND INFORMATION SERVICES CENTRE

Head: M. Shamsul Islam Khan The Centre's programme for storage and retrieval of global information and for diffusion of its research findings--the Dissemination and Information Services Centre (DISC)--is the combination of three components: (1) Information Services Branch (2) Publications Services Branch, and (3) Audiovisual Unit. The Audiovisual Unit was made part of DISC beginning January 1999. The mission of DISC is to diffuse results of global health and population research for solving the common health and population problems, especially in the context of developing world.

DISC collects, processes, stores, and disseminates information on health, population, nutrition, and environment research and related programmes; encourages the use and free flow of information; coordinates and centralizes resources that promotes the Centre's research findings; and optimizes the application of improved practices for information storage, retrieval, publication, and dissemination. Within the mission and objectives, DISC has actively been pursuing to offer efficient information services and disseminate the Centre's research findings with a staff of 11 personnel. Two advisory committees and 4 editorial boards provided continued guidance in the improvement of information services, dissemination of information, and quality of publications.

Information Services

Librarian: Md. Nazimuddin

The Information Services branch, equipped with the modern tools of information technology, including on-line literature-searching facility, maintains one of the best libraries in the country. At the end of 1999, the library had a total collection of over 45,000 books, bound journals, reports, reprints, and documents. The collection was enriched with the addition of over 1,000 new books, bound journals, and articles, 349 current journals and other periodicals, and 3 CD-ROM databases. The collection was extensively used by a large number of readers. In 1999, the total number of reader-visits was 14,128. The Centre's scientists and health professionals and researchers of other organizations, university teachers and students, members of the donor community, trainees, and visitors, equally used the library facilities.

The library patrons, particularly the research staff of the Centre, were regularly kept informed of the incoming learning resources through various means. In 1999, information on 3,156 articles of relevance to the Centre's scientists, new

books, conferences, and training opportunities was electronically transmitted on a weekly basis. The library staff compiled citations and abstracts of papers on diarrhoeal diseases for publication in the bibliography section of the JDDR. The library staff met 1,735 formal and informal queries of library patrons. The in-house databases of the library holdings and the publications of the Centre were updated by adding information on new items. A new database was created with the articles and abstracts published in the Journal of Diarrhoeal Diseases Research from 1983 to 1998. During the year, 347 literature searches were provided from the Medline and Popline databases to the research staff and research-support personnel of the Centre and to the external library users. The total number of pages of photocopies supplied to the library users was 74,056 (37,487 pages for outsiders).

The Centre's staff borrowed 9,262 books and journals from the library, in addition to videos. Under the inter-library loan relationship, borrowing 825 books and bound journals from the library benefited several national organizations. Under the corporate membership, the library borrowed books and video cassettes from the British Council Library, Dhaka. The Nuffield Library of the British Medical Association continued to provide, free of charge, photocopies of articles. Four library staff members of the Bangladesh Navy received 3 months training, and 11 honours course students of the Department of Library and Information Science, University of Dhaka, received a two-week training/orientation.



The Centre's library attracts a wide range of information seekers-both for its rich collection of books and periodicals and for literature search through electronic media

Publications Services

Senior Publications Officer: M.A. Rahim (until 23 July)

During 1999, the Publications Services branch edited, published, and disseminated the Centre's research findings and other output information through its internal publication series. The publication staff prepared materials for the English and Bangla newsletters of the Centre. The Branch produced the Annual Report 1998, two issues of the JDDR; two issues of the annotated Bibliography on Diarrhoeal Diseases; three issues of the English newsletter Glimpse; two issues of the Bangla newsletter Shasthya Sanglap; and two issues of the bilingual (English and Bangla) staff news bulletin ICDDR,B News. It was decided to re-launch the JDDR as the Journal of Health, Population and Nutrition (JHPN) beginning 2000. Prof. David A. Sack assumed the responsibilities of the JDDR and the re-launched journal.

Under the editorial advisory service, different departments and individual scientists of the Centre were given assistance by editing 46 manuscripts. The Branch assisted in the production of 35 internal publications published by other units of the Centre. The Branch performed all printing-related work for the 8th Annual Scientific Conference (ASCON), including editing and publication of the Programme and Abstracts book. Support was also provided in the successful organization of the International Low Birth-Weight Symposium and Workshop held at the Centre.

During the year, 55,361 copies of different publications, such as annual report, Glimpse, and Shasthya Sanglap, were distributed/mailed. The Branch arranged display and dissemination of information on publications in various important meetings, workshops, and conferences to promote the Centre's publications. The Centre's website was further reorganized, updated, and expanded to make it more useful to outsiders. Full-text of several publications, such as, Glimpse, Annual Report 1998, Journal of Diarrhoeal Diseases Research (JDDR), internal publications, ORP publications, etc. and institutional profiles were disseminated through the website.

Audiovisual Unit

Head: Asem Ansari

Support was provided to the Centre's scientists and members of the management team by preparing graphics material for their research papers, scientific reports, brochures, and other display materials, including slides, pictures, microphotography, gels, petridishes stains, test-tube research, and laboratory and animal dissection photography. The Unit took pictures and developed photographs of important events in the Centre, including visits of distinguished persons;



recorded scientific presentations and deliberations of meetings, workshops, and conferences; prepared photo albums and plaques for the outgoing personnel; prepared greeting cards, year planner, etc. The Unit did the page layout and designed covers of the Annual Report, Glimpse, and ICDDR,B News. It also contributed to the promotion of the Centre and the Hospital Endowment Fund campaign by producing footage that documents the Centre's activities in the endowment fund promotion videos and by preparing promotional items for sale to strengthen the Fund.

COMPUTER INFORMATION SERVICES

Manager: Abu Sufian J. Alam The objective of CIS is to develop a fully integrated IT infrastructure to provide end-users with seamless interface and connectivity to all applications functionality. Its activities are managed with 9 personnel.

