ICDDR,B
Centre for Health and Population Research

ANNUAL REPORT 1998

CENTRE
FOR HEALTH AND
POPULATION RESEARCH

ICDDR,B
entre for Health and Population Research

ICDDR,B or 'The Centre' was established in 1978 as successor to the Cholera Research Laboratory created in 1960 to study the epidemiology, treatment, and prevention of cholera. The Centre is an independent, international, non-profit organization for research, education, training, clinical services, and information dissemination. Located in Dhaka, the capital city of Bangladesh, the Centre is the only truly international health research institution based in a developing country. The results of research conducted over the years at the Centre provide guidelines for policy makers, implementing agencies, and health professionals in Bangladesh and around the globe. Researchers at the Centre have made major scientific achievements in diarrhoeal disease control, maternal and child health, nutrition, and population sciences. These significant contributions have been recognized worldwide.

How Is the Centre Organized?

The Centre is governed by a distinguished multinational Board of Trustees comprising researchers, educators, public health administrators, and representatives of the Government of Bangladesh. The Board appoints a Director and four Division Directors who head the Centre's four scientific divisions. The Centre currently has over 240 scientists and medical staff from more than ten countries conducting research and providing expertise in multiple disciplines relating to the Centre's areas of research. In total, over 1,200 personnel work in the Centre

The **Clinical Sciences Division** (CSD) is composed of physicians and scientists trained in paediatrics, general medicine, gastroenterology, infectious diseases, nutrition, and epidemiology. The focus of the Division is on: (i) hospital- and community-based clinical research in the fields of infectious diseases and nutrition; (ii) hospital care to more than 120,000 patients annually at the Clinical Research and Service Centre in Dhaka; (iii) preventive healthcare to mothers and children; and (iv) training in case management and research methodology. Research activities are along the themes of case management (nutritional, fluid, and pharmacologic therapies), pathophysiology, and preventive/maternal and child health.

The **Health and Population Extension Division** (HPED), with staff comprising public health professional, economists, demographers, statisticians, and social scientists, undertakes operations research and interventions in family planning, reproductive and child health, epidemics control, and environmental health. The Division provides technical assistance, training, and environmental laboratory services to the Government of Bangladesh and non-governmental organizations in these fields. The Division comprises the Operations Research Project (ORP), the Epidemic Control Preparedness Programme (ECPP), and the Environmental Health Programme (EHP). The objective of ORP is to strengthen the national health and population programme by improving the efforts of the government, NGO, and private sector

(See inside of the back cover)

B

CENTRE
FOR HEALTH AND
POPULATION RESEARCH

ANNUAL REPORT 1998

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

Chief Editor	George J. Fuchs
Editors	M.A. Rahim M. Shamsul Islam Khan
Managing Editor	M. Shamsul Islam Khan E-mail: msik@icddrb.org
Cover Design, Page Lay-out and Desktop Processing	Asem Ansari
Photographs	Asem Ansari Fakrul Alam
Printing Supervision	Asem Ansari M.A. Rahim Talut Solaiman
Secretarial Assistance	M.M. Hassan
Colour Scanning	Desh Graphics
Printed at	BRAC Printers

© 1999 International Centre for Diarrhoeal Disease Research, Bangladesh

May 1999

ISBN 984-551-173-2

Publisher
International Centre for Diarrhoeal Disease Research, Bangladesh
(GPO Box 128, Dhaka 1000)
Mohakhali, Dhaka 1212, Bangladesh

Phone: (880-2) 871751-60
Cable: CHOLERA DHAKA
Telex: 675612 ICDD BJ
Fax: (880-2) 883116, 886050, and 871686
E-mail: director@icddrb.org
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 1998 of this report.

Cover: 'From barge to bricks' well explains the development of the Centre over the past 20 years after its internationalization. The graphics show the new training centre at Matlab, constructed recently with financial assistance from Japan.

2

Preface

This twentieth Annual Report of the Centre documents many aspects of the activities during 1998, including research, support for research, health services, training, dissemination, and administration.

Scientific papers, abstracts, and other documents produced and published by the Centre's staff, alumni, and by visiting scientists are also listed in the report. Many of the research works included here were initiated in previous years and hence documented in earlier reports. The studies that were completed during 1998 presented the final results. Some of the studies initiated earlier are still ongoing. Preliminary findings from these studies are reported in this document.

If you have any comments on this report or would like to have more information about the Centre or the works described here, please write to the Centre at the address given on the opposite page.

DIRECTOR'S REPORT 7
THE CENTRE OVER THE YEARS 15

CLINICAL SCIENCES DIVISION 17
Division Highlights 17
Case management Research 18
Nutritional Therapy 18
Fluid Therapy 21
Pharmacologic Therapy 23
Pathophysiology Research 24
Preventive/Maternal Child Health Research 27
Clinical Research and Service Centre 30
Nursing Programme 31
Child Health Programme 32
Operations and Policy Research Programme of the BINP 32
Hospital Surveillance Programme 33
Physiology Laboratory 34

HEALTH AND POPULATION EXTENSION DIVISION 37
Division Highlights 37
Operations Research Project 38
ORP Activities in 1998 39
Survey and Field Research Activities 46
Dissemination Activities 47
Technical Assistance 47
Epidemic Control Preparedness Programme 47
Diarrhoea Epidemics in Bangladesh in 1998 48
Epidemic Investigations and Interventions by ECPP 48
Environmental Health Programme 49
Action Research 49
Global Applied Research Network (GARNET) 52

LABORATORY SCIENCES DIVISION 55
Division Highlights 55
Infectious Disease Research Programme 56
Emerging and Re-emerging Infectious Diseases 56
Control of Diarrhoeal Diseases 60
Vaccine Evaluation 62
Nutrition 65
Reproductive Tract Infection 66
Laboratory Services Programme 67
Clinical Pathology Laboratory 67
Clinical Microbiology Laboratory 67
Clinical Biochemistry Laboratory 68
Matlab Clinical Laboratory 69
Administrative Support Services 69
Logistics Support 69
Biomedical Engineering 70
Animal Resources Facility 70

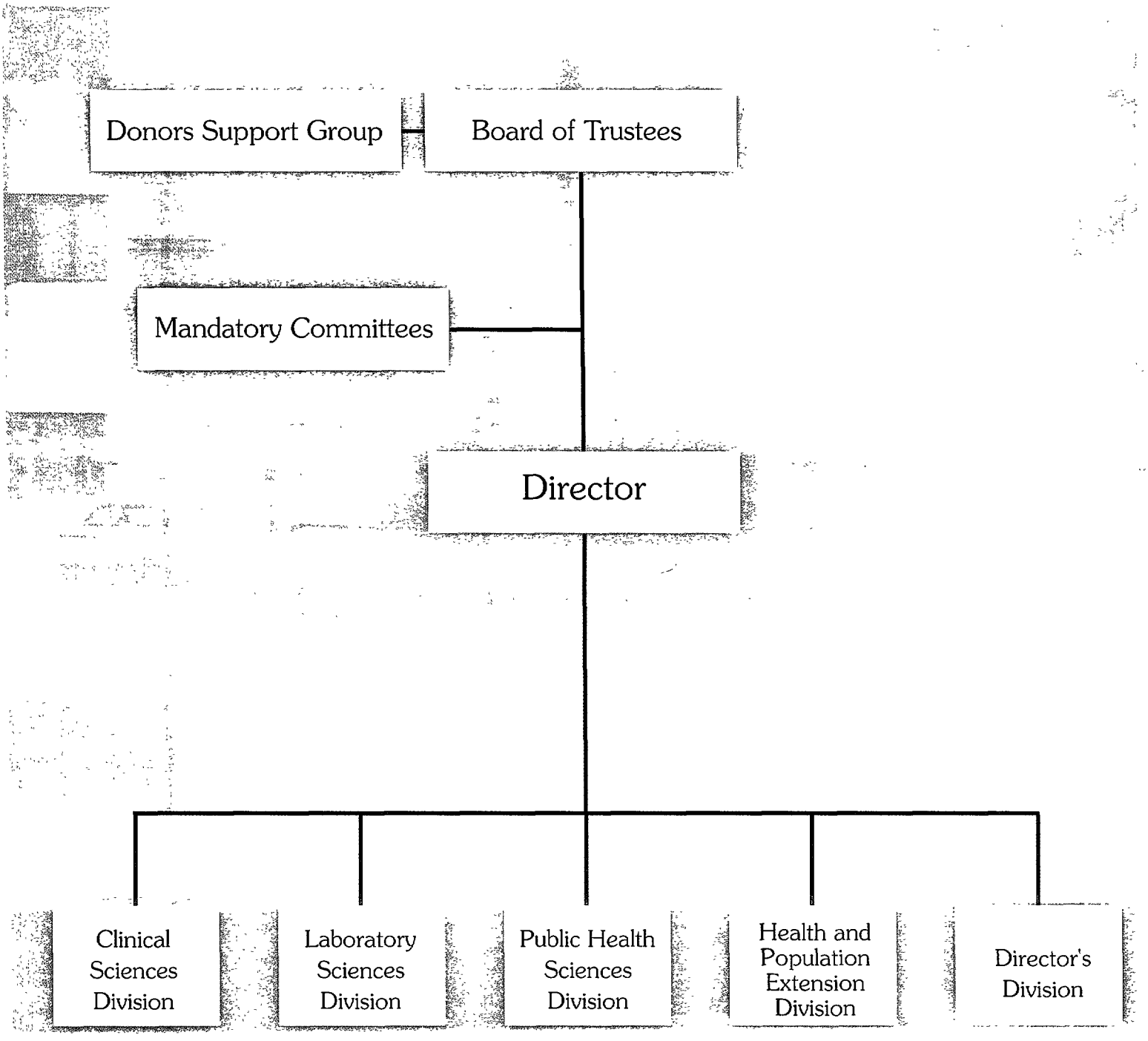
Contents

73 PUBLIC HEALTH SCIENCES DIVISION
73 Division Highlights
74 Matlab Health Research Programme
76 Services Provided in Matlab Community
76 Health Services (Mother and Child)
77 Record Keeping System (RKS) at Matlab
77 Research Activities
78 Reproductive Health Programme
80 Child Health Programme
82 Health and Demographic Surveillance Programme
87 Social and Behavioural Sciences Programme
91 Health Economics Programme

95 DIRECTOR'S DIVISION
95 Division Highlights
96 Personnel Department
96 External Relations and Institutional Development Office
100 Finance Office
100 Financial Highlights
101 Auditors' Report
104 Training and Education Department
104 Health Research Training
104 Training of Trainers (TOT)
106 Fellowships for Training
107 National Training Courses
108 National Workshops
109 Seminars
109 Staff Development
109 Overseas Training
109 In-country Training
109 In-house Training
110 Dissemination and Information Services Centre
110 Information Services
111 Publications Services
111 Audiovisual Unit
111 Computer Information Services
112 Engineering and Support Services Department
112 Procurement Branch
112 Estate Office
112 Travel Services Office
112 Other Support Services
113 COMMITTEES
115 STAFF WELFARE ASSOCIATION
115 VISITORS IN 1998
117 INSTITUTIONAL LINKAGES
119 INTER-DIVISIONAL SCIENTIFIC FORUM LIST
121 ICDDR,B PUBLICATIONS 1998
138 INDEX

CENTRE
FOR HEALTH AND
POPULATION RESEARCH

ICDDR,B
Centre for Health and Population Research



DIRECTOR'S REPORT

1998 hallmarked both achievements and new challenges for the Centre. While the Centre expanded in its project activities and financing, its core staff and budgets decreased thereby requiring major adjustments. A process of right-sizing and restructuring was agreed to by its governing Board of Trustees and initiated by the senior management team. The unprecedented flood of 1998 in Bangladesh posed new challenges to the clinical units of the Dhaka hospital and the Matlab Research and Service Centre expanding daily patient admissions to record highs. Through our epidemiological surveillance and control teams and environmental health initiatives, ICDDR,B provided outreach healthcare to numerous rural and isolated areas to control epidemics of diarrhoeal disease due to the flood. At the same time, ICDDR,B took on new initiatives and acquired new donor support from international organizations and the corporate sector.

In 1998, we saw the departure of several key members of the senior management team, each of whom contributed to the growth and development of the Centre. We acknowledge with sincere appreciation the contribution of Dr. Robert Suskind who served as Director of ICDDR,B till June 1998. During his brief tenure, Dr. Suskind made several noteworthy contributions, like attracting the interest of a new major donor, the World Bank. He also provided a vision of how the Centre might be organized along the lines of scientific themes as a means of integrating the skills of the Centre's scientists across the four scientific divisions. These contributions will have a lasting effect on the future of the Centre. We also gratefully acknowledge the contributions of Mr. Ali Mahbub as Director of the Administration and Personnel Division for almost ten years and of Syed Shamim Ahsan as Director of the Health and Population Extension Division. Professor Patrick Vaughan's contributions to the reorganization of the Public Health Sciences Division and strengthening of the Matlab Research and Service Centre, its community-based clinics and demographic surveillance system are noteworthy and much appreciated as significant accomplishments for the Centre.

Sheikh Hasina, Hon'ble Prime Minister of Bangladesh, saw first-hand the patient care at the permanent facilities as well as the expanded makeshift units during the 1998 flood-related epidemics of diarrhoeal diseases

In July 1998, I agreed to serve as the Centre's Interim Director at the request of and appointment by the Board of Trustees.

In November 1998, the Board of Trustees selected Professor David Sack of the Johns Hopkins School of Hygiene and Public Health to assume the post of Director of ICDDR,B, effective October 1999. As a former director of the Laboratory Sciences Division, Dr. Sack has had a longstanding relationship with the Centre. We look forward to working with him in his future role as Centre Director.

The Prime Minister of Bangladesh Sheikh Hasina visited the Dhaka hospital on 28 September during the height of the diarrhoeal disease epidemic

caused by the unprecedented flood of 1998. During her visit, the Prime Minister observed the treatment of severely malnourished children in the Nutrition Rehabilitation Unit and patients in the Short Stay Ward, the General Ward, and the makeshift unit of the hospital. The makeshift unit had to expand to serve the patient load that tripled in its daily average during the flood epidemic. Once again, the Prime Minister praised the Centre, expressed her satisfaction over the diarrhoea management system, and pledged continued support to the Centre.

Donor support to the Centre was multifaceted. Although unrestricted (core) contributions continued to decline, project support expanded with major funding provided for new initiatives in emerging and re-emerging infectious diseases, safe motherhood and reproductive health, vaccine studies, and nutrition, including micronutrient interventions. The shift of selected core activities to restricted (project) funds, coupled with significant savings in 1998, resulted in a decrease of approximately US$589,000 in our net expenditure, excluding capital costs, for the year that led to a deficit of US$ 818,000. The reduction in our deficit of almost one million US dollar stands in contrast to the previous projection that our deficit would be nearly US$ 1,611,000 in 1998. Initiatives to right-size the Centre's workforce, particularly through streamlining its administrative structure, have resulted in a potential annual reduction in salary outlay of approximately US$ 471,000 in future years. This concerted effort by the Centre has enabled a reduction in our deficit from US$ 1.8 million in 1997 to an actual of US$ 818,000 by the end of 1998. The long-term financial impact of our efforts to right-size, as the first major step in the Centre's reorganization, will not be fully realised till the year 2001.

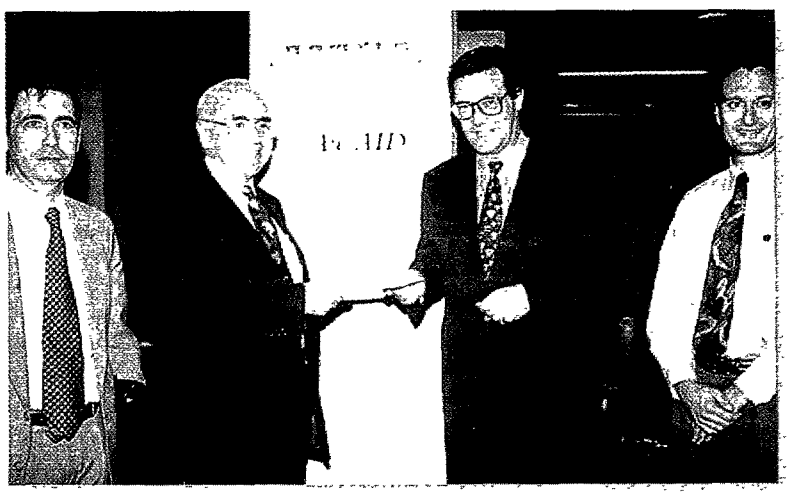
Additional support during the flood-related epidemic from our traditional donors covered the cost of treatment of the expanded patient population, helped us rehabilitate the ICDDR,B facilities in the hospitals and communities affected by the flood damage, and provided new equipment to enable us to better control infection in our hospital and clinical facilities. The contribution from four international energy companies marked the first major private-sector contribution that not only provided relief during an epidemic but also provided support to strengthen the hospital's infrastructure to ensure its ability to successfully manage future epidemics. The External Relations and Institutional Development Office played a key role in coordinating the donor responses to the flood-related epidemic.

Upon completion of a human resources review in May, the staff size was reduced by 94 personnel through separation and retirement packages. The Board of Trustees endorsed the conceptual framework for the Centre's reorganization. Acknowledging that the process will be continued over the next year, the senior management team is carefully approaching reorganization with a view to structuring the Centre in a way that will preserve existing strengths of the institution. At the same time, emphasis will be given to a cross-divisional thematic approach for research and other programmes. This is expected to make more efficient use of the multidisciplinary skills of the Centre and be also more consistent with the way in which donors provide funding.

The Clinical Sciences Division (CSD) continued to strengthen its programmes in research, service, and training in 1998. The Clinical Research and Service Centre—the Dhaka hospital of ICDDR,B—treated a record highest number of 157,441 patients, reflecting in large part the flood-related epidemic of diarrhoeal diseases. This implies a 37% increase in patient

visits compared to 1997. Hospital surveillance data revealed enterotoxigenic *Escherichia coli* to be more significantly associated than *V. cholerae* with summer peak of diarrhoeal diseases while childhood shigellosis and cholera were found to be associated with malnutrition in contrast to rotavirus which was associated with better-nourished children.

Case management remains an important area of CSD's research. Zinc supplementation to under-nourished children with persistent diarrhoea resulted in reduced duration of diarrhoea, better nutritional status, and fewer deaths. The roles of zinc, vitamin A, and iron in the management of severe malnutrition, diarrhoeal diseases, acute respiratory tract infections (ARI), *Helicobacter pylori* infection, and anaemia in children and women, and in the immune response in humans are also being assessed in a number of hospital- and community-based studies. Efforts continued toward development of better oral rehydration solutions to meet special requirements of specific population groups, such as neonates, young infants, and severely malnourished children. Under the emerging and re-emerging disease research initiative, CSD expanded its research activity in ALRI including identification of aetiology, antimicrobial resistance among major bacterial pathogens, and designing better therapeutic interventions.



Mr. Alexander Downer, Hon'ble Foreign Minister of Australia, presenting AusAID's annual contribution to Director Prof. Robert M. Suskind

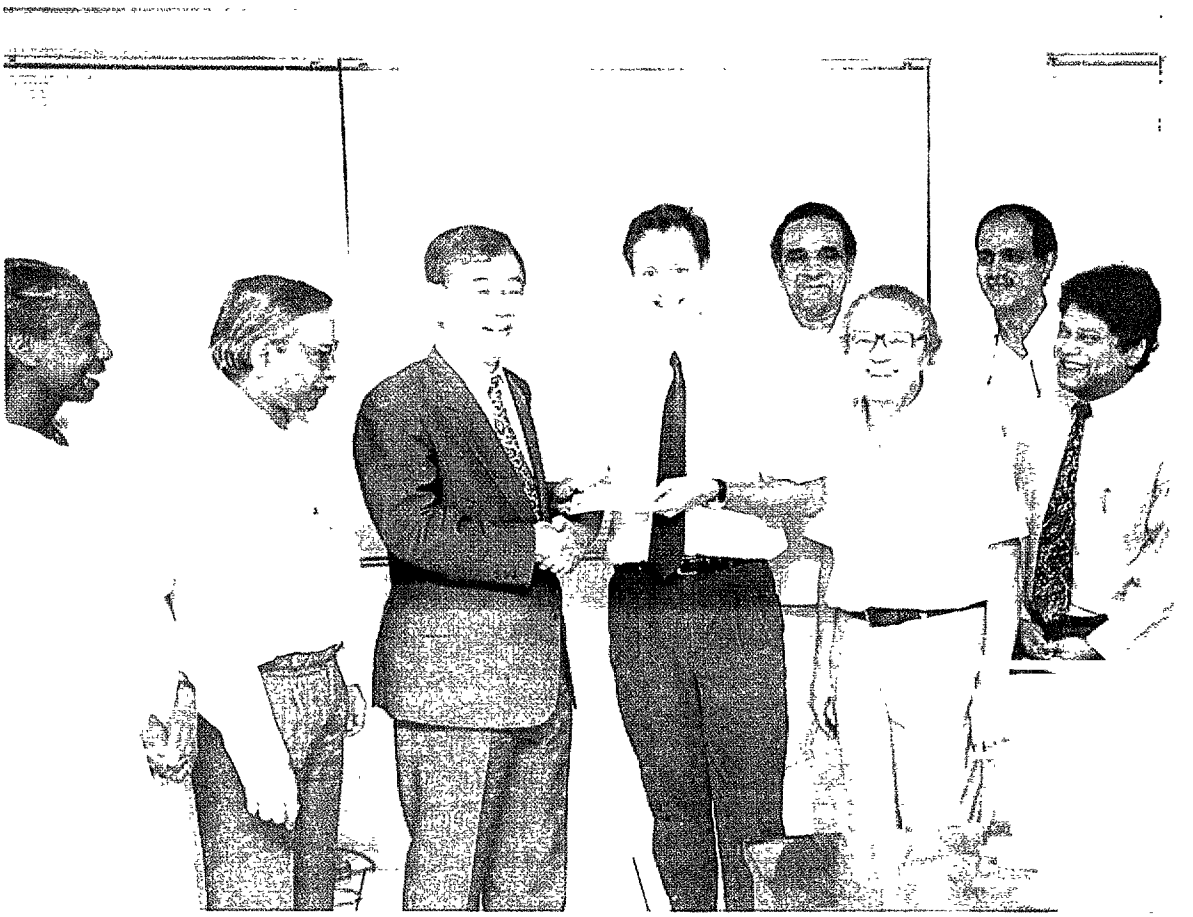
As part of its child survival activities through the Dhaka hospital, CSD maintained its programme for treatment of severely malnourished children, immunization against EPI diseases, and health education. Promotion of home management of diarrhoeal diseases; prevention of malnutrition through the use of locally-available, culturally-acceptable inexpensive foods; promotion of immunizations, exclusive breast-feeding during the first five months of life; and family planning remain the primary objectives of the child survival programme. To continue support for these child survival activities, CSD entered into discussions with JSI Urban Family Health Partnership in Bangladesh as a collaborator in providing services, improving hospital-based educational programmes, developing a referral network to UFHP's urban clinics for follow-up and identifying means of self-sustainability of hospital services. The collaboration is expected to begin in mid-1999.

The Laboratory Sciences Division (LSD) undertook and developed a new strategic plan for the Division in 1998. Research into the causes and reservoirs of *Vibrio cholerae* O1 and *V. cholerae* O139 and the possible mechanisms for the emergence of new epidemic strains of *V. cholerae* continued. In the field of vaccine evaluation, the work of the Laboratory Sciences Division will be an increasingly important part of the Centre's contribution as research continues on the effect of micronutrient supplementation and prior infection or exposure to pathogens on the immune responses. Other achievements included standardizing multiplex PCRs for the detection of

The Executive Board Members of UNICEF with senior members of the Centre's management team, observing patient care at the Dhaka hospital of ICDDR,B

microbial causes of watery diarrhoea and dysentery, reportable findings on early antibody response to ETEC vaccine and advancements in research on children with shigellosis. In the area of emerging and re-emerging infectious diseases, important information has been gained through research on enteric infections, respiratory infections, reproductive tract infections, and sexually transmitted diseases conducted by laboratory scientists in conjunction with clinical and public health scientists in the Centre. A surveillance system for HIV infection and syphilis in high-risk populations began in 1998 and represented

His excellency Mr. Yoshikazu Kaneko, Ambassador of Japan to Bangladesh, presenting his country's annual contribution to Prof. George Fuchs, Interim Director of the Centre



the first HIV/Syphilis National Sentinel Surveillance conducted in Bangladesh. Surveillance of antimicrobial-resistant organisms, responsible for epidemics of diarrhoeal diseases and ALRI, was also conducted as preparation for vaccine development and provided important data to the Government of Bangladesh. With funding through USAID's global initiative on emerging and re-emerging infectious diseases, LSD is strengthening labo-

ratories and scientists in national institutions of Bangladesh with the aim of improving the ability of national institutions to conduct surveillance on patterns of antimicrobial resistance of pathogens. Similarly, a technical consultancy supported by USAID is underway to assist clinical laboratories in Nepal to improve their antimicrobial resistance surveillance activities.

Director General of CIDA's South and Southeast Asia Bureau Ms Ingrid Hall, being given a tour to the Centre's Dhaka hospital by Interim Director Prof. George Fuchs

The Public Health Sciences Division (PHSD) achieved many of its objectives in 1998. The Division completed its construction of the International Training Centre at Matlab, supported by funds from the Government of Japan. A course for the paramedics on clinical treatment and management of childhood illnesses inaugurated the use of the facility. The fourth clinical sub-centre in the Matlab intervention area was also completed with funding from the Belgian Government. Provision of quality care and family meetings in the Matlab clinical sub-centres attracted pregnant women to deliver at health centres rather than in their homes.

Research proposals on rotavirus, *Shigella* and pneumococcal vaccines, essential obstetric care, male involvement in family planning, epidemiology and management of diarrhoea and ARI, nutrition, and behavioural surveillance in HIV/AIDs and other STDs were accepted by and funded with support from the European Union, USAID, the Ford Foundation, the World Bank, and other donors. The expanded research agenda which brought additional project funding, enhanced the financial capability of PHSD and strengthened its prospects for future research activities.

The Matlab and Chakaria intervention sites are PHSD's rural fieldsites for operations research on health and population, efficacy and effectiveness trials on antimicrobials, and vaccine development activities. Matlab served

Mr. Walter Fust, Director General of the Swiss Agency for Development Cooperation, during his visit to the Centre

as the fieldsite for vaccine trials on tetravalent Rhesus Rotavirus and *Shigella* vaccines. A trial on the effect of zinc supplementation during the clinical course of diarrhoea on children of less than five years is underway. The Chakaria Community Health Project, a collaborative project with BRAC and other NGOs, examines the impact of poverty alleviation programmes on health and human well-being in rural areas, sustainability of immunization programmes, community participation in primary healthcare and sexual behaviour in the context of RTIs and STDs. In 1998, the Chakaria Project expanded its activities to three additional thanas.

The Health and Demographic Surveillance Programme (HDSP) of PHSD, composed of the Demographic Surveillance System, the Record Keeping System and Geographic Information System in Matlab, is designed to evaluate the impact of different health and socioeconomic interventions. This programme undertakes research in population and health, determinants, consequences and implications for well-being of the people of the developing world. In 1998, the HDSP modernized the health and demographic surveillance systems with support from the Department for International Development (DfID), UK and also undertook a project on contraceptive use dynamics in Bangladesh, funded by the European Union.

The Health and Population Extension Division (HPED) is composed of the Operations Research Project (ORP), Epidemic Control Preparedness Programme (ECPP), and the Environmental Health Programme (EHP). ORP, funded by USAID, is the largest component of HPED. ORP, in collaboration with the Government of Bangladesh, USAID, and the National Integrated Population and Health Programme (NIPHP) partners, finalized eight operations research proposals for field-testing in the government and NIPHP programme sites. As part of its training and dissemination activities, ORP developed, produced, and disseminated the Essential Services Package (ESP), a set of activities that focuses on the treatment of diarrhoea, acute respiratory infections, RTI and STDs, provision of family planning services and health education and information relating to major health problems, including night-blindness, personal hygiene, worms, antenatal care, and pregnancy complications. ORP is now monitoring the effectiveness of its programme to disseminate this information to the NIPHP partners and government clinics. In collaboration with the Government of Bangladesh, research was begun to operationalize a cost-effective tiered system for delivering the ESP in rural and urban areas. ORP also developed a management information system (MIS) to improve the delivery of ESP and to assist the Government and NGOs involved in the NIPHP in the creation of a national integrated record-keeping and reporting system. And in response to the unacceptably high rate of maternal mortality, ORP established in Mirsarai a model Emergency Obstetrics Care (EOC) facility for the first time in a rural area. In 1998, the Mirsarai model EOC was expanded to five comprehensive EOC units in rural thana health complexes.

ECPP works in conjunction with the Government of Bangladesh and provides an early warning for impending cholera epidemics in the country. In 1998, the government epidemic surveillance system reported a total of 1,657,381 cases of and 2,064 deaths from acute diarrhoea. During the flood and post-flood period of July through November, 1,186,197 cases of and 1,836 deaths from diarrhoea were reported throughout the country. To improve detection of and prompt responses to cholera outbreaks, ECPP trained mid-level government health managers in six training sessions during 1998. With funding from the emergency flood relief, ECPP took its own team to remote rural sites and treated patients of acute diarrhoea and also assisted the local health service facilities to control epidemic outbreaks.

EHP, as past of its ongoing community-based activities, surveyed and identified sources of acceptable drinking water in arsenic-affected areas of Bangladesh. With flood relief assistance, the EHP personnel traveled the rural areas where drinking water sources were affected, and tubewells were damaged by the flood. As part of the coordinated relief effort, EHP reproduced and distributed materials on water, sanitation and hygiene and provided training to community workers at the field level on how to address the problems of water contamination and lack of sanitation due to the flood

Of particular significance in 1998, the Centre increased its emphasis on the cross-divisional approach to research activities in the areas of nutrition and emerging and re-emerging infectious diseases. As part of the Centre's nutrition agenda, the Nutrition Working Group which is composed of scientists from the four scientific divisions, conducted the operations research component of the Bangladesh Integrated Nutrition Programme. The Centre's nutritionists review, strengthen, and then select for funding research protocols submitted by a variety of institutions in Bangladesh, including ICDDR,B. The Centre's clinical protocol on the hospital-based treatment of severely malnourished children, its micronutrient interventions and laboratory, clinical and field research experience in nutrition captured the attention of the World Bank which awarded an initial grant of one million US dollar in 1998 to establish a Nutrition Centre of Excellence.

USAID, as part of its global initiative for emerging and re-emerging infectious diseases, provided support to a hospital-based surveillance of diarrhoeal disease. Surveillance of invasive *Haemophilus influenzae* (Hi) and *Streptococcus pneumoniae* (Spn), major causes of lethal childhood pneumonia, is also being conducted as part of an inter-divisional collaboration in Dhaka and in the Matlab intervention area. Surveillance data will be utilized by both ICDDR,B and the Government of Bangladesh to assess the prevalence of these pathogens and will also be used by the Centre to direct future research and trials related to vaccine development.

ICDDR,B has many challenges during the 1999 calendar year. Our expanding role in nutrition, supported by a grant from the World Bank, will allow us to conduct important research, provide training and further develop as a national and international resource in this field. The Centre plans to expand its partnership in other areas as well. Strengthening laboratories of national facilities and expansion of the diarrhoeal disease and ALRI surveillance activities under our Emerging and Re-emerging Infectious Diseases programme are designed to both improve reporting of the prevalence of infectious diseases and strengthen Bangladeshi national institutions as part of the network in reporting incidence of diseases. A key to the future success of our projects and programmes is an optimal infrastructure with improved human resources. Further emphasis will be placed in the immediate future upon strengthening our managerial capacity, staff development and infrastructural resources, such as our management information systems. We will continue to explore ways for the Centre to strengthen our ongoing activities and to attract new sources of support for work that addresses the global health agenda. In looking forward, we see the Centre moving into a new dimension of activity, with new challenges and new opportunities.

Professor George J. Fuchs
Interim Director

CENTRE
FOR HEALTH AND
POPULATION RESEARCH

Poster Designed and printed by Asem Ansari
Audiovisual Unit/ICDDR,B

He's just one of 10,000 patients we save every month. Those who make it to our Mohakhali hospital have more than a 99.5% chance of survival. That's why we're considered the best diarrhoeal disease hospital in the world. We want to continue providing free treatment to over 120,000 patients a year - and saving almost as many lives.

SO PLEASE, HELP

Your gift to ICDDR,B's Hospital Endowment Fund is a gift of life that will be invested, not spent. Our goal is to raise US$10 million by the year 2000. Your donation of US$ 250 will save one life every year for eternity; US$ 2500 will do the same for 10 lives, and so on...

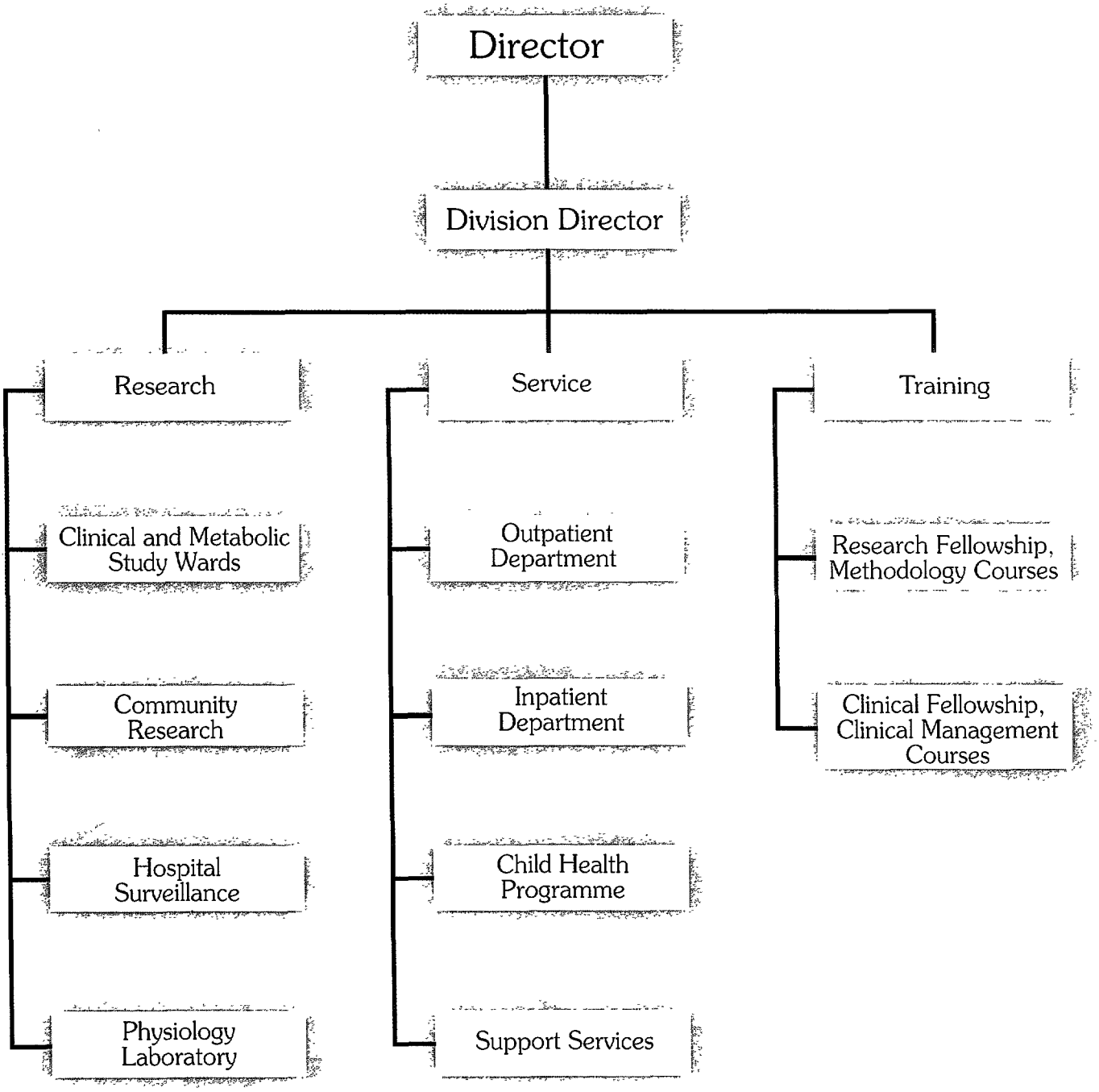
For tax deductible contributions in the USA,
make your check payable to the Child Health Foundation and send it to:
Interim Director Dr. George Fuchs, ICDDR,B Hospital Endowment Fund,
GPO Box 128, Dhaka 1000. Tel : 871751-60
or directly to
Child Health Foundation, 10630 Little Paxtuxent Pkwy, Century Plaza-Suite 325, Columbia, MD 21044, USA

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. 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). 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. Indeed, many of the Centre's alumni have become 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 Oral Rehydration Solution 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
WC/BS cholera vaccine trial launched
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 govern ment 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

Clinical Sciences Division



Clinical Sciences Division

Division Director
George J. Fuchs

Interim Head (since July)
M.A. Salam

The Clinical Sciences Division (CSD) continued its research, patient care, and training activities in 1998 with the support of 175 fixed-term employees (121 core and 54 project personnel). Another 88 health workers, 95 personnel on contractual service agreement (CSA), 13 trainee doctors, 15 trainee nurses, a nurse consultant, and an interna-

Division Highlights

- 1998 was remarkable for the unprecedented flood and the resulting diarrhoea epidemic. Record numbers of daily (917), monthly (21,512), and yearly (157,441) patients were treated at the Clinical Research and Service Centre (CRSC) in 1998.

- Children fed higher-than-currently-recommended amount of protein for 3 weeks during convalescence from shigellosis had significantly better linear growth as well as modest reduction in diarrhoeal morbidity during a 6-month follow-up period.

- Death rates were 48% and 29% among 792 children with shigellosis presenting with unconsciousness and seizure respectively, compared to 6% deaths among children without these features.

- Using steady-state perfusion technique in rabbit colon, short-chain fatty acids (SCFAs) reduced secretion of sodium, potassium, chloride, and water. Similarly, SCFAs resulted in significant improvement in clinical, bacteriologic and pathologic features of the disease in a rabbit model of shigellosis. These findings may help define better therapeutic strategies for treatment of shigellosis.

- Zinc supplementation to children with persistent diarrhoea resulted in reduced duration of diarrhoea, better nutritional status, and fewer deaths among under-nourished children.

- The CRSC hospital surveillance observed enterotoxigenic *Escherichia coli* (36%) to be more significantly associated than *V. cholerae* (23%) with the summer peak of diarrhoeal diseases in Dhaka, contrary to previous understanding.

- A controlled clinical trial showed that folic acid does not decrease either duration or severity of acute watery diarrhoea. This should reduce inappropriate use of this micronutrient.

- Childhood shigellosis and cholera were found to be associated with malnutrition. However, rotavirus exhibited an inverse association with better-nourished children significantly affected. The apparent relative protective effect of malnutrition may have important implications in rotavirus vaccine development.

- Supplementation of zinc to pregnant women of Dhaka slums did not influence gestational age, birth-weight or infant growth during the first six months of life. However, the incidence of dysentery and severity of acute watery diarrhoea was reduced in the infants of the zinc- but not placebo-supplemented mothers.

- The Centre received a US$1.0 million direct grant from the world Bank to establish a Nutrition Centre of Excellence (NCOE) by integrating cross-divisional activites. Scientists of CSD have contributed significantly to the activities of the NCOE, as reflected in the ongoing research projects of the division.

Research

Research activities in CSD are conducted along the following themes:

Case Management Research

Nutritional therapy

Fluid therapy

Pharmacologic therapy

Pathophysiology Research

Preventive/Maternal Child Health Research

tional child survival fellow significantly contributed to achieve the objectives of the Division. Two paediatricians and a consultant radiologist continued to facilitate training of the staff and the clinical fellows during the year.