The department initiated the implementation (final stage) of a V-SAT satellite system by installing an initial 64 kbps bandwidth full circuit link to have the Centre's own satellite link to connect its Internet e-mail server, Web server, and Proxy server to the Internet information backbone (a project under implementation to align the Centre's communication systems with the international information system); improved Centre-wide campus networking effectiveness by introducing switching technology; promoted information system standards and platforms; completed migration of E-mail system from the IBM PC server to the RISC-based Unix system; provided support for about 600 PCs and network support for 400 connected PCs; installed several Internet firewall systems for implementing security systems; managed multiple protocols and related configurations for various servers, such as AS/400 for the Centre's financial accounting system, SUN Solaris for demography database under Oracle, and RS/600 for Internet gateway under the same; provided support for database systems and other applications systems for various areas within the Centre; maintained the Centre's website (www.icddrb.org); and conducted a seminar on Campus Networking and Office Automation at the Centre.

The CIS Manager served as a member of the National Technical Standing Committee for the development of campus networking and a national databank for the Government of Bangladesh.

ADMINISTRATIVE SERVICES

Consultant: Colonel Tajul Islam Ghani, psc (Retd.) The Department provided administrative, technical, engineering and logistics support, and coordinated the security and cleaning services, transport and maintenance support.

Engineering Branch

Senior Assistant Engineer: Rabindra Das (Civil)

Assistant Engineer: N. Sayem Uddin Ahammed (Electrical)

The Branch maintained utility services, civil structure, electrical and telecommunication equipment and establishments; completed the construction of a Community Centre at Chakaria and a main store building at Matlab; improved the water supply system; and supervised the construction of an outpatient department at Matlab. It installed a major bypass switch in the Centre's electrical sub-station to reduce the load on the stand-by generator.

Transport Management Branch

Senior Transport Officer: M. Hamidullah

Coordinating the use of vehicles provided transport support. The Branch provided regular pick-ups and drops to 340 staff members, and operated the wireless communication between Dhaka and Matlab. In total, 750 repair and maintenance works were carried out in its workshop.

General Services Branch

General Services Officer: M. Mujibur Rahman

The Branch provided services for safety and security of the Centre's properties, cleaning, mail, and conference management..

Travel and Estate Office

Manager: Kh. Shafiqul Hossain

Travel-related services were provided to both expatriate and local personnel, Trustees, visitors, trainees, etc. The Office maintained liaison with concerned government authorities for visa to facilitate the stay of expatriate personnel in Bangladesh and to visit foreign countries by the staff. Support was given to arrange Board meetings, workshops, parties, and inter-divisional meetings, in addition to maintaining a guesthouse and assisting in hiring/leasing offices for projects and houses for the expatriate staff.

Procurement Branch

Procurement Manager: Md. Mahbubul Alam

Scientific and other materials from home and abroad worth US\$ 2.97 million were procured. The Branch also procured I.V. fluid materials/equipment for the Institute of Public Health, as per an agreement between the ICDDR,B and the Government of Bangladesh.

COMMITTEES

Coordinators: Ms Judith Bennett Henry (BoT)

Mr. Bejoy R. Saha (PCC, RRC, ERC and AECC) Apart from the Board of Trustees, the final authority of the Centre's activities, the ICDDR,B has mandatory committees that include:

Programme Coordination Committee (PCC), Research Review Committee (RRC), Ethical Review Committee (ERC), and Animal Experimentation Ethics Committee.

Board of Trustees

The multinational Board of Trustees serves as the supreme policy-maker of the Centre. It provides guidance to the Centre's management team responsible for the day-to-day activities. The Board, comprising 15 members, includes: the Director of the Centre, three officials nominated by the Government of Bangladesh, one representative of the World Health Organization (WHO), one representative of the United Nations Children's Fund (UNICEF), and 11 members from different countries and organizations, of whom at least half must come from developing countries. Each June, about 33% of the members complete their three-year term unless re-elected for another, after which they must retire. The Board meets twice a year (in June and in November), and considers matters relating to the Centre's scientific agenda, financial matters, and long-term management strategies. The Director of the Centre acts as Member-Secretary of the Board. The Board of Trustees in 1999 was constituted with the following persons:

Chairperson: Mr. Jacques O. Martin (Switzerland)

Member-Secretary: Prof. George Fuchs (as Interim Director till 30 September); Prof. David A. Sack (from 1 October).

Members: Prof. Peter F. McDonald (Australia); Maj. Gen. (Retd.) M.R. Choudhury (Bangladesh) until 23 June; Prof. A.K. Azad Khan (Bangladesh) from September; Dr. A.K.M. Masihur Rahman (Bangladesh); Mr. M.M. Reza (Bangladesh); Prof. Carol Vlassoff (Canada); Dr. Ricardo Uauy Dagach (Chile) from November; Prof. Zheng Qing-si (China); Prof. Yoshifumi Takeda (Japan); Dr. Tawfik A.M. Khoja (Saudi Arabia); Prof. Marian E. Jacobs (South Africa); Dr. Tikki Pang (WHO, Switzerland) from June; Mr. Rolf C. Carriere (UNICEF); and Prof. Rita R. Colwell (USA). The Centre mourns the death of Maj. Gen. M.R. Choudhury who was a Board member, a prominent scientist, and a long-time friend of the Centre.

Programme Coordination Committee

Chairperson: Prof. M.A. Matin

The Programme Coordination Committee (PCC) was created to strengthen the coordination between the Centre and national health institutions through capacity-building for collaborative research. It is composed of 56 members with representatives from the Centre, Ministry of Health and Family Welfare (MOHFW), and the remainder from the government health departments or institutions, universities, and non-governmental organizations involved in health, nutrition, education, population studies, and development programmes in Bangladesh.

Research Review Committee

Chairperson (Acting): Prof. V.I. Mathan

The Research Review Committee (RRC), composed of clinicians, epidemiologists, social scientists, laboratory scientists, and demographers/population scientists from both within and outside the Centre, reviews scientific research protocols of the Centre, originating from its four scientific divisions (Clinical Sciences Division, Laboratory Sciences Division, Health and Population Extension Division, and Public Health Sciences Division), evaluates their scientific merit, competence of Principal Investigators, and relevance to the Centre's objectives and priorities. The Committee considered 45 protocols in 1999.