CASE MANAGEMENT RESEARCH

Nutritional Therapy

Nutritional Rehabilitation of Severely Malnourished Children Recovering from Diarrhoea: Assessment of a Standardized Dietary Management Protocol

Investigators: T. Ahmed, S. Adhikary, A. Islam, M.A. Salam and G.J. Fuchs
Funded by: USAID, Government of Japan and ICDDR,B

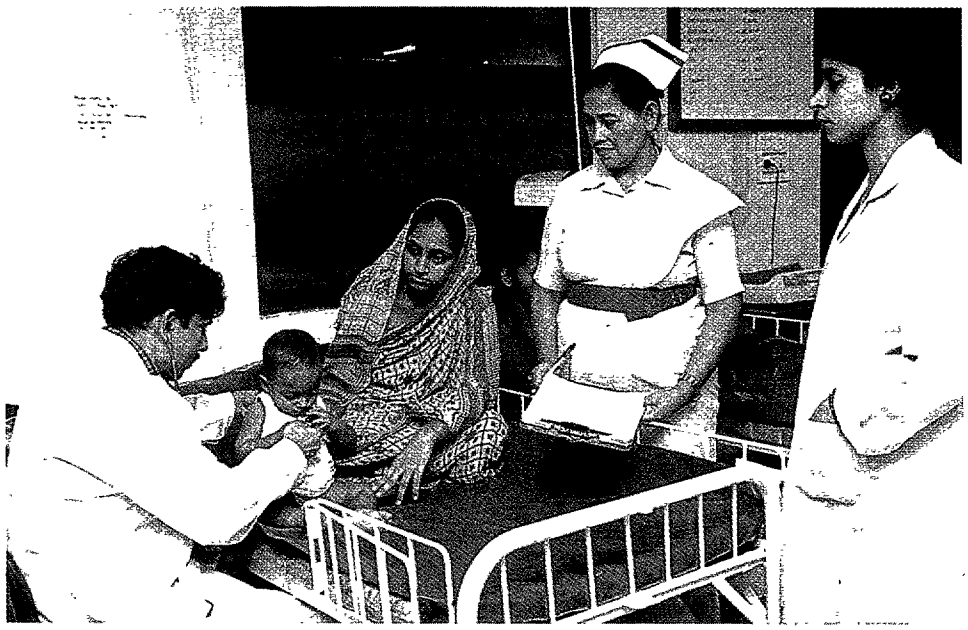
Implementation of a simple dietary management protocol for severely malnourished children with diarrhoea at the CRSC resulted in 47% reduction in deaths. The current study aims at assessing the impact of a new dietary management protocol for severely malnourished children recovering from diarrhoea. Eligible children are admitted to the Nutrition Rehabilitation Ward of the CRSC where they receive three types of locally-available, culturally-acceptable, and inexpensive foods in which vegetables form the principal source of protein. Food intake of these children is gradually increased in a programmed manner. Children in the comparison group are offered conventional foods eight times a day in a non-programmed manner. The rates of growth and morbidity in two dietary groups of children will be compared. Patient enrollment has been completed, and data are being analyzed.

Parenteral Magnesium in the Management of Diarrhoea-associated Ileus in Severely Malnourished Children
Investigators: T. Ahmed, M.A. Salam and G.J. Fuchs
Funded by: USAID, Government of Japan and ICDDR,B

Potassium and magnesium depletion is an important cause of abdominal distention and paralytic ileus in severely malnourished children with diarrhoea. These conditions interfere with oral rehydration as well as feeding—the most important aspects of the management of diarrhoeal patients. The objective of this study is to determine if supplemental magnesium, in addition to potassium, can resolve abdominal distention and ileus. Quick resolution of these complications will permit early initiation of oral rehydration and feeding which, in turn, will reduce the need for intravenous fluids and thus also reduce the risk of infection and fluid overload. Forty eligible children will be randomized to receive, in addition to supplemental potassium, a single intramuscular injection of either 0.3 mL/kg (maximum 2.0 mL) of Magnesium sulphate or an equal volume of normal saline. The rates of therapeutic failure (defined as persistence of ileus for >24 hours of intervention) in the two groups of children will be compared. Till date, 23 children have been enrolled in the study.

Efficacy of L-Glutamine in the Treatment of Children with Persistent Diarrhoea
Investigators: I. Kabir and G.J. Fuchs
Funded by: USAID

Among the diarrhoeal diseases, persistent diarrhoea (PD) is associated with disproportionately higher deaths. The cause and mechanisms of PD are complex. Glutamine is an essential nutrient for intestinal cells, which plays an important role in maintaining the structure, metabolism, and function of the intestine. It may influence the clinical outcome from PD through its mucosal regeneration effect. The role of glutamine in the management of PD will be assessed in this study. A total of 90 children with PD will be randomized to receive a rice-based diet with added glutamine, or the same diet without added glutamine for 7 days. Duration of diarrhoea and intestinal absorption and permeability in the two groups of children will be compared. Till date, 54 children have been enrolled in the study.



In addition to giving treatment, patients attending the Clinical Research and Service Centre are purposively enrolled in different research protocols to identify new and effective interventions in the treatment of diarrhoeal diseases, ALRI, malnutrition, and other health problems relating to morbidity and mortality of young children

Green Banana and Pectin in the Treatment of Persistent Diarrhoea in Bangladeshi Children
Investigators: G.H. Rabbani, G.J. Fuchs, T. Teka and B. Zaman
Funded by: USAID

Green banana is a rich source of fermentable fibres, and thus of SCFA. This study assessed the effects of a rice-based diet containing green banana or pectin on the management of children with persistent diarrhoea. Fifty-eight children, aged 5-12 months, were randomly given either a rice-based diet containing 250 g green cooked-banana/L (n=20), or 4 g of pectin/kg (n=18), or a placebo (n=20) daily for 7 days. Stool character and weight, fluid requirement, and nutrient and energy absorption in three groups of children were compared. Three days after initiation of the intervention, significantly ($p<0.05$) higher proportion of children receiving pectin (41%) or banana (16%) had formed stool compared to placebo (9%). After 7 days, these proportions increased to 65%, 42%, and 19% respectively. Moreover, significantly ($p<0.05$) fewer children receiving banana or pectin required oral or intravenous rehydration fluids. Findings of this study indicate that banana, a cheap and widely-available food item in most communities, may be useful in the management of children with persistent diarrhoea.

Efficacy of Zinc Supplementation in Young Infants with Acute Watery Diarrhoea
Investigators: W.A. Brooks and S.K. Roy
Funded by: USAID (through Johns Hopkins University) and ICDDR,B

The objective of this study is to compare the efficacy of two different doses of supplemental zinc in the management of diarrhoea in infancy. A total of 300 infants, 1-6 month(s) of age with acute watery diarrhoea, will be randomly assigned to receive either 5 mg or 20 mg of elemental zinc, or a placebo once daily during their acute illness. Duration of diarrhoea, frequency and volume of watery stools, requirement of unscheduled intravenous rehydration fluids, and the serum zinc status at baseline and at the end of the therapy in the three groups of children will be compared. Till date, 41 children have been enrolled in the study.

Effect of Simultaneous Administration of Zinc and Vitamin A on the Bioavailability of Vitamin A in Children
Investigators: M.M. Rahman and J.O. Alvarez
Funded by: Thrasher Research Fund (through University of Alabama at Birmingham, USA)

The objectives of this community-based trial were to assess the impact of simultaneous administration of zinc and vitamin A on serum RBP and retinol, diarrhoea morbidity, respiratory tract infections, and growth. Eight hundred children, aged 1-3 year(s), were randomly assigned to receive either 20 mg of elemental zinc daily for 14 days, or a single-dose 200,000 IU of vitamin A or both zinc and vitamin A or a placebo. Blood samples were collected before intervention and 21 days and 3 months later. Morbidity data were collected at weekly intervals, and anthropometric measurements were done at monthly intervals for the first 3 months and then at 6 months. Data analysis is in progress.

Balance and Bioavailability of Zinc from Two Different Dietary Regimens for Children with Persistent Diarrhoea Syndrome in Bangladesh, Using Stable Isotope
Investigators: S.K. Roy, S.F. Tait, A.M. Tomkins, M.A. Wahed and G.J. Fuchs
Funded by: USAID

A significant amount of zinc is lost in the stools of patients with persistent diarrhoea (PD). However, absorption efficiency of dietary and supplemental zinc in the PD patients is not known. The objectives of this collaborative study with the Institute of Food Research, Norwich, UK, are to determine the absorption efficiency of zinc from chicken-and rice-based diets, and from supplemental zinc in children with PD. A total of 45 children, aged 6-24 months with PD, will be randomly assigned to receive zinc^{67} in a rice-based diet plus supplemental zinc, or Zn^{67} in a chicken-based diet plus supplemental zinc, or Zn^{70} in a rice-based diet without supplemental zinc. Children in the supplemented groups will receive 20 mg of elemental zinc in multivitamin syrup daily for 2 weeks. Absorption of zinc from diets and the supplements will be measured, using the stable isotopes of zinc: Zn^{70} and Zn^{67}. Metabolic balance studies will be carried out over a 7-day period; and estimation of faecal zinc, copper, and magnesium and faecal and urinary isotopes will be done during persistent diarrhoea and 4 weeks after clinical recovery. Intestinal permeability will be assessed by dual-sugar (lactulose/mannitol) absorption technique. Thirty children have so far been enrolled in the study.

Evaluation of the Effects of a Soluble Fibre (Benefibre)-supplemented Comminuted Chicken Diet in the Treatment of Persistent Diarrhoea in Children
Investigators: N.H. Alam, S.A. Sarker, R. Meier, H. Schneider, and K. Gyr
Funded by: Novartis Nutrition, Bern, Switzerland

Although the exact pathogenesis of persistent diarrhoea (PD) is not known, it is associated with an array of functional gastrointestinal disturbances, including increased secretion as well as decreased absorption and reabsorption. Fermentation of dietary fibres yield short-chain fatty acids (SCFAs), which serve as metabolic fuel for the gut epithelium, improve small- and large-bowel functions including absorption of nutrients, and promote colonic absorption/salvage of salts and water. Thus, SCFAs could potentially play an important role in the management of PD. This study will assess the effects of a soluble fibre (Benefibre, partially hydrolyzed guar gum)-supplemented comminuted chicken-based diet on the management of children with PD. Ninety male children, aged 5-18 months, will be randomly assigned to a comminuted chicken diet supplemented with Benefibre or the same diet without added fibre; other aspects of the management will be similar. Stool volume, duration of diarrhoea, and body weight changes are the major outcome measures. Till date, 30 children have been enrolled in the study.

Fluid Therapy

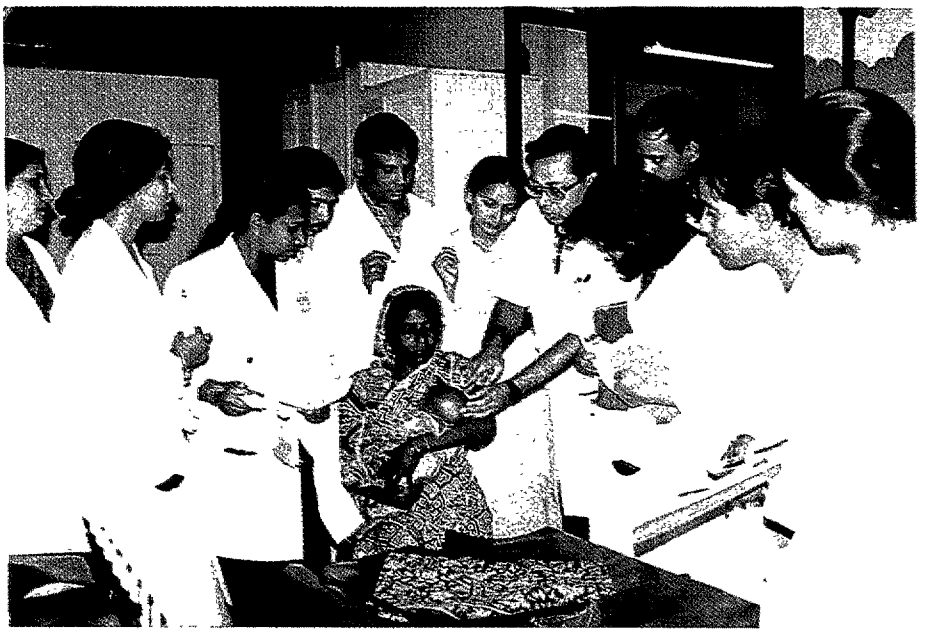
The discovery of oral rehydration salts (ORS) has simplified treatment of diarrhoea to the extent that milder cases of diarrhoea can now be managed at home. The currently used WHO/UNICEF-ORS is effective and safe for management of dehydration, irrespective of diarrhoea aetiology and patients' age. However, efforts are being continued to further develop ORS, particularly to shorten duration of diarrhoea, and to meet special requirements of specific population groups, such as neonates and children with severe malnutrition and persistent diarrhoea. As the birthplace of ORS, ICDDR,B is naturally the best place to test newer formulations of ORS. The following ongoing clinical trials indicate Centre's continued efforts in this endeavour:

Efficacy of Modified Oral Rehydration Solution (ReSoMal) in Severely Malnourished Children with Watery Diarrhoea
Investigators: N.H. Alam, J.D. Hamadani and G.J. Fuchs
Funded by: WHO

This study is comparing the efficacy and safety of a new formulation of ORS (ReSoMal) with those of the WHO-ORS in the management of diarrhoea in severely malnourished children. ReSoMal contains less amount of sodium (45 mmol/L) and higher amount of potassium (40 mmol/L) than does the WHO-ORS, and additionally, contains 6 mmol magnesium/L, 300 mmol zinc/L, and 45 mmol copper/L. A total of 120 severely malnourished children, aged 6-36 months with acute watery diarrhoea, will be randomly assigned to receive either of the two solutions while other aspects of the management of diarrhoea will remain the same. The risk of development of overhydration and heart failure and the serum concentrations of sodium and potassium are the major outcome measures. Eighty-five children have been enrolled in the study till date.

Reduced-osmolarity Oral Rehydration Solution in the Treatment of Severe Persistent Diarrhoea in Children
PI: S.A. Sarker
Funded by: USAID

The objective of this study is to compare the efficacy of the WHO-ORS; a rice-based ORS; a glucose-based, low-sodium (75 mmol/L), reduced-osmolarity ORS; and a rice-based, low-sodium (75 mmol/L), reduced-osmolarity ORS in the management of PD in children. A total of 260 male children, aged 4-24 months with PD, will be randomly assigned to receive one



Health professionals of Bangladesh and Bhutan, receiving training from CSD scientists on protocilized management of severely malnourished children

of the four ORSs for correction of dehydration as well as a replacement therapy up to 7 days. The volume of unformed stool, amount of ORS intake, and the duration of diarrhoea among children in the four treatment groups will be compared. In total, 110 children have been enrolled in the study till date.

Comparison of the Efficacy of a Low-sodium Oral Rehydration Solution with That of the WHO-ORS in the Treatment of Neonates and Young Infants with Acute Dehydrating Diarrhoea
PI: A.M. Khan
Funded by: USAID

In this study, the efficacy and safety of a low-sodium (75 mmol/L) and hypo-osmolar ORS will be compared with the WHO-ORS in neonates and young infants with diarrhoea. Ninety-six neonates and infants, $\leq$2 months of age with acute dehydrating diarrhoea, will be randomly assigned to receive either of the two ORSs. The volume of unformed stools, requirements of rehydration fluids, duration of diarrhoea, and incidence of hypernatraemia and hyponatraemia in infants in the two treatment groups will be compared. In total, 54 infants have been enrolled in the study till date.

Pharmacologic Therapy

A Multi-centre Study to Evaluate Efficacy of a Short-course Ciprofloxacin Therapy in the Treatment of Children with Dysentery Due to *Shigella dysenteriae* Type 1

PIs: M.A. Salam and W.A. Khan
Funded by: New England Medical Center, USA

The objective of this multi-centre clinical trial is to compare the efficacy of a 3-day course with the standard 5-day course of ciprofloxacin in the treatment of children with dysentery due to *S. dysenteriae* type 1. Children, aged 1-12 year(s) with ≤72 hours history of diarrhoea and culture-proven *S. dysenteriae* type 1 infection, are eligible. Children who received prior antimicrobial therapy or have any concomitant illness are excluded. A total of 50 children, hospitalized for 6 days, will be randomly assigned to one of the two therapies and be followed up 2 weeks after discharge. The rate of clinical cure and the duration of faecal excretion of *S. dysenteriae* type 1 are the primary and major secondary outcome measure respectively. Fifteen children have been enrolled in the study.

Evaluation of Hyper-immune Bovine Colostrum (HBC) in the Management of Children with Rotavirus Diarrhoea

Investigators: S.A. Sarker, G.J. Fuchs and P. Marshall
Funded by: North Field Laboratories Pty Ltd., South Australia

Globally, rotavirus is the most important diarrhoeal pathogen, and is responsible for one million deaths of infants and young children each year. Oral rehydration therapy is effective and safe for management of rotavirus diarrhoea. However, a pharmacologic agent for reducing disease severity or diarrhoea duration is not currently available. The objective of this study was to test the effectiveness of an orally-administered anti-rotavirus HBC, cross-reactive against major human serotypes of rotavirus (G1-G4), in enhancing viral clearance, reducing stool output, and shortening the duration of diarrhoea. In total, 160 children were enrolled in the study, of whom 40% were infected with G1-G4 strains of rotavirus, and 36% were infected with an untypeable/unusual strain. Daily and total stool output, ORS intake, and diarrhoea duration were not significantly different in the two groups of children, whether or not the comparisons were confined to all children or only to those who were infected with G1-G4 serotypes. The observed ineffectiveness of the HBC in this study may be related to suboptimal immunological titre of the anti-rotavirus HBC.

Evaluation of Chicken Egg-yolk Immunoglobulin (IgY) in the Treatment of Diarrhoea Due to Rotavirus

Investigators: S.A. Sarker, T. Casswall and I. Hammarstrom
Funded by: Swedish Academy of Research and Cooperation (SAREC)/ Karolinska Institute, Sweden

The objective of this study was to assess the efficacy of an orally-administered chicken-egg yolk immunoglobulin in reducing disease severity and in shortening the course of rotavirus-associated diarrhoea in infants and young children. In total, 100 eligible children were randomly assigned to receive either IgY obtained from immunized hens (intervention) or IgY obtained from non-immunized hens (comparison). However, other aspects of the management of diarrhoea were similar for all study children. The frequency and volume of unformed stools and the duration of faecal ex-

cretion of rotavirus are the major outcome measures. Analyses of data are now being done.

Efficacy of Single Daily Dose versus Conventional 8-hourly Parenteral Gentamicin in the Treatment of Severe Infections in Malnourished Children
PIs: A.M. Khan and G.J. Fuchs
Funded by: USAID (Targeted Research)

The objective of this trial is to determine the efficacy and pharmacokinetics of single daily dose of gentamicin, compared to conventional 8-hourly dose of parenteral gentamicin in the treatment of severe infections in malnourished children. One hundred fifty-six malnourished and 20 well-nourished children, aged 1-5 year(s) with severe infection requiring aminoglycoside therapy, are randomly assigned to two treatment groups. Efficacy is assessed by clinical and laboratory parameters, and drug-related toxicity is assessed by renal, auditory, and vestibular function tests. If the single daily dose regimen is found effective, this will result in a more cost-effective regimen. Seventy-six children have been enrolled in this ongoing study.

PATHOPHYSIOLOGY RESEARCH

Evaluation of "Premier EHEC" for Rapid Diagnosis of *Shigella dysenteriae* Type 1 (SD1) Infection and Evaluation of the Effect of Antimicrobial Therapy on Stool Shiga Toxin Excretion
Investigators: W.A. Khan, M.A. Salam and M. Begum
Funded by: New England Medical Center, USA and ICDDR,B

An ELISA kit ("Premier EHEC" ELISA, Meridian Diagnostics Inc., USA) was developed for detection of faecal Shiga toxin produced by enterohaemorrhagic *Escherichia coli* (EHEC). The objectives of this study were to assess the utility of this kit to detect Shiga toxin produced by *S. dysenteriae* type 1 and the impact of antimicrobial therapy on the amount of faecal Shiga toxin. Stool specimens obtained from 47 patients with *S. dysenteriae* type 1 were tested, with 45 (96%) being positive for Shiga toxin by ELISA. In comparison with stool culture, the sensitivity, specificity, positive predictive value, and negative predictive value of the ELISA in the identification of *S. dysenteriae* type 1 were 75%, 98%, 96%, and 90% respectively. The effect of antimicrobial therapy on faecal excretion of Shiga toxin was determined in 20 children. The median concentration of Shiga toxin was higher ($p<0.001$) before initiation of antimicrobial therapy than at any other time periods (4-6, 24, 48 and 120 hours after initiation of the therapy). Only four (20%) children had higher post-therapy than pre-treatment faecal Shiga toxin concentration. This ELISA kit appears to be useful in rapid diagnosis of *S. dysenteriae* type 1 infection. Moreover, treatment of *S. dysenteriae* 1 infection with ciprofloxacin or pivamdinocillin was not associated with increased faecal excretion of Shiga toxin or apparent increased risk of development of HUS.

Effects of Iron Supplementation on the Growth and Intestinal Permeability in Iron-deplete and Iron-replete Children
Investigators: T. Ahmed and G.J. Fuchs
Funded by: USAID

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 will compare the effects of iron supplementation on the growth and intestinal permeability in children with and without iron deficiency. On the basis of haemoglobin, serum ferritin, and serum transferrin receptor concentrations of 315 children aged less than 5 years who were not severely malnourished, 60 eligible children (30 in each group) were enrolled. Intestinal permeability and endocrine- and bone-metabolism markers of growth of these children were determined before and after one month of iron supplementation, and their growth monitoring is in progress.

Short-chain Fatty Acids Inhibit Water and Electrolyte Secretion Induced by Cholera Toxin in Rabbit Colon in vivo
Investigators: G.H. Rabbani, M.J. Albert and H. Rahman
Funded by: USAID

Short-chain fatty acids (SCFAs) acetate, propionate, and butyrate are produced by the anaerobic fermentation of unabsorbed carbohydrates in the colon, and are readily absorbed by the colon. SCFAs stimulate Na^+ and Cl^- absorption in the colon. The objective of this study was to assess the effect of SCFA on fluid and electrolyte absorption in cholera toxin-induced colonic secretion in rabbits. After inducing secretion, colonic loops were perfused with a mixture of SCFAs, and the transport rates of ions and water were determined. SCFAs significantly ($p<0.01$) reduced colonic water secretion; butyrate reduced maximum water secretion (95%), followed by propionate (90%), and acetate (80%). Butyrate also significantly ($p<0.001$) reduced secretions of Na^+ (95.5%), K^+ (75.2%), and Cl^- (80.7%) ions but not HCO_3^- ions. Propionate induced similar reduction in the secretion of these ions including HCO_3^- (45.3%). Acetate significantly ($p<0.001$) inhibited Na^+ (76.4%) and Cl^- (75.7%) secretion, but the inhibitions of K^+ (23.6%) and HCO_3^- (28.8%) were not significantly different from that in the control animals. Results of this study indicate that SCFAs or their dietary precursors may be clinically useful in reducing fluid and electrolyte loss in secretory diarrhoea.

Therapeutic Evaluation of L-Histidine in Experimental Shigellosis in Rabbits
Investigators: G.H. Rabbani, D. Sack, G.J. Fuchs and J. Peterson
Funded by: Cytos Pharmaceuticals, USA

The objective of this study is to determine the role of reactive oxygen species (ROS) in the pathogenesis of colonic inflammation in shigellosis, and to assess the efficacy of L-Histidine in its treatment. The treatment effects will be evaluated by clinical, histopathological, bacteriological, and biochemical (MPO, TBARS, TNFa, LTB4, LTC4, etc.) characteristics in the rabbit model of shigellosis. This study is expected to provide information for better understanding of the disease, and open up new treatment options.

***Helicobacter pylori* Infection As a Cause of Iron-deficiency Anaemia or a Reason for Failure of Iron Therapy in the Treatment of Iron-deficiency Anaemia in Bangladeshi Children**
PIs: S.A. Sarker and G.J. Fuchs
Funded by: National Institutes of Health (NIH), USA

Gastric acid is necessary for intestinal uptake of dietary iron. This community-based study will assess the role of *H. pylori* (HP) infection as a cause of impaired iron absorption and iron-deficiency anaemia (IDA) through gastritis and reduced gastric acid output, and examine if it is a cause for

failure of iron therapy among children with IDA. A total of 325 children, aged 2-5 years with IDA, will be divided into five groups with equal number of children in each group—four groups with and one group without HP infection. HP-infected children with IDA will be randomly assigned to one of the four treatments: anti-HP therapy alone, iron supplementation alone, anti-HP therapy in combination with iron supplementation, and placebo. Haemoglobin, serum ferritin, and serum transferrin receptor concentrations will be determined for all children before interventions, and 1 and 3 month(s) later. Gastric acid output and iron absorption will be determined in a sub-set of 20 children before and after treatment for HP infection, using double-stable isotope technique. In total, 40 children have been enrolled till date, and iron absorption and gastric acid output have been assessed in 15 children. It is expected that the results of this study will be relevant for prevention and treatment strategies of IDA in children of developing countries.

Identification of Risk Factors and Study of the Outcome of *Shigella*-associated Haemolytic-Uraemic Syndrome
PIs: M.A. Salam and T. Azim
Funded by: Government of Japan

Haemolytic-Uraemic Syndrome (HUS) is an important complication of diarrhoea due to enterohaemorrhagic *Escherichia coli* and shigellosis, particularly in association with *S. dysenteriae* type 1 infections. The objectives of this case-control study, being conducted in collaboration with the Laboratory Sciences Division, are to identify clinical (particularly the associa-

Trainee physicians receive hands-on training under the direct supervision of CSD scientists and experienced clinicians

tion with antimicrobial therapy) and laboratory risk factors for development of HUS in children with shigellosis. Children with shigellosis who develop HUS will constitute the study group, and those who do not develop HUS will constitute the control group. Children developing HUS will be followed up for a one-year period, particularly to observe development

of chronic renal problems. Of the total 38 children with dysentery initially screened, 24 had either *S. dysenteriae* type 1 or Shiga toxin gene (*stx*) identified from their stools. Eight of these children developed HUS, of whom 2 died, one developed chronic renal failure, 4 improved, and one child was discharged against medical advice with a poor clinical condition. Results of this study are expected to provide useful information for prevention of the development of HUS in children with shigellosis.

Immunological Effects of Vitamin A and Zinc Supplementation
Investigators: S.K. Roy, T. Azim, G.J. Fuchs, S.M. Akramuzzaman, S.A. Ahmed, K.E. Islam, D. Mahalanabis and M. Rahman
Funded by: USAID

The objective of this placebo-controlled 4-cell trial was to compare the immunological effects of vitamin A and zinc. Children without any acute illness, aged 1-3 year(s) with a weight-for-age of 61-75% of the NCHS median, were randomly assigned to receive either 200,000 IU of vitamin A or 40 mg elemental zinc daily or both vitamin A and zinc or a placebo for 7 days. Serum zinc, vitamin A, RBP and TTR, and measles IgG titres were determined. The concentrations of IL-2 and IL-10 were measured in whole blood stimulated with PHA. Stimulation pattern of peripheral blood mononuclear cells (PBMCs) in response to PHA, Con-A, PWM and PPD, and polarization of granulocytes in response to a chemo-attractant (FMLP) were observed. All tests were performed before and after the intervention. Significant increases in granulocytes polarization at the level of 10^{-8} ($p=0.05$) and in the measles antibody titre ($p=0.01$) were observed only in zinc-supplemented children; significant height-gain was observed only in vitamin A-supplemented children ($p=0.01$); and significant weight-gain was observed in all children except those in the placebo group ($p<0.0001$). Diarrhoea episode was significantly less among zinc-supplemented children ($p=0.01$), and a positive Relative Dose Response was observed in significantly higher proportion of children receiving vitamin A either alone or along with zinc ($p<0.002$).

PREVENTIVE/MATERNAL CHILD HEALTH RESEARCH

Dietary Fat and Infection: Relationship with Vitamin A Status of Women and Their Infants
Investigators: G.J. Fuchs, D.H. Alam, J. van Raiij, K.M.A. Aziz, Md. Yunus, M.A. Wahed and A. de Francisco
Funded by: OMNI/USAID

Increased intake of dark green leafy vegetables (DGLV) is promoted as a sustainable method to improve vitamin A (VA) status in developing countries, although the efficacy of this approach has been questioned. Populations depending on DGLV as the major dietary source for vitamin A are also often characterized by very low dietary fat intake. While fat is considered essential for absorption and utilization of ingested vitamin A and carotenoids, the relative importance of dietary fat as a determinant of VA status is not known. Infectious illness has the potential to inhibit absorption and/or increase loss of vitamin A. In collaboration with PHSD and Wageningen Agricultural University (Netherlands), this study aimed at determining the effect of increased dietary fat and infectious illnesses during pregnancy and the first six months of lactation on vitamin A status of pregnant and lactating women and their breastfed infants in rural Bangladesh.

Beginning at 5-7 months gestation, 341 pregnant women received fat supplementation (20 mL of soybean oil) per day, and 335 were enrolled as

controls and followed till six months postpartum. Longitudinal assessment of provitamin A intake, quantification of dietary fat intake, maternal plasma retinol/carotenoids and breastmilk retinol concentrations, infant plasma retinol/carotenoids concentrations (at 6 months), maternal and infant anthropometry, maternal morbidity and parasitic infestations have been completed. Early results indicate that the modest increase in dietary fat intake through fat supplementation had significant and beneficial effects on maternal plasma retinol, β-carotene and lutein concentration, and breastmilk retinol concentrations in early lactation (1 month and 3 months postpartum). No relationship was observed between VA status and diarrhoeal or respiratory illnesses of mothers. Infant plasma retinol/carotenoids concentrations, measured once at six months of age, did not differ between the intervention and the control groups. Further analyses are in progress.

Evaluation of the Impact of Home-gardening in Rural Bangladesh
Investigators: G.J. Fuchs, M. Khan and A.S.G. Faruque
Funded by: USAID

Vitamin A deficiency is a major public health problem that results in long-term health and social consequences. The Helen Keller International (HKI) has initiated a nationwide 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. In addition to other outcome measures, serum retinol concentrations will be determined on 600 mothers and 800 children in five randomly-selected rural communities of Bangladesh. The project activities will be completed within 1999.

Effective Means to Address Moderately Malnourished Children within BINP Communities (HPQR-7)
Investigators: S.K. Roy, S. Chowdhury and J. Mahmud
Funded by: Bangladesh Integrated Nutrition Project (BINP)

This operations research was initiated in October 1998 in Shahrasti thana of Chandpur district, a BINP programme site, to investigate a strategy to addressing the issue of moderate malnutrition among children. Three hundred children and mothers from the Community Nutrition Centres will be entered in one of the three groups; one group will receive intensive nutrition education and demonstration of complementary feeding to increase the feeding of appropriate foods; another group will receive nutrition education plus a packet of standard BINP food supplement; and another group will receive nutrition education only. Weekly data on feeding practices, health and hygiene, food security, disease control and caring practices are collected. The study aims at improving nutritional status of the children, capacity-building, and community empowerment for actions against malnutrition.

Impact of Zinc on Birth-weight and Early Infant Growth, Morbidity, and Immune Response
PIs: S. Osendarp and G.J. Fuchs
Funded by: The Royal Netherlands Government and USAID

The effects of zinc supplementation during pregnancy and infancy on pregnancy outcome, infant growth, morbidity, and immune response were investigated in two cohorts in Dhaka city slums. 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 who had been supplemented with 5 mg elemental zinc/day or placebo from 4-24 weeks of age received three doses of Tetramune and three doses of the 7-valent Pneumococcal conjugate vaccine. Data collection for this study was completed on 4 January 1998, and analyses, report writing, and antibody assays are currently ongoing.

No differences between zinc-supplemented and placebo-supplemented mothers were observed in 410 singleton infants for birth-weight, gestational age, and growth during the first 6 months of life. However, preliminary analyses on the postnatal surveillance indicate that infants of mothers supplemented with zinc during pregnancy experienced a reduced incidence of dysentery and reduced severity of acute watery diarrhoea during the first 6 months of life.

Efficacy and Acceptability of Osmotic Bag for Preparation of Therapeutic Feed for Home Management of Malnutrition
Investigators: S.K. Roy, M.S. Islam, T. Ahmed, A.M. Tomkins and A. Seal
Funded by: UCB Osmotics Ltd., UK

Microbiologically contaminated water and food are the principal modes of transmission of enteric pathogens in the developing countries, and the incidence of diarrhoeal diseases can be significantly reduced through provision of safe drink and food. A unique duplo-sachet system has been developed that uses a semi-permeable cellulose-membrane for preparation of microbiologically safe ORS and milk for children. The osmotic sachet has two compartments- a waterproof upper compartment for holding dry therapeutic milk, and the semi-permeable lower chamber containing sucrose, which acts as osmotic driver. About 4-5 hours are required for full hydration of the sachet which has been designed to prevent all high-molecular-weight toxins, bacteria, viruses, protozoa, and other noxious components that commonly contaminate drinking water. The self-hydrating sachets have the potential to produce microbiologically safe food in localities lacking in clean water supply.

The objective of this community-based study is to assess acceptability of the sachets for preparation of therapeutic milk at home, and difficulties in their use by the mothers. Results of the study will help determine the usefulness of the sachets in the community, particularly under emergency relief situations.

A similar study titled "Evaluation of a newly-designed osmotic bag for preparation of microbiologically safe ORS and therapeutic milk from contaminated water," conducted by S.K. Roy, G.J. Fuchs, M.S. Islam, and A.M. Tomkins, assessed microbiological quality and ionic composition of the filtrate. Sachets were soaked for 7-9 hours in water containing 10^6 colony-forming units of *Escherichia coli*,. The filtrate had acceptable ionic composition and was free from coliform bacteria.

Role of Zinc Supplementation in Preventing Acute Respiratory Infections and Diarrhoea among Children of Less Than Two Years
Investigators: W.A. Brooks and A.S.G. Faruque
Funded by: Swiss Development Cooperation and USAID

This community-based study will assess the effect of zinc supplementation on the incidence of acute lower respiratory tract infections and diarrhoeal diseases among children aged two years or less. Eligible children will be

randomly assigned to receive 70 mg of elemental zinc or placebo at weekly intervals for one year. The incidence of pneumonia and diarrhoea among the zinc and the placebo group of children will be compared. The efficacy of the weekly zinc supplementation will also be compared with the reported efficacy of daily zinc supplementation. The study will also assess if there is any differential effect of zinc supplementation on children of <12 months versus children of 12-24 months. Community mapping has recently been completed, and enrollment of the study subjects will be started soon.

***Plesiomonas shigelloides*-associated Diarrhoea in Bangladeshi Children: Clinical and Epidemiologic Features**
Investigators: A.M. Khan and A.S.G. Faruque
Funded by: USAID and ICDDR,B

The objective of this study was to compare the clinical and epidemiological features of *Plesiomonas shigelloides*-associated diarrhoea in 38 Bangladeshi children with features of cholera due to *V. cholerae* in 128 children. Trained paramedics interviewed parents/guardians of the children, and physicians performed physical examinations. Results indicate that *P. shigelloides* infections occur throughout the year with a male preponderance, and in children of less than two years, this is more common than *V. cholerae* O1 infection. It produces a less severe disease than cholera and clinical dehydration is uncommon. A few patients with *P. shigelloides* infection presented with dysenteric (blood in stool) illness and fever.

Fig 1. Yearly Patient Visits 1962-1998
Clinical Research and Service Centre

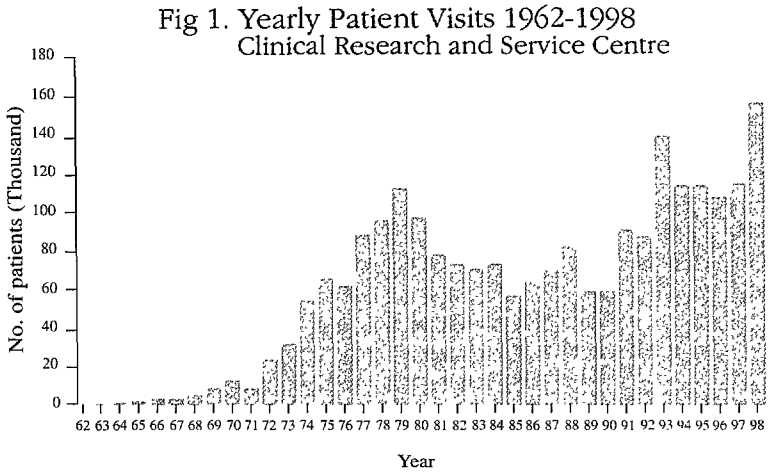
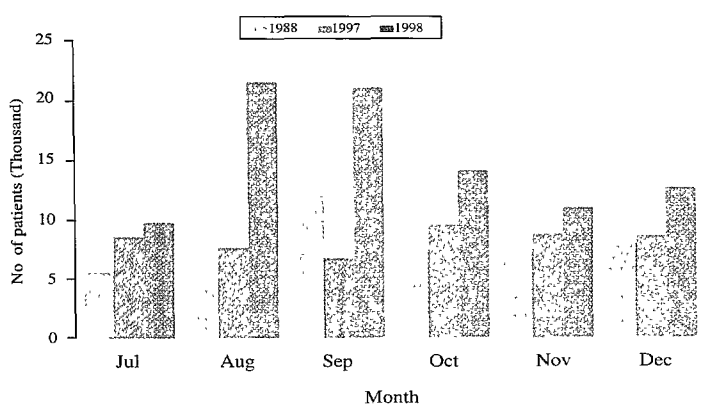


Fig 2. Monthly Patient Visits at the Clinical Research and Service Centre (July-December 1988, 1997 and 1998)



CLINICAL RESEARCH AND SERVICE CENTRE

Chief Physician: M.A. Salam
Funded by: ICDDR,B

1998 was remarkable to the Clinical Research and Service Centre (CRSC) for unprecedented flood and its impact on public health, particularly on the incidence of diarrhoeal diseases. Unusually high number of patient visits (Fig. 1) and higher incidence of cholera were seen during the winter months of this year. Record numbers of daily (917), monthly (21,512), and yearly (157,441) patient visits were seen in 1998 (Fig. 2). Provision of care to the additional patients required extension of the existing pavilion on the south side of the hospital, and further extension in two large tents. As many as 43 nurses, 8 doctors, and 30 health workers were hired on a temporary basis to assist the regular hospital staff. Even during the epidemic period, the CRSC personnel continued to provide training to the staff of national institutions and NGOs. Prompt financial and other support from the donors were extremely helpful in enabling the hospital to successfully perform its activities.

During the 1998 flood-related epidemic of diarrhoeal diseases, the Dhaka hospital of ICDDR,B had to be expanded by establishing makeshift unit for accommodating extra ptient load

The number of patient visits in 1998 was 42,454 (37%) more than in the previous year (1997). Of the total 157,441 patients, 91,544 (58%) were admitted to the Short Stay Ward (SSW), 76% of whom were discharged within 24 hours. In total, 4.6% of the patients were admitted to the longer-stay General Ward (GW) and Special Care Unit (SCU). Another 795 patients were admitted to either the Clinical Study Ward (CSW) or the Metabolic Study Ward (MSW) under 15 different research protocols, conducted alone or jointly by the Clinical Sciences Division and the Laboratory Sciences Division. Of the total 7,212 patients admitted in the GW and SCU, 450 (6.2%) died, with approximately half occurring within a few hours after admission, indicating their arrival in severe condition. In total, 33 (0.04%) of the 91,544 patients admitted in the SSW died, and another 30 patients were dead upon arrival at the CRSC. Thus, there was a total mortality rate of 0.3%. A total of 153,755 litre of intravenous fluids, and 792,660 litre of oral rehydration fluids (ratio of ORS to IV: 1:5) were used at the CRSC during 1998.

NURSING PROGRAMME

Consultant: Mohammad Ullah

Unlike in the many other national healthcare facilities, the nurses of the Dhaka hospital of ICDDR,B have a much more prominent role in the management of patients attending the CRSC. They provide initial care to 94% of the patients, including history-taking, assessment of dehydration, referral to appropriate unit of the hospital, and institution of rehydration therapy with oral and/or intravenous fluids. Additionally, the services of our highly experienced nurses are instrumental in successful conduction of clinical and metabolic research of CSD and other divisions of the Centre.

CRSC has only 52 nurses of all categories, including a consultant, and 4 nursing officers. Additionally, there are 15 trainee nurses who provide substantial assistance to the regular nurses. Despite the need for more nurses and increased demand on nursing care, all regular and trainee nurses were trained on the modified "Dhaka Method" of assessment of dehydration and theoretical and practical aspects of pulse oximetry used for patients with dyspnea. Selected nurses attended a peer education course on HIV/AIDS, and training of trainers (TOT) on HIV/AIDS organized by the Centre. One nurse attended the "Behavioural Change Communication" course organized by WHO/Dhaka.

CHILD HEALTH PROGRAMME

Coordinator: T. Ahmed
Funded by: World Bank and ICDDR,B

Approximately, two-thirds of the patients attending the Dhaka hospital of ICDDR,B are children, 80% of whom have moderate or severe malnutrition. Many of them have been inadequately immunized against the common vaccine-preventable diseases in their community. Their mothers often have poor knowledge about the preparation of nutritious food for their children using inexpensive, locally-available ingredients. The Child Health Programme (CHP) was established at the CRSC in 1988 with the objectives to provide preventive as well as curative healthcare to children and their mothers. The services offered by CHP include: health education, nutritional rehabilitation of severely malnourished children and their growth monitoring, immunization, and family planning. Training of healthcare providers and operations research in these areas are additional activities of CHP. During 1998, CHP conducted 27,027 focus group sessions with mothers and female attendants of patients. The objectives of these sessions are to provide health education on prevention and home management of diarrhoeal diseases, prevention of malnutrition through use of appropriate complementary diets, and on the importance of immunization and family planning, covering an estimated 162,162 individuals. Sessions are interactive, include video shows, and are conducted in all wards/units of the CRSC with the exception of the Special Care Unit. Immunizations against six vaccine-preventable diseases were provided to 8,374 (99% of the eligible) children, aged two years or less, making this the largest fixed-site immunization centre in Bangladesh. In addition, tetanus toxoid was provided to 5,751 women of reproductive age. Vitamin A capsules were administered to all children who did not receive the vitamin during the previous 6 months.

Among the most severely malnourished children, 333 were admitted to the inpatient Nutrition Rehabilitation Unit where a standardized feeding protocol is used with inexpensive, locally-available diets. Nutrition follow-up and growth monitoring of a total of 2,009 severely malnourished children were done at the outpatient unit of CHP. CHP also provided family planning services to 293 parents of children attending the hospital.
The activities of the programme and its role as a model for primary healthcare is a part of the Centre's scheduled training courses for national and international participants, including medical doctors and students, nurses, and other health workers.

OPERATIONS AND POLICY RESEARCH COMPONENT OF THE BANGLADESH INTEGRATED NUTRITION PROJECT

Programme Director: G.J. Fuchs

The Government of Bangladesh initiated the World Bank-funded Bangladesh Integrated Nutrition Project (BINP) three years ago. The objectives of

this comprehensive, nationwide project are to reduce malnutrition among children of less than two years and women through community-based nutrition interventions and to foster a comprehensive national and intersectoral initiatives for nutritional development. ICDDR,B coordinates activities and conducts the operations research component of the BINP through ICDDR,B-BINP Operations and Policy Research Project (OPRP). The BINP-OPRP Steering Committee consists of scientists from all scientific divisions of ICDDR,B to monitor and assist in the scientific activities. The daily management is under the responsibility of the BINP-OPRP Secretariat run by Prof. George Fuchs, Dr. S.K. Roy, and Ms Saskia Osendarp.

Providing nutrition education to the caretakers of outgoing patients is part of the Nutrition Rehabilitation Unit of the CRSC

During 1998, ten research contracts were made with scientists from six different national institutions and ICDDR,B after an extensive peer-review bidding procedure. The Final Award Committee consisting of four scientists from ICDDR,B and two scientists from outside the Centre provided technical guidance to the investigators during study design and ultimately awarded the funding on the basis of merit. Several ICDDR,B scientists have been involved in the Project by providing substantial technical assistance to investigators in the design, implementation, and analysis of the studies. Studies under the BINP-OPRP test a range of issues relating to effectiveness, cost-effectiveness, and culturally-acceptable and sustainable community-based interventions to ensure effective implementation of programmes of the BINP. Topics of the BINP/OPRP studies have included: optimum duration of nutrient supplementation in women and children aged less than two years, health education strategies for child care and feeding practices, the potential for a sustainable community participation, costing of the activities at a community level, effective means to address moderately malnourished children, and development of improved complementary foods.

HOSPITAL SURVEILLANCE PROGRAMME

PIs: G.J. Fuchs and A.S.G. Faruque
Funded by: USAID

Each year, thousands of patients (157,411 in 1998) attend the CRSC for treatment of diarrhoeal illness and associated problems. The objective of the Surveillance Programme is to collect information on clinical, epidemiological, and demographic characteristics of patients attending this facility. The programme provides key information to the Government for 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 a database to conduct epidemiological studies; assists in the identification and development of new research areas; and help in defining improved patient care strategies as well as in introducing preventive programmes.

A systematic 2% sub-sample of the patients attending the CRSC is enrolled into this surveillance. Trained personnel interview the patients and/or their

attendants to obtain information on patients' socioeconomic and demographic characteristics, housing and environmental conditions, feeding practices (particularly of infants and young children), and the use of drugs and fluid therapy at home. Extensive microbiological assessments of faecal samples (microscopy, culture, and ELISA) of patients are performed to

Aetiological agents isolated from patients in the Surveillance Programme in 1998

Month	No. of patients	V. cholerae 01	V. cholerae 0139	Shigella	Salmonella	Rotavirus	Other vibrios
January	147	30	0	11	2	72	18
February	128	22	0	5	1	50	11
March	221	57	2	9	1	33	27
April	289	92	12	10	7	28	26
May	312	107	9	16	5	30	28
June	256	65	9	17	5	46	29
July	193	42	1	11	11	58	19
August	430	169	4	22	12	79	49
September	423	187	3	21	9	52	51
October	281	102	7	21	7	27	30
November	216	50	13	25	2	19	40
December	252	72	24	19	5	54	27
Total	3148	995	84	187	67	548	355
%	-	31.6	2.7	5.9	2.1	17.4	11.3
Estimated	157400	49750	4200	9350	3350	27400	17750

Extrapolated to the total of patients attending CRSC from the 2% sub-sample

identify diarrhoeal pathogens and to determine antimicrobial susceptibility of the bacterial pathogens. The clinical characteristics, anthropometric measurements, treatment received at the CRSC, and outcomes of the patients are also recorded. In total, 3148 patients were enrolled in the surveillance in 1998. *V. cholerae* O1 and *Shigella* (*S. flexneri* species accounting for 72% of the total) were isolated from 32% and 5.9% respectively of the patients under surveillance (see table). Routine screening of ETEC, EPEC, and EAggEC incorporated into the surveillance since 1996, accounted respectively for 14%, 9%, and 6% of the enteric pathogens isolated. Between July 1997 and June 1998, one or more of the diarrhoeagenic *Escherichia coli* were isolated from more than 30% of the patients.

PHYSIOLOGY LABORATORY

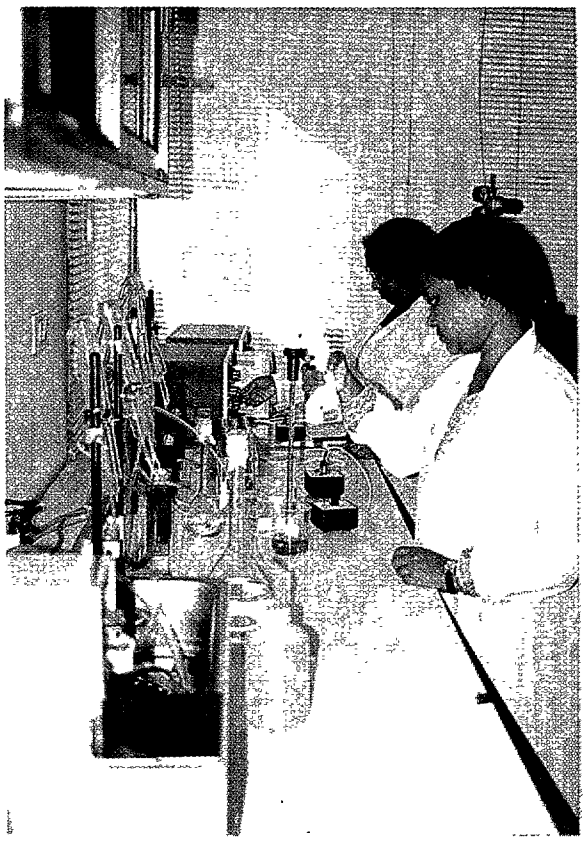
Coordinator: G.H. Rabbani

The Physiology Laboratory, established in 1995, is equipped for clinical and animal experimentation, and provides opportunities to CSD and LSD scientists to conduct more basic research in selected fields with direct relevance to the ICDDR,B's overall research objectives.

Previously-established methods, including those for measurement of nitric oxide, bioelectrical impedance analysis (BIA), total radical antioxidant parameter (TRAP), have contributed to a variety of protocols. The Laboratory continued to be expanded and upgraded in 1998, and research on intestinal absorptive and secretory function, and experiments with Ussing Chamber technique to examine the changes in ion transport across the intestinal epithelia were continued.

With financial assistance from and academic collaboration with the Department of Pharmacy, University of Dhaka and INSERM, Paris, France, a project was undertaken to study intestinal ion transport during infection and malnutrition. This project will be the basis for doctoral thesis of a faculty member of the University of Dhaka.

A study was initiated by Sufia Islam, a member of the CSD staff and a doctoral student of the University of Dhaka, to investigate the physiologic mechanism of dehydration by examining the intestinal ion transport and epithelial repair in a rabbit model of diarrhoea and malnutrition. This study will be partially supported by the French Government through Prof. Desjuex's Laboratory in France.



Investigators in the Physiology Laboratory of CSD, engaged in Ussing Chamber study for measuring ion flux across the intestinal epithelium

A study to examine the role of a rice-based ORS with low-sodium (CeraLyte–70) in intestinal ion and water transport in a secretory diarrhoea model in rabbit has been completed.

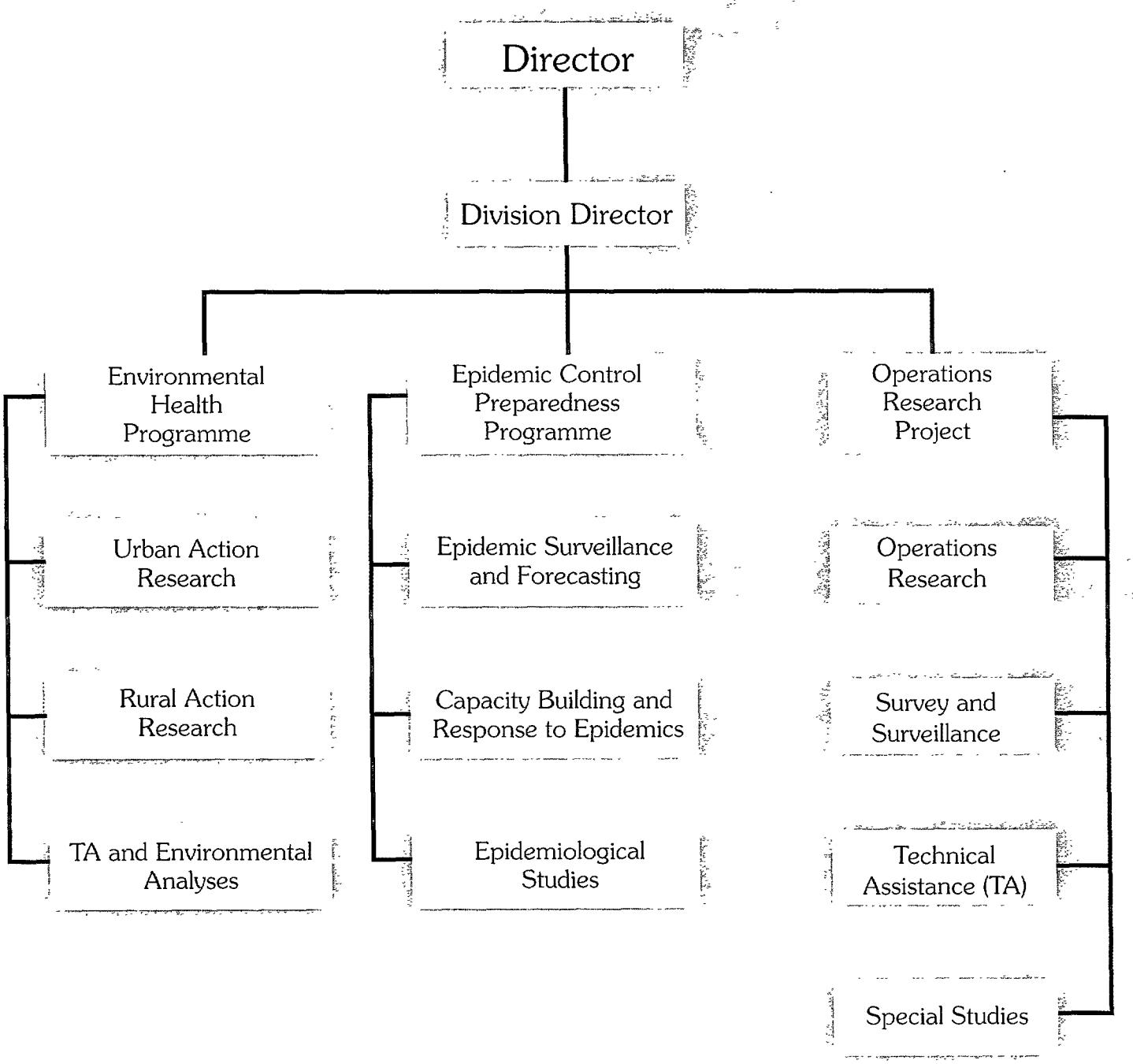
A new study to assess the role of nitric oxide and reactive oxygen species in the pathogenesis of experimental shigellosis was initiated with support from the Cytos Pharmaceuticals, USA. The therapeutic role of antioxidants (L-Histidine, ascorbic acid, beta-carotine, and selenium) in experimental shigellosis will also be evaluated.

AWARDS

Ms Saskia Osendarp received the 1998 American Society of Clinical Nutrition (ASCN) Young Investigator Award presented in Washington, DC at the Federation of Societies of Experimental Biology (FASEB) for her work in zinc supplementation during pregnancy and effect on birth-weight done as part of her doctoral work.

At the 6th Annual Conference of the Indian Academy of Paediatrics and CAPGAN Update on Paediatric Gastroenterology, New Delhi, India, Dr. Tahmeed Ahmed received the Best Paper Award in Gastroenterology for his work in the management of severely malnourished children.

Health and Population Extension Division



Health and Population Extension Division

Acting Division Director
Barkat-e-Khuda

The Health and Population Extension Division (HPED) of the Centre has the largest collaborative project with the host government. The Division has a long history of accomplishments in applied research which focuses on the application of simple and effective technologies and strategies to improve the health and family welfare of the population.

The primary focus of the Division is on: conducting operations research (OR) in health and family planning, including environmental health and epidemic control; disseminating research findings nationally and globally, through seminars, conferences, and publications; scaling-up the lessons learned from successful operations research interventions; and providing technical assistance to the Government of Bangladesh (GoB) and non-government organizations (NGOs) to strengthen the national health and family planning programme.

Division Highlights

- The recently-conducted review of the Division by the Board of Trustees concluded that HPED is doing excellent work in supporting the development of health systems and quality of care in Bangladesh and in striving to implement the recommendations of the International Conference on Population and Development (ICPD)held in Cairo.
- The Operations Research Project, in collaboration with the Bangladesh Government, USAID, and the National Integrated Population and Health Programme (NIPHP) partners, finalized eight operations research proposals for field-testing in the government and NIPHP programme sites.
- English and Bangla versions of the Essential Services Package (ESP) service-delivery protocols were developed, produced, and disseminated. These will be used by providers at the primary healthcare level. Eleven training modules for ESP delivery were also developed.
- In collaboration with the Government, the Operations Research Project initiated research on operationalizing a cost-effective tiered system for delivering the ESP in rural and urban areas.
- ORP developed a management information system (MIS) for NGOs involved in the NIPHP.
- The Environmental Health Programme initiated identification of the acceptable drinking water sources in arsenic-affected areas of Bangladesh.

HPED is composed of three projects: Operations Research Project, Environmental Health Programme, and Epidemic Control Preparedness Programme.

The Division's total staff strength in 1998 was 296, including five international-level personnel, 54 national officers, and 237 general services officers and other field-level staff.

OPERATIONS RESEARCH PROJECT

Chief of Party: Barkat-e-Khuda
Funded by: USAID

The Operations Research Project (ORP) is the outcome of the merger of resources and lessons learned from the two components of the former MCH-FP Extension Project that operated in rural and urban areas of Bangladesh. ORP represents the Centre's contribution to a broad partnership involving the Ministry of Health and Family Welfare and other service-delivery organizations under the USAID-funded National Integrated Population and Health Programme (NIPHP).

The focus of the Project is on strengthening the national health and population programme through improvements in management, quality of care and sustainability. ORP interventions are designed and field-tested through the government agencies and NGOs delivering health and family planning services in rural and urban Bangladesh. ORP maintains four field offices located in Abhoynagar thana in Jessore district; Mirsarai and Patiya thanas in Chittagong district; and in Dhaka city. These field offices coordinate the OR activities in the respective 'laboratory areas' of the Project.

The commitments of ORP echo the message of ICPD: addressing priorities in women's reproductive health, safe motherhood, child survival, and the prevention of sexually transmitted diseases; facilitating the development of government policies supporting the delivery of Essential Services Package (ESP) aimed at improving family health. The ORP's effectiveness is measured by the number of operations research projects conducted, findings disseminated, and the number of OR findings scaled-up/replicated in the national programme. Thus, the expectations of the Government and USAID from ORP directly relate to programmatic and policy improvements. In collaboration with other NIPHP partners and the commercial sector, ORP is mandated to design and test sustainable service delivery systems for rural and urban areas. This includes conducting applied research to operationalize the ESP and to strengthen the support systems (e.g. management, quality of care) for a sustainable national health and population programme.

The project efforts are divided into three major areas, i.e. improvement of management, improvement of quality of care, and improvement of sustainability of the national programme. Accordingly, within the Project, three teams (one each for Management, Quality of Care, and Health Financing and Sustainability) conduct applied research and provide technical assistance (TA) to the governmental and local service-delivery organizations on each of the three mentioned areas. The main thrust of the TA is to bring about enhanced use of the high-impact family health services, higher quality of services, strengthening of management support systems, and sustainability of family health services. These teams are supported by a Surveillance and Field Research Support Team, a Coordination and Technical Support Team, and the Project's Administrative Unit.

ORP Activities in 1998

In September 1998, ORP stepped into its second year of operations. The workplan for the Project during 1 October 1998-30 September 1999 has been developed and approved by the Government and USAID. During the reporting period, the salient activities of the Project included: identification of the priority areas for applied research and TA, reviews of existing information and experiences in eight identified areas of programmatic relevance, development and finalization of eight OR proposals, provision of TA to the Ministry of Health and Family Welfare and the NIPHP partners for the design and scaling-up of various aspects of ESP delivery, development of protocols and training manuals for the delivery of ESP, and dissemination of findings and lessons learned.

Finalization and implementation of the workplans and research activities of the ORP are overseen by a Working Group, chaired by the Joint Chief (Planning) of the MOHFW. Members of the ORP Working Group also include: the Director Generals of Health Services and Family Planning, officials of the MOHFW, the two ESP Line Directors, Director General of the National Institute of Population Research and Training (NIPORT), Director of the Bangladesh Medical Research Council (BMRC), Senior Policy Advisor to NIPHP, and representatives of USAID and NIPHP partners. The research activities of ORP are also overseen by the standing committees of ICDDR,B, such as the Research Review Committee (RRC) and the Ethical Review Committee (ERC).

The specific accomplishments of each key OR activity of the workplan, during the reporting period, are outlined below:

Operations Research on Operationalizing a Cost-effective Tiered System for Delivering the ESP in the Public Sector

Research Team: Subrata Routh, Sukumar Sarker, Shamsuddin Alamgir, Yousuf Hasan, Suraiya Begum, Tariq Azim, Ahsan Shahriar and Barkat-e-Khuda

Collaborating Agencies: Directorate General of Health Services (DGHS), Directorate of Family Planning (DFP), and Ministry of Health and Family Welfare (MOHFW)

ORP applied research activities are focused on increasing the availability of services included in the Essential Services Package (ESP) at Union Health and Family Welfare Centres and Community Clinics

In July 1998, the GoB initiated the current five-year health programme, namely the Health and Population Sector Programme (HPSP). The central theme of HPSP is to provide a wide array of services for reproductive health, child survival, and curative care from fixed sites, ranging from community clinics (CC) to the health and family welfare centres (H&FWCs) at the union level and thana health complexes (THCs). As part of design of the intervention and development of the proposal to operationalize, monitor, evaluate, and improve ESP delivery, including the functioning of all tiers at the thana level and below, a review of the existing information on various service-delivery strategies of health and family planning services has

been completed. The proposal of the study has been developed and approved by the OR Working Group.

ORP designed and introduced the ESP Flip Chart as a health education tool to help communicate key elements of the ESP to the community. The flip chart contains key pictorial information on major problems covered by ESP services (e.g. ARI, diarrhoea, RTI/STI, family planning, night blindness, personal hygiene, worms, antenatal care, and pregnancy complications). Government personnel were trained through workshops, organized in Dhaka and field sites, on the use of this flip chart. The use of the flip chart is being monitored.

Operations Research on the Operationalization of a Cost-effective Tiered System for Delivering the ESP in Urban Areas through GoB Clinics

Research Team: Ali Ashraf, Yousuf Hassan, Jahanara Khatun, Shamsuddin Alamgir, Subrata Routh, Cris Tunon and Barkat-e-Khuda
Collaborating Agencies: DGHS, DFP, and Dhaka City Corporation (DCC)

ORP began an intervention at the Sher-e-Bangla Nagar Government Outdoor Dispensary in December 1997 aiming at establishing a model clinic for delivering ESP services. The clinic serves one of the largest slums in Dhaka. Over the reporting period, the following were accomplished:

- The clinic provided training to service providers of the GoB's Model ESP Clinic on the use of the ESP service-delivery protocols developed by ORP.
- It identified information and logistics systems needed to deliver ESP at the clinic level.
- A needs assessment report is in press. The assessment includes inventories made at the existing GoB and NGO facilities in the catchment area of the Model ESP Clinic and baseline information on issues relating to the quality of services available, including counseling.

The intervention is coordinated by the Dhaka City ESP Committee. This committee comprises senior managers from the offices of Civil Surgeon, Dhaka and Deputy Director for Family Planning, and the Health Department of Dhaka City Corporation. A mid-term evaluation will be conducted in the second quarter of 1999.

Implementation of a Cost-effective Tiered System to Deliver the ESP in Rural Areas by NGOs involved in the NIPHP

Research Team: Shamsuddin Alamgir, Rukhsana Gazi, Cris Tunon and Barkat-e-Khuda
Collaborating Agency: Rural Service-delivery Partnership (RSDP) of NIPHP

The team coordinated the process of designing a special study on the role and contribution of depot-holders toward NIPHP service-delivery outcomes. This special study involves an in-depth investigation of the performance of depot-holders to identify the job description that maximizes their contribution to NIPHP service-delivery strategies.

The performance of the depot-holders regarding these tasks will be monitored and evaluated together with the expectations and acceptance expressed by community members. Both qualitative and quantitative analyses will be used for assessing these issues.

The team was also instrumental in designing and implementing a national survey to monitor the impact of service-delivery strategies of NGOs involved in the NIPHP. The survey aims at obtaining population-based data on the coverage and utilization of selected ESP indicators in NGO areas, including the analysis of a profile of users and non-users of NIPHP-funded NGO facilities. Further work included a sample size projection and the drafting of a questionnaire.

Improving Planning Strategies in the Low-performing Locations
Research Team: Shamsuddin Alamgir, Khorshed Alam Mozumder, Jasim Uddin and Cris Tunon
Collaborating Agencies: DGHS and DFP

The research team completed a review of the planning methodologies used by GoB and NGO projects. The review focused on the possible application of GIS methodology and regional planning to improve the health and family planning performance in the low-performing locations in Bangladesh. The team also completed a review of existing strategies for the low-performing locations. The team began an analysis of the geographical distribution of resources for delivery of the ESP.

Strategies for Meeting the Health Needs of Adolescents
Research Team: Quamrun Nahar, Samina Manaf, Rukhsana Gazi, Cris Tuòón and Barkat-e-Khuda
Collaborating Agencies: DGHS and DFP

This is part of a series of planned OR activities designed to improve the services intended to meet the needs of underserved demographic groups. The studies on adolescent health will be followed by research on other special population segments, such as men, working women, floating populations, and commercial sex workers. In October 1998 the team, jointly with the Directorate of Family Planning of the MOHFW, organized the First Stocktaking Workshop on Adolescent Health Activities in Bangladesh. The workshop analyzed and discussed key issues for design of the future reproductive health interventions of the Government aimed at adolescents in schools and in the community. It also reviewed some important experiences learned from the activities of BRAC, Nari Maitree, Concerned Women for Family Planning, and Family Development Services and Research in their work with adolescents. The workshop proceedings and a review report are being finalized.

Data are being collected on a randomly-selected group of 4,800 adolescents (10-19 years of age) from the rural and urban ORP field sites. The study will obtain information on knowledge, attitudes, and behaviour of adolescents with regard to reproductive health. The survey will be followed by qualitative studies to explore these areas further and to identify decision-making processes and social networks influencing the reproductive health behaviour of this group.

Strategies for Improving RTI/STI Prevention and Management
Research Team: Mohsin Uddin Ahmed, Saifur Rahman, Shameem Ahmed, Iffat Shams and Barkat-e-Khuda
Collaborating Agencies: DGHS, RSDP, Urban Family Health Partnership (UFHP) and Laboratory Sciences Division of ICDDR,B

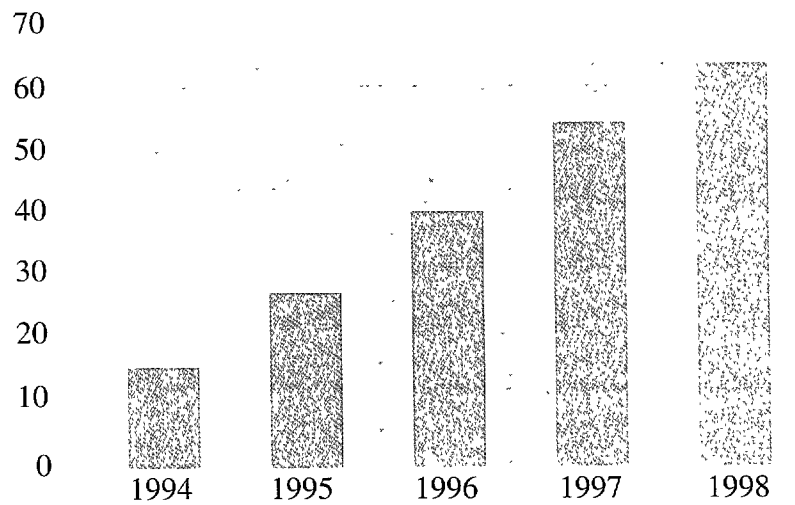
The intervention on RTI/STD prevention and management has three components: (1) operationalization of syndromic management at the primary

healthcare level, (2) antenatal screening for syphilis, and (3) capacity building of pharmacies for RTI/STD services. The intervention proposal has been finalized and approved by the ORP Working Group. Baseline data collection for the first and third components has been completed. A review report on the prevention and management of RTI/STD is in press.

Strategies for Ensuring Referral and Linkage for Essential Obstetric Care (EOC)
Research Team: M.A. Quaiyum, Shameem Ahmed, Parveen A. Khanum, Shameem A. Jahan, Ariful Islam and Iffat Shams
Collaborating Agencies: DGHS, DFP and RSDP

This intervention is a modification of the ongoing intervention called Strengthening Maternal and Neonatal Health: Improving Linkages at All Levels. The intervention has been modified to involve the village practitioners, various social groups, and formal and informal leaders in the organization of awareness-raising activities designed to encourage families to take pregnant women to the hospital in the event of an obstetric emergency. Development of various intervention tools as well as orientation and training programmes for providers and other community groups have been initiated. The ongoing intervention on emergency obstetric care has led to a continuing increase in the number of maternity patients admitted at the thana health complex as shown in the following figure. A review report on strategies for ensuring referral and linkage for essential obstetric care is in press.

Number of maternity cases admitted at Mirsarai Thana Health Complex during 1994-1998



Scaling-up of the Mirsarai EOC Model in Five Thanas
Research Team: Farzana Sobhan, Mohsin Uddin Ahmed and Shameem Ahmed
Collaborating Agencies: DGHS and DFP

As part of the scaling-up of the Mirsarai EOC model, five new EOC units have been constructed at Abhoynagar, Dumuria, Mithapukur, Narsingdi,

and Saharasti THCs. Training of physicians on anaesthesiology and obstetrics has been initiated.

Technical Standards, Protocols and Input Standards for Emergency Obstetric Care at Different Tiers of Service Delivery
Research Team: Setara Rahman, Farzana Sobhan and Shameem Ahmed
Collaborating Agencies: DGHS, DFP, MOHFW and Quality Improvement Partnership (QIP) of NIPHP

Protocols and manuals for Emergency Obstatric Care (EmOC) at different tiers of service delivery have been finalized for submission to the technical review committee of the MOHFW.

Strategies for Improving the Quality and Performance of Contraceptive Services
Research Team: Shameem Ahmed, Rabeya Khatun, Farzana Sobhan, Ariful Islam and Iffat Shams
Collaborating Agencies: DFP, RSDP, UFHP and QIP

The proposal for this intervention has only recently been finalized and approved by the ORP Working Group. Baseline data collection has begun. Development of various intervention tools and orientation and training programmes for service providers and other community groups have been initiated. A core committee on clinical contraceptives has been formed, with the Programme Manager, Family Planning Clinical Services as the Chair. Various other NIPHP partners are included in this committee. A review report on developing strategies for improving quality and performance of clinical contraceptive services is in press.

Strengthening of Management Support Systems for Effective Delivery of ESP

The overall objective of the OR activities under this initiative is to assist the Government and NGOs in the development, pilot-testing, implementation, documentation, monitoring and evaluation of selected management support systems. The systems currently being assessed, improved or developed include: the management information system, performance monitoring and local-level planning, and review processes involving stakeholders in the health and population sector. These systems are described below in more detail:

Management Information Systems (MIS)
Research Team: Tariq Azim, Mafizur Rahman, Cris Tunon, Nowsher Uddin and Barkat-e-Khuda
Collaborating Agencies: DGHS, DFP, RSDP and UFHP

In February, ORP submitted a proposal to the MOHFW for a national integrated record-keeping and reporting system for community and union clinics, based on the tools developed for the GoB service providers in Patiya thana and Chittagong district. The tools were also shared with national-level officials of the MIS Units for the Directorates of Health Services and Family Planning. The proposals, particularly those relating to the clients' cards, were later incorporated into the proposal for a unified MIS prepared for the Government's HPSP.

One of the year's major achievements for the MIS team was its leading role in the development, pilot-testing and nationwide introduction of the record-

keeping and reporting forms that are now being used by NGOs involved in the NIPHP in 300 clinics and service-delivery points.

The research team supported this implementation with specially-developed users' and training manuals and through their involvement in the training of clinic managers (from the rural and urban NGOs involved in the NIPHP).

The MIS team also worked in the adaptation of monitoring and supervision tools developed by the DGHS for use by local managers and supervisors.

The following review reports were completed by the MIS team:

- Past and current interventions in the field of record-keeping and reporting
- Barriers to effective supervision of health and population programmes

Planning and coordination among service providers in municipalities
Research Team: Jahanara Khatun, Jasim Uddin, Mafizur Rahman and Cris Tunon
Collaborating Agencies: DCC, DGHS and DFP

Till now, this intervention has been limited to Dhaka city. This ongoing intervention seeks to promote local-level planning and coordination through zonal and ward-level committees involving government and non-government service-delivery agencies in Zone 3, 4, 6, and 7 of Dhaka City Corporation. The committees have monitored the implementation of their respective action plans over the year and have contributed to improved coordination among NGOs and more effective health promotion campaigns (e.g. National Immunization Days). In November, the research team, the Health Department of Dhaka City Corporation, and the Urban Primary Healthcare Project of the Asian Development Bank jointly organized a consensus-building workshop with all zonal executives and health officers to assess the progress and identify the strengths and weaknesses of the programme with regard to coordination and planning. The results from the workshop and findings from a survey of the committee members will be used for modifying this intervention. The team has also conducted an inventory of all government and NGO facilities providing ESP services in the area of Dhaka City Corporation.

Local-level planning in rural areas
Research Team: Jasim Uddin, Jahanara Khatun, Rukhsana Gazi, Nowsher Uddin and Mafizur Rahman
Collaborating Agencies: RSDP, University of North Carolina, USA, DGHS and DFP

This research team is conducting work in collaboration with Pathfinder International, University of North Carolina (UNC), and thana managers of local NGOs, and GoB. It documents the process of implementing action plans to improve health and family planning indicators in eight low-performing thanas. The action plans are designed to improve ESP service-delivery coverage, quality of care, and teamwork. They also incorporate innovative incentives to improve union-level performance. The team has

designed and pre-tested questionnaire and guidelines for observation of field activities and for focus group discussions. The data collection phase of this study will begin in the first quarter of 1999. The team collaborated with RSDP in designing terms of reference (TOR) for a request for proposal (RFP) to conduct two surveys (baseline and endline) in eight thanas to assess the impact of the training course "Improving Management and Performance of Delivery of the ESP at the Thàna Level" by the UNC in August 1998. The team is also investigating issues relating to the implementation of action plan in collaboration with the GoB's Thana Functional Improvement Pilot Project (TFIPP). A review of past and current interventions to promote local-level planning is in press.

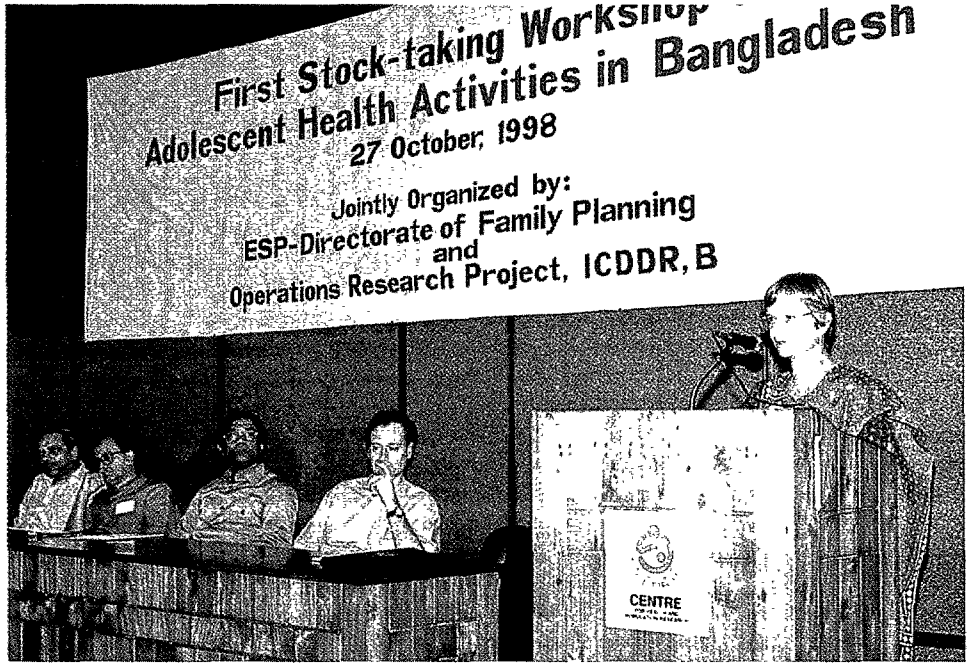
Operations Research on the Cost-recovery of ESP Delivery through Systematic Pricing and Revenue Management in Public Sector and NGO Programmes under NIPHP

Research Team: Zahidul Quayyum, Subrata Routh, Mahbub Alam Mozumder and Barkat-e-Khuda

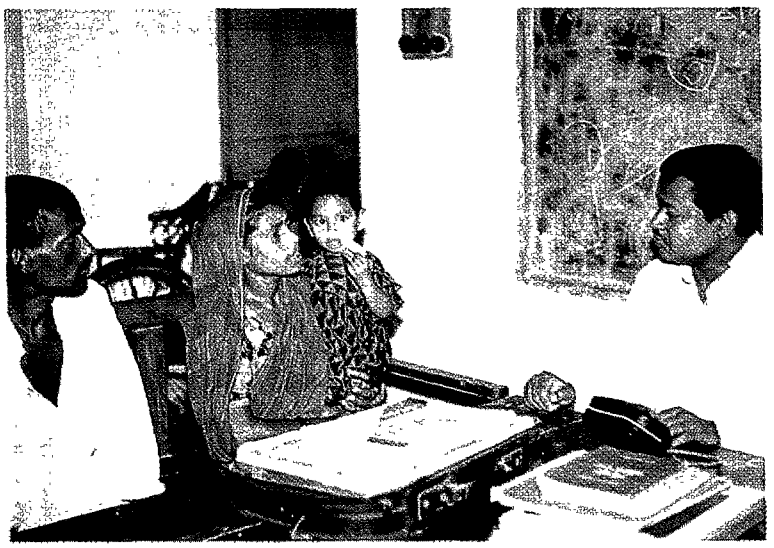
Collaborating Agencies: DGHS, DFP, MOHFW, RSDP (Pathfinder International) and UFHP (John Snow, Inc.)

The HPSP and the NIPHP have underscored the importance of financial sustainability with regard to health and population services. Against a backdrop of the increasing needs of the growing population for essential health and family planning services and consequent introduction of the ESP and high dependency of the programme upon donor funds, issues relating to health financing and sustainability have become critical. The Project has, therefore, undertaken OR on the feasibility of cost-recovery for ESP delivery through charging of user-fees (pricing) and revenue management. ORP has completed a literature review of the national and international experiences with the cost-recovery strategies. Based on the findings of the literature review and an analysis of the findings from the Project's past interventions on charging user-fees for family planning and limited maternal and child healthcare services, two proposals for the modified interventions on cost-recovery of ESP delivery have been developed—one for the government sector and another for the NGO sector. These proposals have been reviewed by the appropriate counterparts and approved by the OR Working Group. Implementation of the modified interventions was initiated in November with these activities: situation analysis, survey of willingness to pay and ability of the clients to pay, and study of demand and household expenditure for health and family planning services. Also, the Project is collaborating with the NGOs involved in the NIPHP in a special study on quality, costing, and pricing of ESP services.

Part of OPR's technical collaboration with government agencies involves the development of interventions aimed at improving services to key demographic groups such as adolescents



Cost and Cost-effectiveness Analyses of ESP Delivery
Research Team: Subrata Routh, Zahidul Quayyum,
Mahbub Alam Mozumder and Barkat-e-Khuda
Collaborating Agencies: DGHS, DFP, MOHFW, RSDP (Pathfinder International) and UFHP (John Snow, Inc.)



Promotion of male involvement in reproductive health is high in all ORP interventions

One of the major activities of the Project in the area of health financing and sustainability relates to analysis of cost and cost-effectiveness of ESP delivery from various tiers, like community clinics, depot-holders, satellite clinics, static clinics, health and family welfare centres, and thana health complexes. To this end, a literature review of the relevant work done in Bangladesh has been completed, and a draft report has been prepared. Also, the Project has initiated collaborative work with the Centre's Health Economics Programme in conducting the cost and cost-effectiveness analyses of the ESP delivery systems.