Ethical Review Committee

Chairperson: Brig. (Retd.) Q.M.S. Hafiz

Prof. Mahmudur Rahman (since June)

The Ethical Review Committee (ERC), a mandatory committee of the Centre, meets regularly to examine and consider the ethical issues of research protocols, involving human subjects. Its five-member subcommittee periodically inspects and audits research projects to ensure that studies are ethically conducted according to the approved proposal. The 15-member full committee comprises four from the Centre, one each from Programme Coordination Committee, Bangladesh Medical Research Council, WHO's Country Programme Office in Bangladesh, and eight from varying disciplines. The Committee considered 36 protocols in 1999.

Animal Experimentation Ethics Committee

Chairperson: Dr. Mirza A. Jalil

The Animal Experimentation Ethics Committee, established by the Board of Trustees to ensure compliance of the standard procedures for protection of research animals at the Centre, reviews protocols, involving research with animals, and gives clearance on those protocols. The Committee considered 5 protocols in 1999.

STAFF WELFARE ASSOCIATION

President: G.H. Rabbani The ICDDR,B Staff Welfare Association (SWA) is a body of elected staff representatives aimed at contributing to the development of staff relations in the Centre, including executive, socioeconomic and other welfare activities. In 1999, the SWA made efforts to constructively resolve some problems of the staff and to improve the conditions of their service through dialogues and amicable discussions with the Management and the Board of Trustees. Several accomplishments were made in 1999. Some of them are: staff salary enhanced; Welfare Ceremony organized in honour of Prof. David A. Sack, the new Director at Dhaka and Matlab; a cultural function organized; an Annual Feast held; financial help (Tk 2,80,824.00) provided to several employees through Medical Assistance Fund. Education stipends provided to children of staff and condolence meetings for the deceased staff organized; and election for a new body for the 2000-2001 period arranged.

The newly-elected office-bearers of the SWA for the term 2000-2001 are: *President: Dr. G.H.*

Rabbani; *Vice Presidents*: Dhaka--Mr. Md. Abul Hossain, Matlab--Mr. Khalilur Rahman; *General Secretaries*: Dhaka--Mr. K. M. Rafique, Matlab--Mr. Nasir Ahmed; *Joint-Secretaries*: Dhaka--Mr. Shaikh Abdul Aziz, Matlab--Mr. Md. Abdul Malek Patwary; *Treasurers*: Dhaka--Mr. Md. Rezaur Rahman, Matlab--Mr. Tofazzaal Hossain; *Athletic Secretaries*: Dhaka--Mr. Md. Moniruzzaman Miah, Matlab--Mr. Khandaker Ahsan Kabir; *Social & Entertainment Secretaries*: Dhaka--Mr. S.M. Akramul Haque, Matlab--Mr. Md. Sukkur Ali; *Literary & Cultural Secretaries*: Dhaka--Mr. Md. Kabir Ahmed Bhuiyan, Matlab--Mr. Javed Ali; *Members*: Dhaka--Mr. Bachchu Miah, Mr. Md. Delwar Hossain, Mr. Nurul Hoque Sikder, Mr. Md. Osman Ali, and Abdul Mannan-II, Matlab--Mr. Md. Mazibur Rahman, Mrs. Fatema Akter, and Mr. Rehan Uddin.



*High Commissioner of Canada to Bangladesh
H.E. Mr. David Preston*



*The new Japanese Ambassador to Bangladesh
H.E. Mr. Kazuyoshi Urabe (front row, middle)*

VISITORS IN 1999 Notable persons from different regions of the world visited the Centre during 1999, touring the Centre's facilities both at the Dhaka hospital and/or Matlab to observe the patient-care activities, health-intervention strategies, and matters relating to support for the Centre's research services and training activities. Some paid their visits to attend special events, including Annual Scientific Conference (ASCON), other important conferences, workshops, meetings, and seminars. Many diplomats, foreign government officials, and representatives of donor agencies, and private sector companies visited in connection with providing their financial contributions to the Centre.



*H.E. Mr. Abdullah Omar Barry, Ambassador
of the Kingdom of Saudi Arabia (KSA)*



Mr. John Imle, President of Unocal, with his colleagues

In February 1999, the Hon'ble Prime Minister of the People's Republic of Bangladesh Sheikh Hasina visited the Centre to address the inaugural ceremony of the 9th ASCON and 20th Anniversary Celebration of the Centre as Chief Guest. Mr. Salah Uddin Yusuf, Hon'ble Minister for Health and Family Welfare, Government of Bangladesh, also spoke as Special Guest in this occasion. Dr. Gro Harlem Brundtland, the new Director General of WHO, visited the Centre on 8 September. During their one-week visit in May 1999, a five-member high-powered Japanese team, led by Mr. Hirohisa Soma, Deputy Director, International Organization Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, reviewed the Centre's work undertaken with the Japanese funding. Representatives of the international energy companies visited the Centre's Dhaka and Matlab facilities to see themselves the significance of their grants that enabled the Centre to combat the epidemic during the 1998 floods. The EU Ambassador H.E. Mr. Antonio de Souza Menezes and senior officials visited Matlab to see the first-hand progress of the three EU-funded reproductive health projects. The new CIDA official Ms Sophia Robineault at the Canadian High Commission also visited the Centre. Mr. Bill Gates Sr. of the Bill and Melinda Gates Foundation, accompanied by Dr. Gordon Perkin and Ms Suzanne Cluett also from the Foundation, visited the Centre's Dhaka and Matlab facilities. All these distinguished guests were apprised of the activities and the institutional history of the Centre, and how its agenda have expanded over time.



Mr. A.K.M. Shamsuddin, President of the Foreign Investors' Chambers of Commerce & Industry (FICCI), and other FICCI member



*H.E. Mr. Charles Stuart, Australian
High Commissioner in Bangladesh*

Some other distinguished guests who visited the Centre in 1999 are listed below in alphabetical order of the names of organizations:

Asian Development Bank, Philippines: Mr. Vincent J.P. de Wit, Health Specialist, Education, Health and Population Division (West); **Abt Associate, Inc., USA:** Dr. Ann Levin, Health Economist; **Australian High Commission, Bangladesh:** H.E. Mr. Charles Stuart, High Commissioner, and Mr. Mark Collins, First Secretary; **Boston University School of Public Health, USA:** Mr. Andrew C. Beggs, Faculty, Department of International Health; **British Women's Association:** A 12-member team led by Mrs. Anita Bell, Vice President; **Cairn Energy Plc:** Mr. Richard Heaton, General Manager; **Centre for International Child Health, Institute of Child Health, University College, UK:** Prof. Sally G. McGregori; **DfID, Dhaka:** Dr. Frank Atherton, First Secretary; **Embassy of Japan, Dhaka:** H.E. Mr. Yoshikazu Kaneko, Ambassador, and Mr. Koji Tomita, First Secretary; **European Union:** Mr. Antoine Gilbert, First Secretary; **The Futures Group International, USA:** Ms Nancy Piet, Senior Consultant; **Global Health Program, USA:** Dr. Gordon W. Perkin, Director; **Government of Gujarat, India:** Ms S.K. Varma, Additional Chief Secretary and Commissioner (F.W.), Health and Family Welfare Department; **Government of the Islamic Republic of Iran:** Ms Jaleh Davanloo, Senior Expert and Ms Parvin Farazdaghi, Expert International Bureau; **Government of Madhya Pradesh, India:** Mr. Ashok Das, Commissioner, Health; **Institute of Epidemiology, Disease Control and Research, Bangladesh:** Dr. A.M. Zakir Hussain, Director; **Institute of Medicine, Tribhuban University, Nepal:** Dr. H.G. Shrestha; **International Development Center of Japan:** Ms Kimiko Abe, Development Studies Division; **International Science and Technology Institute, Inc, USA:** Ms Kimberly S.



H.E. Mr. Antonio De Souza Menezes, Ambassador of the European Union to Bangladesh (extreme left)



Sri Lankan High Commissioner H.E. Mr. E.G. Dayananda

Allen, Asian Regional Coordinator; **Iran Medical University:** Dr. Valiollah Hassani, Professor; **Johns Hopkins University, USA:** Prof. Henry Mosley, Prof. R. Bradley Sack, and Dr. Sally G. McGregor; **JSI Research and Training Institute, USA:** Dr. Sidney R. Schuler; **Ministry of Finance, Japan:** Mr. Murao, Director; **Ministry of Foreign Affairs, Japan:** Mr. Tomohiro Goto, Economic Cooperation Bureau; **Ministry of Health, Indonesia:** Dr. Ardi Kaptiningsih; **Ministry of Health and Family Welfare, Bangladesh:** Prof. A.K.M. Nurul Anwar, Director General, and Dr. Shamsul Hoque, Director, Directorate General of Health Services; Mr. D.K. Nath, Director General, Directorate of Family Planning; **Ministry of Health and Family Welfare, India:** Dr. S. Malhotra, Assistant Commissioner, Mr. Vijay Singh, Joint Secretary and Financial Adviser; **National Centre for Epidemiology and Population Health, Australian National University, Australia:** Prof. John C. Caldwell, Coordinator, Dr. Tony Adams, Professor of Public Health, Professor R.M. Douglas, Dr. Bruce K. Caldwell, Research Fellow, and Dr. Wayne Smith, Epidemiologist; **National Institutes of Health, USA:** Dr. George Curlin, Deputy Director; **Nepal:** A 13-member team from Nepal led by Mr. Y.P. Shrestha; **Nugata University, Japan:** Dr. Yamamoto; **Occidental, Dhaka:** Mr. Nigel L. Hopkinson, President and General Manager;

Partners in Population and Development, Dhaka: Dr. Atiqur Rahman Khan, Senior Adviser; **SDC, Dhaka:** Mr. Giambattista Mondada, Charge d'Affaires, Mr. Philippe Besson, Resident Coordinator, and Dr. Walter Meyer, Deputy Resident Coordinator; **Shahid Beheshti Medical University, Iran:** Dr. (Ms) Safieh Shahriari Afshar, Gynecologist and Dr. (Ms) Hourieh Shamshiri Milani, Professor; **Shell Bangladesh Exploration & Dev. B.V.:** Mr. Ton van der Helm, General Manager; **SmithKline Beecham Pharmaceuticals, India:** Mr. Bharat Rawal, Senior Marketing Manager, Bangladesh Operation; **SmithKline Beecham International, UK:** Dr. Manouchehr Yazhari, Director, Community Treatment; **Swedish Embassy, Dhaka:** Mr. Klas Rasmusson, First Secretary; **Swiss Parliament:** Mrs. Trix Heberlein, President; **Tohoku University School of Medicine, Japan:** Prof. Naruo Uehara, Professor of International Health; **Tokyo University, Japan:** Dr. Daisaku Yasui; **Toronto University, Canada:** Ms Melanni Edwards; **UNFPA, Dhaka:** Ms Janet E. Jackson, Deputy Representative; **UNFPA, Tehran:** Dr. M. Mosleh-Uddin, Representative; **UNICEF, New York:** Prof. Roger Shrimpton; **University of El Valle Cali, Colombia:** Dr. Julian Herrera, Professor; **University Village place NE, USA:** Ms Suzanne Cluett, Associate Director; **UNOCAL, USA:** Mr. John Imle, President; **UNOCAL Bangladesh Ltd.:** Mr. Terry Budden, President; **USAID, Dhaka:** Mr. Matt Friedman, Technical Advisor in AIDS and Child Survival, and Dr. Zareen Khair, Cognizant Technical Officer; **USAID, Washington:** Mr. Neal Brandes, Child Health Advisor, and Mr. Charles Llewellyn, Team Leader, PHN, Asia & Near East Bureau, and Ms Laura M. Kelley, Director, Child Health Research Project; **World Bank, Washington:** Mr. Eduardo Doryan, Vice President for Human Development Network, Ms Mieko Nishimizu, Vice President, Dr. Anne Tinker, Principal Health Specialist, Health, Population and Nutrition Unit, South Asia Region, Dr. Milla McLachlan, and Ms Nina L. Frankel, Consultant; **WHO, Bangladesh:** Dr. Derek Lobo, Consultant; **WHO, Switzerland:** Dr. Jerker Liljestrand, Department of Reproductive Health and Research.