Strategies for Involvement of the Commercial Sector in ESP Delivery
Research Team: Subrata Routh, Mahbub Alam Mozumder
and Barkat-e-Khuda
Collaborating Agency: Social Marketing Company

To encourage involvement of the commercial sector in the delivery of ESP commodities and services, the Project initially focused on a joint activity with the Social Marketing Company (SMC) to help diversify its activities. ORP now provides TA to SMC for test-marketing of injectable contraceptives through commercial outlets, such as doctor-attended pharmacies, and in marketing progestin-only pills (PoPs) for use as a contraceptive among lactating mothers.

Survey and Field Research Activities

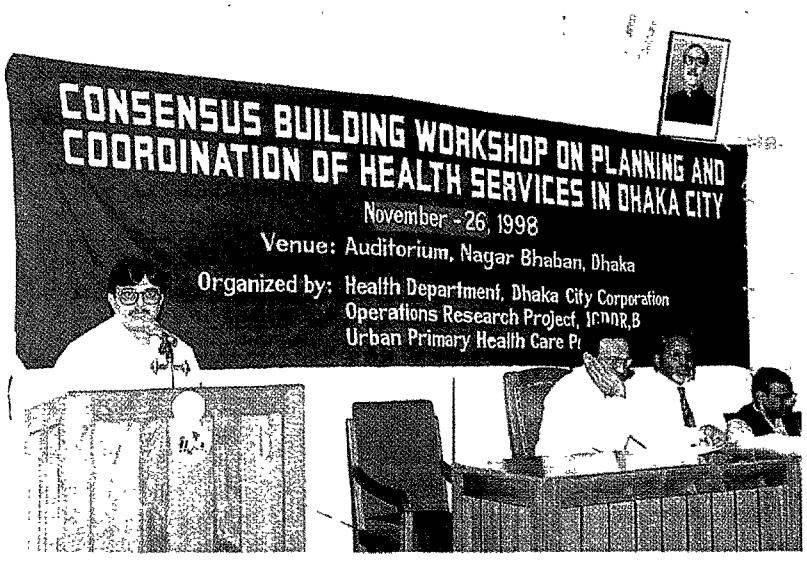
Routine surveillance and monitoring of intervention activities was carried out in the Project's rural and Dhaka city field sites, covering 25,132 households and a population of 133,082. The surveillance system was expanded to Patiya thana, effective January 1998, and in Dhaka city to the Sher-e-Bangla Nagar area, effective November 1998.

Three special surveys, namely the Combined Baseline Survey (CBS) for the ORP interventions; Reproductive Health Survey on Adolescents; and Ability and Willingness to Pay and Healthcare Demand for GoB Services in Rural Areas, have been conducted at the field level. Over 18,000 married women of reproductive age and 16,000 married men were the respondents of the CBS. Reproductive Health Survey of Adolescents sampled 4,800 girls and boys from the rural sites and Dhaka city. Ability and Willingness to Pay and Healthcare Demand survey will cover 6,000 married women of reproductive age. All of these surveys are in well progress.

Dissemination Activities

An important part of ORP's responsibility is to disseminate key results and findings of research activities. Government agencies, NGOs, donors, and the international community seek such information through meetings, workshops, seminars, conferences, and publications. During the reporting period, 21 intervention updates were published. The English and Bangla versions of the ESP protocols were disseminated. These protocols were designed to be followed by the service providers at the primary healthcare level in the delivery of ESP services. Also, 11 training modules for ESP delivery were developed and disseminated. Other publications included: nine working papers, three articles in international journals, and 15 special publications. Moreover, 18 scientific papers and 18 posters were presented at the national and international conferences by the project staff during the reporting period. In addition, 11 articles have been accepted by various peer-reviewed international journals for publication. National and international representatives from the government agencies, donor organizations, academic institutions, and international development organizations visited the various field sites of the Project.

The Project provided inputs to other divisions at the Centre as trainers or course directors in workshops and international events, dealing with reproductive health, financing of health services, and research methodology.



Workshops to strengthen management capabilities at zone level are held jointly with the Health Department of Dhaka City Corporation and Urban Primary Health Care Project of ADB

Technical Assistance

ORP provided TA to various government and non-government agencies. This was done by placing its personnel into various committees, working groups, and task forces of these agencies. During the reporting period, ORP provided TA to the MOHFW in the development of a unified MIS, development of a report titled "Summary of IEC Activities: Findings from a Review of IEC Activities in Health and Family Planning Programmes in Bangladesh", and in scaling-up lessons from ORP interventions in EmOC to other thanas. ORP also provided TA to the NIPHP partners in designing, pilot-testing, adapting, and introducing a management information system; designing special studies to assess the impact of NGOs; increasing the availability of injectable contraceptives at commercial outlets; developing needs assessment instruments for a study on revolving drug funds; and adapting ESP standards, protocols, and training materials.

EPIDEMIC CONTROL PREPAREDNESS PROGRAMME

Programme Head: A.K. Siddique
Funded by: Norwegian Agency for Development Cooperation (NORAD)

The Epidemic Control Preparedness Programme (ECPP) is attempting to develop a system of early warning for impending cholera epidemics in the country. ECPP works in collaboration with the MOHFW. It maintains sentinel surveillance for cholera in five locations across the country. ECPP

also conducts epidemiological and ecological studies on cholera in collaboration with the Public Health Sciences Division and the Laboratory Sciences Division.

Diarrhoea Epidemics in Bangladesh in 1998

The government epidemic surveillance system reported a total of 1,657,381 cases and 2,064 deaths from acute diarrhoea in 1998. The dry season epidemics (March-June) which mostly affected the southern regions accounted for 171,184 cases and 228 deaths. The incidence of diarrhoea greatly increased during the later half of the year and was marked by unprecedented flooding that affected 49 (72%) of the country's 64 districts. During the flood (July-November), 1,486,197 cases and 1,836 deaths from diarrhoea were reported throughout the country. This figure was considerably higher than it was for the last five years during the same period.

Epidemic Investigations and Interventions by ECPP

During the dry season epidemics, ECPP conducted investigations in 46 epidemic-affected thanas. In total, 572 patients were identified and treated by the ECPP physicians at the household level. A sample of 263 rectal swabs was collected for culture at the ICDDR,B laboratories. *Vibrio cholerae* was isolated from 33.5% of the samples: 84% of the isolates were identified to be *V. cholerae* O1; *V. cholerae* O139 accounted for 16%. During the flood-induced epidemic period, investigations were conducted in 76 thanas. In total, 452 rectal swabs were collected from 1,021 acute watery diarrhoea patients treated by the ECPP physicians. *V. cholerae* was isolated from 62% of the thanas. The isolation rate of *V. cholerae* (O1 and O139) was 554 per 1,000 rectal swabs. These figures were much higher than those during the first half of the year (554 per 1,000 vs. 335 per 1,000). *V. cholerae* O1, biotype El Tor accounted for 97% of the positive vibrio isolates. Three percent were O139. Both O1 and O139 were sensitive to tetracycline and erythromycin. *V. cholerae* O1 strains were resistant to cotrimoxazole; O139 strains were sensitive to this drug.

Epidemic Management Training for Mid-level Government Health Managers

The objective of this ongoing training is to improve capabilities for detection and prompt responses to cholera outbreaks at the local (thana) level. During the year, ECPP, in collaboration with the government diarrhoeal disease project, conducted six training sessions for the mid-level government health managers. The programme 'Epidemic Management of Diarrhoeal Diseases' had a total of 138 participants (110 thana health and family planning officers, 22 medical officers of disease control and surveillance and 6 deputy civil surgeons) attended the training sessions. Participants represented each division of the country.

Clinical Surveillance for the Study on Ecology and Epidemiology of Cholera in Bangladesh
PI: A.K. Siddique
Funded by: National Institutes of Health (NIH), USA

In cholera-endemic parts of the world including Bangladesh, cholera exhibits regular periodicity. Unfortunately, the mechanisms controlling the periodicity and pandemicity of cholera are not known. In Bangladesh, cholera outbreaks occur regularly —twice a year— both before and after the monsoon. This project examined the hypothesis that environmental

factors, particularly the growth of plankton, play a significant role in regulating the periodicity of cholera. Four sentinel sites have been established in Bangladesh, three of which are known to exhibit cholera periodicity. The other is usually free of cholera. A year-round effort was maintained to monitor: (1) the clinical cases infected with *V. cholerae*; (2) occurrence and density of *V. cholerae* in the surface water at these sites, including those attached to planktons in both its culturable and viable but non-culturable (VBNC) forms; and to determine the correlation between the clinical and environmental isolates using genetic and phenotypic markers.

During the course of clinical surveillance over the past two years, 1,829 patients with watery diarrhoea were studied. *V. cholerae* was isolated from 16.5% of the cases. Cholera occurred in all four sites; three of the sites had at least one epidemic, and one site (Matlab) had an almost continuous stream of cholera patients. The cholera attack rate during this period at Matlab, where the population is accurately known, was 3.84/1,000 population per year. In the other sites, where only catchment areas were known, the cholera attack rates were estimated to be: 0.73 at Chattak; 1.08 at Bakerganj; and 0.18 at Chaugacha. Cholera patients, compared to non-cholera patients, used tubewells less for drinking water and used pond water more for washing and bathing, suggesting a possible relationship between use of surface water and the incidence of cholera.

ENVIRONMENTAL HEALTH PROGRAMME

Programme Head: Bilqis Amin Hoque
Funded by: SDC, USAID, MOHFW, Oil Companies, World Bank and DfID (UK)

EHP contributes significantly to the development of the environmental health sector at national and international levels. EHP conducts both basic and actions research while responding to requests for technical assistance from the government and non-government agencies. EHP has also greatly contributed to the development of policies and programmes of the government agencies, NGOs, and donor agencies.

Other activities include: environmental health laboratory services, training, and networking. All these activities were carried at the national and international levels.

Action Research

Action Research and Impact Studies on Community Water, Sanitation and Hygiene Education Interventions in Rural Areas (ongoing)

Investigators: Bilqis Amin Hoque, Shafiul Azam Ahmed, Abdullah Al Mahmud, Hashmat Ara, Saumendra Nath Saha, Shabbir Hossain, Hasnath Iftekhar Hossain, R. Bradley Sack and R.E. Black
Funded by: Swiss Development Cooperation (SDC)
Collaborating Agencies: Ministry of Local Government, Rural Development and Cooperatives (MLGRD&C), Department of Public Health Engineering (DPHE), Directorate General of Health Services (DGHS), Concerned Women for Family Planning (CWFP), Johns Hopkins University (JHU) and local NGOs

The objectives of this longitudinal observational study in 11 unions of Singair, Manikganj are to provide technical assistance to DPHE in further

developing the Social Mobilization for Sanitation Project launched by DPHE-UNICEF, and to conduct pilot studies on measurement and mitigation options for potable water in arsenic-affected areas.

An arsenic treatment filter, developed by the Environmental Health Programme of ICDDR,B, is being field-tested

This actions research programme facilitated the development of the local institutions at union and village levels, trained the members of these institutions and partner NGOs, undertook laboratory and pilot-tests to develop water supply technologies, and monitored and evaluated the behavioural impacts of the activities implemented by the Project.

The Union Water Sanitation (UWATSAN) Committee, local volunteer women and NGOs played a major role in local mobilization and promotion of WSH issues. Sanitary latrine coverage improved 22% to 80% in the intervention area and 12% to 28% in the comparison area.

Arsenic contamination of groundwater was identified in the project area in September 1997 for the first time. The degree of contamination varied even within short distances. A participatory approach (involving the community) for testing tubewells is being studied. Moreover, techniques currently being used for arsenic testing have been found to be unreliable, costly, and only sporadically available. Therefore, other less costly locally-available options are being explored.

Pilot-level laboratory studies on water sources and treatment options (including rainwater harvesting, solar disinfecting, chlorination and alum treatment of surface water, chemical and physical treatment of arsenic-contaminated water at both household and community levels, pond sand filtration, dugwell-handpump and deep tubewell) are showing encouraging results. Continued and broader studies will be required for conclusive results.

Applied Research on Replicable Environmental Health Interventions in Primary Healthcare Perception (ongoing)
Investigators: Bilqis Amin Hoque, Hashmat Ara, Golam Morshed, Shabbir Hossain, Hasnath Iftekhar Hossain, Shah Monirul Kabir, Shafiul Azam Ahmed, Nazrul Islam and R.E. Black
Funded by: MOHFW and World Bank

The pilot phase of this project was initiated in June 1997, in collaboration with the Directorate General of Health Services, Ansar and Village Defense Party, and the Family Planning Association of Bangladesh. Although appropriate WSH practices are promoted by the Primary Healthcare Programme and this has direct health implications, there is need and scope for improvement in this regard. The long-term objective of this project is to provide technical assistance to improve water supply, sanitation, hygiene, and solid waste (WSHS) component of the primary healthcare pro-

grammes based on applied research. The immediate objectives include: studying and developing a replicable WSHS information, education and communication package for normal and flood situations.

This is a two-phase longitudinal study. During the reporting period (first phase), it has initiated a number of specific components: (i) needs assessment; (ii) information, education and communication; (iii) techniques and technologies for appropriate water storage, rainwater harvesting, community latrine, faeces disposal and handwashing; (iv) coordination and collaboration mechanisms among concerned agencies; (v) incorporation of gender issues; and (vi) cost-sharing for WSHS facilities. The study is being conducted in one thana of Patuakhali and slums or poor settlements in Ward 5, 41, 59, and 85 of Dhaka City Corporation.

Poor people shared costs for WSH provisions. Rural families assumed 70% of the costs of latrines. These were household-based ring-slab latrines. In the case of community latrines, 20% of the costs were shared by the slum dwellers.

The proposal for installing the first community-based, cost-sharing piped water supply in the Bauniabad slum was accepted by the concerned ministry and the Water Supply and Sewage Authority (WASA). The implementation of this system is in progress. Upon review, the concerned government monitoring teams found its first year's performance satisfactory and recommended continuation and extension of this study.

Problems and Potentials of Traditional Pond Management As a Sustainable Alternative for the Future Water Resource Management in Bangladesh (ongoing)
Investigators: Irene Kranzlin, Bilqis Amin Hoque, Rita Schneider-Sliwa and Klaus Gyr
Funded by: SDC

The study has three broad goals: (a) to analyze pond management in rural Bangladesh with its social, economical and ecological implications and to propose some measures for a sustainable pond management; (b) to provide a better understanding of the relations between man and environment in the case of ponds in rural Bangladesh; and (c) to provide basic data for situation and problem analysis to plan further development projects.

The study has used a variety of social (geographical) methods, including quantitative and qualitative research methods, mapping, and literature search. Data analysis and report writing are in progress.

Biological Contamination of Tubewell Water
Investigator: Bilqis Amin Hoque
Funded by: DfID (UK)

The development of groundwater resources for potable use has increased substantially over the last few decades, but the country is facing challenge from arsenic in groundwater/tubewell water. One of the immediate and obvious actions is to support drinking water from tubewells that are safe in terms of arsenic and biological contamination.

The objectives of the study were to: (i) determine which tubewells, tested for arsenic contamination in the DfID-funded sampling programme, are

free from biological contamination, and (ii) indicate the type and extent of common biological contamination of tubewell water and relate this to the conditions at the wellhead.

A cross-sectional survey was conducted to collect about 2,000 water samples from 274 thanas. The samples were tested in the Environmental Health Laboratory for faecal coliform bacteria, ammonia, nitrogen, and pH.

The geometric mean and median value of faecal coliform bacteria were as low as 3 cfu/100 mL and 1 cfu/100 mL respectively. However, only about 46% of the water samples met the WHO-standard (nil faecal coliform count/ 100 mL sample) for drinking water. About 65% of the samples had less than 1.5 mg/L ammonia-nitrogen concentration. The presence of dirty ditch within 15 metres of the tubewell was positively and significantly associated ($p=0.09$) with the faecal coliform bacteria, after controlling for other factors. Presence of platform and depth of tubewell showed negative association with the faecal coliform pollution, though not statistically significant. This issue needs further study.

Environmental Health Impacts of 1998 Flood
Investigators: Bilqis Amin Hoque, Golam Morshed, Hasnat Iftekhar Hossain, Shah Monirul Kabir and Rashadul Islam
Funded by: DfID (UK) and oil companies

Flood is almost an annual event in Bangladesh. However, lack of appropriate measures at national level to address the environmental health issues in relation to flood has been observed repeatedly. This has health as well as development implications.

The objectives of this applied research are to assess environmental health impacts of the 1998 flood in 29 thanas of 11 districts and to undertake brief rehabilitation activities in the most severely-affected areas of the country. Of these 29 thanas, rehabilitation options are being studied in four thanas. The study will be completed by January 1999.

Environmental Health Programme Laboratory
Investigators: Bilqis Amin Hoque, J.T.A. Chowdhury, U.K. Chowdhury, F. Khan and D. Chowdhury
Funded by: Requesting projects and agencies

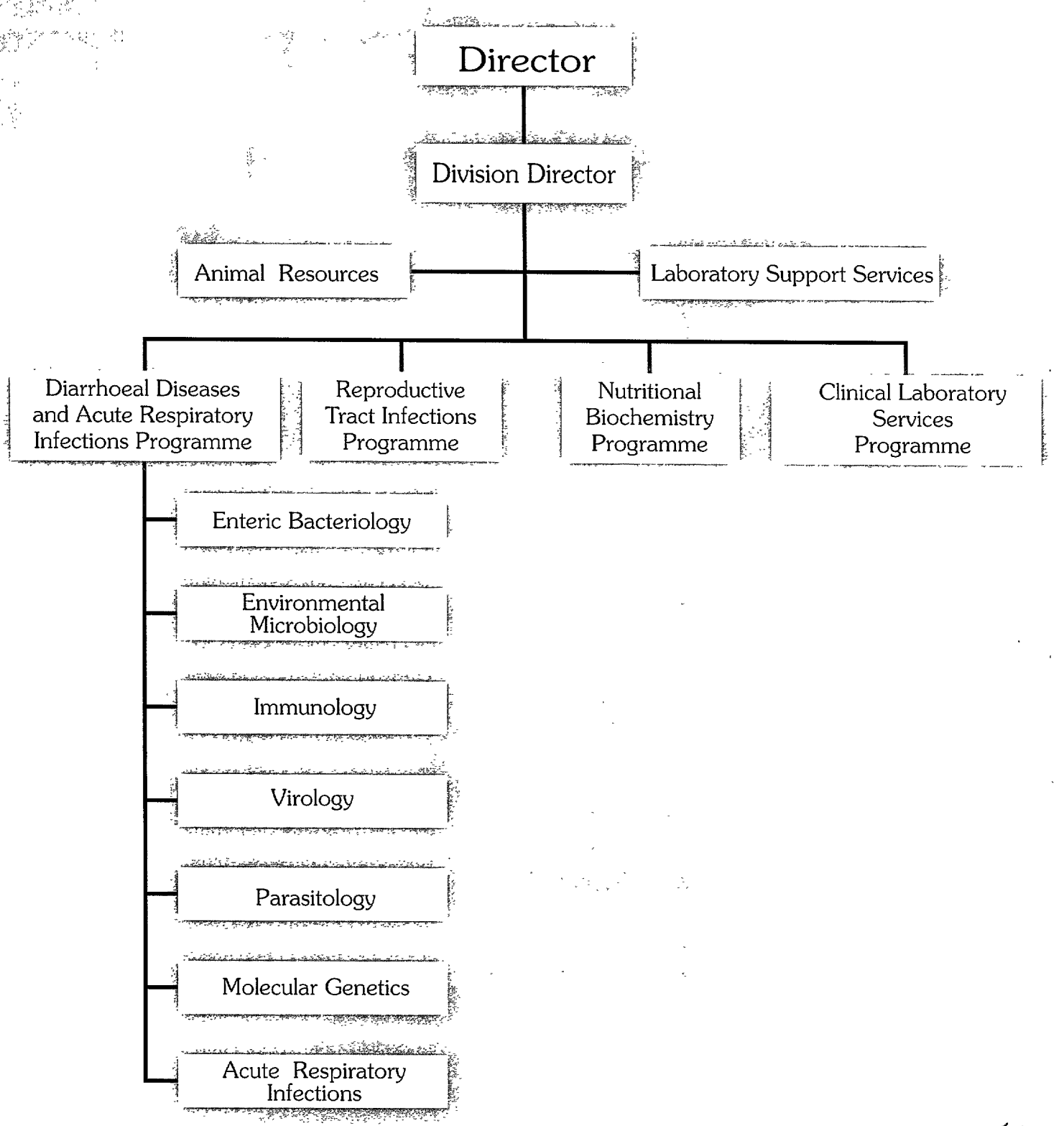
EHP maintains a full-fledged in-house environmental laboratory to conduct various biochemical, physical, chemical and microbiological tests on environmental samples from research projects and external agencies. The laboratory is also capable of conducting tests to detect arsenic in water, food and urine samples and can perform speciation of arsenic. It has tested about 2,560, 300, 3,000, 6,000, 500, 700, 2,100, samples for total arsenic, arsenic (III) and (V), iron, faecal coliform, BOD, COD, ammonia-nitrogen and other parameters in relation to the various research and technical assistance projects. Many other water samples have been tested on request also.

Global Applied Research Network (GARNET)
Coordinator: Bilqis Amin Hoque
Funded by: WEDC (Loughborough University, UK), World Bank, UNICEF and GARNET members

EHP coordinates activities of the Bangladesh as well as South Asia chapters of the GARNET. It is an activity of the Collaboration Council of Water

Supply and Sanitation for External Support Agencies. About 250 government, UN, NGO and donor agencies from Bangladesh and other countries are members of this chapter. Four meetings were held in 1998 on various issues relating to arsenic in drinking water and environmental health impacts of the 1998 flood. A website: http://www.citechco.net/garnet-lncsa/ has been established. Four issues of a quarterly newsletter were also published.

Laboratory Sciences Division



Laboratory Sciences Division

Division Director
V.I. Mathan

The mission of the Laboratory Sciences Division of ICDDR,B is to adopt, develop, and use the best scientific technology to address the infectious diseases and nutritional problems of developing countries, in partnership with the other divisions of the Centre, and national, regional, and international partners who share our commitment to maintain healthy populations.

The Division developed a strategic plan based on scientific themes relevant to the mission and strategic plan of the Centre. The mandate of the Division was identified as: "Apply science to promote health where disease exists." The Division has been reorganized into three programmes: Infectious Disease Research, Clinical Laboratory Services, and Administrative Support Services.

During the year, 24 personnel from areas of unrestricted funds of the Centre left the Division and were not replaced. The number of personnel in projects varied according to the needs of the projects. Professor V.I. Mathan joined as Division Director on 1 January 1998.

Division Highlights

- A strategic plan and a new organogram were developed by the Division.
- A newly-identified cytotoxin produced by *Vibrio cholerae* O1 has been characterized at the genetic level and had 97% homology to the haemagglutinin/protease (HAP) gene.
- Monoclonal antibodies to the capsule of *V. cholerae* O139 were found to be protective in the suckling mouse model of cholera.
- The cholera toxin phage has been transmitted in vitro and in vivo to non-toxigenic *V. cholerae* suggesting a possible mechanism for the emergence of new epidemic strains of *V. cholerae*.
- Multiplex PCRs for detection of microbial causes of watery diarrhoea and dysentery have been standardized.
- Early antibody response to ETEC vaccine suggested that it was acting as a booster in an already-primed population.
- Superoxide dismutase was down-regulated for up to one month in the rectal mucosa of children with shigellosis.
- The Division undertook the coordination of the National Sentinel Surveillance for HIV and syphilis with partners from the Government of Bangladesh and several NGOs.
- A technical consultancy has been undertaken to help clinical laboratories in Nepal for improving their antimicrobial resistance surveillance activities with funds from USAID/Washington.

INFECTIOUS DISEASE RESEARCH PROGRAMME

Thirty-six projects were undertaken during the year under the following scientific themes:

- Emerging and Re-emerging Infectious Diseases
  - Enteric infection
  - Respiratory tract infection
  - Human immunodeficiency virus infection
  - Surveillance and antimicrobial resistance
- Control of Diarrhoeal Diseases
- Vaccine Evaluation
- Nutrition
- Reproductive Tract Infection

Emerging and Re-emerging Infectious Diseases

Monitoring antimicrobial resistance is a priority, along with the study of pathogens of selected infectious diseases.

Enteric Infection

Studies on the Capsule of *Vibrio cholerae* O139 Bengal
PIs: M.J. Albert and F. Qadri
CIs: A. Weintraub and P-E Jansson, Huddinge Hospital, Karolinska Institute, Stockholm, Sweden
Funded by: SIDA-SAREC

Vibrio cholerae O139 Bengal has a capsule built by hexasaccharide repeating units of one D-glactose residue, two colitose residues, one N-acetyl D-quinovosamine residue, one galacturonic acid residue, and one phosphate residue. Six monoclonal antibodies to *V. cholerae* O139 capsule were tested in the suckling mouse cholera model, and two were found to be completely protective. The previously isolated phage JA1, specifically lyses, capsulated *V. cholerae* O139 by hydrolyzing the site between the glucosamine residue and the galacturonic acid residue producing oligosaccharide units. These oligosaccharides will be conjugated to carrier proteins to evaluate their immunizing potential and ability to protect against O139 cholera.

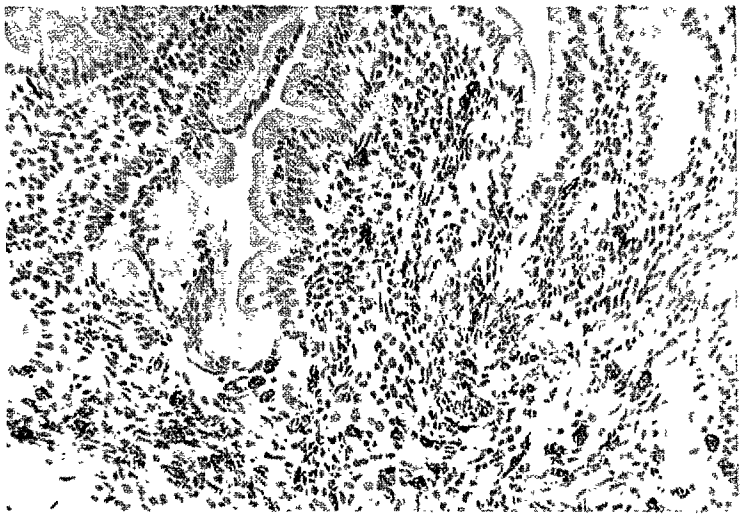
Molecular Characterization of Novel Cell Rounding Factor (CRF) of *Vibrio cholerae*
PIs: M.J. Albert and M. Rahman
CI: G.B. Nair, National Institute of Cholera & Enteric Diseases, Calcutta, India
Funded by: ICDDR,B

Cholera toxin-attenuated *V. cholerae* strains and *V. cholerae* strains that do not contain any of the known enterotoxins were shown to have cytotoxic effect on certain epithelial cells by Nair *et al.* This cytotoxin has been characterized as a 32-kDa protein which has been purified to homogeneity. The N-terminal sequence was highly homologous with haemagglutinin/protease (HAP) of *V. cholerae*. The corresponding gene from a non-O1,

non-O139 *V. cholerae* strain V249 was cloned and sequenced, which showed 97% homology to HAP gene of *V. cholerae*. Current work focuses on producing an isogenic mutant of the strain V249 which does not produce the cytotoxin.

Characterization of Epidemic Strains of *Vibrio cholerae* O1 and Non-O1 Based on Genetic and Phenotypic Traits
PI: S.M. Faruque
CIs: A.K. Siddique and M.J. Albert
Funded by: USAID

While investigating the molecular basis of the emergence of new epidemic strains of *Vibrio cholerae*, the induction of the bacteriophage-encoding cholera toxin in naturally-occurring strains of toxigenic *V. cholerae* has been studied. The transmission of the cholera toxin phage to non-toxigenic strains of *V. cholerae* has been demonstrated suggesting the origination of potential epidemic strains of *V. cholerae* from non-toxigenic progenitors.



Immunohistochemical staining of IgE in paraffin-embedded section from a patient with cholera at the acute stage

Molecular Characterization of Invasion-associated Gene(s) in *Providencia alcalifaciens* by *TnphoA* Mutagenesis
PIs: M. Rahman and M.J. Albert
Funded by: ICDDR,B

Providencia alcalifaciens produced diarrhoea in the RITARD assay and was invasive and caused actin condensation in the gentamicin-Hep-2 cell assay. *TnphoA* was introduced into an invasive strain of *P. alcalifaciens* (PA 2939, a spontaneous tetracycline-resistant isolate) from *Escherichia coli* strain SM 10, containing the *pho*A gene in a suicide vector pRT733 by conjugation. Of the 87 transconjugants obtained, 8 were invasion-deficient, and the localization of the transposon is now being determined.

Ecological and Epidemiological Studies of *Aeromonas* spp. in Bangladesh with Special Emphasis on Their Spread in the Environment and Humans
PIs: M.J. Albert, M. Ansaruzzaman, A.S.G. Faruque, M.S. Islam and A.K. Siddique
CIs: R. Mollby and I. Khun, Microbiology and Tumor Biology Centre, Karolinska Institute, Stockholm, Sweden; and R.B. Sack, Johns Hopkins University, Baltimore, MD, USA
Funded by: SIDA-SAREC

To identify potential diarrhoeagenic clones of *Aeromonas* spp., 160 isolates from 1444 patients with diarrhoea, 26 isolates from 30 matched controls, 600 isolates from aquatic samples from four different field sites, and 10 isolates from 707 diarrhoeal patients at these field sites have been fingerprinted by PhP typing and are being screened for the distribution of two different cytotonic enterotoxin genes and one cytotoxic enterotoxin gene.

Molecular Characterization of *Helicobacter pylori* Strains Isolated from Patients with Duodenal Ulcer and Gastric Cancer and from Asymptomatic Carriers
PIs: M. Rahman, M.J. Albert, S. Sarker and F. Qadri
CIs: S. Normark and L. Engstrand, Microbiology and Tumor Biology Centre, Karolinska Institute, Stockholm, Sweden
Funded by: SIDA-SAREC

Helicobacter pylori strains isolated from patients with gastroduodenal ulcer, non-ulcer dyspepsia, and gastric cancer will be characterized for their antimicrobial susceptibility and for the expression of virulence factors by studying the genotypes of CagA and Vac. The study has just started.

Respiratory Tract Infection

Detection of *Streptococcus pneumoniae* and *Haemophilus influenzae* type b Directly from Blood and Cerebrospinal Fluid by Multiplex Polymerase Chain Reaction
PIs: M. Rahman, N. Mehjabin and S. Nasreen
Funded by: ICDDR,B

A multiplex PCR assay showed that a few blood samples which were negative by culture were positive by this assay. However, one of the 10 positive samples by culture was missed. The test is now being optimized so that it can be evaluated for early detection of these important pathogens.

Immune Responses in Children with Both Acute Lower Respiratory Tract Infection and Diarrhoea
PIs: D. Islam, A. Brooks, M.A. Salam and R. Raqib
CIs: A. Kowsar, Bangabandhu Sheikh Mujib Medical University;
B. Christensson, Karolinska Institute at Huddinge University Hospital, Stockholm, Sweden
Funded by: USAID

To understand the immune responses in children with acute lower respiratory tract infection and diarrhoea, this project has just been initiated.

Human Immunodeficiency Virus Infection

National Sentinel Surveillance for HIV and Syphilis
PIs: T. Azim, J. Bogaerts and C. Jenkins
CIs: Nazrul Islam, Project Head, Bangladesh AIDS Prevention and Control Programme
Funded by: UNAIDS

ICDDR,B is the coordinating body for the National Sentinel Surveillance for HIV and syphilis. Of a target of 4000 samples from groups of individuals exhibiting high-risk behaviour, including brothel-based sex workers, floating sex workers, truckers, injecting drug users, men having sex with men, and STD patients, so far 3700 samples have been collected and tested for HIV and syphilis. The sample collection is done in association with a variety of government and non-government organizations, including medical colleges in Chittagong, Sylhet, and Rajshahi. Testing for syphilis is linked, and the results are returned to the clinic for appropriate treatment. Testing for HIV is unlinked anonymous, and the ELISA-positive samples are confirmed by Western blot. Where possible, the virus is also being typed. A

social and behavioural study is also being carried out on these individuals. Preliminary results show that the highest rates of prevalence are observed in intravenous drug users and the residents of some brothels.

Surveillance and Antimicrobial Resistance

Surveillance of Invasive *Streptococcus pneumoniae* (Spn) and *Haemophilus influenzae* (Hi) Diseases in Bangladeshi Children and the Antimicrobial Resistance and Serotype Patterns of Hi and Spn Isolates in Bangladesh

PIs: M. Rahman, A.H. Baqui and S. Hossain
Funded by: USAID

This project in the ICDDR,B hospital, Dhaka Medical College Hospital, and Matlab field project area aims at investigating the prevalence of *Streptococcus pneumoniae* and *Haemophilus influenzae* in children with acute lower respiratory infections. This new study, including characterization of antimicrobial resistance, has been initiated at the end of 1998 and will continue for 3 years.

Detection of Common and Newly-recognized *Staphylococcus* Species and Their Antibiotic Resistance Pattern

PIs: M. Rahman, M. Alam and J.D. Silva
Funded by: ICDDR,B

In total, 411 clinical staphylococcal isolates were identified up to species level. While *S. aureus* (24%) and *S. epidemidis* (18%) were the dominant species, newly-recognized species: *S. haemolyticus* (15%), *S. schleiferi* (4%), and *S. warneri* (4%) were identified. Eighty-five percent of the isolates were resistant to penicillin and 37% to methicillin. The methicillin resistance was higher than in the previous year (19%).

Technical Assistance for Antimicrobial Resistance Surveillance of Bacterial Pathogens in Nepal

PIs: M.J. Albert, V.I. Mathan and A. Hossain
Funded by: USAID

This new initiative is intended to provide technical assistance to various clinical laboratories in Nepal for establishing an antimicrobial resistance surveillance programme. A preliminary survey of 10 hospital-based clinical microbiology laboratories, from which a few will be selected for training the scientific and technical staff, has been completed. There will be a workshop in Nepal in early 1999 after which the surveillance will start and continue for a 3-year period.

The Enteric Bacteriology laboratory recently upgraded its facilities for studies on molecular mechanisms of microbial pathogenesis. Picture shows an experiment in progress to transfer a recombinant plasmid into a recipient strain of Escherichia coli

Surveillance of Enteric Pathogens in Patients with Diarrhoea

PIs: G.J. Fuchs, A.S.G. Faruque, S.M. Faruque, M.J. Albert and Md. Yunus
Funded by: USAID

The surveillance of 2% patients with diarrhoea, attending the Dhaka hospital and surveillance of 10% patients with diar-

rhoea in the Matlab hospital, are being conducted under the leadership of the Clinical Sciences Division. The clinical microbiology laboratory service of the Laboratory Sciences Division provides all technical inputs for isolation and characterization of pathogens from the surveillance sample.

Control of Diarrhoeal Diseases

The programme consolidates all the research activities which will ultimately contribute to the control of diarrhoeal diseases. Research on cholera is the major priority while there are studies on shigellosis, Norwalk virus, and various parasite-associated diarrhoeas. These studies are done in collaboration with other divisions of the Centre and with external academic institutions.

Cholera

Epidemiology and Ecology of *Vibrio cholerae* in Bangladesh
PIs: M.S. Islam, S.M. Faruque, F. Qadri, A.K. Siddique, Md. Yunus and M.J. Albert
CI: R.B. Sack, Johns Hopkins University, Baltimore, MD, USA
Funded by: National Institutes of Health (NIH), USA

This is a major multidisciplinary collaborative approach to study the epidemiology and ecology of *V. cholerae* in Bangladesh. There are 3 major areas of activities in the Laboratory Sciences Division:

I. The Environmental Microbiology Laboratory of the Division is elucidating the role of various environmental parameters in triggering bloom in algae in the environment. *V. cholerae* O1 and O139 have been found to be associated with these algae, and the blooms may be temporally related to cholera outbreaks. Environmental samples from 4 different areas from Bangladesh are being monitored. The highest isolation has been observed in Matlab where there was also the highest number of cholera cases. Cultivable and non-culturable *V. cholerae* O1/O139 are being looked for by culture techniques as well as by fluorescent antibody techniques. A polymerase chain reaction (PCR) for detecting the toxin is also being developed.

II. The Molecular Genetic Laboratory of the Division is characterizing the molecular epidemiology by genetic fingerprinting of toxigenic *V. cholerae* strains isolated from the aquatic ecosystems and from patients with cholera to identify clonality and genetic relatedness.

III. The Immunology Laboratory of the Division is developing monoclonal antibodies to virulence antigens of enteric pathogens, including *V. cholerae* O1 and O139, to evaluate their specificity and sensitivity for rapid diagnosis.

Development and Application of Multiplex Diagnostic PCR Assay As an Aid to Clinical and Environmental Studies
PIs: S.M. Faruque and M.J. Albert
Funded by: USAID

The aim of this study is to develop and standardize rapid and sensitive diagnostic techniques for different enteric pathogens and test the applicability of these techniques in clinical and epidemiological studies. This study employs the polymerase chain reaction (PCR) to amplify specific segments

of pathogenic genes and thus identify the enteric pathogens. Multiplex PCR assays for pathogens causing watery diarrhoea and pathogens involved in invasive diarrhoea have been developed. These assays have been tested using control strains and reconstituted stools. Evaluation of the assays are being carried out on clinical and environmental samples.

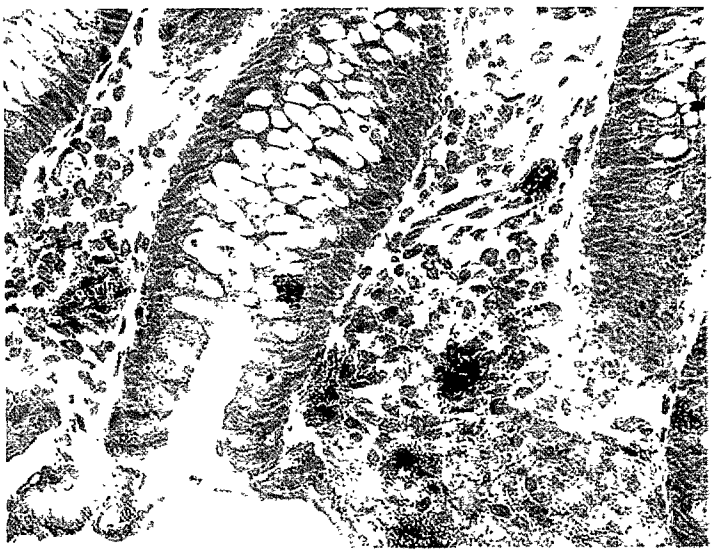
Are Waste-stabilization Ponds (WSP) Barriers to, or Reservoirs of Cholera? How Much *V. cholerae* Is There in Wastewater?
PI: M.S. Islam
CIs: T. Curtis and M. Barer, University of Newcastle upon Tyne, UK
Funded by: DfID, UK

The first phase of this protocol started from August 1998. Laboratory techniques for enumeration of *V. cholerae* from environmental samples have been set up. A new ELISA is also being established. These methods will be applied to study the waste-stabilization ponds associated with the sewage disposal system in Dhaka to determine whether they are reservoirs of cholera or whether they eliminate the organisms during the period the sewage effluent is held in them.

A Simple Water Filtration for Cholera Intervention
PI: M.S. Islam
CIs: A. Huq and R.R. Colwell, University of Maryland Biotechnology Institute, USA
Funded by: National Institutes of Health (NIH), USA

The observation that outbreaks of *V. cholerae* are associated with algal blooms and the association of viable but non-culturable *V. cholerae* with blue-green algae has prompted this field trial in the Matlab area of a simple filtration of surface water for domestic purposes to see whether it can significantly reduce the incidence of cholera.

Extensive expression of β–defensin in the rectal mucosa of a patient with infection due to S. dysenteriae type 1



Shigella Infections

Identification of Risk Factors and Study the Outcome of *Shigella*-associated Haemolytic-Uraemic Syndrome
PIs: T. Azim, M.A. Salam, T. Ahmed, N.H. Alam, R. Raqib and F. Qadri
CIs: M. Hanif, Dhaka Shishu Hospital; Shinji Yamasaki and Yoshifumi Takeda, International Medical Center of Japan, Tokyo, Japan
Funded by: Government of Japan through UNOPS

This study, a joint LSD-CSD project, aims at comparing the history of antibiotic intake, clinical features, immune response, and other parameters between children who develop haemolytic-uraemic syndrome (HUS) from *Shigella dysenteriae* 1 infection and those who do not develop it. *Shigellae* are identified both by culture and by PCR for the Shiga toxin gene in the stool. So far, 29 patients with dysentery have been screened, of whom 14 had *Shigella dysenteriae* 1 or the toxin gene in their stools. Four children developed HUS. The study is being continued.

Viral Diarrhoeas

Investigation of the Importance of Norwalk-like Viruses in Childhood Diarrhoea in Bangladesh

PIs: T. Azim, G. Podder, Z. Hasan, M.A. Salam, A.S.G. Faruque and M.J. Albert
CIs: L. Unicomb, Australia; R. Glass, Centers for Disease Control and Prevention (CDC), Atlanta, GA, USA
Funded by: USAID

The first phase of the study to determine the age of acquisition of Norwalk-like virus infection by testing for antibodies in a large sample of children is about to be completed. Once the age of acquisition is determined, samples from the diarrhoea surveillance will be screened for Norwalk-viruses.

Parasitic Diarrhoeas

Intra-species Variation in *Entamoeba histolytica* and Protective Immunity with *E. histolytica* Infection

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

The genetic heterogeneity of *E. histolytica* isolates will be determined by isoenzyme classification, analysis of DNA polymorphism of two single-copy genes, polymerase chain reaction, and ribotyping. Initial results show distinct differences between the standard laboratory isolates of *E. histolytica* and clinical isolates obtained from Bangladesh.

Field Studies of Human Immunity to Amoebiasis in Bangladesh

PI: R. Haque
CI: W.A. Petri, Jr., University of Virginia, USA
Funded by: National Institutes of Health (NIH), USA

Children aged 2-5 years in the Mirpur urban slum of Dhaka will be screened for antibody against *E. histolytica*. Two cohorts of 180 children—one antibody-positive, giving evidence of prior *E. histolytica* infection and the other without evidence of prior infection—will be followed up for a 3-year period to see if prior infection and antibodies in the sera are an index of protection against *E. histolytica* infection.

Association of *Blastocystis hominis* with Diarrhoeal and Non-diarrhoeal Humans in Dhaka, Bangladesh

PIs: M. Rahman, R.R. Chowdhury and J.D. Silva
Funded by: ICDDR,B

Blastocystis hominis was detected in faecal samples from 30 of the 710 diarrhoeal patients (4.2%) and 14 of the 400 non-diarrhoeal controls (3.5%). This difference was not statistically significant. *B. hominis* was associated with other pathogens in 18 of the 30 patients and 6 of the 14 controls.

Vaccine Evaluation

The Centre can play a key role in the evaluation of vaccines for developing countries. The testing of vaccines in phase 1, 2, and 3 trials, the evaluation of nutritional and other factors which may influence immune response

and characterization of immune responses of patients, to identify potential protective antigens, are the priorities.

Cholera and Other Watery Diarrhoeas

Further Evaluation of an Oral Enterotoxigenic *Escherichia coli* Vaccine and Studies on the Immune Response in Acute Watery Diarrhoea

PIs: F. Qadri, D. Islam, R. Raqib, N.H. Alam, M.A. Salam, A.S.G. Faruque and M.J. Albert
CI: A-M Svennerholm, Göteborg University, Göteborg, Sweden
Funded by: SIDA-SAREC

This study has three parts. The prevalence of specific colonization antigens in enterotoxigenic *E. coli* (ETEC) is determined in isolates from the 2% surveillance sample in ICDDR,B. Twelve monoclonal antibodies have been used for the detection of colonization factor (CF), and the highest frequencies were found for CFA/IV (31%), CFA/I (23%), and CFA/II (21%). Other CFs, such as CS7 and PCFO166, were also detected. ETEC strains were isolated throughout the year with the highest isolation in children aged less than 5 years.

Cytokines have been detected by RT-PCR and ELISA techniques for IL-6, IL-8, IL-10, and TNF-alpha as well as IL-2, IL-4, IL-5, IL-12, IFN-τ, and IL-1ß in stimulated mononuclear cells as well as in duodenal biopsies from patients with ETEC diarrhoea. The cells in frozen sections from the gut are being phenotyped by immunohistochemical procedures. These studies are done at the acute and convalescence stages to understand the changes that take place during the course of the disease.

The safety and immunogenicity of an oral B-subunit plus colonization factor of ETEC vaccine (BS-CFA ETEC) are being studied. Two doses of the vaccine were given 14 days apart in adults and children. The vaccine was found to be safe and did not give rise to adverse effects. The majority of the vaccines responded with antibody-secreting cells specific for rCTB and CFs with responses mainly in the IgA and IgG isotypes by seven days after the first dose of vaccination. This indicates that, in an ETEC-endemic area such as Bangladesh, individuals are primed with natural ETEC infection, and vaccination is likely to induce a booster response.

Effect of Vitamin A and Zinc Supplementation on Immune Response to Oral Cholera Vaccination

PIs: M.J. Albert, F. Qadri, A.H. Baqui and G.J. Fuchs
CIs: J. Clemens, National Institute of Child Health and Human Development, USA and R.E. Black, Johns Hopkins University School of Hygiene and Public Health, USA
Funded by: Thrasher Research Fund, USA

To understand the poor response of children (2-5 years old) in the 1985 field trial of the killed oral cholera vaccine in Matlab, Bangladesh, children in this age group are being supplemented with vitamin A and zinc. Their responses to two doses of the killed oral cholera vaccine will be studied in a 4-cell placebo-controlled field trial. The study started in September 1998.

Shigellosis

Further Studies of Systemic and Local Immune Responses in Shigellosis to Establish a Protective Vaccine

PIs: D. Islam, R. Raqib and N.H. Alam
CIs: J. Andersson and B. Christensson, Karolinska Institute at Huddinge University Hospital, Stockholm, Sweden
Funded by: SIDA-SAREC

Humoral mediators of the innate defense system against shigellosis are studied in adult and paediatric patients with matched healthy controls. Concentrations of eicosinoids, lactoferrin, and nitrate were higher and superoxide dismutase lower in patients during the acute stage. In children, superoxide dismutase activity remained low up to a month after the illness, suggesting decreased scavenging of oxygen radicals leading to increased oxidative stress. As expected, the level of myeloperoxidase was higher in patients with shigellosis, compared to those with acute watery diarrhoea. Frequencies of the antibacterial peptides, defensins (HN1-3) were increased in the rectal mucosa during acute shigellosis, although a down-regulation of the antimicrobial peptide LL-37 was present.

Detailed Study of the Humoral and Cellular Immune Responses in Children with Primary Infection Due to *Shigella* Species

PIs: R. Raqib, D. Islam, M.J. Albert and N.H. Alam
Funded by: WHO

Peak antibody-secreting cell responses against Shiga toxin and IpaB protein occurred within 6-7 days after onset of shigellosis. In children, the levels of the pro-inflammatory cytokine TNFα increased, and the level of IL-ß decreased in comparison to adults.

Rotavirus-associated Diarrhoea

Study of the Distribution of Group A Rotavirus P Types in Bangladesh

PIs: L. Unicomb, T. Azim and G. Podder
CI: J. Gentsch, CDC, Atlanta, GA, USA
Funded by: WHO

The prevailing rotavirus types in Bangladesh are being determined by testing stool samples from five cities, using a combination of ELISAs and reverse-transcriptase-PCR. G1 (22.1%) and G9 (14%) were found to be the predominant serotypes in preliminary results.

Cellular and Humoral Immune Responses to Rotavirus Infection in Bangladeshi Infants and Relevance to Rotavirus Vaccine Studies

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

Patient enrolment has just commenced in the study which aims at determining the immune response that is the best correlate of rotavirus infection and describe the kinetics and nature of the cellular and humoral immune response in Bangladeshi children with natural rotavirus infection. The relationship of malnutrition to prolonged viral excretion will also be investigated.

Studies in Preparation for Introduction of Rotavirus Vaccines for Routine Childhood Immunization in Bangladesh
PIs: L. Unicomb, T. Azim, G. Podder and M.A. Salam
CIs: J. Gentsch and R. Glass, Centers for Disease Control (CDC), Atlanta, GA, USA
Funded by: USAID

This study aims at understanding the humoral and cellular immune response to natural rotavirus infection in Bangladeshi children which could be useful in appropriate vaccine design. Patient enrolment is complete, and assays on stored samples are being conducted.

Collaboration with Other Divisions in Vaccine Evaluation

Scientists from the Division, particularly from the Immunology Section, are involved in the evaluation of two vaccines at the field level. This includes field trial of the safety and the immunogenicity of an oral live attenuated *Shigella flexneri* 2a vaccine (PI: A.H. Baqui, PHSD) and of the tetravalent rotavirus vaccine (PI: Md. Yunus, PHSD).

Nutrition

Evaluation of a Reduced-viscosity Supplementary Foods for Malnourished Children
PIs: M.A. Wahed, S. Ahmed and I. Hossain
Funded by: BINP-ICDDR,B Operations Research Fund (Research support only)

The use of amylase-rich flour from germinated wheat can reduce viscosity while keeping the nutrient density high. A field acceptability trial in Narshingdi thana has started.

High Blood Concentrations of Lead and Cadmium among Children Living in High-risk Areas in Dhaka city
PIs: M.A. Wahed and V.I. Mathan
CI: M. Vahter, Karolinska Institute, Sweden
Funded by: ICDDR,B

A pilot study to assess the serum blood and cadmium levels in children, living in the industrial areas, was undertaken in collaboration with the Karolinska Institute, Sweden. The median blood lead levels of 177 μg/L, range: 100-294 μ/L and cadmium levels of 0.9 μg/L, range: 0.1-2.8 μg/L were high in children of these areas. There are differences between the 3 industrial areas in the cadmium and lead levels which are now being analyzed.

Field Trial of ß-carotene and Antihelminthic Therapy to Improve Vitamin A Nutriture among Preschoolers in Bangladesh
PIs: R. Haque, M.A. Wahed and M.J. Albert
Funded by: Thrasher Research Fund, USA

In a randomized double-masked, placebo-controlled four-cell field trial, the effect of low-dose ß-carotene supplementation and antihelminthic therapy on the vitamin A status of preschool children was studied. Preliminary results show that antihelminthic therapy along with low-dose daily ß-carotene supplementation significantly increased serum retinol and ß-carotene at six months, compared to the placebo group.

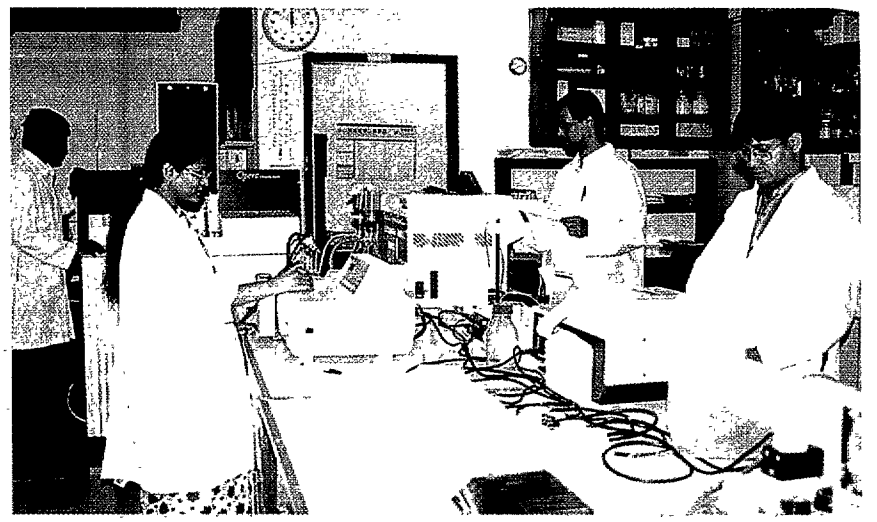
Prevalence of Night-blindness amongst Pregnant Women in Bangladesh
PIs: M.A. Wahed, S. Ahmed and K.A. Mazumder
Funded by: USAID

To determine the prevalence of night-blindness—a common symptom of vitamin A deficiency in children and mothers in Bangladesh—a field trial, in collaboration with the HPED, has just been initiated.

Reproductive Tract Infection

Prevalence and Aetiology of Reproductive Tract Infections among Women Attending the Bangladesh Women's Health Coalition Clinic in Mirpur
PIs: J. Bogaerts, J. Ahmed, N. Akhter and N. Begum
Funded by: BADC

Automated electrolyte analyzer and hormone analyzer are in operation in the Clinical Biochemistry Laboratory



The aim of this study in the Bangladesh Women's Health Coalition (BWHC), Mirpur clinic, was to better understand the epidemiology of reproductive tract infections, to provide more appropriate treatment to patients and to strengthen the BWHC's management of RTIs. Among married women undergoing all laboratory tests, the prevalence of *Neisseria gonorrhoeae* was 0.5%, *Chlamydia trachomatis* 1.9%, and *Trichomonas vaginalis* 1.9%. Reactive syphilis serology was detected in 2.7% of the individuals. Thirty percent of the women presenting with abnormal vaginal discharge had a Gram stain compatible with bacterial vaginosis. Only two women had a positive ELISA test for HIV infection which was not confirmed on Western blot. The preliminary evaluation showed that the appropriateness of the syndromic approach as recommended by WHO was poor.

Prevalence of Sexually Transmitted Infections among Female Sex Workers in Dhaka
PIs: M. Rahman and M.J. Allbert
Funded by: ICDDR,B

Of the 293 commercial sex workers examined in the limits of the Dhaka city, 31% were positive for *N. gonorrhoeae*, 34% for syphilis, and 38% for *T. vaginalis*. Further studies with the isolated organisms are being conducted.

Molecular Characterization of *Neisseria gonorrhoeae* Isolated from Commercial Sex Workers in Bangladesh
PIs: M. Rahman and M.J. Albert
Funded by: ICDDR,B

Ninety-four isolates of *Neisseria gonorrhoeae* were cultured from endocer-

vical swabs from 214 commercial sex workers in Dhaka city. Among the isolates, 66% were resistant to penicillin, 60% were resistant to tetracycline, 11.7% were resistant and 26.6% had reduced susceptibility to ciprofloxacin, 2.1% were resistant, and 11.7% had reduced susceptibility to cefuroxime, and 1% resistant to ceftriaxone. The clonal relationship among the isolates is being studied by molecular typing.

A busy day in the virology laboratory

CLINICAL LABORATORY SERVICES PROGRAMME

The Clinical Laboratory Services Programme includes clinical laboratories in Dhaka (Clinical Microbiology, Clinical Pathology, Clinical Biochemistry, the Outpatient Services Project) and the Diagnostic Laboratory in the Matlab rural hospital. This programme also caters to the needs of scientists in the other divisions for community and field studies. The scientists of the clinical laboratory services, in addition to their heavy service load, are also involved in research activities.

One of the major contributions of this programme is the provision of a safe blood transfusion service for the Dhaka and Matlab hospitals with financial support from the Ford Foundation. Blood bags purchased from outside sources are tested for confirming the blood group and screened for HIV, hepatitis B and other sexually transmitted diseases, and malaria to ensure that only safe screened blood is provided. In total, 228 bags were purchased in 1998, of which 59 were unsuitable for transfusion. Ninety-nine units of blood were used in the Clinical Research and Service Centre in Dhaka and 28 units in the Matlab rural hospital.

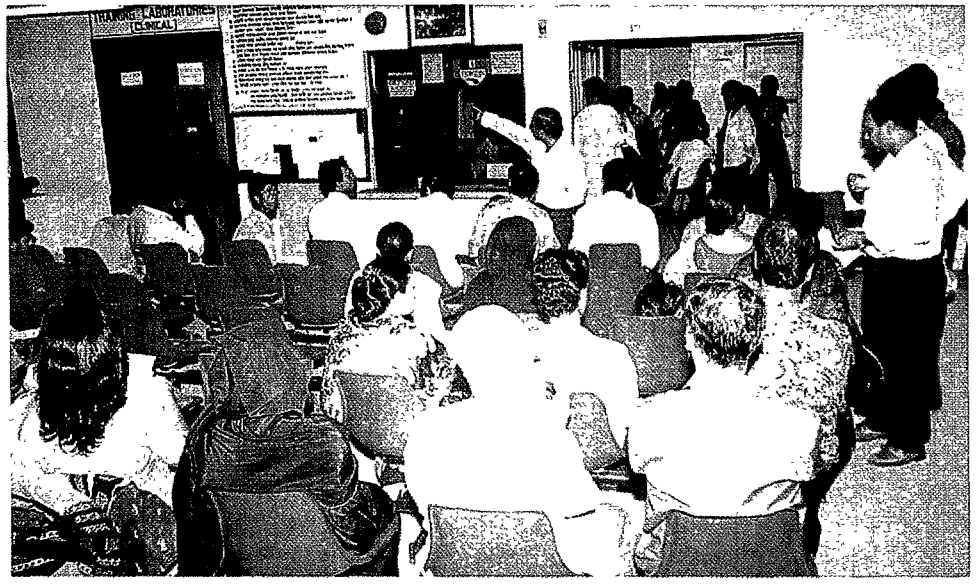
The Outpatient Services Project is primarily for reception of patients who use the diagnostic services. During the year, the unit handled a total of 129,408 specimens, including 21,052 blood samples. A new brochure on laboratory information was compiled, and an attempt will be made next year to maximize the use of this service. This maximization can only be achieved if we can find a separate area for this service which is patient-friendly, with improvement in the waiting area airconditioning, better counter and toilet facilities.

Clinical Pathology Laboratory

The laboratory performed 121,947 tests and provided full emergency service at night. The quality assurance scheme of the College of American Pathologists is subscribed to by the laboratory, and it came within the acceptable target value (95% confidence interval for all tests and 100% in parasitology as in previous years).

Clinical Microbiology Laboratory

In total, 37,372 microbiological samples were processed during the year. The commonest blood isolate was *Salmonella typhi* (328 of 6,714 cultures). *V. cholerae* O1 continued to be the most frequently isolated enteric pathogen. *V. cholerae* O139 in 1998 was found in less than 1% of the total samples. Antimicrobial resistance pattern in *Shigellae* was published as a paper. External quality assurance scheme of the University of Leuven, Belgium, sponsored by WHO, is continuing, and the performance was evaluated within 95% confidence interval.



Clinical laboratories provide service to the public on payment basis which generates income for the Centre. Picture shows public in the specimen reception area of the clinical laboratories

Clinical Biochemistry Laboratory

In total, 112,600 tests were done on 30,839 specimens. The new tests introduced during the year were for drug monitoring, valine mandelic acid, and aldolase. The Laboratory continued to support the Institute of Public Health, Dhaka, in the quality control of intravenous fluids for electrolyte glucose, etc. and helped the Bangabandhu Sheikh Mujib Medical University in establishing quality control procedures in their clinical biochemistry laboratory.

Total workload of the Clinical Laboratory Service programme is given in the table.

An attempt has been made to calculate "workload units" using internationally accepted criteria. These need further refinement for application in the Bangladesh situation.

Activities of clinical laboratories in 1998

Activity	Clinical Pathology	Clinical Biochemistry	Clinical Microbiology
Total specimens processed	60776	30839	37372
Specimens from paying cases	42788	17059	19313
Specimens from internal cases	17988	13780	18059
Total number of tests	121947	112600	-
Total workload units (WLUs)	1085536	1043960	1438822
Total work-hours	19318	18412	26184
WLUs per person-hour	56.19	56.70	54.95
Research protocol supported	13	27	17
Paper published	01	Nil	01
No. of trainees of different levels	21	04	16
Total manpower	**09**	**09**	**12**
Scientists and technologists	**07**	**08**	**08**

Matlab Clinical Laboratory

During the year, the laboratory processed a total of 10,436 specimens. The common pattern of pathogens isolated is shown in the table.

The quality of work improved during the year as two of the technicians were given in-service training. This laboratory supported the clinical and research activities in the Matlab field hospital.

Total number of organisms isolated from 4704 faecal samples and 1,912 other specimens in the Matlab Field Laboratory

Organism	Serotype	Number (n=1,108)	Percentage
V. cholerae (El Tor)	Inaba	23	2.1
	Ogawa	401	36.2
V. cholerae O139		224	20.2
Other *Vibrio* species (Non-O1 and non-O139)	-	137	12.4
S. dysenteriae	-	28	2.5
S. flexneri	-	180	16.2
Other *Shigella* species	-	46	4.2
Salmonella species	-	31	2.8
Other pathogens from blood, urine, throat swab, etc.	-	38	3.4

ADMINISTRATIVE SUPPORT SERVICES

During the year, the Division's administrative structure and organogram was revised. The Archive Unit has been merged with the Division office. Logistics support, the biomedical engineering unit, and the animal resource laboratory are now part of the Administrative Support Services.

Logistics Support

Media preparation decontamination and bacterial stock culture maintenance are the responsibilities of the logistics support unit which has a total of 8 personnel. In 1998, the media section has supported 34 research projects by supplying 4726 litre of bacteriological media for growth and identification of organisms. The bacterial stock culture collection has supported 5 research projects lyophilizing a total of 3222 samples. Continuous training is given to the technical staff to ensure quality control of media and lyophilization. Collaborative support was provided to the Institute of Public Health, University of Dhaka, and Dhaka Shishu Hospital for lyophilization, and we have trained technologists sent from two other institutions.

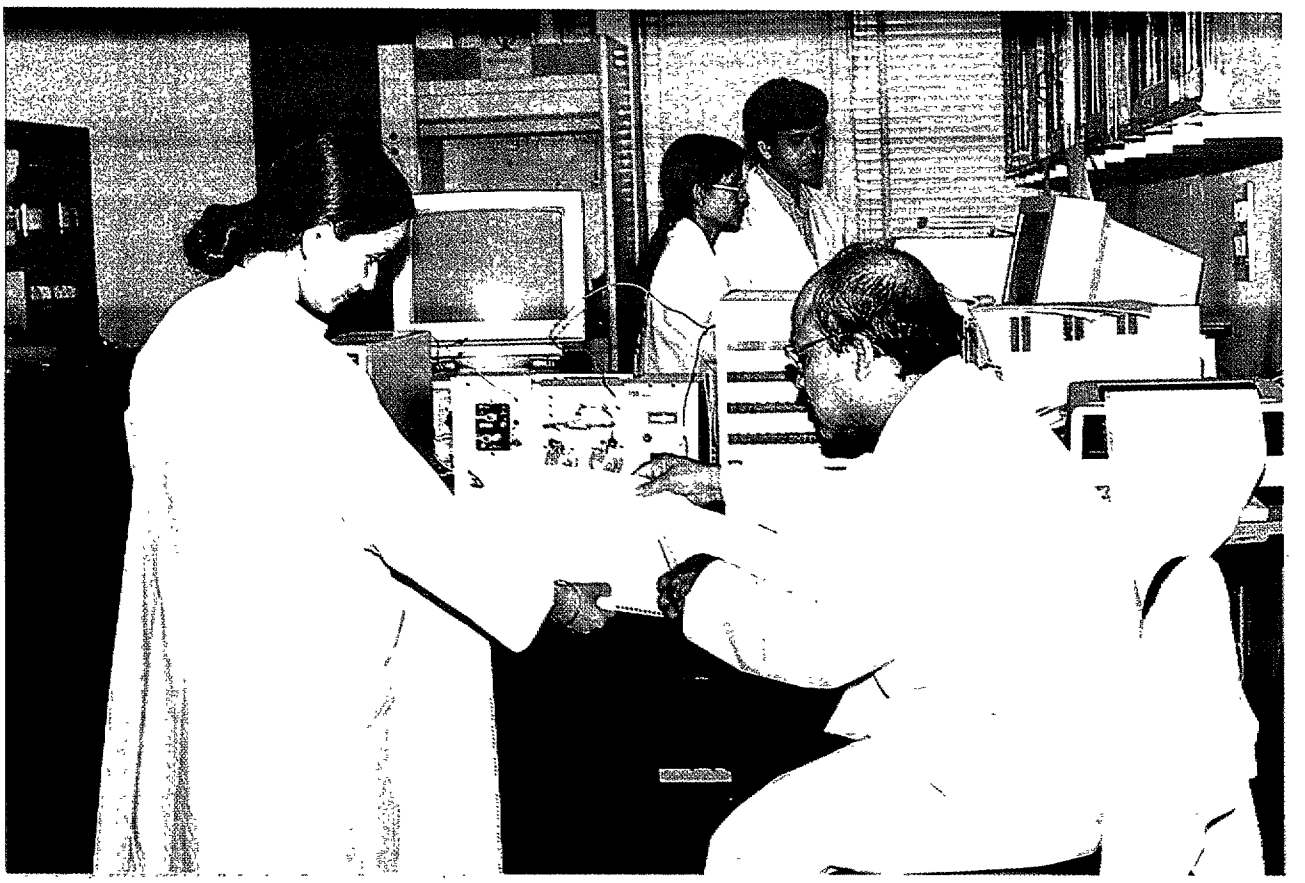
Biomedical Engineering

The equipment in the laboratory continued to be maintained well, and the problems associated with irregular voltage in the power supply were tackled. Ten new equipment have been installed. National institutions, such as Institute of Public Health, Dhaka Shishu Hospital, and the Tuberculosis Control and Training Centre, have been helped in solving their technical problems and repair of equipment.

Animal Resources Facility

During the year, Dr. Al-Mahmud who had headed this section for many years superannuated. We place on record his valuable contribution to the Centre and wish him a happy retired life. The research support for animal experiments continued. Animals were provided free of charge to the Institute of Public Health. Various other national institutions: Bangabandhu Sheikh Mujib Medical University, BIRDEM, Bangladesh Agricultural University, University of Dhaka, American International School, and some pharmaceutical companies have purchased animals. Our animal house facility is unique in the country.

Chromatography equipment in the Nutritional Biochemistry Laboratory to assay serum retinol

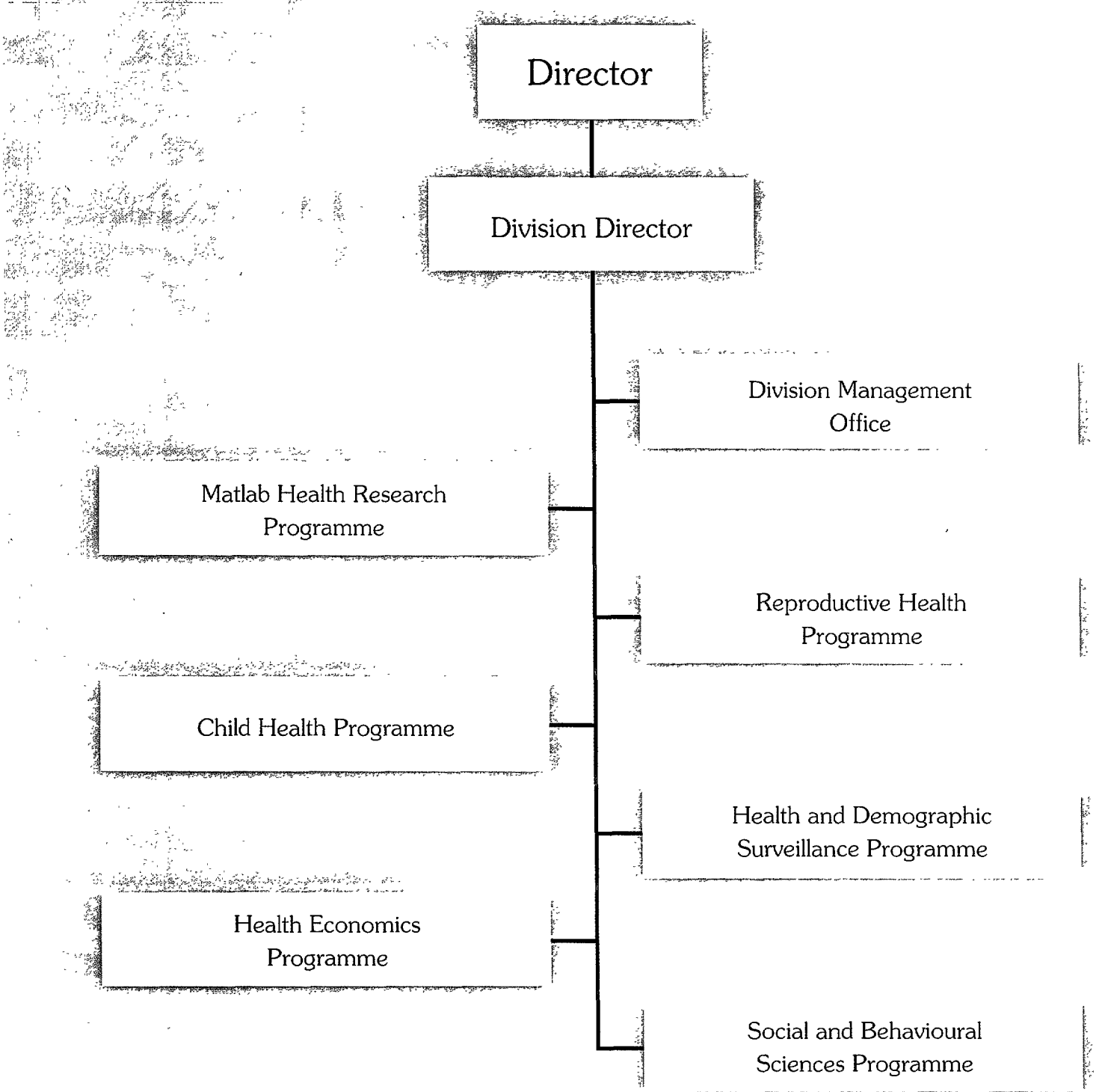


The total production and use of animals and animal blood is given in the table.

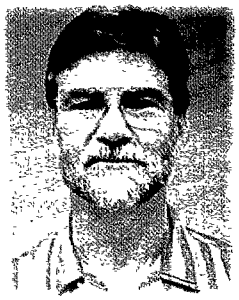
Species/ Blood	Number produced	No.*/Vol.* issued	Remarks
Rabbit	532	412	
Guineapig	484	394	
Rat	305	212	
Mouse (Swiss albino)	9273	7396	
Mouse (Balb/c)	405	300	
Sheep blood	-	27956/mL	Sheep and chicken are not bred in this facility.
Rabbit blood	-	1009/mL	These species are procured from the
Guineapig blood	-	280/mL	local market
Chicken blood	-	25/mL	

**Includes the number and volume issued to other institutions*

Public Health Sciences Division



Public Health Sciences Division



Division Director
J. Patrick Vaughan

The Public Health Sciences Division (PHSD) focuses on the design and evaluation of population-based interventions to improve child, adolescent and reproductive health. The staff comprises public health professionals, epidemiologists, social scientists, and health economists. In 1998, activities of the Division were performed by 10 personnel of international level (5 left by the end of the year), 33 national officers, and 331 personnel of other categories, including 144 community health workers (CHWs). The Division has a strong research infrastructure, including provision of primary healthcare services in rural Matlab where about 210,000 people are under the health and demographic surveillance system. Besides the Matlab Health Research Programme and Surveillance System, the Division has research programmes in reproductive health, child health, social and behavioural sciences, and health economics. The broad

Division Highlights

- Professor J. Patrick Vaughan completed 2 years and 9 months at ICDDR,B as Division Director of PHSD in June 1998. Dr. Abdullah H. Baqui, Dr. Jeroen van Ginneken, Dr. Andres de Francisco, and Dr. Abbas Bhuiya took additional responsibilities at different times as Acting Division Director.

- Activities of the Division underwent a scientific review by an external team. The review team was impressed with the large number of research proposals that have been prepared and submitted since the last review. These included research on rotavirus and pneumococcal vaccines, abortion dynamics, essential obstetric care, adolescent health, male involvement in family planning, STD/HIV, integrated management of childhood illness (IMCI), diarrhoea and ARI epidemiology and management, nutrition education, iodine deficiency, and several others. Many of these new proposals have been approved and funded, enhancing the financial situation of PHSD.

- Construction of the Matlab International Training Centre was completed with financial assistance from the Government of Japan.

- Provision of quality care and family meetings attracted women to deliver at health centres, who would otherwise deliver at home.

- Even in populations with low prevalence of syphilis, it is cost-effective to screen pregnant women, using RPR and to treat positive cases, along with their husbands. The benefit derived is 4.5 US dollar for each dollar spent.

- The Chakaria Community Health Project has expanded its activities to another three unions. It has also started an experiment on community financing in healthcare. The construction of field office has also commenced.

range of research interests includes: epidemiological patterns of ill health, transmission of infectious agents (especially for diarrhoeal and acute respiratory illnesses), community nutrition, delivery of healthcare, prevention of illness through education, modification of risk behaviours, vaccine trials, and community development.

Progress in Priorities Set for 1998

- As a prelude to the study on multi-country growth standards, a pilot survey has been completed. Final report was submitted to WHO.

- Trial on tetravalent Rhesus Rotavirus Vaccine (RRV-TV) with or without zinc supplementation; effectiveness trials on zinc in diarrhoea; *Shigella* vaccine trial; surveillance of invasive *Haemophilus influenzae* (*Hi*) and *Streptococcus pneumoniae* (*Spn*)-associated diseases in Bangladeshi children and the antimicrobial resistance and serotype patterns of *Hi* and *Spn* isolates in Bangladesh; trial on male involvement in reproductive health programme and safe motherhood initiatives in Matlab; studies on contraceptive use dynamics in Matlab and Kalkini, effect of the menstrual regulation (MR) services of the Government of Bangladesh on abortion rates, causes and correlates of child mortality; and evaluation of sustainability of nutrition education on vegetable intake are in progress.

- A draft proposal has been submitted to DfID (UK) for funding a study on adolescent health in rural and urban Bangladesh.

- Other priorities set for the year included: modernizing health and demographic information system through household data collection by CHWs (to be started from January 1999), introduction of quality control procedures (planning completed), and computerization of data entry and handling (ongoing); proposal for a reproductive health indicators surveillance (completed); a strategy (finalized and submitted to WHO) for the IMCI; determination of unmet obstetric needs (proposal submitted to BADC); strengthening Health Economics Programme of the Centre; and implementation of the 1998 health and socioeconomic impact survey by the BRAC-ICDDR,B Joint Project at Matlab (deferred till mid-1999 due to the 1998 flood).

MATLAB HEALTH RESEARCH PROGRAMME

Head: Md. Yunus

The Matlab Health Research Programme (MHRP), comprising a Clinical Research Unit (CRU), a Community Health Research Unit (CHRU), and an Administrative Services Unit, offers an excellent facility for conducting research in diverse issues concerning public health in developing countries.

CRU is involved in conducting clinical and epidemiologic research, and provides services for diarrhoea, ARI, malnutrition, and other child health and reproductive health problems, including maternity services at Matlab. CHRU provides curative and preventive services for primary healthcare in reproductive and child health both at the sub-centre and community level. The Unit also collects health information on children of less than five years and women of childbearing age.

In total, 13,439 patients with diarrhoea received treatment at Matlab in 1998. About 17.7% came from within the Demographic Surveillance Sys-

tem (DSS) area and 82.3% from outside. CRU started outdoor facilities for diarrhoea from July 1998. Since then, 8,001 patients attended the diarrhoea treatment centre. The overall case fatality rate was 0.4%, but the case fatality rate among the patients admitted at the inpatient wards was 0.8%.

Rectal swabs of 2,384 patients from the DSS area were cultured which yielded 427 (17.9%) *Vibrio cholerae* O1, 211 (8.9%) *V. cholerae* O139, 279 (11.7%) *Shigella,* and 30 (1.3%) *Salmonella.* These data show that *V. cholerae* O1 and *V. cholerae* O139 are coexisting and endemic in this area, and *V. cholerae* O139 increased from 3.7% to 8.9% over the last year. *Shigella* species increased from 9.6% to 11.7%, compared to the last year, *S. flexneri* (74%) and *S. dysenteriae* type 1 (10.2%) being the most common.

Table 1 shows the patterns of antibiotic resistance of *Shigellae* isolated over the last six years. The resistance of all isolates to mecillinam has increased over the last year whereas *S. flexneri* and other species of *Shi-*

Table 1: Isolation and resistance patterns of *Shigella* species in the Matlab Clinical Research Unit for 1993-1998

Year	*Shigella* species	No. of isolates	Resistance (%)			
			AM	SXT	NA	MEC
1993	*S. dysenteriae* type 1	158	97	98	97	30
	S. flexneri	153	58	82	8	57
	Other *Shigellae*	24	8	58	0	25
1994	*S. dysenteriae* type 1	162	94	96	93	14
	S. flexneri	132	60	67	5	35
	Other *Shigellae*	17	6	53	0	18
1995	*S. dysenteriae* type 1	187	97	100	99	10
	S. flexneri	162	63	69	2	38
	Other *Shigellae*	31	3	39	0	26
1996	*S. dysenteriae* type 1	58	98	97	97	31
	S. flexneri	131	63	76	5	38
	Other *Shigellae*	18	17	72	0	39
1997	*S. dysenteriae* type 1	57	95	100	84	25
	S. flexneri	137	69	78	9	34
	Other *Shigellae*	36	11	36	3	8
1998	*S. dysenteriae* type 1	28	100	96	100	43
	S. flexneri	206	70	71	8	35
	Other *Shigellae*	45	16	40	13	33

AM=Ampicillin, SXT=Trimethoprim+Sulphamethoxazole, NA=Nalidixic acid, MEC=Mecillinam

gella were still sensitive to nalidixic acid. *S. dysentariae* type 1 was almost 100% resistant to ampicillin, trimethoprim+sulphamethoxazole (SXT), and nalidixic acid; and the resistance to mecillinam has increased from 25% to 43% over the last year. No resistance to ciprofloxacin was found in any of the isolates during the year.

A total of 8,452 women of childbearing age (15-49 years) and their children aged less than five years attended the MCH-FP clinic in 1998. One hundred and eighty-four women were admitted with complications of pregnancy and delivered at the clinic. Of the 888 admitted children, 675 (76%) were treated for acute lower respiratory tract infections (ALRIs). The case fatality rate for ALRI was 1%.

Services Provided in Matlab Community

Family planning activities, funded by the Government of Japan, are carried out following the concept of service-oriented research. Contraceptive use prevalence rate (CPR) continued to remain high in 1998. Services for continuation of this high CPR included screening and treatment of women for side-effects and other health problems of mother and children by the CHWs, and referral to the sub-centres and Matlab CRU for further management. In total, 11,325 women visited the four sub-centres during the year.

Health workers maintain a cordial relationship with village women. A community health worker is seen providing health advice to a village woman

Safe motherhood activities, supported by BADC and the local community, started in one block covering a population of about 27,000 in 1997 to promote facility-based delivery at the community-level health sub-centre where standard delivery facilities (with trained nurse/midwife) were established for providing quality service. Promotional activities at the community were carried out by the CHWs through information dissemination, education and communication, and distribution of a pictorial card to pregnant women showing danger signs for attending a sub-centre for delivery as well as antenatal and postnatal care. Similar delivery facilities were developed in another block in early 1998 and made functional from May 1998. Plans are underway to establish delivery facilities in the 3rd sub-centre in 1999. During the year, 225 deliveries were conducted in these two sub-centres. In addition, there were 2,996 antenatal and 968 postnatal visits in the four sub-centres by 2,514 pregnant women.

Health Services (Mother and Child): The services included management of morbidity of women of reproductive age and their children aged less than five years and preventive care to reduce mortality and morbidity in the intervention area. The services were monitored by the Record Keeping System (RKS). Immunization data showed that 95.1% of the infants

were immunized with BCG, 80% with DPTP-3rd dose; 89.3% of the children aged 9-23 months were immunized against measles; and 97.3% of the women of reproductive age with two doses of tetanus toxoid. In total, 13,475 children aged over six months were given vitamin A capsule with coverage of about 98%. Nine hundred seventy cases of ALRIs were detected (active and passive detection) by the CHWs during the year. Of these, 696 (72%) were treated at home by the CHWs, and the rest were referred to Matlab CRU for management under hospital facilities. During the year, 169,875 locally-made ORS packets were distributed for management of diarrhoea at home, and 2,367 safe delivery-kits were produced and distributed to pregnant women in the intervention area. In the four sub-centres, 11,523 children were given care for various illnesses. Two hundred thirty-three males attended the weekly male clinics at the sub-centres for sexual health problems.