Mr. Murao, Director of the Ministry of Finance in Tokyo, Japan and Mr. Urahe, Director of Accounts of the Ministry of Foreign Affairs



Officials of the Lzumi Foundation of Japan

INSTITUTIONAL LINKAGES The Centre and its scientific divisions maintained institutional linkages with various international and national organizations in 1999. Some major ones are listed below (in alphabetical order):

International Level

Abt Associates, USA; Albany Medical College, USA; AMP, France; Armed Forces Research Institute of Medical Sciences, Thailand; Australian National University; Centers for Disease Control and Prevention, USA; Centre for International Child Health, UK; Chiba University, Japan; CNAM, France; Cornell University, USA; Emory University, USA; FOCUS Project, USA; Global Forum for Health Research, Switzerland; Harvard Medical School, USA; Harvard University, USA; Hasan Sadekin Hospital, Indonesia; INSERM, France; International Institute for Population Studies, India; Institute of Child Health, UK; Institution of Food Sciences, Switzerland; International Atomic Energy Agency, Austria; International Vaccine Institute, Korea; Johns Hopkins University, USA; Johns Hopkins University School of Public Health, USA; Karolinska Institute, Sweden; London School of Hygiene & Tropical Medicine, UK; Louisiana State University Medical Center, USA; McGill University, Canada; Maryland Biotechnology Institute, USA; National Institute of Cholera and Enteric Diseases, India; National Institute of Immunology, India; National Institute of Infectious Diseases, Japan; National Institutes of Health, USA; Netherlands Interdisciplinary Demographic Institute; New England Medical Center, USA; Oxford University, UK; Partnerships for Health Reforms, USA; Pasteur Institute, France; Population Council, India; Population Studies Centre, University of Pennsylvania, USA; RAND Corporation, USA; Southampton University, UK; St. John Medical School, India; Tufts University, USA; UNICEF; University of Alabama at Birmingham, USA; University of Basel, Switzerland; University of California-Davis, USA; University of Göteborg, Sweden; University of Leuven, Belgium; University of Liege, Belgium; University of Maryland, USA; University of New Castle, UK; University of Umea, Sweden; University of Texas at Galveston, USA; University of Virginia, USA; Wageningen Agricultural University, The Netherlands; Walter Reed Army Institute of Research, USA; World Health Organization, Switzerland; Wyeth-Lederle-Praxis, USA.

National Level

Access to Voluntary and Safe Contraception; ARI Control Programme, Government of

Bangladesh; Bangabandhu Sheikh Mujib Medical University; Bangladesh Bureau of Statistics; Bangladesh Center for Communication Programs; Bangladesh Institute of Development Studies; Bangladesh Institute of Research for Promotion of Essential and Reproductive Health & Technologies (BIRPERHT); Bangladesh Integrated Nutrition Project; Bangladesh Rural Advancement Committee (BRAC); Bangladesh Women's Health Coalition; CARE-Bangladesh; Concern Bangladesh; Concerned Women for Family Development; Department of Public Health Engineering; Dhaka City Corporation; Dhaka Medical College Hospital; Dhaka Shishu (Children's) Hospital; Directorate of Family Planning; Directorate General of Health Services; EPI Programme, Government of Bangladesh; Grameen Bank; Health Economics Unit, Ministry of Health and Family Welfare; Helen Keller International, Dhaka; Holy Family Hospital; Institute of Epidemiology, Disease Control and Research; Institute of Health Economics, University of Dhaka; Institute of Nutrition and Food Science, University of Dhaka; Institute of Public Health Nutrition; Jahangirnagar University; John Snow Inc., Dhaka; Kumudini Welfare Trust (Kumudini Hospital); Management Change Unit, Ministry of Health and Family Welfare; Management Sciences for Health, Dhaka; Ministry of Health and Family Welfare; National Institute of Population Research and Training; National Institute of Preventive and Social Medicine; Pathfinder International, Dhaka; Population Council, Dhaka; Population Services and Training Centre; Programme Coordination Cell, Ministry of Health and Family Welfare; Radda MCH-FP Centre; Shahjalal University of Science and Technology; Social Marketing Company; TB/Leprosy Control Programme, Government of Bangladesh; UNICEF, Dhaka; University of Dhaka; University of Rajshahi; World Health Organization, Dhaka; World Bank, Dhaka.

INTER-DIVISIONAL SCIENTIFIC FORUM LIST

Holding inter-divisional scientific forum is a regular activity of the Centre. These fora are intended to generate ideas to undertake collaborative research work involving multidisciplinary approach. In total, 29 inter-division scientific fora were organized for scientific divisions of the Centre in 1999. A division-wise list of these fora is presented below:

Clinical Sciences Division

Jehan-Francois Desjeux (France). Why diarrhoea is a self-limited disease?