Record Keeping System (RKS) at Matlab: This system maintains computerized information on reproductive and child health services delivered by health workers in the intervention area. The information is recorded by CHWs in service record books and this serves to provide early feedback to increase service coverage and to monitor balances of supplies. The system serves as a management tool for the supervisors, and researchers use it to conduct evaluation of health interventions. During 1998, computer entry of all pending information was completed, and the dataset has been cleaned for analysis on the impact of the components of MCH-FP intervention. Computer management of the RKS has been integrated with the DSS and the Geographic Information System (GIS) as part of the Health and Demographic Surveillance Programme in 1998.

Following is a brief description of studies conducted in 1998 under the Matlab Health Research Programme:

Tetravalent Rhesus Rotavirus Vaccine: A Randomized Placebo-controlled Trial to Evaluate Immunogenicity, Reactogenicity, and Acceptability in Infants of Matlab, Bangladesh
PIs: Md. Yunus and Joseph Bresee
Funded by: WHO, Geneva (vaccines donated by Wyeth-Ayerst International)

The primary objective of this trial was to evaluate the immunogenicity, safety, and acceptability of 3 doses of an oral tetravalent Rhesus Rotavirus Vaccine (RRV-TV) in a small population of Bangladeshi infants in Matlab. Later, an addendum to this protocol has been included with an additional cell where infants receiving RRV-TV will also receive zinc supplementation to test the additional hypothesis that simultaneous daily zinc supplementation would significantly improve the immunogenicity of RRV-TV in infants.

This is a collaborative project of the Matlab Health Research Programme and the Child Health Programme of PHSD, Centers for Disease Control and Prevention, USA, and the Johns Hopkins University, USA. The study, started in October 1998, has so far enrolled more than 120 infants, and it is progressing well. Collection of field data is expected to be completed by the end of April 1999.

If the vaccine is found immunogenic and safe in this population, a large population-based trial will be conducted to assess the efficacy of the vaccine in reducing the incidence of rotavirus-associated hospitalizations and possibly rotavirus-related mortality in this population.

Children's Fluid Intake during Diarrhoea: A Comparison of Questionnaire Response with Data from Observation
PIs: K. Zaman, J. Chakraborty, Md. Yunus, A. de Francisco, D.S. Alam and K.M.A. Aziz
Funded by: WHO, Geneva

Two groups of children (A and B) in Matlab and their caretakers were recruited by active surveillance. Children aged 4-35 months and having diarrhoea, starting in the last 24 hours at the time of surveillance, were recruited in Group A. The following day (Day 2) and 2 weeks later (Day 15), these children were observed for a 12-hour period (6 am to 6 pm) to estimate the amount of fluid consumed and to evaluate practices and behaviours relating to fluid intake. On the day following the second observation (Day 16), the caretakers were interviewed using a standard WHO-questionnaire. Children aged 4-35 months at surveillance, with diarrhoea at any time in the past two weeks, were recruited in Group B. The same questionnaire (as for Group A) was administered to the caretakers of Group B children on the day of surveillance. Two hundred fifteen children were included in Group A with a mean age of 16.40±9.24 months. Four hundred twenty-one children were included in Group B with a mean age of 18.74±8.91 months.

The findings of the study suggest that the study children had significantly higher fluid intake (breastmilk and other fluids) during acute episodes of diarrhoea compared to their normal periods. The study also showed that responses of caretakers to simple questions on children's fluid intake during diarrhoea appeared to be consistent with the children's observed intake of fluids. The results will help develop guidelines for home management of diarrhoea.

Evaluation of Packaged Rice-ORS Fed to Children and Adults with Cholera and Cholera-like Illnesses
PIs: K. Zaman and Md. Yunus
Funded by: Thrasher Research Fund, USA

A new packet form of rice-ORS (CeraLyte 90) was evaluated in boys aged 5-15 years with cholera and cholera-like diarrhoeas in Matlab hospital. In total, 167 boys with a history of diarrhoea for less than 48 hours and moderate to severe dehydration were randomized to receive either rice-ORS (n=85) or glucose-ORS (n=82). The efficacies of the two solutions were compared for stool output (during the first 8 hours, the first 24 hours, and total output), duration of diarrhoea, haematocrit, serum electrolytes, and requirements for unscheduled intravenous fluids. Clinical and laboratory characteristics of the two groups were comparable on admission into the study. Most had cholera symptoms (88% in the rice group and 84% in the glucose group). The mean (±SE) stool output was significantly lower in the rice group during the first 8 hours of treatment (86.2±6.6 mL/kg vs. 108.8±7.9 mL/kg, $p<0.05$), but the outputs during the other time periods were similar in the two groups. All patients in both the groups maintained normal electrolytes during the treatment. The study documents the safety and efficacy of the new packaged rice-ORS. As with freshly-prepared rice-ORS, patients receiving packaged rice-ORS had lower purging rates when compared to glucose-ORS during the early phase of their treatment.

REPRODUCTIVE HEALTH PROGRAMME
Head: Andres de Francisco

1998 was an important year for new initiatives of the Reproductive Health Programme. With signing of the contract with the European Union (EU)

for the projects on "Safe Motherhood: Essential Obstetric Care" and "Male Involvement in Reproductive Health", the programme ensured funding for the next four to five years. These two projects are interventions to be carried out jointly with the Government of Bangladesh. Careful planning, coordination, and design of questionnaire, forms, data-capturing systems, and setting strategies to implement the projects in the field were central activities in Matlab.

Given the success of the intervention implemented in 1997 to provide antenatal and delivery care at the health-centre level, one additional health centre was upgraded to provide these services. A thorough review of the information available is ongoing.

A project to evaluate the requirements for tetanus toxoid doses for women who were vaccinated during infancy completed its field work. The laboratory work is going on, and results are expected soon. A proposal aiming at setting up priorities and defining methodologies in interventions for adolescents was submitted to DfID. The proposal, reviewed earlier positively by DfID, may start in early 1999.

The Reproductive Health Programme collaborated with investigators in Antwerp to contribute to estimating the unmet obstetric needs of the population. The role of Matlab in this study will be to validate the tools used in an ongoing multi-country study.

Essential Obstetric Care
PIs: Andres de Francisco and Therese Juncker
Funded by: European Union

The specific purpose of this intervention is to test and evaluate the impact of implementing an essential obstetric care intervention in a rural area of Bangladesh. The intervention will include establishment and functioning of Caesarian section facility at the Matlab Thana Health Complex (THC), essential obstetric care at the union health centres and at the community level, and involvement of the community through meetings and surveys on transportation of referred patients to the Matlab THC.

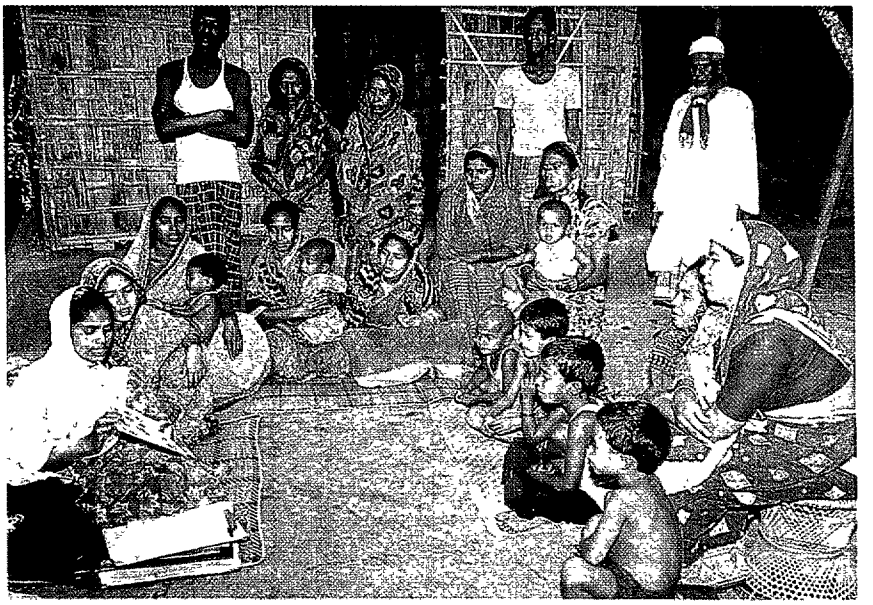
The Matlab Thana Health Complex will be upgraded, and resident physicians will be trained to perform Caesarean sections. In total, eight health centres will be upgraded to attend complicated deliveries and referrals. A meeting was held with the Secretary, Ministry of Health and Family Welfare, Government of Bangladesh, and his support to this project was evident. An Advisory Committee will be established soon. Planning-phase meetings have been held in collaboration with the THC officials at Matlab. All aspects of implementation of the intervention have been discussed, and minutes of the meetings are available.

Male Involvement in Reproductive Health
PI: Andres de Francisco and J. Chakraborty
Funded by: European Union

The study intends to test the hypothesis that male involvement in reproductive health and family planning is dependent on an active programme targeting male clients in rural Bangladesh. Qualitative and quantitative research was initiated during 1998 to understand male behaviour and practices toward reproduction. Male clinics will be set up, and potential avenues to access males in the community will be explored. An active programme of education and involvement of males will be started in the communities, and IEC material to involve men will be designed.

A Cohort Study to Estimate Optimal Duration of Nutritional Supplementation to Pregnant Women and Its Impacts on Birth-weight
PIs: R. Shaheen and Andres de Francisco
Funded by: BINP–ORP

The purpose of this study in four unions under Saharasti thana of Chandpur district is to estimate an optimal duration of nutritional supplementation to malnourished pregnant women and to explore the impact of the duration of supplementation on birth-weights of the newborns. So far, 320 pregnant women who received nutritional supplementation and are likely to deliver between 30 December 1998 and 29 April 1999 have been recruited in the study. The information on the duration of supplementation has been collected from Bangladesh Integrated Nutrition Project (BINP) record books, although it will also be explored by interviewing the study women, using a structured questionnaire. Birth-weights of the babies born to the study women will be measured. The body weights and heights of women will also be measured, and a structured questionnaire will be administered for exploring factors affecting duration of supplementation. Analysis will be directed toward finding an optimal duration of nutritional supplementation for pregnant women to measure its impact in terms of birth-weights while taking into consideration the confounding factors.



An important function of the community health workers of the Matlab Health Research Programme is to provide health education to villagers

CHILD HEALTH PROGRAMME
Head: Abdullah Hel Baqui

In January 1998, the programme was strengthened with the joining of Dr. Abdullah Hel Baqui as Senior Epidemiologist and Head and Dr. Shams El Arifeen as Epidemiologist. The programme broadened its agenda by developing studies in the area of disease surveillance, vaccine evaluation, nutrition including micronutrients, and health systems research. During the reporting period, the programme secured funding and started implementation of the following studies:

Assess the Effect of Zinc Supplementation to <5-year Old Bangladeshi Children during Diarrhoea on the Clinical Course of Diarrhoea, Subsequent Diarrhoea and ARI Morbidity, and Growth
PIs: Abdullah Hel Baqui and Robert E. Black
Funded by: USAID/CHR (Johns Hopkins University, USA and ICDDR,B)

Diarrhoeal episodes result in considerable loss of zinc which probably contributes to the high levels of zinc deficiency seen in Bangladesh. This community-based, randomized, controlled trial is being conducted to see the effect of zinc supplementation on these parameters. Lack of body stor-

age of zinc complicates strategies for improving zinc status. The study is based on the premise that if all episodes of diarrhoea are treated with zinc, the duration and severity of the treated episodes will be reduced, a positive zinc balance will be maintained with a positive effect on later morbidity and growth. Thirty areas in Matlab covered by thirty CHWs have been randomized to intervention and control areas with diarrhoea cases (children of less than five years) in the intervention areas having access to a 14-day zinc therapy in addition to ORT through established depot holders of ICDDR,B. A morbidity and growth surveillance is in place to measure outcomes. If the proposed intervention is effective, it can be easily incorporated in the existing diarrhoea control programmes.

Inpatient and Outpatient Studies on Safety, Dosage and Immunogenicity of an Oral, Live, Attenuated *Shigella flexneri* 2a Vaccine Candidate (SC602) in a Rural Community in Bangladesh
PIs: Abdullah Hel Baqui and Daniel Isenbarger
Funded by: Walter Reed Army Institute for Research, National Vaccine Program Office, USA, and USAID

The study aims at evaluating the safety and immunogenicity and determining the appropriate dosage of the SC602 live, oral, attenuated *Shigella flexneri* 2a candidate vaccine. An inpatient study on safety in 20 volunteers was conducted in the Matlab hospital of ICDDR,B. Four groups of 5 volunteers in each group received 4 logs, 5 logs, or 6 logs of the vaccine, or placebo. Preliminary findings indicate that the vaccine is well-tolerated even at the highest dose. A larger outpatient trial of the vaccine has been approved, funded, and is awaiting implementation.

Safety and Immunogenicity of $4x10^5$ pfu Tetravalent Rhesus Rotavirus Vaccine With or Without Zinc Supplementation in Matlab, Bangladesh
PIs: Shams El Arifeen, Md. Yunus and Joseph Bresee
Funded by: USAID/CHR (Johns Hopkins University) and WHO (Vaccines donated by Wyeth-Ayerst International)

This is a collaborative effort of the Child Health Programme and the Matlab Health Research Programme of ICDDR,B and the Centers for Disease Control and Prevention, USA. The study is designed to assess the safety and IgA serological response of 3 doses of oral tetravalent Rhesus Rotavirus Vaccine in Bangladeshi infants, when it is given with or without zinc supplementation and to test the hypothesis that simultaneous daily zinc supplementation will significantly improve the immunogenicity of the RRV-TV rotavirus vaccine in infants. More than 120 infants have already been enrolled in the study in Matlab, and completion of field data collection is expected by the end of April 1999.

Surveillance of Invasive *Haemophilus influenzae* (Hi) and *Streptococcus pneumoniae* (Spn) Diseases in Bangladeshi Children and the Antimicrobial Resistance and Serotype Patterns of Hi and Spn Isolates in Bangladesh (Population-based Component)
PI: Abdullah Hel Baqui
Funded by: USAID

Acute lower respiratory infections (ALRIs), primarily pneumonia, is a leading cause of morbidity and mortality in children of less than five years in all developing countries. The growing antimicrobial resistance to common antibiotics is threatening the success of the case management ap-

proach to reducing ALRI deaths. This three-year trial in 12,500 children of less than five years in Matlab treatment area aims at studying the epidemiology of invasive Hi and Spn infections to determine the prevalence, patterns, and trends in antimicrobial resistance and to disseminate relevant information for policy decisions.

Immunogenicity of Conjugate Pneumococcal Vaccine in Infants of Mothers Vaccinated with the Pneumococcal Polysaccharide Vaccine
PIs: Nigar S. Shahid and Mark Steinhoff
Funded by: Thrasher Research Fund and USAID/CHR

The study is held up pending approval of an amendment adding an early neonatal vaccination cell.

Causes and Correlates of Childhood Mortality in Bangladesh: A Follow-on Verbal Autopsy Study and Further Analysis of the Bangladesh Demographic and Health Survey (BDHS) 1996-1997 Data
PI: Abdullah Hel Baqui
Funded by: Macro International, Inc., USA

Comparison of the BDHS 1996-1997 data with the BDHS 1993-1994 data revealed a very little decline in infant mortality but a 27% decline in child mortality rates. The data from the two surveys also show a mixed change in other health indicators. The current study aims at understanding the factors accounting for the large decline in child mortality in the short period between 1993-1994 and 1996-1997 and the changes in the causes of deaths. A nationwide verbal autopsy survey has been completed. All deaths of less than 5-year old children reported in the BDHS 1996-1997 were revisited in this survey. A report is being prepared.

HEALTH AND DEMOGRAPHIC SURVEILLANCE PROGRAMME

Head: Jeroen van Ginneken (till October)
Radheshyam Bairagi (since November)

The mission of the Health and Demographic Surveillance Programme (HDSP) is to provide facilities and undertake research in population and health, its determinants, consequences, and implications for well-being of the people of the developing world.

The HDSP has been designed to evaluate the impact of different health and socioeconomic interventions. It has three functional units: Demographic Surveillance System (DSS), Record Keeping System (RKS) and Geographic Information System (GIS). While the DSS was started in 1966 and the RKS in 1978, the GIS was started only in 1994, and it is yet to grow. The DSS, in which vital events, like birth, death, marriage and migration, have been recorded on more than 200,000 population, is the largest and the longest longitudinal demographic dataset in the developing world (Table 2). Many breakthrough contributions have been made to population and health sciences from Matlab DSS data. The RKS has been implemented in half of the DSS area. The RKS workers provide family planning (FP) and some child and maternal health services and keep the records under careful supervision. The RKS design and data demonstrated for the first time that a good delivery system of family planning services, in absence of any socioeconomic interventions, can make a big change in

Table 2: Vital statistics of the Matlab MCH-FP and comparison areas, 1986-1997

Vital rates (per 1000)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Crude birth rate												
MCH-FP area	33.6	33.6	30.9	28.4	28.3	25.4	25.4	24.7	25.9	25.2	22.4	23.7
Comparison area	39.6	39.2	40.4	36.6	37.8	32.7	31.1	29.4	29.4	27.8	26.7	26.8
Both areas	36.5	36.4	35.5	32.4	32.9	29.0	28.2	27.0	27.6	26.5	24.5	25.2
Total fertility rate**												
MCH-FP area	4.3	4.2	3.8	3.4	3.4	3.0	3.0	2.9	3.0	2.9	2.7	2.8
Comparison area	5.5	5.4	5.4	4.9	5.0	4.3	4.0	3.8	3.8	3.6	3.5	3.4
Both areas	4.9	4.8	4.5	4.1	4.1	3.6	3.5	3.3	3.4	3.2	3.0	3.1
Crude death rate												
MCH-FP area	9.9	9.3	8.7	8.0	7.6	8.1	8.3	7.7	8.0	7.3	7.6	6.6
Comparison area	12.2	11.2	11.0	9.5	9.4	10.2	9.8	10.2	9.2	8.4	7.9	8.0
Both areas	11.0	10.2	9.9	8.7	8.5	9.1	9.0	8.9	8.6	7.9	7.7	7.3
Neonatal mortality*												
MCH-FP area	45.4	43.8	42.8	46.0	47.8	47.7	49.6	42.8	36.4	30.6	39.5	33.1
Comparison area	53.0	54.9	57.7	52.7	53.3	63.2	53.3	64.5	56.4	50.3	42.1	50.0
Both areas	49.4	49.7	51.1	49.7	50.9	56.3	51.6	54.4	46.9	40.8	40.9	41.9
Post-neonatal mortality*												
MCH-FP area	36.4	34.6	38.0	28.3	27.4	32.3	30.8	20.3	27.3	20.6	26.6	16.4
Comparison area	39.7	39.5	39.0	38.0	34.1	51.7	37.0	34.8	30.8	28.3	24.8	28.6
Both areas	38.2	37.2	38.6	33.6	31.2	43.0	34.1	28.0	29.2	24.6	25.7	22.7
Infant mortality*												
MCH-FP area	81.8	78.4	80.8	74.3	75.2	80.0	80.5	63.1	63.7	51.1	66.2	49.5
Comparison area	92.7	94.4	96.6	90.7	87.5	114.9	90.2	99.3	87.2	78.6	67.0	78.6
Both areas	87.6	86.9	89.6	83.3	82.1	99.2	85.7	82.4	76.0	65.3	66.6	64.7
Child mortality (1-4 yrs)												
MCH-FP area	13.4	9.9	7.6	6.4	5.3	7.0	5.9	5.9	5.3	6.7	6.0	4.5
Comparison area	20.7	15.0	14.4	11.5	9.3	9.1	10.4	10.0	7.0	8.4	8.0	7.0
Both areas	17.2	12.6	11.1	9.0	7.4	8.1	8.3	8.1	6.2	7.6	7.1	5.8
Under-five mortality***												
MCH-FP area	129.8	113.1	107.4	97.5	94.8	105.7	102.0	86.1	83.6	76.7	87.9	66.7
Comparison area	164.0	145.2	146.1	131.1	120.4	146.2	127.1	135.1	113.1	109.5	96.4	104.4
Both areas	148.0	130.2	128.3	115.7	108.7	128.1	115.7	112.5	99.1	93.8	92.3	86.3
Rate of natural increase												
MCH-FP area	23.7	24.3	22.1	20.4	20.7	17.3	17.1	17.0	17.9	17.9	14.8	17.1
Comparison area	27.4	28.0	29.4	27.1	28.4	22.5	21.2	19.2	20.2	19.4	18.8	18.7
Both areas	25.5	26.1	25.7	23.6	24.4	19.9	19.1	18.1	19.1	18.6	16.8	17.9
In-migration	28.3	33.6	26.5	29.3	26.0	26.9	33.6	25.5	26.5	27.0	25.1	34.6
Out-migration	41.7	44.3	41.5	43.9	42.4	41.9	48.5	36.1	41.4	37.4	35.0	41.7
Growth (%)	1.2	1.5	1.1	0.9	0.8	0.5	0.4	0.8	0.4	0.8	0.7	1.1

**Per 1000 live-births*
***Per woman*
****Calculated from life table*

the contraceptive use rate and reduction in fertility. The Bangladesh Family Planning Programme is considered a model for the developing world. Matlab RKS can take a pride in this success because the origin of the plans and programmes of Bangladesh's FP programme lies in the Matlab RKS.

In addition to the regular work of these units, the scientists of the HDSP undertake different projects in population, family planning, and health, funded by different national and international organizations. One of such projects on contraceptive use dynamics in Bangladesh, funded by the European Union, was undertaken in 1998. The other main project that was undertaken is modernization of Matlab health and demographic surveillance system 1998-2001, funded by DfID, UK.

Measuring Children's Acute Morbidity in Matlab, Bangladesh: A Comparison of Perceived versus Checklist Data
PI: N. Alam
Funded by: Fogarty Fellowship

The Matlab Health and Socioeconomic Survey 1996 collected morbidity data on children aged less than 15 years, asking these questions to mothers at their homes: (a) was the child (name of child) sick (e.g. fever, cough, cold, etc.) during the last one month? (mother-perceived illness question); (b) had the child had any of the symptoms of: headache, eye infection, cough-cold-fever, diarrhoea, etc. in the last month? (the checklist question).

The checklist question yielded 9.2% higher period prevalence than did the mother-perceived question.

Teenage Fertility and Neonatal Mortality in Bangladesh: Maternal Age-dependent Effect of Parity One
PI: N. Alam
Funded by: ICDDR,B

This study examined neonatal mortality of first births and second births by mothers' age at birth, controlling for a number of other variables. The results showed that the odds of dying were critically higher for children born to women aged <18 years than children born to women aged 20-24 years. For teenage mothers, the odds were critically higher for second than first births. Unlike teenage births, the odds were higher for first than second births if mothers were aged 20-24 years.

Factors Affecting the Performance of Family Planning Workers: Importance of Geographical Information System in Empirical Analysis
PI: Mohammad Ali
Funded by: BADC

The study examined the determinants of performance of the CHWs by introducing geographical factors with socioeconomic and other related variables. One significant finding of the empirical analysis is that the size of catchment area influences performance of the CHWs significantly. Geographic barriers to movement in the catchment area also affect performance of a CHW.

Proximate Determinants of Fertility in Bangladesh
PI: R. Bairagi
Funded by: East-West Center, USA and NIPORT, Bangladesh

This study examined the level, trend, and proximate determinants of fertility in Bangladesh, using data of the Bangladesh Demographic and Health Survey (BDHS) 1993-1994. The analysis reveals that although the fertility-reducing effect of the marriage variable is increasing, its effect is offset by the declining trend in lactational amenorrhoea period. This study did not have reliable data on abortion. It seems that the use of contraception will be the dominant factor for further reduction in fertility in Bangladesh.

Does an MCH-FP Programme Bring about Any Changes in the Quantity, Quality, and Health Consequences of Abortion?
PI: R. Bairagi
Funded by: WHO, Geneva

The objective of this study was to investigate the effect of an MCH-FP programme on the quantity, quality, and health consequences of abortions in a rural area of Bangladesh. Data for this study came from the Matlab DSS area. The results of this study suggest that the abortion ratio is significantly higher in the comparison area than in the intervention area, but the quality of abortion in the two areas is almost the same.

Trends in and Determinants of Mortality in the Elderly Population of Matlab, Bangladesh in 1983-1995
PI: G. Mostafa
Funded by: ICDDR,B

Using data of the Matlab DSS, the study analyzed mortality of elderly population in 1983-1995 to determine the trends in and the levels and causes of death. The analysis indicates that the mortality rates among the male are, in general, somewhat higher than that among the female. The exception is observed in the age group 80 years and over. The study did not find evidence of a decline in old-age mortality during the study period in Matlab.

A similar study titled "Do daughters also provide old-age security to parents, as do sons in Bangladesh?" by the same investigator showed that having a daughter (or daughters) in the household reduces the risk of mortality by about 24%. A woman who is the head of a household has lower mortality than her peer who is not the head of a household. Survival of elderly women is higher if they live with their daughter(s) than with others, indicating that daughters also provide old-age security as the sons do.

Trends in and Determinants of Infant Mortality by Age at Death and Cause of Death in Matlab, Bangladesh in 1983-1996
PI: G. Mostafa
Funded by: ICDDR,B

The decline in infant mortality was more marked in the treatment than in the comparison area. Neonatal tetanus mortality declined dramatically in the 1980s. Neonatal mortality continued to be high due to other causes even in the treatment area. Diarrhoea, ARI, and malnutrition were major causes of death after the first month of life. Zero parity is a risk factor at all ages below one. High parity is important as a risk factor in the post-neonatal period.

Change in Socioeconomic Differentials of Age at Marriage and First Birth during 1983-1994
PI: L. Nahar
Funded by: ICDDR,B

Longitudinal data from Matlab were analyzed to examine the differentials of age at first marriage and first birth during 1983-85 and 1992-94. Girls with secondary or higher education or girls from educated households were married later than those who had lower or no education or those who were from households without educated person(s). Girls from poor households were married later than those from rich households. Hindus were married later than Muslims. The increase in age at marriage was more pronounced among the educated, rich, and Hindus, compared to those who had no education, were poor and Muslims. Delay in marriage did not necessarily lead to delay in having the first birth because the later the women were married the earlier they had their first child. Education of women or their husbands delayed the first birth.

Paramedics in the sub-centres at Matlab provide a wide range of services, from primary diagnosis to treatment and health education

Empowerment of Poor Women through Rural Credit Programme and the Healthcare-seeking Behaviour of Women in Matlab, Bangladesh
PI: L. Nahar
Funded by: ICDDR,B

The study examined whether women's empowerment has any impact on the healthcare-seeking behaviour of the poor rural women in Bangladesh. The results showed that women who had controlled their credited loan had higher rate of prenatal care existing in the area, compared to the women whose credited loans are controlled by their husbands. The same is true for use of trained midwives during the time of delivery.

Desire for Children and Subsequent Abortion in Matlab, Bangladesh
PI: A. Razzaque
Funded by: ICDDR,B

This study investigated the relationship between desire for children and subsequent abortion in the MCH-FP and comparison areas of Matlab. Women interviewed in the KAP 1984 and KAP 1990 surveys were followed for four years through DSS to ascertain subsequent pregnancy termination. Results of logistic regression analysis showed that in each area the women who wanted no more children had higher odds of abortion than

those who wanted more, and abortion increased more over time in the former than in the latter category.

Desire for Children and Contraceptive Use Dynamics in Matlab, Bangladesh
PI: A. Razzaque
Funded by: ICDDR,B

The study examined desire for children and contraceptive use dynamics in the MCH-FP area of Matlab, Bangladesh. Women interviewed in 1988 were followed for four years through the RKS to ascertain contraceptive continuation, switching, and subsequent adoption. Results showed that those women who wanted no more child(ren) had higher rate of contraceptive continuation, lower switching, and almost similar subsequent adoption, compared to those who wanted more child(ren). Subsequent adoption of contraception was higher for those who wanted no more child(ren) than those who wanted more.

SOCIAL AND BEHAVIOURAL SCIENCES PROGRAMME

Head: Abbas Bhuiya

Programme activities during 1998 were focused on achieving the mission of institutionalizing social and behavioural sciences research in the Centre. This was done by way of 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, sustainability of immunization programme, community participation in primary healthcare, sexuality and sexual behaviour in the context of STIs/HIV/AIDS, the programme also organized the 4th International Course on the Anthropology of Health and Healthcare, jointly with BRAC, Mahidol University, Bangkok, De La Salle University in The Philippines, the Royal Tropical Institute in Amsterdam, and the University of Amsterdam. The Programme also organized the concluding conference of the Global Health Equity Initiative, in collaboration with BRAC and with financial support from the Rockefeller Foundation. The conference was attended by the Prime Minister of Bangladesh and Prof. Amartya Sen, the 1998 Nobel Laureate in Economics, and 40 participants from all around the world.

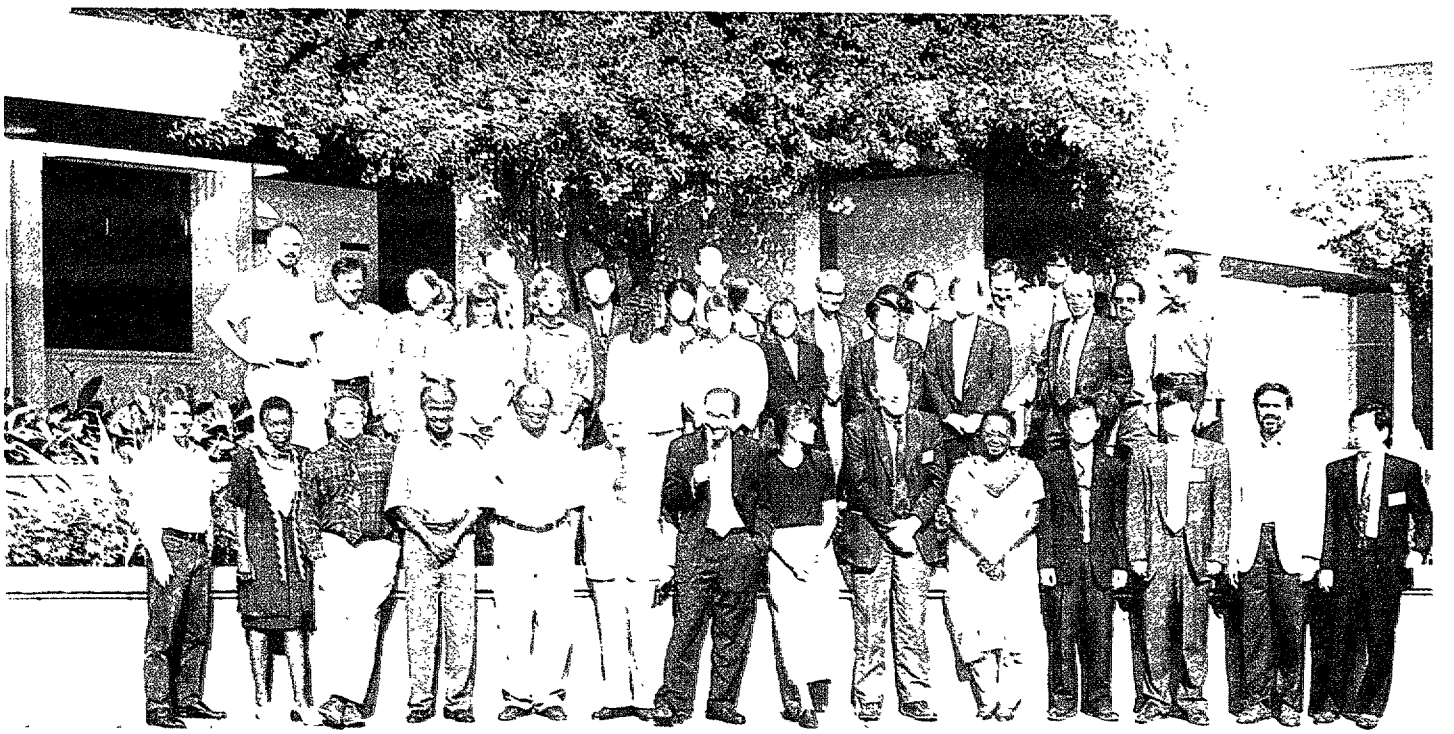
Collection of health and demographic information from the household level helps formulate policy, plan and design appropriate interventions for the targeted population

Following is a brief description of some of the major activities carried out during 1998:

Impact of Social and Economic Development Programmes on Health and Human Well-being: The BRAC-ICDDR,B Joint Project at Matlab

PIs: Abbas Bhuiya and Mushtaque R. Chowdhury (BRAC)
Funded by: Ford Foundation and International Center for Research on Women

Analysis of data collected in the previous year was the major activity. Six working papers have been published, and a number of journal articles were submitted for publication.



A section of the participants at the International Meeting of the Global Health Equity Initiative, jointly organized by BRAC and ICDDR,B in December 1998. Professor Amartya Sen, the 1998 Nobel Laureate who delivered the keynote speech in the meeting is seen the picture among others

It is observed that the survival of children of economically poor households who joined the poverty alleviation programme is significantly higher than that of the children (from economically comparable households) who did not participate in the programme. However, the participation in the poverty alleviation programme did not alter the pattern of male superiority in survival over female. The impact of the poverty alleviation programme on children's nutritional status, sickness, healthcare-seeking behaviour, and other proximate determinants is being analyzed. The impact evaluation survey on the poverty alleviation programme which was due in 1998 has been deferred due to severe flood.

To utilize the BRAC's women groups for promotion of reproductive, sexual and family health, an exploratory study on sexual issues and RTIs/STIs was carried out. Based on the findings of this study, a training module has been developed. This is being used for training the healthcare providers and other relevant community members and its impact on family, sexual and reproductive health is also being studied.

Improvement of Health through a Community Development-oriented Programme in Rural Bangladesh: Chakaria Community Health Project
PI: Abbas Bhuiya
Technical Adviser: Peter Eppler
Funded by: Swiss-Dutch 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 project activities are now being carried out in 6 unions of Chakaria thana of Cox's Bazaar district with about 12,000 population. Training of representatives of the self-help organizations on hygiene, nutrition, malaria, ARI, mother and child health, and reproductive health problems, has continued in all the unions. A system of community financing for curative services has been introduced in the three village health posts. Six CHWs have received a three-month training on midwifery and started to provide antenatal, postnatal, and delivery services. As in the previous years, an HIV/AIDS awareness campaign was carried out in the six unions as well as in Cox's Bazar town on the occasion of the World AIDS Day. The Project had its external review, and recommendations received are being implemented.

Peer Education for HIV/STD Prevention among the Youths in Dhaka
PI: Carol L. Jenkins
Funded by: Ford Foundation

This research was a support service for the Red Crescent Society of Bangladesh to develop a peer education strategy. It aimed at understanding the sexual beliefs, norms, values, and behaviours that exist among young adolescents (14-24 years old) to help prepare safe sex materials. Data were collected during November 1997-April 1998. A group of young Red Crescent Youth Volunteers was selected and trained by the SBSP research team to collect data from the Maghbazar area of Dhaka city. In-depth interviews with 37 female and 47 male adolescents were conducted by using opportunistic and snowball sampling techniques. Data showed that adolescents are at risk of contracting HIV. There is clear evidence of unprotected sexual activities with multiple partners. Ignorance about transmission and prevention of HIV/AIDs is common. None of the adolescents perceives one at risk. Myths on contracting HIV are very much prevalent.

Pattern of Male-to-Male Sexual Behaviours in Dhaka City
PI: Carol L. Jenkins and Sharful Islam Khan
Funded by: Ford Foundation

This study was done in collaboration with the Bondhu Social Welfare Society, an organization working on male reproductive health in Dhaka city. The objective of this study was to explore and describe the male-to-male sexual (MSM) behaviour pattern in Bangladesh and its relation with STD/HIV transmission. Qualitative research method was employed. Six MSM peer interviewers were trained for conducting in-depth interviews. In total, 315 in-depth interviews were tape-recorded. These were translated into English, and then entered into computer for analysis. Data are now being analyzed.

Chittagong Port and the Bay of Bengal: Research and Intervention for STD/HIV Prevention
PIs: Carol L. Jenkins and Sharful Islam Khan
Funded by: FHI/USAID

This study was carried out to gather in-depth information on behavioural factors contributing to the risk of HIV infection in the port city of Chittagong, Bangladesh, with an immediate objective of designing HIV/STD prevention programmes.

The populations selected for study were dock workers, Bangladeshi and foreign seamen, fishermen, male and female sex workers, and rickshaw-pullers. The topics of investigation included: risk-taking behaviours, STD experience, and treatment-seeking issues, knowledge of AIDS/STDs, and perceptions of risk. The other objective was to sensitize port agencies to the need of HIV prevention. The findings strongly suggest that social and behavioral risk factors and associated environmental settings for rapid STD/HIV transmission are existing in Chittagong, and there are windows of opportunity for immediate move for interventions. The study was followed by several disseminating workshops with officials, union leaders, medical practitioners, Chittagong City Corporation, and some NGOs to inform them of the findings and consequences, and to motivate them for getting further cooperation and assistance during the future interventions.

National Sentinel Surveillance for HIV and Syphilis
PIs: Carol L. Jenkins (ICDDR,B), Nazrul Islam (BAPCP), Tasnim Azim and J. Bogaerts (ICDDR,B)
Funded by: UNAIDS

The behavioural surveillance part of the National Sentinel Surveillance project has been conducted by the research team of the Social and Behavioural Sciences Programme. Data for behavioural surveillance were collected from high-risk groups: sex workers, intravenous drug users, truckers, and males who have sex with males from catchment areas all over Bangladesh. The data are now being analyzed.

Social Science and Immunization Project
PIs: Mushtaque R. Chowhdury (BRAC), Abbas Bhuiya (ICDDR,B) and K.M.A. Aziz (BRAC)
Funded by: DANIDA

This was a component of the two-year six-country study coordinated by the Royal Tropical Institute of The Netherlands. Bangladesh part with special focus on the sustainability of the EPI was jointly carried out by ICDDR,B and BRAC. Study sites included one rural and one urban area in Bhairab, and two remote sites in Sylhet Tea Estate and the Chittagong Hill Tracts. The study revealed that there exists a social demand for EPI services but it is yet to be a part of the culture. Thus, push from the programme side needs to be continued to maintain the level of EPI coverage achieved in the past. Moreover, the programme should be tuned to the prevailing cultural aspects and be more responsive to the community need. The final conference to disseminate findings took place in The Netherlands in May 1998. A country report is now under preparation.

HEALTH ECONOMICS PROGRAMME

Head: M. Mahmud Khan

The Health Economics Programme (HEP) of ICDDR,B was established in December 1996 with financial support from DfID (UK), BADC, International Development Research Centre (IDRC, Canada), and ICDDR,B.

The overall goal of the programme is to establish and strengthen a resource unit at ICDDR,B for organizing and conducting practical policy-oriented research and training with emphasis on application of state-of-the-art technical tools and methodology.

The main objectives of the programme are: to develop expertise in health economics/systems research and training in Bangladesh, identify policy-relevant health economics/systems research projects, demonstrate economic costs and benefits of alternative health interventions, estimate the impacts of health and nutrition programmes on economic and social development activities and vice-versa, collaborate with the Government of Bangladesh in policy review and analysis, and to develop links with other institutions in both developed and developing countries for health economics teaching.

Costing of the Integrated Management of Childhood Illnesses (IMCI) based on Matlab Data

PI: M. Mahmud Khan
Funded by: Abt Associates, DfID, UK

The purpose of this study is to estimate the recurrent cost of implementing the newly-proposed IMCI in the first level health facilities (FLHFs) in rural Bangladesh. The study has been conducted in the experiment site of ICDDR,B at Matlab. Data on all illness cases (children of 2 months to 5 years) who came to seek treatment from CHWs at their residences and also who visited the child healthcare sub-centres were collected. Illnesses of all sample cases were categorized according to the IMCI illness classification based on the reported symptoms and clinical evaluation by the CHWs and the paramedics. Management pattern of the childhood illnesses has also been suggested based on the illness categories. Data from the CHW level were used for estimating the additional cost of using IMCI guidelines in this setting. Some of the preliminary findings from the primary data analysis suggest: adoption of IMCI should significantly reduce the number of referrals from the community level to higher facilities; composition of needed drugs will also change and cost of drug for IMCI is likely to be 50% higher than the current cost.