Olle Hernell (Sweden). Iron needs in infancy

Saskia Osendarp. Zinc supplementation during pregnancy and effect on an infant's growth and morbidity during the first 6 months of life

Anneli Ivarsoon (Sweden). Epidemiology of coeliac disease (gluten intolerance) in Sweden

Iqbal Kabir. Effect of feeding a low-cost vegetable protein-based diet to malnourished children during recovery from shigellosis

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G.H. Rabbani. Role of nitric oxide in the pathogenesis of cholera and shigellosis

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Health and Population Extension Division

Mohsin Uddin Ahmed. Reproductive tract infections and sexually transmitted diseases: what is happening in Bangladesh

Shameem Ahmed. Neonatal morbidity and care-seeking behaviour in rural Bangladesh

Ali Ashraf. Alternative strategies for delivering MCH-FP services: key findings and lessons learned from rural and urban areas

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Saifur Rahman. Can medicine-sellers in pharmacies meet the needs of STD clients? Observations from Tongi municipality area

Laboratory Sciences Division

Rashidul Haque. Diagnosis of *Entamoeba histolytica* and *E. dispar* infection

Dilara Islam. Immune responses in children with both acute lower respiratory tract infection and diarrhoea

M. Sirajul Islam. Role of zooplankton in maintaining endemicity and seasonality of cholera in Bangladesh

Firdausi Qadri. The immune response in children: attempts to understand it better

A.S.M. Hamidur Rahman. Raising *Coccidia*-free rabbit with medicated chaw in a conventional laboratory animal facility

Rubhana Raqib. Innate immune responses in children and adults with shigellosis

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Mohammad Ali. Spatial data analysis in the health and environmental studies: some useful applications of GIS

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K. Zaman. Children's fluid intake during diarrhoea: a comparison of questionnaire responses with data from observations

A. Internal Publication Series

1. ICDDR,B Annual Report 1998. May 1999. 143 p.

Working Papers

2. Ahmed S, Wirzba H, Hakim JA, Barkat-e-Khuda, Khatun R. Disease patterns, treatment practices and drug requirements in rural Bangladesh: a review of five studies. Edited by M. Shamsul Islam Khan. 1999. 17 p. (ICDDR,B working paper, 119; Operations Research Project working paper, 153)
3. Ahmed S, Islam A, Mitra DK, Khanum PA, Barkat-e-Khuda. Use of a sub-district hospital for management of obstetric complications in rural Bangladesh. Edited by M. Shamsul Islam Khan. 1999. 28 p. (ICDDR,B working paper, 124; Operations Research Project working paper, 156)
4. Alamgir S, Manaf S, Hasan Y, Rahman S, Tuñón C, Kane TT, Islam M, Nazrul H. Operationalizing a cost-effective tiered system for delivering the essential services package: a needs assessment study for the Sher-e-Bangla Nagar Government Outdoor Dispensary in urban Dhaka. Edited by M. Shamsul Islam Khan. 1999. 128 p. (ICDDR,B working paper, 125; Operations Research Project working paper, 157)
5. Azim SMT, Islam MT, Tuñón C, Mahmood S, Kabir H, Mahbub-ul-Alam, Saha NC. Testing validity of ARI diagnosis made by primary healthcare field workers with and without a checklist. Edited by M. Shamsul Islam Khan. 1999. 20 p. (ICDDR,B working paper, 126; Operations Research Project working paper, 158)
6. Desmet M, Bashir I, Sohel N. Illness profile and health-care utilization patterns of slum residents in Dhaka-city, Bangladesh. Edited by M. Shamsul Islam Khan and Kuntal Kumar Saha. 1998. 165 p. (ICDDR,B working paper, 111; Health Economics Programme working paper, 4-98)*
7. Nahar Q, Tunon C, Houvras I, Gazi R, Reza M, Huq NL, Barkat-e-Khuda. Reproductive health needs of adolescents in Bangladesh: a study report. Edited by M. Shamsul Islam Khan. 1999. 56 p. (ICDDR,B working paper, 130; Operations Research Project working paper, 161).
8. Rahman MM, Barkat-e-Khuda, Reza MM. Determinants of safe-delivery practices in rural Bangladesh: evidence from the Bangladesh demographic and health survey, 1996-1997. Edited by M. Shamsul Islam Khan. 1999. 10 p. (ICDDR,B working paper, 123; Operations Research Project working paper, 155)
9. Rahman S, Ahmed MU, Barkat-e-Khuda, Ahmed S. Can medicine-sellers in pharmacies meet the needs of STD clients? Observations from an urban area of Bangladesh. Edited by M. Shamsul Islam Khan. 1999. 18 p. (ICDDR,B working paper, 127; Operations Research Project working paper, 159)
10. Routh S, Barkat-e-Khuda. An economic appraisal of alternative strategies for delivery of MCH-FP services in urban Dhaka, Bangladesh. Edited by M. Shamsul Islam Khan. 1999. 28 p. (ICDDR,B working paper, 120; Operations Research Project working paper, 154)
11. Shahriar A, Routh S, Bhuiyan MA, Sarker S, Ashraf A. Operationalization of ESP delivery and community clinics: behaviour change communication needs of community clinics, a study of providers' perspectives. Edited by M. Shamsul Islam Khan. 1999. 42 p. (ICDDR,B working paper, 129; Operations Research Project working paper, 162).

12. Sobhan F, Islam A, Quaiyum MA, Barkat-e-Khuda, Ahmed S. Clinical contraceptives: situation in rural Bangladesh. Edited by M. Shamsul Islam Khan. 1999. 28 p. (ICDDR,B working paper, 128; Operations Research Project working paper, 160).

Scientific Reports

13. Bhuiya A, Aziz A, Chowdhury M. Induced abortion in a rural area of Bangladesh: process management health consequences. Edited by M.A. Rahim. 1999. 27 p. (ICDDR,B scientific report, 86)
14. Bhuiya A, Chowdhury M, Momen M, Khatun M. Marital disruption in a rural area of Bangladesh: predisposing factors and consequences on women's lives. Edited by M.A. Rahim. 1999. 32 p. (ICDDR,B scientific report, 85)
15. Mostafa G, Razzaque A, Sarder AM, Saha SK, van Ginneken JK, Bairagi R. Demographic surveillance system--Matlab. V. 30. Registration of demographic events 1997. 1999. 76 p. (ICDDR,B scientific report, 84)