Healthcare Use Pattern of Non-slum Residents of Dhaka City

PIs: M. Desmet and M. Siddiqi
Funded by: IDRC, BADC, UNICEF, and DUCHP

The overall aim of this study is to better understand the healthcare utilization pattern of the non-slum population of Dhaka city and their expenditure on healthcare. The household survey has been conducted in the non-slum population of selected thanas of Dhaka city in 1997. It identified the illness patterns among the non-slum population, components of decision-making for healthcare, and variables contributing to healthcare choice and utilization. The survey has also collected information on direct and indirect household expenditure on healthcare. This is one component of series of the studies undertaken by the programme to understand the

healthcare-seeking behaviour of different socioeconomic groups in Bangladesh. The first study was conducted among the slum population of Dhaka city in 1993. Comparison of findings from these two studies may provide valuable information on use of healthcare services, need for healthcare and cost of illness for different population groups in a developing country.

Healthcare Use Patterns in the Catchment Area of the Gonoshasthya Kendra Healthcare System in Savar and Gazipur Thanas in Bangladesh
PIs: M. Desmet and A. Qashem Chowdhury
Funded by: IDRC, BADC and Gonoshasthya Kendra

The activities of the Gonoshasthaya Kendra (GK) healthcare system cover a semi-rural area of about 165,000 inhabitants in Savar and Gazipur thanas. The aim was to understand the healthcare utilization pattern and then contribute to an enhanced health policy formulation and implementation by the GK. This study used 3 consecutive data collection phases: key informant interviews with villagers, a six-month longitudinal survey through fortnightly visits to 788 households, and case studies on specific healthcare-seeking behaviour. The data collection was completed in June 1998. Preliminary findings suggest that healthcare-seeking is a complex process and various social, cultural, economic and community-related factors affect decision-making.for healthcare

Cost Analysis of the Urban Expanded Programme on Immunization (EPI) in Bangladesh
PI: Damian Walker, M. Mahmud Khan, Suhaila H. Khan
Funded by: LSH&TM , UK

The purpose of this study is to determine the costs of delivering the urban EPI from the perspective of the providers. The delivery of EPI services in urban Bangladesh is a complex mechanism implemented through a multitude of delivery partners, including the Government of Bangladesh, NGOs, and independent private providers. For this study, 128 EPI delivery sites were randomly selected, which represent 25% of organized EPI delivery sites located in Dhaka City Corporation area. Additional information will also be collected from the organizations involved in the delivery of EPI services. Data collection from the EPI delivery sites is being done using semi-structured open-ended questionnaire. The first phase of data collection will be completed by the end of May 1999.

Evaluation of Home-gardening Programme of Helen Keller International
PIs: George Fuchs and M Mahmud Khan
Funded by : USAID

The Health Economics Programme of the Centre is examining the economic, social and anthropological components of the Home-gardening Project undertaken by Helen Keller International (HKI).The objective of the study is to evaluate the impact of home-gardening on household income, health and nutritional status of children and women, and to examine the potential of using home-gardening as an alternative sustainable mechanism to delivering vitamin A. To empirically estimate the effect of home-gardening programme, 39 villages were randomly selected from the project areas of HKI. Census of the villages was completed in November 1998. The quantitative data collection was supplemented by in-depth qualitative surveys. Data analysis is ongoing and expected to be completed by July 1999.

Cost of the Bangladesh Integrated Nutrition Project (BINP) Activities at the Community Level
PI : M. Mahmud Khan and Shakil Ahmed
Funded by: BINP-OPRP

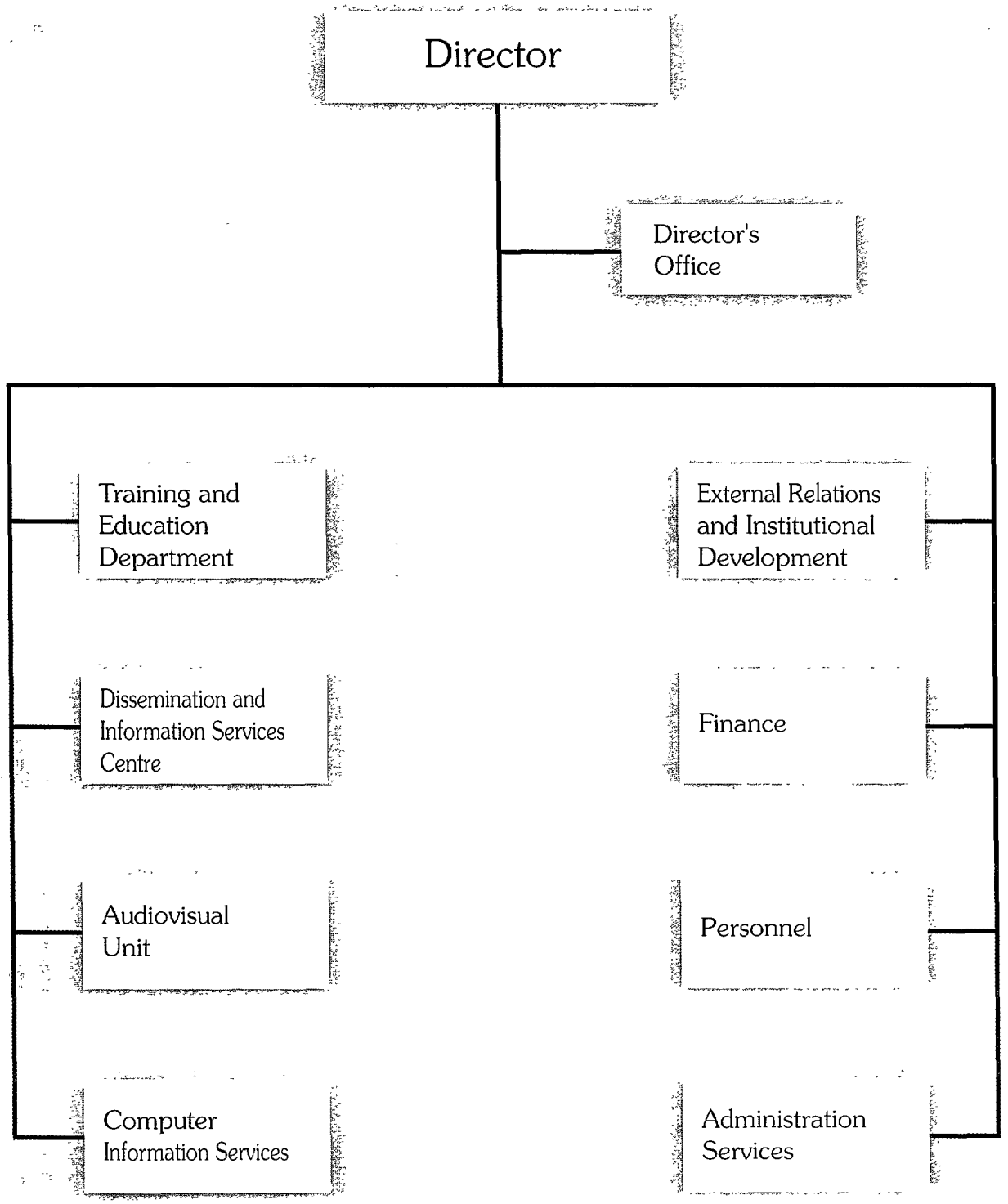
This project estimated the cost of BINP activities at the community level from the perspective of the project. The purpose is to define the resource requirements of nutrition interventions more concretely. Preliminary results of the study indicate that the average cost of running community-based nutrition activities, including food supplementation is about Tk. 59,000 per centre per year. Food cost is the most important cost component explaining 85% of total cost. Community-donated resources and time are also important. Currently, they contribute about 7% of the total project cost. Exit interview of beneficiaries shows that although the households are satisfied with the quality of nutrition services, they are not willing to pay any user charges for the interventions. The study is now identifying some effectiveness indicators to carry out a cost-effectiveness analysis of the BINP activities.

Estimating the Cost of Providing Community-based Nutrition Services Under the National Nutrition Programme
PI: M. Mahmud Khan
Funded by: World Bank

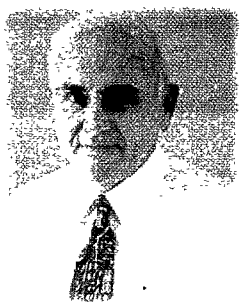
The purpose of this research is to estimate the total cost of providing nutrition services from the community-level nutrition centres of rural Bangladesh. Under the National Nutrition Programme (NNP), all rural thanas of Bangladesh will establish one community nutrition centre for every 1,250 individuals. The phasing of the project in various thanas of the country over the next 10 years has been defined by the World Bank technical mission, which was used as the basic underlying assumption for the cost projection. The nutrition intervention activities considered for this costing are: food supplementation for malnourished children, pregnant women and lactating mothers, nutrition education, provision of vitamin A and iron, and growth monitoring of children. Using experiences of the Bangladesh Integrated Nutrition Project (BINP), the cost-coefficients as well as the participation rates of target population in the programme were estimated for defining the parameters of the national-level cost projections. One important part of the exercise is to estimate the number of potential beneficiaries per rural thana over the next 10 years. The Bangladesh Bureau of Statistics (BBS) data from the sample vital registration and child nutrition status surveys are being used for estimating the temporal trend of the number of potential beneficiaries.

Under its activities on advising/evaluating other programmes, HEP reviewed the Chakaria Community Health Project twice (1997 and 1998); developed a number of research proposals jointly with other programmes of the Public Health Sciences Division, Laboratory Sciences Division, and the Clinical Sciences Division.

Director's Division



Director's Division



Director
Robert M Suskind

As part of an infrastructural reorganization of the Centre, the Director's Division was newly created through merger of the Administration and Personnel Division, the Finance Division, and all offices under the Director's Bureau (External Relations and Institutional Development Office, Training and Education Department, Dissemination and Information Services Centre, Audiovisual Unit).

Division Highlights

- Prof. George Fuchs accepted the post of Interim Director following departure of Director Prof. Robert M. Suskind.
- The Board of Trustees appointed Prof. David Sack as new Director of the Centre, effective 01 October 1999.
- Following a human resources and workforce needs assessment, right-sizing of the Centre was implemented resulting in reduction of 94 personnel through separation packages, abolishing redundant posts. Fourteen personnel retired in 1998.
- The ER&ID Office coordinated emergency relief activities during the 1998 flood and post-flood diarrhoeal disease epidemics.
- Efforts to improve the Centre's financial health continued. The most significant accomplishments include new funds for Emerging and Re-emerging Infectious Diseases (ERID), Bangladesh Health and Action Research Project (BHARP), Bangladesh Integrated Nutrition Project (BINP), Nutrition Centre of Excellence, and for addressing post-flood epidemic of diarrhoeal diseases from almost all major donors, including four private sector energy companies.
- Expenditure, excluding capital costs, decreased by US$ 589,000 from 1997. Unrestricted expenditure decreased by US$ 1,532,000, and restricted expenditure increased by US$ 943,000.
- A plan was implemented to test all financial programmes, payrolls, and computer hardware to ensure that all processes be compliant with the year 2000. It is expected that all necessary changes will be made by mid-1999.
- Seven hundred fifty-two scientists, physicians, health administrators, health personnel, trainers, and students from 36 countries received training at the Centre in 1998. Under the Centre's staff development programme, 172 personnel received overseas, in-country, and/or in-house training, including graduate and postgraduate studies.
- A total of 14,924 users availed the Centre's library facilities. Dissemination activities were strengthened by distributing new publications of the Centre, and installation of new tools of information technology in the Centre's websites.

Interim Director (since August)
Acting Director (since 9 June)
George J. Fuchs

PERSONNEL DEPARTMENT

Chief Personnel Officer: Wahabuzzaman Ahmed

At the end of 1998, the Centre had 937 personnel: 18 of international level, 4 of whom were on secondment, 158 national officers, and 761 in the general services category. In addition, 156 community health workers and 61 health workers also provided their services.

Retirement, Departure, and Obituary

Key members of the Centre's senior management team resigned during 1998, including Prof. Robert M. Suskind, Director; Mr. Ali Mahbub, Director of Administration and Personnel Division; and Mr. Syed Shamim Ahsan, Division Director, HPED. Prof. J. Patrick Vaughan, Division Director, PHSD, departed upon completion of his 3-year tenure. Prof. George J. Fuchs assumed the position of Interim Director in August 1998.

Fourteen personnel retired from the Centre during the year. Other departures included 57 personnel through voluntary severance, 37 through involuntary severance, and 2 by mutual agreement.

With deep sorrow, we record the deaths of three personnel who served the Centre for many years. They were: Mr. Md. Ful Miah (49), Driver, Director's Division; Mr. A.R.M. Alim (57), Senior Scientific Officer, LSD; and Mr. Shah Alam (52), Laboratory Attendant, LSD.

Long Service Award

During 1998, twelve personnel were awarded for their 30 years of service in the Centre. They are: Mr. Md. Anowar Ali, Director's Division; Mr. Abdul Khaleque, Director's Division; Mr. Abdur Razzaque, PHSD; Mr. Md. Mongal Mia, PHSD; Mr. Sarder Matiur Rahman, Director's Division; Mr. Chowdhury Shah Alam, Director's Division; Mr. Kazi Md. Shafiullah, LSD; Mr. Md. Feroz Miah, LSD; Mr. Md. Anowar Hossain, Director's Division; Mr. Khorshed Alam, LSD; Mr. Md. Abdul Wahed, LSD; and Dr. Md. Yunus, PHSD.

EXTERNAL RELATIONS AND INSTITUTIONAL DEVELOPMENT OFFICE

Grants Administrator: Vanessa Brooks
Technical Cooperation Officer: Ishtiaque A. Zaman

The ER&ID Office continued its role in maintaining liaison between the donor community and ICDDR,B. The related functions in 1998 included: preparing the agenda for special visitors to ICDDR,B and arranging their tours to the Centre's hospitals, laboratory facilities, and field research sites; identifying sources of fund for ICDDR,B's new activities; identifying new donors for the Centre; drafting and submitting proposals for new sources of fund; assisting the scientists at the Centre in finalizing proposals for submission to the donors; and providing a final review of contracts between donors and ICDDR,B scientists to assure agreement between the parties. Other external relations activities included: coordinating press conferences and briefings and responding to press inquiries; publicising scientific fora and special events; and coordinating and facilitating acquisition of funds and distribution of pharmaceuticals and other supplies to the ICDDR,B hospitals and programmes during the 1998 Emergency Flood Relief. The ER&ID Office, as the Secretariat for the Donor Support Group (DSG), assumed responsibility for disseminating reports on institutional

Hospital Endowment Fund Contributions 1998

Individuals (in alphabetical order of the last name)

Mr. Rolf Carriere

Dr. Rita R. Colwell

Ms Inga Davidsson

Ms Lena Davidsson

Dr. Sheila Gore

Dr. Tom Kane

Mr. Jacques O. Martin

Dr. Lisa Messersmith

Ms Saskia Osendarp

Mrs. Nazneen Taher

Mr. Suman Taher

Dr. Cesar G. Victora

Mr. Graham Wright

Patients, ICDDR,B Dhaka hospital

Corporate and Institutional Donors (in alphabetical order)

American International School, Dhaka

ANZ Ladies Club

British Women's Association

Dhaka Hospital Women's Welfare Cooperative Society of ICDDR,B

Eastland Insurance

French Catholic Mission

Ganges Travel Services

Global Health Equity Initiative

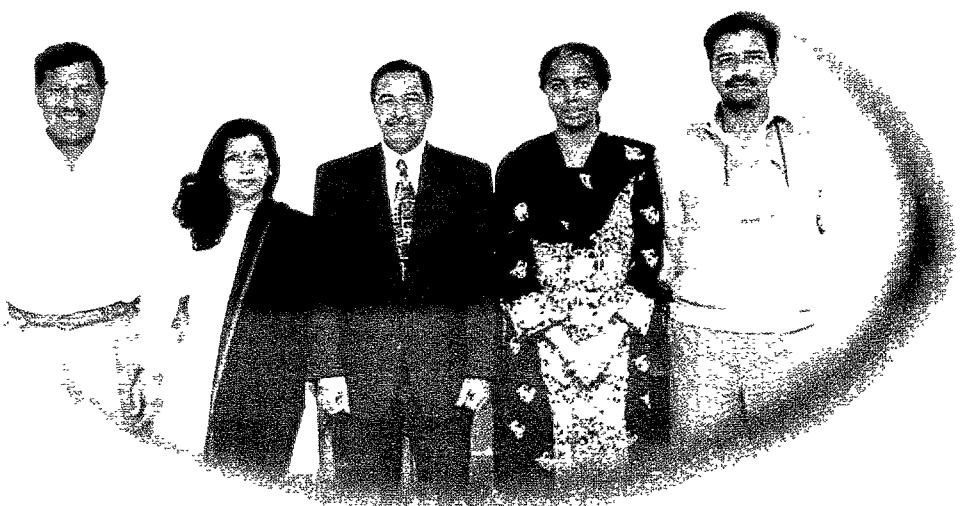
Reliance Insurance, Ltd.

Seana Tate International

Scobie & Mackinnon Trust, Australia

United Nations Women's Association

Zonta Club

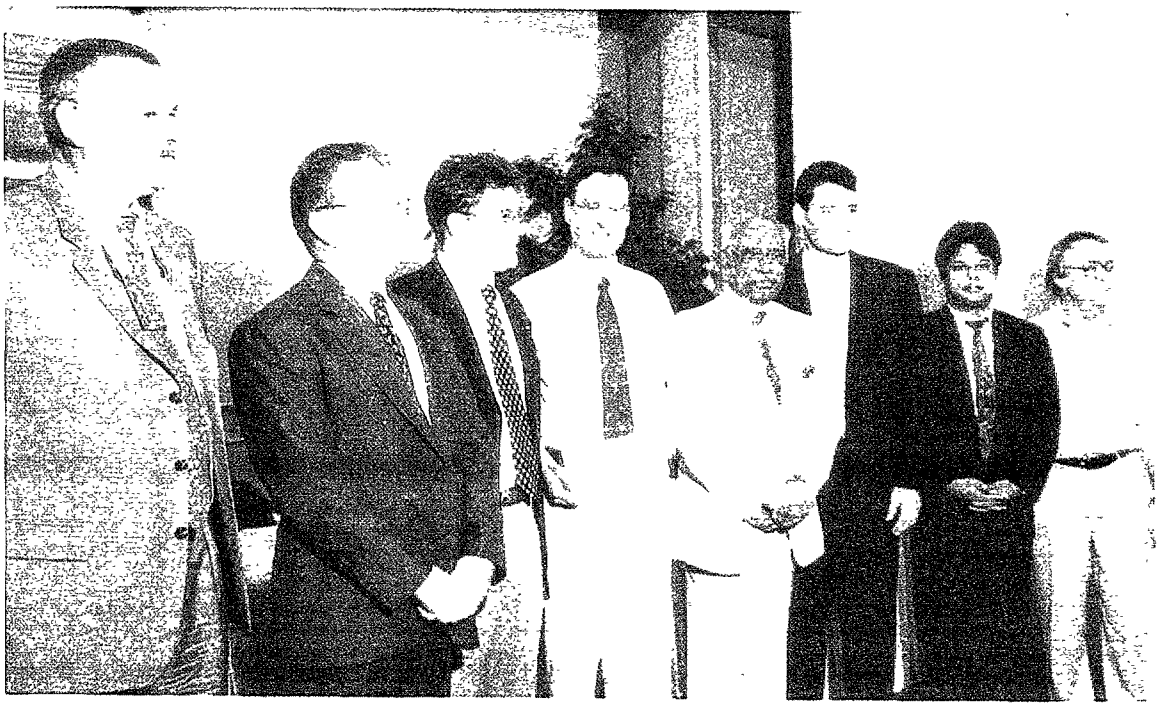


A new Events Committee to strengthen the HEF campaign was formed in 1998. The members of this new committee (from left to right) are: Mr. Ramzan Ali, Ms Loretta Saldanha, Dr. Shahadat Hossain, Ms Vanessa Brooks, and Mr. Asem Ansari

reform and human resource activities to the DSG members and preparing them in their meetings with the Board of Trustees.

As part of the institutional development activities, the ER&ID Office was instrumental in securing support from new donors, such as the World Bank, the European Union, for major programme activities and a consortium of the international energy companies for Emergency Flood Relief. The ER&ID Office also continued efforts for strengthening the Centre Endowment Fund and the Hospital Endowment Fund.

A number of donors made significant contributions to addressing the 1998 flood-induced epidemic of diarrhoeal diseases. Pictures show representatives of these corporate and institutional donors, presenting their contributions to senior members of the Centre's management team:

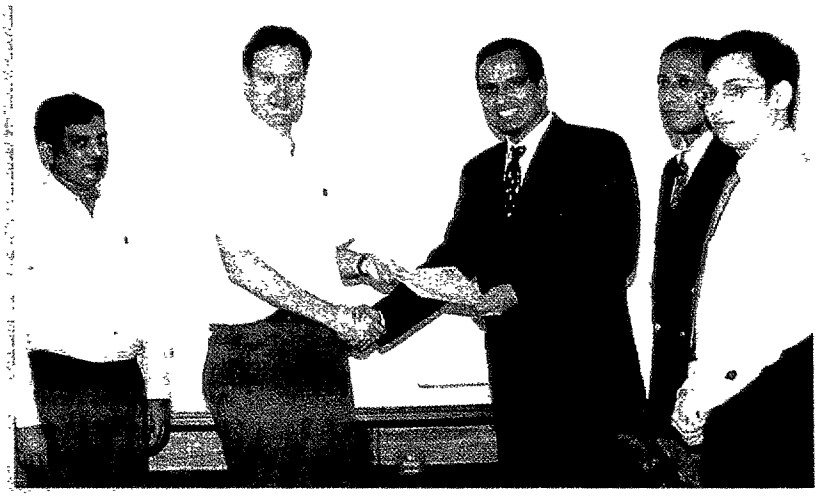


Representatives from four energy companies: Occidental of Bangladesh Ltd., UNOCAL, Cairn Energy Plc, and Shell Bangladesh Exploration & Development B.V.

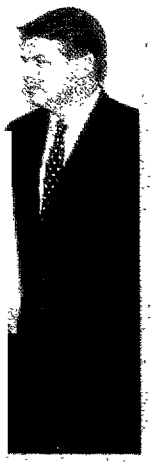
ANZ Grindlays Bank

American Express Bank

American Life Insurance Company (ALICO)



British Women's Association



Endowment Fund Campaign

The Hospital Endowment Fund (HEF) continued to receive support from organizations and individuals in 1998. The aim of the fundraising campaign is to meet a target of raising US$ 10 million by the year 2000.

In the first half of 1998, the Centre's North American Office in Baltimore worked for the endowment campaign and performed activities for general development. In June, the activities of the North American Office were consolidated under the ER&ID Office in Dhaka. The Endowment Fund Management Committee in North America continued overseeing the investment activities by our fund managers in North America at New York-based Morgan Stanley. Dr. William B. Greenough, III, a former director

of the Centre and the current Head of the Maryland-based Child Health Foundation, serves as the Chairman of the Endowment Fund Management Committee.

The North American Office and the ER&ID Office in Dhaka worked with Mr. Jay Hoffman and Mr. Osman Yousuf of USA Global, Inc., in their efforts to launch worldwide fundraising activities.

International Health Solutions Trust

The ER&ID Office assisted in launching of the Centre's fundraising campaign in the United Kingdom by International Health Solutions Trust (IHST), a registered trust in the UK that was created to raise funds on behalf of the Centre. A new fundraising brochure, produced by the Centre's Audiovisual Unit, was circulated to 2000 organizations and individual prospective donors by the IHST trustees.

Others

Beginning with the December 1998 issue of the Centre's English newsletter Glimpse, Grants Administrator Ms Vanessa Brooks of the ER&ID Office serves as Editor-in-Chief of the newsletter.

FINANCE OFFICE

Chief Finance Officer: John F. Winkelmann

The Finance Department of the Centre has the overall responsibility for financial operations, central stores, and fixed asset management with a total manpower of 32. 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 the monthly and annual reports. The Department is also responsible for facilitating the annual external audit and assuring that audits for all necessary donors' contributions are completed in time.

Financial highlights for the year are given below:

- A plan was implemented to test all financial programmes, payrolls, and computer hardware to ensure that all processes be compliant with the year 2000 before the end of the millennium. It is expected that all necessary changes will be made by mid-1999.

- Revenue contributions from donors increased by US$ 716,120. Contributions to projects increased by US$ 1,264,572. However, contributions for central activities decreased by US$ 548,452.

- Contributions from donors, after deducting the expenditure for fixed assets of US$ 495,737 (US$ 184,931 in 1997), increased by 3.9% from US$ 10,488,410 to US$ 10,893,724.

- Net expenditure, after deducting miscellaneous receipts of US$ 1,084,981 (US$ 1,120,800 in 1997), not including depreciation, decreased by US$ 586,770 (4.8%) from US$ 12,298,126 to US$ 11,711,356.

- The operating deficit was US$ 817,632 (US$ 1,809,716 in 1997) which, after charging depreciation of US$ 894,651 (US$ 899,838 in 1997), resulted in a net deficit of US$ 1,712,283 (US$ 2,709,554 in 1997).

- Net current assets decreased by US$ 1,771,454 due to a decrease in cash and equivalents of US$ 759,176 and a decrease of US$ 1,012,278 in other net current assets.

- Receipts on account of Capital contributions decreased by US$ 238,191 from US$ 355,165 to US$ 116,974.

Despite continued strict controls over expenditure, the Centre was unable to generate a cash-operating surplus, though the deficit reduced significantly. Additional revenue is required to ensure the continued high-quality research and necessary support services at the Centre.

Dr. A.K.M. Masihur Rahman, Secretary (ERD), Ministry of Finance and member of the Centre's Board of Trustees is seen signing the 1998 Annual Financial Statements, together with the Interim Director, Chief Finance Officer, and the auditors

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, 1998, from which the abridged financial statements were derived. In our report of same date we expressed an opinion that the financial statements from which the 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, 1998 of US$8,402,021 and corresponding investments with Generali Worldwide Insurance Company Limited of Guernsey, Channel Islands, in these accounts, (b) recoverability of funded support of $200,000 from Arab Gulf Fund and (c) treatment of Voluntary Severance Pay of $576,037 as Deferred Revenue Expenditure.

In our opinion, the attached abridged financial statements, except for the above, are consistent, in all material respects, with the 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 the abridged financial statements were derived and our report (in particular paragraph 5) thereon.

ACNABIN & Co.
Chartered Accountants

Price Waterhouse
Chartered Accountants

Dhaka, March 18, 1999

CENTRE FOR HEALTH AND POPULATION RESEARCH

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH
Statement of Financial Position as of December 31, 1998 (US$ 000) – Abridged

	1998	1997
Total Assets and Deferred Revenue Expenditure	**13,690**	**14,175**
Assets	**13,114**	**14,175**
Cash and deposits	2,867	3,626
Accounts receivable	1,735	2,294
Centre Endowment Fund investments	3,180	3,180
Inventories	624	568
Property, plant and equipment	4,708	4,507
Deferred Revenue Expenditure	**576**	-
Total liabilities and fund balances	**13,690**	**14,175**
Accounts payable and other	**7,316**	**6,807**
Fund balances	**6,374**	**7,368**
Fixed Asset Fund	4,708	4,508
Fixed Asset Acquisition and Replacement Fund	147	279
Centre Endowment Funds	3,180	3,180
Reserve Fund	2,260	2,155
Operating Fund	(3,921)	(2,754)

Statement of Activities (US$ 000) – Abridged

Income	**11,979**	**11,609**
Donors' contributions	11,389	10,673
Other items - net	590	936
Expenditure	**13,691**	**14,319**
Personnel	8,323	9,228
Depreciation	895	900
Other items	4,473	4,191
Operating deficit	**1,712**	**2,710**

Statement of Cash Flows (US$ 000) – Abridged

Cash flows from operating activities	(958)	504
Cash flows from investment activities	(991)	(1,147)
Cash flows from financing activities	1,190	540
Net Increase/(Decrease) in cash and equivalents	**(759)**	**(103)**
Cash and equivalents beginning of year	**3,626**	**3,729**
Cash and equivalents end of year	**2,867**	**3,626**

Interim Director

Member, Board of Trustees

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

ACNABIN & Co.
Chartered Accountants

Price Waterhouse
Chartered Accountants

Dhaka, March 18, 1999

102

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

	1998	1997
Revenue Contribution	**11,389**	**10,673**
Australia - AusAID	207	340
Bangladesh	435	464
Belgium – BADC	236	298
Canada – CIDA	143	216
European Union	123	90
Ford Foundation	333	361
Japan	580	680
Netherlands	40	157
Norway – NORAD	125	162
Saudi Arabia	50	58
Sweden – Sida/SAREC	482	501
Switzerland – SDC	436	806
Swiss Red Cross	292	212
Thrasher Foundation	58	73
United Kingdom – DfID	460	664
United States – AID etc.	5,636	4,817
United Nations – UNAIDS	95	-
UNDP/Japan	59	-
UNICEF	113	214
WHO	187	67
World Bank	185	-
Disaster/Epidemic (a)	542	-
Others (b)	572	493
Capital Contributions	**117**	**355**
Bangladesh	232	210
United Kingdom - DfID	(115)	145

a) Contributions in 1998 for Disaster/Epidemic funds were received from USAID/CARE, CIDA, DfID, AusAID, American Express Bank, American Life Insurance Co., ANZ Grindlays Bank, Cairn Energy Plc., UNOCAL, Shell Bangladesh Exploration & Dev. B.V. and Occidental of Bangladesh Ltd.

b) Contributions in 1998 from others for project funds were received from Bangladesh-DGHS, George Mason Foundation, Helen Keller International, International Atomic Energy Centre, North Field Laboratories, Proctor & Gamble, New England Medical Center, Rand Corporation, Wander Ag., SDC, Japan, Canadian High Commission, Population Council, Cytos Pharmaceutical Inc., Novartis, British Geological Survey, UNICEF, UCB/Sidac, USAID/FHI, Urban Family Health Partnership and Universities of Alabama, Pennsylvania, New Castle, Loughbourg and Virginia.

During 1998 contributions in kind, for specific and general activities were received from Bangladesh, Belgium, Ford Foundation, Netherlands, UNICEF, USAID/OFDA and US Govt. Department of Defence.

Interim Director

Member, Board of Trustees

TRAINING AND EDUCATION DEPARTMENT

Head: A.N. Alam

ICDDR,B undertakes training programmes to disseminate its research findings to help develop capacity for research, management of the Control of Diarrhoeal Disease (CDD) programmes, and family planning services. As part of the Centre's effort to develop trained manpower for health services of the national and international institutions, training courses and workshops offered by the Centre are designed to provide knowledge and skills applicable to the needs of the participants.

During the reporting year, 752 scientists, physicians, health administrators, health personnel, trainers, and students from 36 countries received training at the Centre.

The Government of Japan, Swedish International Development Cooperation Agency (SIDA), and the US Office of the Foreign Disaster Assistance (OFDA) through USAID/Dhaka, provided support to conduct most of the training courses; WHO and Belgian Administration for Development Cooperation (BADC) sponsored participants and fellows from Afghanistan, Saudi Arabia, Cambodia, and Laos.

Health Research Training

The major components of health research training are: (a) Health Research Training Fellowship, (b) Research Methodology Workshop, (c) Introductory Course on Epidemiology and Biostatistics, and (d) Supervision of academic research work of Bangladeshi nationals through the Centre's ongoing research projects. Workshops and courses are designed to enhance the training and improve the skills of health researchers in the areas of clinical research and services, epidemiology, laboratory research methodology, and protocol development. A total of 64 researchers from 7 countries participated in these programmes. Courses were organized in collaboration with international agencies, national institutions and NGOs, and were funded by ICDDR,B with support from UN agencies and the donor governments.

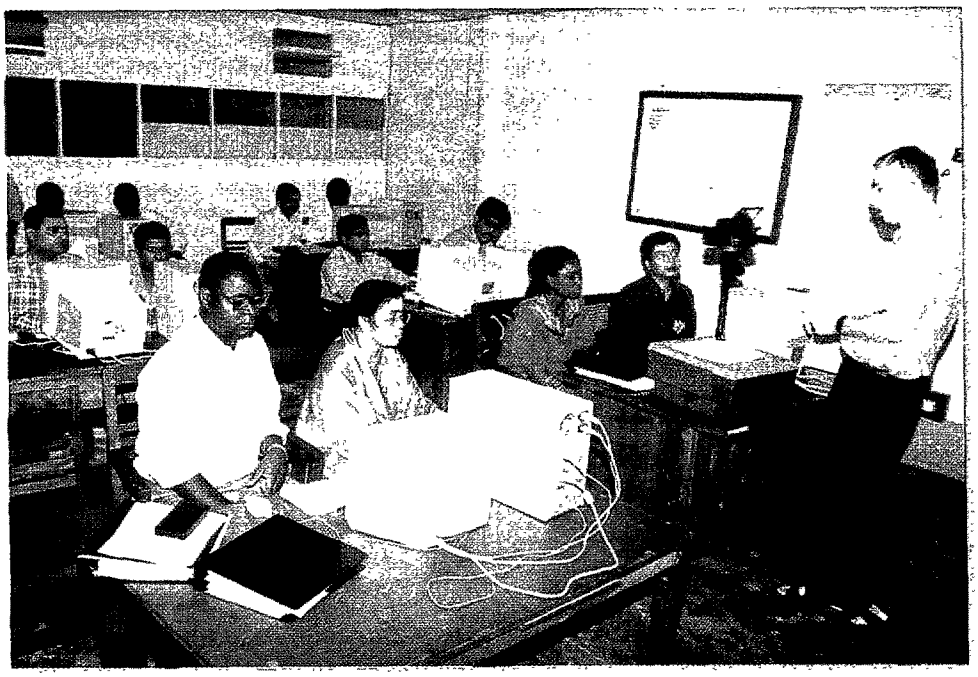
The Centre's scientists supervised the academic research work of Bangladeshi university students through a programme monitored by the Training and Education Department. Ten M.Sc and one Ph.D students from the University of Dhaka and the Bangabandhu Sheikh Mujib Medical University carried out research work for their dissertations at the Centre's research laboratories under direct supervision of scientists of the Centre.

Training of Trainers

The Training and Education Department of the Centre organized three international training courses to update knowledge and skills of trainers in prevention, case management, laboratory diagnosis of diarrhoeal diseases, and emerging and re-emerging pathogens. The goal of the Training of Trainers (TOT) programme is to create efficient manpower in these areas, so that the trainers are able to organize appropriate training programmes in their own countries and/or places of work.

Emerging and Re-emerging Pathogens: A four-week course, sponsored by the Japan International Corporation of Welfare Services, was attended by six participants from different hospitals and medical schools of Japan.

The course aimed at: (a) reviewing different factors that led to changes in the patterns of infectious diseases, (b) evaluating the emergence of multidrug-resistant pathogens that cause infectious diseases, (c) discussing the clinical presentations of these illnesses, and (d) discussing the ways of managing outbreaks of diseases caused by these pathogens. The course included one module on hands-on-training at the Centre's Dhaka hospital and management of patients with cholera and *Shigella*-associated dysentery, another on laboratory training for the diagnosis of diarrhoeal pathogens and identifying their sensitivity patterns. Visit to the Matlab Health Research Programme sites to gain practical experience in community management of diarrhoea was an additional component of the course.



Participants of the Research Methodology Workshop in a session

Clinical Management of Diarrhoeal Diseases: Nine physicians, nurses, and managers of diarrhoeal disease control programmes from Afghanistan, Bangladesh, Bhutan, Pakistan, Tanzania, and Zimbabwe attended the two-week course. They learned diagnosis, management, and prevention of acute and persistent diarrhoea.

Laboratory Diagnosis of Common Diarrhoeal Disease Agents: A two-week course was attended by 10 participants from Afghanistan, Bangladesh, Sri Lanka, Saudi Arabia, Thailand, Ethiopia, and Kenya. The participants 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: The Centre organized two workshops to train healthcare professionals of international NGOs and other agencies that respond to disaster situations. The workshop was attended by 26 participants from 17 countries, representing World Vision International, UNICEF, WHO, Save the Children (USA), International Medical Corps., CARE, Medical Emergency Relief International, American Refugee Committee, Catholic Relief Service, and Medicines Sans Frontiers. The objectives were to strengthen the capacity of the international NGOs in managing epidemic of cholera and shigellosis effectively to reduce morbidity and mortality. The workshop also emphasized on preparedness to handle disaster situations, prevention of diarrhoea, ensuring safe water supply, and addressing sanitation hazards. The participants received hands-on training at the Centre's facility in Dhaka and in the makeshift treatment centres in the field and prepared an action plan to be used by their organizations during disasters and epidemics.

Workshop on Reproductive Health Programme through Operations Research

In 1998, the Centre organized the International Workshop on Improving Effectiveness, Quality of Service and Sustainability in Reproductive Health Programme through Operations Research, based on experiences and lessons learnt from Matlab and the ICDDR,B's Operations Research Project field sites. The objectives were to: (a) familiarize participants with the operations research activities and lessons learnt in the field of reproductive health by the Centre's scientists, (b) acquaint the participants with innovative interventions by service-delivery agencies working in reproductive health in Bangladesh, and (c) disseminate the experiences of linking operations research with the process of policy formulation to improve reproductive health programmes. Eleven participants from Bangladesh, Egypt, India, Indonesia, Malaysia, Pakistan, The Philippines, Thailand, and Tanzania attended the workshop. The participants felt that such workshops can greatly contribute toward strengthening the MCH-FP programmes in developing countries.

Fellowships for Training

The Centre offered fellowships to 60 persons for providing them training on clinical aspects of diarrhoeal diseases. The main objective of this programme was to provide the fellows with skills in clinical diagnosis and treatment of patients with diarrhoea and malnutrition with some insight into research methods. The different fellowship programmes in 1998 were as follows:

Fellowships for SAARC Countries: The Centre offered a 6-week training for fellows from member countries of the South Asian Association for Regional Cooperation (SAARC). The aim of this programme was to provide hands-on training to health professionals on different 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. Ten fellows from Bangladesh, Bhutan, The Maldives, Nepal, and Sri Lanka received training during the year.

Clinical Fellowships: The programme provided intensive training on different aspects of diarrhoeal diseases to physicians from Bangladesh, who have completed at least one year's training either on paediatrics or on internal medicine and are interested to have postgraduate studies. Fellows are selected on a competitive basis. Training at the Centre is recognized by the University of Dhaka and Bangladesh College of Physicians and Surgeons for postgraduate diploma/degree in paediatrics or in medicine. A total of 9 fellows received training in 1998.

BADC Fellowships: The Belgian Administration for Development Cooperation (BADC) offered 4 fellowships for 3 months to participants from Cambodia and Laos for training at the Centre in the field of clinical management or laboratory diagnosis of diarrhoeal diseases.

Fellowships for Nurses: The programme aimed at training nurses in the management of patients with diarrhoeal diseases. The Centre offered 15 fellowships in 1998 on a competitive basis.

Other Fellowships: Twenty-two health professionals from Australia, Bangladesh, The Netherlands, Sudan, Sweden, UK, and USA, received train-

ing on different aspects of diarrhoeal diseases. The large majority came for 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

Eleven sessions of 3 national training courses were organized in 1998. A total of 183 researchers, students, and paramedics attended these courses or workshops.

Training Course for Paramedics on Child Survival Interventions: Four courses were conducted at the newly-constructed International Training Centre of the Matlab Health Research Programme under the USAID-supported National Integrated Population and Health Programme (NIPHP). Fifty-six paramedics, nominated by the Urban Family Health Partnership and Rural Service Delivery Partnership from different NGOs, attended these courses. The courses aimed at training the paramedics for rendering quality services under NIPHP.