Special Publications

16. Ahmed KS, Mozumder ABMKA, Barkat-e-Khuda. Redesigning the Operations Research Project surveillance system. 1999. 36 p. (ICDDR,B special publication, 107).
17. Anowar N, Barkat-e-Khuda, Azim SMT, Kabir MH, editors. Record-keeping and reporting guidelines for field/community clinic and union-level service providers. 1999. 23 p. (ICDDR,B special publication, 102) [Bangla]
18. Ashraf A, Kane TT, Shahriar A, Barkat-e-Khuda. Male involvement in reproductive health services in Bangladesh: a review. Edited by M. Shamsul Islam Khan. 1999. 20 p. (ICDDR,B special publication, 94)
19. Azim SMT, Kabir MH, Alam MM. Current record keeping systems in the context of delivery of essential services package: a review. Edited by M. Shamsul Islam Khan. 1999. 36 p. (ICDDR,B special publication, 97)
20. Hasan Y, Alamgir S, Reza M, Ashraf A, Barkat-e-Khuda. Developing a cost-effective tiered system for delivering essential services package: a review. Edited by M. Shamsul Islam Khan. 1999. 28 p. (ICDDR,B special publication, 93)
21. Islam Z, Sarker S, Routh S, Mesbahuddin M, Shahjahan M, Khan ZA. Guidelines for thana health and family planning officers for selection of sites for community clinics. Edited by M. Shamsul Islam Khan. 1999. 36 p. (ICDDR,B special publication, 104) [Bangla]
22. Islam Z, Sarker S, Routh S, Barkat-e-Khuda, Mesbahuddin M, Shahjahan M. Operations research on ESP delivery and community clinics in Bangladesh; site selection for community clinics: a field experience. Edited by M. Shamsul Islam Khan. 1999. 28 p. (ICDDR,B special publication, 106).
23. Karim AM, Ahmed S, Sobhan F, Faisel AJ. Developing strategies for improving the quality and performance of clinical contraceptive services: a review. Edited by M. Shamsul Islam Khan. 1999. 28 p. (ICDDR,B special publication, 89)

24. Khatun J, Gazi R, Uddin MA. Consensus building: Workshop on Planning and Coordination of Health Services in Dhaka City, 26 November 1998; summary proceedings. Edited by M. Shamsul Islam Khan. 1999. 18 p. (ICDDR,B special publication, 96)
25. Nahar Q, Amin S, Sultan R, Nazrul H, Islam M, Kane TT, Barkat-e-Khuda, Tuñón C. Strategies to meet the health needs of adolescents: a review. Edited by M. Shamsul Islam Khan. 1999. 38 p. (ICDDR,B special publication, 91)
26. Orientation manual-1: UMIS record-keeping and reporting formats for community clinic and field-level service providers. Edited by Azim SMT, Kabir MH, Alam MM, Hossain AMZ, Anowar N, Ahmed T. 1999. 55 p. (ICDDR,B special publication, 99) [Bangla]
27. Orientation manual-2: UMIS record-keeping and reporting formats for community clinic and field-level service providers. Edited by Azim SMT, Kabir MH, Alam MM, Hossain AMZ, Anowar N, Ahmed T. 1999. 48 p. (ICDDR,B special publication, 100) [Bangla]
28. Orientation manual-3: UMIS record-keeping and reporting formats for community clinic and field-level service providers. Edited by Hossain AMZ, Anowar N, Ahmed T, Azim SMT, Kabir MH, Alam MM. 1999. 43 p. (ICDDR,B special publication, 101) [Bangla]
29. Quaiyum MA, Ahmed S, Islam A, Khanum PA. Strategies for ensuring referral and linkage for essential obstetric care: a review. Edited by M. Shamsul Islam Khan. 1999. 22 p. (ICDDR,B special publication, 95)
30. Quaiyum Z, Routh S, Rahman MA, Jahan M, Barkat-e-Khuda. Cost-recovery strategies in the health and population programmes of Bangladesh: issues for the application of users fees. Edited by M. Shamsul Islam Khan. 1999. 24 p. (ICDDR,B special publication, 90)
31. Rahman S, Ahmed MU, Barkat-e-Khuda, Ahmed S, Kane TT. Prevention and management of reproductive tract infections and sexually transmitted diseases: a review. Edited by M. Shamsul Islam Khan. 1999. 38 p. (ICDDR,B special publication, 86)
32. Sarker S, Islam Z, Routh S, Mesbahuddin M, Shahjahan M, Khan ZA. Guidelines for national-level facilitators for selection of sites for community clinics. Edited by M. Shamsul Islam Khan. 1999. 41 p. (ICDDR,B special publication, 103) [Bangla]
33. Sarker S, Routh S, Islam Z, Barkat-e-Khuda, Nasim SMA, Khan ZA. Operations research on ESP delivery and community clinics in Bangladesh; orientation on HPSP and ESP: issues for consideration. Edited by M. Shamsul Islam Khan. 1999. 38 p. (ICDDR,B special publication, 105).
34. Shahriar A, Nahar Q, Sultan R. Proceedings of the First Stock-taking Workshop on Adolescent Health Activities in Bangladesh, held on October 27, 1998, Sasakawa Auditorium, ICDDR,B, Dhaka. Edited by M. Shamsul Islam Khan. 1999. 62 p. Dhaka. (ICDDR,B special publication, 88)
35. Uddin MJ, Sirajuddin AKM, Mazumder MA, Chowdhury AI, Tuñón C, Uddin MA, Khatun J. ESP services in Dhaka city: an inventory of GoB and NGO health facilities. Edited by M. Shamsul Islam Khan. 1999. 192 p. (ICDDR,B special publication, 98)
36. Uddin MJ, Khatun J, Rahman MM, Tuñón C, Sirajuddin AKM. Interventions to promote local-level planning and coordination of essential health and family planning services: a review. Edited by M. Shamsul Islam Khan. 1999. 36 p. (ICDDR,B special publication, 92)
37. Vaccine research and environmental health; programme and abstracts of the Eighth Annual Scientific Conference (ASCON VIII) of the International Centre for Diarrhoeal Disease Research, Bangladesh, Dhaka, 13-14 February 1999. Edited by M. Shamsul Islam Khan and M.A. Rahim. 1999. 92 p. (ICDDR,B

special publication, 87)

Journal and Newsletters

- a. Journal of Diarrhoeal Diseases Research (also includes: Bibliography on Diarrhoeal Diseases). V.16, no. 4, 1998* and v.17, no. 1, 1999
- b. Glimpse. V.20, no. 4, 1998* and v. 21, nos. 1-2, 1999
- c. Shasthya Sanglap. V.7, no. 3, 1998* and v. 8, no. 1, 1999
- d. Electronic DISC Bulletin. No.1-52, 1999
- e. ICDDR,B News. V.9, nos. 3-4, 1998

B. Original Scientific Papers (Including Short Reports)

1. Ahmed HS, Chowdhury AMR, Khan MSI, Ullah AKMA. Sustainability of scientific journals in the developing world with special reference to Bangladesh. J Appl Commun 1999;83(4):23-42
2. Ahmed MK, Rahman M, van Ginneken J. Epidemiology of child deaths due to drowning in Matlab, Bangladesh. Int J Epidemiol 1999 Apr;28(2):306-11
3. Ahmed MU, Alam MM, Chowdhury NS, Haque MM, Shahid N, Kobayashi N, Taniguchi K, Urasawa T, Urasawa S. Analysis of human rotavirus G serotype in Bangladesh by enzyme-linked immunosorbent assay and polymerase chain reaction. J Diarrhoeal Dis Res 1999 Mar;17(1):22-7
4. Ahmed MU, Mirza T, Khanum PA, Khan MA, Ahmed S, Khan MH. Management of reproductive tract infections in rural Bangladesh [short report]. Int J STD AIDS 1999 Apr;10(4):263-7
5. Ahmed S, Islam A, Khanum PA, Barkat-e-Khuda. Induced abortion: what's happening in rural Bangladesh. Reprod Health Matter 1999 Nov;7(14):19-29
6. Ahmed S, Parveen SD, Islam A. Infant feeding practices in rural Bangladesh: policy implications. J Trop Pediatr 1999 Feb;45(1):37-41
7. Ahmed SM, Chowdhury AMR, Bhuiya A. Expanded programme on immunization and nutrition of under-five children: experiences from Matlab, Bangladesh. J Preven Soc Med 1998 Jun;17(1):1-9
8. Ahmed T, Ali M, Ullah MM, Choudhury IA, Haque ME, Salam MA, Rabbani GH, Suskind RM, Fuchs GJ. Mortality in severely malnourished children with diarrhoea and use of a standardised management protocol. Lancet 1999 Jun 5;353(9168):1919-22
9. Alam N, van Ginneken JK. Repeated neonatal deaths in families with special reference to causes of death. Paediatr Perinat Epidemiol 1999 Jan;13(1):78-88
10. Alam NH, Majumder RN, Fuchs GJ, and the CHOICE study group. Efficacy and safety of oral rehydration solution with reduced osmolality in adults with cholera: a randomised double-blind clinical trial. Lancet 1999 Jul 24;354(9175):296-9
11. Albert MJ, Faruque ASG, Faruque SM, Sack RB, Mahalanabis D. Case-control study of enteropathogens associated with childhood diarrhea in Dhaka, Bangladesh. J Clin Microbiol 1999 Nov;37(11):3458-64
12. Albert MJ, Qadri F, Bhuiyan NA, Ahmad SM, Ansaruzzaman M, Weintraub A. Phagocytosis of *V. cholerae* O139 Bengal by human polymorphonuclear leukocytes. Clin Diagn Lab Immunol 1999 Mar;6(2):276-8

13. Ali M, de Francisco A, Khan MM, Chakraborty J, Myaux J. Factors affecting the performance of family planning workers: importance of geographical information systems in empirical analysis. *Int J Pop Geogr* 1999;5:19-29
14. Ansaruzzaman M, Shimada T, Bhuiyan NA, Nahar S, Alam K, Islam MS, Albert MJ. Cross-reaction between a strain of *Vibrio mimicus* and with *V. cholerae* O139 Bengal. *J Med Microbiol* 1999 Sep;48(9):873-7
15. Arends-Kuenning M, Hossain MB, Barkat-e-Khuda. The effects of family planning workers' contact on fertility preferences: evidence from Bangladesh. *Stud Fam Plann* 1999 Sep;30(3):183-92
16. Azim T, Rashid A, Qadri F, Sarker MS, Hamadani J, Salam MA, Wahed MA, Albert MJ. Antibodies to *Shiga* toxin in the serum of children with *Shigella*-associated haemolytic uraemic syndrome. *J Med Microbiol* 1999 Jan;48(1):11-6
17. Azim T, Ahmad SM, Sefat-e-Khuda, Sarker MS, Unicomb LE, De S, Hamadani JD, Salam MA, Wahed MA, Albert MJ. Immune response of children who develop persistent diarrhea following rotavirus infection. *Clin Diagn Lab Immunol* 1999 Sep;6(5):690-5
18. Bairagi R, Sutradhar SC, Alam N. Levels, trends and determinants of child mortality in Matlab, Bangladesh, 1966-1994. *Asia-Pacific Pop J* 1999 Jun;14(2):51-68
19. Barkat-e-Khuda, Roy NC, Rahman DMM. Unmet contraceptive need in Bangladesh: evidence from the 1993/94 and 1996/97 demographic and health surveys. *Asia-Pacific Pop J* 1999 Jun;14(2):37-50
20. Bhuiyan BU, Rahman M, Miah MR, Nahar S, Islam N, Ahmed M, Rahman KM, Albert MJ. Antimicrobial susceptibilities and plasmid contents of *Neisseria gonorrhoeae* isolates from commercial sex workers in Dhaka, Bangladesh: emergence of high-level resistance to ciprofloxacin. *J Clin Microbiol* 1999 Apr;37(4):1130-6
21. Bhutta ZA, Black RE, Brown KH, Gardner JM, Gore S, Hidayat A, Khatun F, Martorell R, Ninh NX, Penny ME, Rosado JL, Roy SK, Ruel M, Sazawal S, Shankar A. Prevention of diarrhea and pneumonia by zinc supplementation in children in developing countries: pooled analysis of randomized controlled trials. *J Pediatr* 1999 Dec;135(6):689-97
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