The objectives of the course were to enable the participants to: (i) organize and provide immunization services at the field level, (ii) provide appropriate services on case management of children with diarrhoea and acute respiratory infections, and (ii) administer vitamin A capsules appropriately to children and provide appropriate counselling on vitamin A and breast-feeding. In addition to theoretical lectures, the participants were given hands-on training on different aspects of child survival interventions at the hospital as well as at the satellite clinics.

Courses on Clinical Management

Two national training courses on clinical management were organized in 1998. Twenty-four DCH, MD, and FCGP students from the Bangladesh Institute of Child Health, Bangladesh Medical University, and the College of General Practitioners of Bangladesh attended these courses.

Participants of the workshop on Emergency Response to Cholera and Shigella Epidemics, receiving hands-on training at the Centre's Dhaka hospital

Training of Trainers and Peer Educators' Training under the Centre's HIV/AIDS Staff Education Programme

The HIV/AIDS Staff Education Programme was initiated in June 1996. The overall objective of the programme is to protect the ICDDR,B personnel themselves and their family members from HIV infections. The specific objectives are to: (a) create awareness of the existing threat of HIV/AIDS, (b) understand the HIV/AIDS situation and potential threat of an extensive spread of HIV/AIDS in Bangladesh, and (c) improve the knowledge on modes of transmission and prevention of HIV/AIDS. As prevention of HIV/AIDS infections is seen as a social process, the concept of peer education approach has been chosen as the strategy. To implement the project, a group of Core Trainers (a total of 28 personnel) has been developed by the Swiss Development Cooperation Consultant for HIV/AIDS through a series of three TOTs. The core trainers subsequently have trained 45 peer educators in Dhaka and Matlab. The programme is now in place, and the peer educators have been disseminating the HIV/AIDS information to the fellow staff.

Course on Applied Health Economics for Developing Countries

A 2-week intensive course on Applied Health Economics with focus on developing countries, was organized. The course, designed with inputs from the faculty members involved in Health Economics teaching in the US and British universities, was attended by 17 participants, including 2 from Pakistan and 4 from ICDDR,B. The course covered: (a) demand for healthcare services, (b) behaviour of healthcare providers: private practitioners and hospitals, (c) evaluation of the economics 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 developing world: private and social insurance.

Other Training Activities

Through individually assigned programme and short-term courses, participants received training on management of laboratory animals and clinical management of patients. During the year, series of one- and two-day sessions were organized on the management of diarrhoeal diseases for 345 medical students and health professionals from national institutions.

Twelve persons from various institutions received hands-on training at the Centre's library to gain experience in the management and dissemination of information. The durations of their training ranged from one month to three months.

National Workshops

Workshops on Use of the Matlab Health and Socioeconomic Survey (MHSS) Data

Two workshops of one week duration were organized in collaboration with the Fogarty Foundation of the National Institutes of Health, USA. The MHSS data on various aspects of health and human development in rural Bangladesh were disseminated through these two workshops. One of the goals of the workshop was to accelerate and expand the involvement of Bangladeshi scientists in analyzing data of importance to Bangladesh. The

unique features of the MHSS data are that these provide important information on health and health-related matters covering all age groups, focusing especially on adults. In addition, these data provide a wide range of demographic information covering fertility, education, marriage, migration, economic status, and characteristics of family networks. The workshops were attended by 37 participants from various universities, research organizations, and NGOs.

Seminars

To provide opportunities for exchange of information and views, 15 seminars were organized, in addition to 40 inter-divisional scientific fora. Both resident and visiting scientists made presentations on various topics.

Staff Development

Manager: Bejoy R. Saha

The Centre is mandated to have a systematic staff development programme. To achieve this objective, the Centre continued its human resource development programme to sustain the ongoing research and training and to maintain a well-trained staff. This was done through organizing workshops and training courses and sending the Centre's selected personnel to national and overseas institutions, benefiting 174 personnel in 1998. The Centre received financial support from the Swiss Development Cooperation and fellowships from several other agencies for the programme.

Overseas Training

Fifty-six personnel received overseas training in various universities in Australia, Germany, India, Japan, The Netherlands, Switzerland, Thailand, UK, and USA. Fifteen scientists and researchers completed their study and training, and two, after completing their course work, returned to the Centre to undertake research work for their dissertation for PhD degree from the London School of Hygiene & Tropical Medicine (LSH&TM), UK, and University of Liege, Belgium. Of the 15 personnel who completed their study and training, one received PhD degree, two obtained masters degree, and 12 completed non-degree programmes in various disciplines.

In addition to the above, fifty-six personnel attended 42 scientific conferences outside Bangladesh.

In-country Training

During the year, 62 personnel received in-country training in the areas of: midwifery, effective meeting organization, computer programming, TOT on child survival intervention, office management, TOT on participatory training methodology, anthropology of health and healthcare, and nutrition.

A number of personnel presented papers on the findings of their results at scientific conferences held inside the country.

In-house Training

Two training courses on English language—one for the administrative and secretarial staff and the other on basic spoken English for drivers and office attendants—were organized at the Centre. These courses were at-

tended by 34 personnel of Operations Research Project. In addition, 4 personnel attended the international workshop on research methodology, 14 attended an introductory course on epidemiology and biostatistics; and 4 on applied health economics for developing countries.

DISSEMINATION AND INFORMATION SERVICES CENTRE

Head: M. Shamsul Islam Khan

The Dissemination and Information Services Centre (DISC) is the combination of two components: (1) Information Services Branch and (2) Publications Services Branch. The broad aims and objectives of DISC are to: (a) collect, process, store, and disseminate information on health and population research and related programmes, (b) encourage the use and flow of information, (c) coordinate and centralize resources that will promote the Centre's research findings, and (d) optimize the application of improved practices for information storage, retrieval, publication, and dissemination concerned with the issues relating to health, population, and environment. Within these broad objectives, DISC has actively pursued the development of more effective and efficient information services and an improved information support system.

The Library Advisory Committee and the editorial boards for the Journal and newsletters have continued guidance for the improvement of information services and quality of publications. Activities and services of DISC were managed and maintained with a total regular staff of 10 personnel.

During 1998, activities of DISC proliferated to keep pace with the Centre's accelerated growth and development in using the tools of New Information Technology (NIT) to better disseminate its research findings and information on other activities.

The year will remain a milestone for DISC in its use of the electronic media for dissemination of the Centre's publications. DISC continued to liaise with the PANAsia Network for strengthening the Centre's website and with AHEAD (Asian Health, Environmental & Allied Databases) by disseminating the Centre's publications for processing in electronic format. In late 1998, DISC was given the responsibility of inputting material of the annual reports, periodicals and other publications,.announcements, etc. into the Centre's web pages. Accordingly, soft copies of publications and regular periodicals were made available in the Centre's web pages.

Information Services

The Information Services Branch is equipped with the modern tools of information technology, including on-line literature search facility, and has now a total collection of over 30,000 books and bound journals, and 12,990 reprints and other documents on diarrhoeal diseases and related subjects.

Collection of books, journals and other periodicals, and CD-ROM diskettes through purchase and inter-library loan continued in 1998. Referral services, bibliographic and photocopying services, Current Awareness Service (CAS), and Selective Dissemination of Information (SDI) were strengthened during the year.

The library collection was enriched with the addition of 1,520 new books and bound journals, 354 current journals and other periodicals, and 5

databases on CD-ROM diskettes. The library extended its borrowing facilities under the inter-library loan relationship to the National Health Library and Documentation Centre, Bangladesh Institute of Development Studies, and the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine & Metabolic Disorders (BIRDEM). The Centre's scientists were kept informed of the incoming learning resources through the weekly Electronic DISC Bulletin, hard copy of which was discontinued at the end of June 1998.

Publications Services

During 1998, Publications Services of DISC edited, published, and disseminated the Centre's research findings and other output information through its internal publication series which included: Annual Report for 1997, four issues of the Journal of Diarrhoeal Diseases Research; four issues of the Bibliography on Diarrhoeal Diseases; four issues of the English newsletter Glimpse; three issues of the 4-monthly Bangla newsletter Shasthya Sanglap; and three issues of the bilingual (English and Bangla) staff news bulletin—the ICDDR,B News.

The Publications Services Branch performed all printing-related work for the 7th Annual Scientific Conference (ASCON), including editing and publication of the Programme and Abstracts. It also assisted in the production of 29 internal publications published by other units of the Centre.

AUDIOVISUAL UNIT

Head: Asem Ansari

The Audiovisual Unit (AVU) of the Centre provided support 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. AVU is also responsible for photographic coverage of important events in the Centre, including visits of distinguished persons; audio- and video-recording of scientific presentations and deliberations during meetings, seminars, workshops, and conferences. AVU did the page layout and designed covers of several publications of the Centre, such as Annual Report, Glimpse, and ICDDR,B News.

COMPUTER INFORMATION SERVICES

Manager: Abu Sufian J. Alam

In the context of the overall goals of developing a strategy for the new information technology in the Centre, a fibre optic system, creating a network of over 200 computers, was introduced and completed under Phase-II funded by DfID. This technology will allow the Centre's various administrative and scientific personnel to communicate and transfer data within the Centre and to outside institutions more rapidly and efficiently. The installation of the Centrewide Intranet E-mail System, using MS Exchange, has established a paperless Office Automation in the Centre.

Additionally, the Matlab station of ICDDR,B is now equipped with a Internet server that connects Matlab directly to ICDDR,B headquarters at Dhaka through rural telecom system for e-mail, data and voice communication. The Computer Information Services (CIS) plays a key role in the redesign of the Centre's web page. Improvements in web pages aim at reflecting a brochure range of activities conducted by each of the Centre's divisions.

ENGINEERING AND SUPPORT SERVICES DEPARTMENT

Chief Engineer: Taqsem A. Khan

The Engineering and Support Services Department coordinated security and cleaning services, transport, logistics support management, and the procurement of goods and services. The Department managed planning and execution of construction, installation and maintenance of electrical and mechanical equipment, maintenance of buildings, roads, and all physical facilities of the Centre. The Department has two engineering branches, a procurement branch, an estate office and a travel office.

Engineering Branch

Senior Assistant Engineer: Rabindra Das (Civil)
Assistant Engineer: N. Sayem Uddin Ahmed (Electrical)

The Engineering Branch interfaced with all relevant government-owned utilities. In 1998, the Civil Engineering Branch successfully completed the construction of approximately 8,000 sq. ft. on the 2nd floor of the south-east wing of the hospital building to accommodate CSD offices. During the year, the Director's Office, CSD, ER&ID Office, Estate, Travel, and Personnel offices occupied the newly-constructed 2nd floor of the hospital, expanding the ORP offices in the IPH building. Other major renovations included accommodation of the PHSD offices in the library building.

The Electrical Engineering Branch routinely maintains all electrical equipment and electrical sub-stations for Dhaka and Matlab. During the flood-related diarrhoea epidemic in 1998, the Electrical Engineering Branch provided technical support to the hospital management and ensured constant power supply and round-the-clock maintenance service both in Dhaka and Matlab hospitals.

Procurement Branch

Procurement Manager: Mahbubul Alam

The Branch procured scientific and other materials for the Centre through local and overseas purchase for support to the Centre's research work, training and service activities. The Branch completed the periodical Rate Running Contract for minimizing cost and reducing lead time and selection of vendors. The Branch also procured and coordinated the distribution of emergency flood relief medical supplies from USAID/UNICEF for the hospitals and other project offices.

Estate Office

Senior Estate Officer: A.M. Alamgir

The Estate Office maintained the telecommunication system of the Centre and assisted in hiring/leasing of offices for projects and houses for international staff, merged the system of bills and taxes, and other services provided by the Government of Bangladesh to ensure uninterrupted services.

Travel Services Office

Manager: Kh. Shafiqul Hossain

The Travel Services Office provided all travel-related services to both expatriate and local personnel, members of the Board of Trustees, visitors, and trainees and facilitated their arrival, departure, and stay in the ICDDR,B

facilities. The Office also maintained liaison with concerned government authorities for issuance of visa, landing permit, and customs passbook, clearance of shipments of the personal and household goods (incoming and outgoing) of the expatriate personnel. In addition to these, the Office arranged accommodation to participants of the BOT and Donor Support Group meetings, workshops, conferences, and symposia.

Other Support Services

The Staff Clinic provided improved healthcare services to the Centre's staff and their dependants during 1998. In total, 20,118 patient visits took place in the Staff Clinic, and 391 were vaccinated. The Staff Canteen prepared and served meals to about 375 personnel, 500 patients, and their attendants daily, and catered for various seminars, conferences, and meetings of the Centre.

COMMITTEES

Coordination Manager (Acting): Sirajul Islam Mollah

Apart from the Board of Trustees--the final authority of the Centre's activities--ICDDR,B has mandatory committees that include: Programme Coordination Committee, Research Review Committee, Ethical Review Committee, 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 work. The Board comprising 17 members, includes: the Director of the Centre, three persons 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 1998 was constituted with the following persons:

Chairperson: Mr. Jacques O. Martin (Switzerland)

Member-Secretary: Prof. Robert M. Suskind (till 8 June); Prof. George Fuchs (from 9 June as Acting Director and from 01 August as Interim Director).

Members: Prof. Peter F. McDonald (Australia); Mr. Muhammed Ali (Bangladesh) till June; Mr. M.M. Reza (Bangladesh) from July; Dr. A.K.M. Masihur Rahman (Bangladesh); Maj. Gen. (Retd.) M.R. Choudhury (Bangladesh); Prof. Cesar G. Victora (Brazil); Prof. Chen Chunming (China) till June; Prof. Zheng Qing-si from July, Prof. Carol Vlassoff (Canada) from July; Prof. P. Helena Makela (Finland); Prof. Yoshifumi Takeda (Japan); Prof. Fehmida Jalil (Pakistan); Dr. Tawfik A.M. Khoja (Saudi Arabia); Prof. Marian E. Jacobs (South Africa); Dr. Ralph H. Henderson (WHO, Switzerland); Mr. Rolf C. Carriere (UNICEF); and Prof. Rita R. Colwell (USA).

Programme Coordination Committee

Chairperson: Prof. M.A. Matin

In June 1998, the Programme Coordination Committee (PCC) was reconstituted to strengthen coordination efforts between the Centre and national health institutions through capacity building for collaborative research. The areas of research priorities have been redefined and cover broader agenda with these key topics: (1) emerging and re-emerging infections, especially antimicrobial resistance to such infections, (2) malnutrition, and (3) population dynamics. With its multidisciplinary approach, the Centre offers extraordinary opportunities for researchers of national institutions to address their critical issues of global significance in their collaborative protocols through PCC.

PCC is composed of 56 members with representatives from the Centre, the Ministry of Health and Family Welfare and the remaining from the government health departments or institutions, universities, and non-governmental organizations involved in health, nutrition, education, population studies, and development in Bangladesh.

As part of the PCC activities, the Centre's scientists provided technical assistance and guidance to the scientific staff of national institutions in developing research proposals, undertaking research in their institutions, and writing scientific papers. Investigators from these institutions also participated in the ongoing research protocols at the Centre.

Research Review Committee

Chairperson (Acting): Prof. Patrick Vaughan
Prof. V.I. Mathan (since April)

Research Review Committee (RRC) reviews all scientific research proposals of the Centre, originating from its four scientific divisions, evaluates their scientific merit, competence of the PIs, and relevance to the Centre's objectives and priorities. The Committee is composed of clinicians, epidemiologists, social scientists, laboratory scientists, and demographers from both within and outside the Centre. In 1998, the RRC met 11 times and considered 38 protocols.

Ethical Review Committee

Chairperson: Prof. Farida Haq
Brig. Q.M.S. Hafiz (since July)

Ethical Review Committee (ERC) is a mandatory committee of the Centre which meets regularly to examine and consider the ethical issues of research protocols involving human subjects. Its five-member subcommittee undertakes periodic inspection and audit of research projects on behalf of the Committee to ensure that studies are conducted ethically and according to the approved proposal. The full committee is composed of 15 members: four from the Centre, one each from PCC, Bangladesh Medical Research Council (BMRC) and WHO's Country Programme Office in Bangladesh. In 1998, the remaining eight members were individuals from varying disciplines. ERC met 13 times and considered 38 protocols in 1998.

In September, the ER&ID Office sent a signed draft copy of the Multiple Project Assurance (MPA) document for consideration of the Office for Research Subjects (Committee on Human Research, Animal Care and Use) at

the Johns Hopkins University School of Hygiene and Public Health. The document details the modalities of institutional research collaboration between ICDDR,B and JHU for protection of human subjects. The Centre is currently seeking an MPA with the National Institutes of Health, USA.

Animal Experimentation Ethics Committee

Animal Experimentation Ethics Committee (AEEC) was established by the Board of Trustees to ensure compliance of the standard procedures for protection of research animals at the Centre. This Committee reviews protocols involving research with animals and gives clearance to those protocols.

STAFF WELFARE ASSOCIATION

President: Shahadat Hossain
G.H. Rabbani (since July)

The ICDDR,B Staff Welfare Association (SWA) is a body of elected staff representatives and is recognized by the Centre for the purpose of maintaining dialogue between staff and the management. In 1998, SWA continued to make proposals to the Director in the primary interest of ICDDR,B personnel concerning conditions of service.

VISITORS IN 1998

Notable persons from different regions of the world visited the Centre during 1998, 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, symposia, 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.

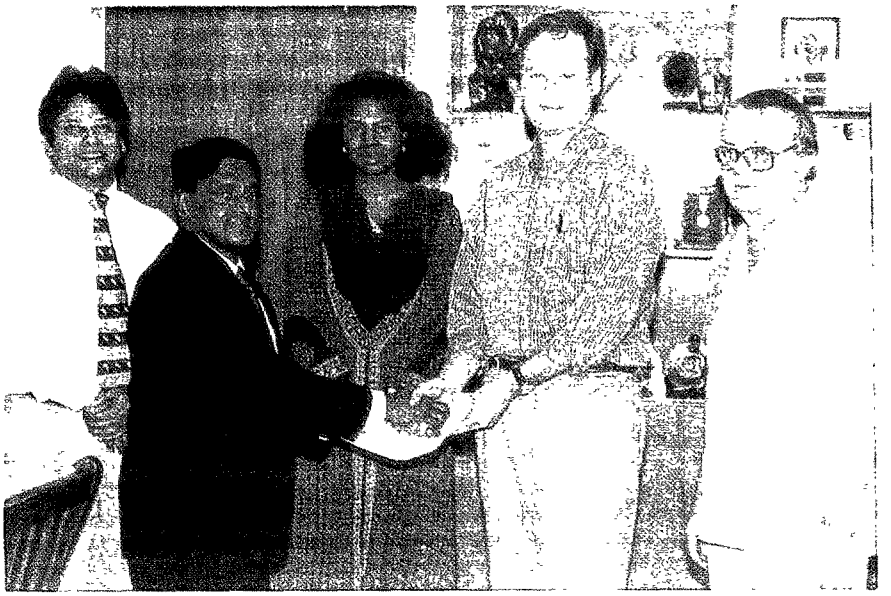
The Hon'ble Prime Minister of the People's Republic of Bangladesh Sheikh Hasina visited the Centre's Dhaka hospital on 28 September to witness first-hand the patient care provided during the post-flood epidemic of diarrhoeal diseases. The Hon'ble Prime Minister visited the Nutrition Rehabilitation Unit for severely malnourished children and the General Ward which housed a record number of patients and was expanded with a makeshift unit to accommodate the patient load during the epidemic.

Mr. Alexander Downer, Hon'ble Foreign Minister of Australia and Head of AusAID paid his visit to the Centre on 10 February.

Other distinguished guests in 1998 are listed below in alphabetical order of the names of organizations/countries:

ANZ Ladies Club: Members and officials; **Canada:** Ms Ingrid M. Hall, Director General of the Canadian International Development Agency (CIDA) who is in charge of the CIDA's South and South-East Asia Bureau under the Department of Foreign Affairs and International Trade; Ms Cecile Latour, Director of South Asia Division, CIDA Headquarters; H.E. Mr. Nicholas Etheridge, Canadian High Commissioner in Bangladesh; Ms Annick Amyot, First Secretary of CIDA, Canadian High Commission in

Many diplomats and high-ranking officials of the donor community visited the Centre at different times in 1998. In alphabetical order of the last name, the pictures show:



H.E. Mr. E.G. Dayananda, Sri Lankan High Commissioner in Bangladesh

Bangladesh; **Directorate of Health Services, Government of Bangladesh:** Prof. A.K.M. Nurul Anwar, Director General; **European Union:** Dr. Ines Perin, Desk Officer for Bangladesh in DG-I Wing and Ms Michaela Wright, Desk Officer for Bangladesh in the Science, Research & Development Wing of DG-XII; **Global Forum for Health Research:** Mr. Louis Currat, Executive Secretary; **Japan:** An eight-member team from the Japanese Organization for International Cooperation in Family Planning (JOICFP); Mr. Hiroyuki Aratake, an official of the Ministry of Foreign Affairs; H.E. Mr. Yoshikazu Kaneko, Ambassador of Japan to Bangladesh; Mr. Koji Tomita, Second Secretary, Embassy of Japan in Bangladesh; Mr. Tomohero Goto, Officer, Ministry of Foreign Affairs; **The Netherlands:** H.E. Mr. D.C.B. Den Haas, Ambassador of The Netherlands to Bangladesh; Mr. Tom Lan Sink, Desk Officer for Bangladesh in the Ministry of Foreign Affairs; Mrs. Marjan Kroon, First Secretary and Mr. Tapati Das, Adviser of the Dutch Embassy in Bangladesh; **Sweden:** H.E. Mr. Anders Johnson, Ambassador of Sweden to Bangladesh, accompanied by his wife Mrs. Johnson; Dr. Anita Sandstrom, Senior Research Officer, Department for Research Cooperation, SIDA/SAREC; **Swiss Agency for Development and Cooperation (SDC):** Mr. Walter Fust, Director General; Ms Suzzane Muller, Deputy Resident Coordinator of SDC-Dhaka Office; **UNICEF:** The Executive Board members: Ms Cheryl

H.E. Ms Christina Funes-Noppen, Ambassador of Belgium to Bangladesh

Mr Gordon West, Mission Director, USAID

Gordon (Jamaica), Mr. Heimo Laakkonen (Finland), H.E. Mr. Le Luong Minh (Vietnam), Mr. Sam Otuyelu (Nigeria), Dr. Fikret Pashayev (Azerbaijan), and Mr. Dino Berti (Switzerland); **United Kingdom:** A twelve-member delegation from the British Women's Association; Mr. Tom Cormick and Ms Dilruba Haider, Programme Officer, Dhaka Office of DfID; Mr. Scott Hardie, Adviser, Health and Population Division, DfID Headquarters; **United Nations Women's Association (UNWA) of Bangladesh:** A ten-member team; **United States of America:** Dr. Jane Menken, Professor of Sociology, University of Colorado at Boulder; Dr. Omar Rahman, Assistant Professor of Demography in the School of Public Health of Harvard University; Mr. Gordon West, Mission Director, USAID; Ms Chandi Duke Hefner, Duke Foundation; Mr. Tom Fox, Assistant Administrator of USAID/Washington; Dr. Andrew Clements, AAAS Fellow, USAID/Washington; **World Bank:** Mr. Richard Skolnik, Head of SASHP.

H.E. Mr. D.C.B. Den Haas, Ambassador of The Netherlands to Bangladesh

INSTITUTIONAL LINKAGES

International Level

(*in alphabetical order*)

All India Institute of Hygiene and Public Health, India; All India Institute of Medical Sciences, India; AMP/France; Army Medical Core (AMC), Armed Forces Research Institute of Medical Science (AFRIMS), Thailand; Australian National University, Australia; Centers for Disease Control and Prevention (CDC), USA; Centre for International Child Health (CICH), UK; Christian Medical College Hospital, India; East-West Population Center, USA; Free University of Brussels; St. Pierre University Hospital, Belgium; Harvard University, USA; Huddinge Hospital, Sweden; Institute of Child Health, UK; Institute of Tropical Medicine, Belgium; Institute of

Virology and Immunology, University of Wurzburg, Germany; Institute of Food Sciences, Switzerland; International Atomic Energy Agency, Austria; Johns Hopkins University, USA; Karolinska Institute, Sweden; London School of Hygiene & Tropical Medicine, UK; Louisiana State University Medical Center, USA; Macro International, Inc., USA; National Institute for Cholera and Enteric Diseases (NICED), India; National Institutes of Health (NIH), USA; National Institute of Standard Technology, USA; National Public Health Institute, Finland; Population Council, Bangladesh; Population Studies Center, University of Pennsylvania, USA; RAND Corporation, USA; Thrasher Research Foundation, USA; Tufts University, USA; Universite Libre De Bruxelles, Faculte De Medecine Et De Pharmacie, Ecole De Sante Publique, Campus Erasme, Belgium; University of Adelaide, Australia; University of Alabama at Birmingham, USA; University of Basel, Switzerland; University of California-Davis, USA; University of Connecticut, USA; University of Edinburgh, UK; University of Goteborg, Sweden; University of Helsinki, Finland; University of Maryland, USA; University of North Carolina at Chapel Hill, USA; University of Virginia-Charlottesville, USA; USAID/Bangladesh; USAID/Washington; Wageningen Agricultural University, The Netherlands; Walter Reed Army Institute for Research (WRAIR), USA; Water, Engineering and Development Centre (WEDC), UK; World Health Organization (WHO), Switzerland; Wyeth-Lederle Praxis, USA.

National Level

(in alphabetical order)

ARI Programme of the Government of Bangladesh; Bangabandhu Sheikh Mujib Medical University; Bangladesh-based International Evaluation Team of EPI; Bangladesh Institute of Development Studies; Bangladesh Integrated Nutrition Project (BINP); Bangladesh Institute of Research for Promotion of Essential and Reproductive Health & Technologies (BIRPERHT); Bangladesh Bureau of Statistics (BBS); Concerned Women for Family Planning; Department of Environment; Department of Public Health Engineering; Dhaka City Corporation; Dhaka Medical College Hospital; Dhaka Office of the World Bank; Dhaka Shishu Hospital; Dhaka WASA; Directorate General of Health Services; Directorate of Family Planning; Gonoshasthaya Kendra, Savar; Grameen Bank; Health and Population Project-V, Government of Bangladesh; Health Economics Unit of the Ministry of Health and Family Welfare; Holy Family Hospital; Institute of Nutrition and Food Science (University of Dhaka); Institute of Public Health and Nutrition; Jahangirnagar University; Kumudini Welfare Trust (Kumudini Hospital); Local Government Engineering Department; Ministry of Local Government, Rural Development and Cooperatives; Ministry of Science and Technology; National Institute of Preventive & Social Medicine (NIPSOM); National Nutrition Programme (NNP); Population, Development and Evaluation Unit, Ministry of Planning; Rajshahi University; Shahjalal University of Science & Technology; UNICEF Bangladesh; University of Dhaka; World Vision of Bangladesh; and a number of other NGOs.

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, 40 inter-division scientific fora were organized in 1998. A division-wise list of these fora is presented below:

Clinical Sciences Division

S.M. Akramuzzaman. Increased childhood morbidity after measles is short-term in urban Bangladesh

Iqbal Kabir and Iqbal Hossain. Nutrient absorption from a vegetable protein-based diet in malnourished children during recovery from shigellosis

Saskia Osendarp. Zinc supplementation during pregnancy: does it affect pregnancy outcome?

G.H. Rabbani. Food-borne cholera

G.H. Rabbani. Short-chain fatty acids, banana and diarrhoea: transition from molecule to man

M. Mujibur Rahman. Effect of long-term oral iron supplementation on morbidity and growth in malnourished Bangladeshi children

S.K. Roy. A randomized four-cell clinical trial of zinc and vitamin A in under-nourished children with persistent diarrhoea in Bangladesh

Shafiqul Alam Sarker. Evaluation of reduced-osmolarity oral rehydration solution in children with persistent diarrhoea

Damian Walker. Methods for estimating the cost-effectiveness of measles vaccination in Dhaka city

Health and Population Extension Division

Shafiul Azam Ahmed. Arsenic contamination of drinking water in Bangladesh

S.M. Tariq Azim. Improving early identification of ARI at community level through checklist for field workers

Irene Kranzlin. Problems, prospects, and sustainability: pond management in rural Bangladesh

A.B.M. Khorshed Alam Mozumder. Determinants of infant and child mortality in rural Bangladesh

Quamrun Nahar. Utilization of antenatal care in an urban area of Dhaka, Bangladesh

Zahidul Quayyum. An assessment of willingness to pay for MCH-FP services of selected urban NGO programmes

Zahidul Quayyum. Reducing drug cost through rationalization of diarrhoea and ARI case management at urban PHC level

M. Mafizur Rahman. Determinants of safe-delivery practices in rural Bangladesh

Laboratory Sciences Division

Tasnim Azim. Rotavirus and persistent diarrhoea

Joseph Bogaerts. Sexually transmitted infections among women attending the BWHC clinic in Mirpur

Shah M. Faruque. Molecular basis for the emergence of epidemic strains of *Vibrio cholerae*: role of the cholera toxin-converting bacteriophage

Rashidul Haque. Detection of *Entamoeba histolytica* infection: comparison of PCR, iso-enzyme analysis, and antigen detection

Dilara Islam. Down-regulation of the expression of the human antimicrobial peptide "LL-37" in patients with shigellosis

M. Sirajul Islam. Role of blue-green algae on seasonality and endemicity of cholera in Bangladesh: development of a model

V.I. Mathan. New ideas on the pathogenesis of cholera

Mitsuaki Nishibuchi. Pandemic spread of a clone of *Vibrio parahaemolyticus* serotype O3:K6

Rubhana Raqib. Innate defense mechanisms in acute shigellosis in children are different from that in adults

Mahbubur Rahman. Detection of *Streptococcus pneumoniae* and *Haemophilus influenzae* B from clinical samples by multiplex PCR

Motiur Rahman. Characterization of *Neisseria gonorrhoeae* strains isolated from commercial sex workers in Dhaka

M.A. Wahed. Short-term effect of β-carotene supplementation and antihelminthic therapy on the vitamin A status of preschool children in urban slums

Public Health Sciences Division

Disha Ali. Economic evaluation of hepatitis B vaccination in Bangladesh

Shams El Arifeen. Size and maturity at birth: a prospective study of infant growth and survival in the slums of Dhaka

Ishtiaq Bashir. Utilization patterns of healthcare services in urban Dhaka: a comparative analysis

Abbas Bhuiya. Gender and socioeconomic inequality in mortality in rural Bangladesh: recent trends and effect of health and poverty-alleviation programmes

Elizabeth. Predictive markers for HIV-associated *Dementia* and sensory neuropathy

Andres de Francisco. A strategy for reproductive health

Heidi Bart Johnston. Induced abortion: users and providers in Matlab

Lazeena Muna. Discourse of being at risk: assessing risk of contracting HIV for female adolescents in urban Dhaka

Mizanur Rahman. Influence of the Grameen Bank on fertility behaviour among the poor in rural Bangladesh

Abdur Razzaque. Desire for children and subsequent abortion in Matlab, Bangladesh

Rubina Shaheen. Healthcare utilization by pregnant, intrapartum and postpartum women in three villages in Bangladesh: an empirical study

ICDDR,B PUBLICATIONS 1998

A. Internal Publication Series

ICDDR,B Annual Report 1997. May 1998. 148 p.

Working Papers

1. Ahmed S, Islam A, Parveen SD. Infant feeding practices in rural Bangladesh: policy implications. Edited by M. Shamsul Islam Khan. 1998. iii, 14 p. (ICDDR,B working paper no. 108; Operations Research Project working paper no. 146)

2. Ahmed S, Khanum PA, Islam A. Maternal morbidity in rural Bangladesh: where do women go for care? Edited by M. Shamsul Islam Khan. 1998. vi, 30 p. (ICDDR,B working paper no. 113; Operations Research Project working paper no. 147)

3. Ahmed S, Sobhan F, Islam A. Neonatal morbidity and care-seeking behaviour in rural areas of Bangladesh. Edited by M. Shamsul Islam Khan. 1998. iv, 18 p. (ICDDR,B working paper no. 114; Operations Research Project working paper no. 148)

4. Ahsan SS, Thwin AA. Bangladesh's experiences with human resource development strategies in family planning service delivery: a critical look at the past and directions for the future. Edited by M. Shamsul Islam Khan. 1998. iv, 21 p. (ICDDR,B working paper no. 118; Operations Research Project working paper no. 152)

5. Desmet M, Bashir I, Sohel N. Demographic, socio-cultural and economic profile of slum residents in Dhaka-city, Bangladesh. Edited by Taskin Saadad. 1998. v, 76 p. (ICDDR,B working paper no. 110; Health Economics Programme working paper no. 3-98)

6. Desmet M, Bashir I, Sohel N. Direct and indirect health-care user expenditure by slum residents in Dhaka-city, Bangladesh. Edited by M. Shamsul Islam Khan and Taskin Saadad. 1998. vi, 94 p. (ICDDR,B working paper no. 112; Health Economics Programme working paper no. 5-98)

7. Hasan Y, Barkat-e-Khuda, Ashraf A. Performance planning and monitoring at the local level. Edited by M. Shamsul Islam Khan. 1998. iv, 17 p. (ICDDR,B working paper no. 107; Operations Research Project working paper no. 145)

8. Islam M, Kane TT, Barkat-e-Khuda, Reza MM, Hossain MB. Determinants of contraceptive use among married teenage women and newlywed couples. Edited by M. Shamsul Islam Khan. 1998. vi, 35 p. (ICDDR,B working paper no. 117; Operations Research Project working paper no. 151)

9. Kane TT, Hossain MB, Barkat-e-Khuda. Quality of care, client satisfaction, and contraceptive use in rural Bangladesh. Edited by M. Shamsul Islam Khan. 1998. vi, 24 p. (ICDDR,B working paper no. 104; Operations Research Project working paper no. 144)

10. Khan MM, Zhu N, Ling JC. Cooperative medical system in Taicang County of China: lessons for Bangladesh and other developing countries. 1998. vi, 16 p. (ICDDR,B working paper no. 109; Health Economics Programme working paper no. 02-98)

11. Khan MM, Al Mamun A, Ferdousy Z. Revenue and expenditure patterns of a tertiary hospital: case study of BIRDEM, Dhaka. 1998. vi, 29 p. (ICDDR,B working paper no. 108; Health Economics Programme working paper no. 01-98)

12. Levin A, Rahman MA, Quayyum Z, Routh S, Barkat-e-Khuda. Demand for child curative care in two rural thanas of Bangladesh:

effects of income and women's employment. Edited by M. Shamsul Islam Khan. 1998. iv, 24 p. (ICDDR,B working paper no. 116; Operations Research Project working paper no. 150)

13. Mozumder ABMKA, Barkat-e-Khuda, Kane TT. Determinants of infant and child mortality in rural Bangladesh. Edited by M. Shamsul Islam Khan. 1998. iv, 22 p. (ICDDR,B working paper no. 115; Operations Research Project working paper no. 149)

Scientific Reports

1. Mostafa G, Shaikh MAK, van Ginneken JK, Sarder AM. Demographic surveillance system—Matlab. V. 28. Registration of demographic events 1996. 1998. viii, 92 p. (ICDDR,B scientific report no. 82)

2. Razzaque A, Nahar L, Sarder AM, van Ginneken JK, Shaikh MAK. Demographic surveillance system—Matlab. V. 29. 1996 socio-economic census. 1998. ix, 72 p. (ICDDR,B scientific report no. 83)

Special Publications

1. Ahmed S, Khanum PA, Shams I. Referral and linkage for emergency obstetric care: a manual for programme managers. Edited by M. Shamsul Islam Khan. 1998. v, 76 p. (ICDDR,B special publication no. 85)

2. Begum S, Shafinaz S. Essential services package (ESP). Training manual. 1998. 54 p. (ICDDR,B special publication no. 74). [Bangla]

3. Begum S, Shafinaz S. Essential services package (ESP). Training module-1: antenatal care. 1998. 44 p. (ICDDR,B special publication no. 75). [Bangla]

4. Begum S, Shafinaz S. Essential services package (ESP). Training module-2: delivery care. 1998. 49 p. (ICDDR,B special publication no. 76). [Bangla]

5. Begum S, Shafinaz S. Essential services package (ESP). Training module-3: postnatal care. 1998. 33 p. (ICDDR,B special publication no. 77). [Bangla]

6. Begum S, Shafinaz S. Essential services package (ESP). Training module-4: infant feeding. 1998. 44 p. (ICDDR,B special publication no. 78). [Bangla]

7. Begum S, Shafinaz S. Essential services package (ESP). Training module-5: EPI. 1998. 49 p. (ICDDR,B special publication no. 79). [Bangla]

8. Begum S, Shafinaz S. Essential services package (ESP). Training module-6: management of acute respiratory infection. 1998. 77 p. (ICDDR,B special publication no. 80). [Bangla]

9. Begum S, Shafinaz S. Essential services package (ESP). Training module-7: management of diarrhoeal diseases. 1998. 54 p. (ICDDR,B special publication no. 81). [Bangla]

10. Begum S, Shafinaz S. Essential services package (ESP). Training module-8: family planning. 1998. 99 p. (ICDDR,B special publication no. 82). [Bangla]

11. Begum S, Shafinaz S. Essential services package (ESP). Training module-9: management of reproductive tract infection/sexually transmitted disease. 1998. 146 p. (ICDDR,B special publication no. 83). [Bangla]

12. Begum S, Begum S. Essential services package (ESP). Training module-10: skin diseases. 1998. 30 p. (ICDDR,B special publication no. 84). [Bangla]

13. Hoque BA, Ahmed SA, Mahmud AA, Ahmad AU, Shafique SAKM. Proceedings of the Workshop on Action Research on Social Mobilization for Sanitation, Dhaka, 15-16 February 1997. Edited by: M. Shamsul Islam Khan. Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh, 1997. 39 p. (ICDDR,B special publication no. 62)*

14. Operations Research Project. The essential services package (ESP): protocols for primary health care. 1998. 46 p. (ICDDR,B special publication no. 67).

15. Khanum PA, Ahmed S, Rahman S, Parveen SD. Manual for the use of pictorial card and pregnant women register for emergency obstetric care. Edited by M. Shamsul Islam Khan. 1998. iv, 25 p. (ICDDR,B special publication no. 71)

16. Nutrition and emerging/re-emerging infectious diseases; programme and abstracts of the Seventh Annual Scientific Conference (ASCON VII) of the International Centre for Diarrhoeal Disease Research, Bangladesh, Dhaka, 14-15 February 1998. Edited by M. Shamsul Islam Khan and M.A. Rahim. 1998. viii, 144 p. (ICDDR,B special publication no. 68)

17. Uddin MJ, Bhuiyan MA, Uddin MA, Khatun J. Manual for urban health and family planning coordination committees. Edited by M. Shamsul Islam Khan. 1998. iii, 33 p. (ICDDR,B special publication no. 70)

18. van Ginneken J, Bairagi R, de Francisco A, Sarder AM, Vaughan P. Health and demographic surveillance in Matlab: past, present and future. Edited by Gillian Duffy. 1998. viii, 44 p. (ICDDR,B special publication no. 72)

Journal and Newsletters

1. Journal of Diarrhoeal Diseases Research (also includes: Bibliography on Diarrhoeal Diseases). V.15, no.4, 1997* and V.16, no.1-3, 1998

2. Glimpse. V.19, no.4, 1997* and V.20, no.1-3, 1998

3. Shasthya Sanglap. V.6, no.1-3, 1997* and V.7, no.1-2, 1998

4. DISC Bulletin. V.22, no.1-12, 1998 and Electronic DISC Bulletin. No.9-31, 1998

5. ICDDR,B News. V.8, no.4, 1997* and v.9, no.1-2, 1998

B. Original Scientific Papers (including short reports)

1. Ahmed MK, Rahman M, van Ginneken J. Induced abortion in Matlab, Bangladesh: trends and determinants. Int Fam Plann Perspect 1998 Sep;24(3):128-32

2. Ahmed SA, Hoque BA, Mahmud A. Water management practices in rural and urban homes: a case study from Bangladesh on ingestion of polluted water. Public Health 1998 Sep;112(5):317-21

3. Ahmed SM, Adams A, Chowdhury AMR, Bhuiya A. Chronic energy deficiency in women from rural Bangladesh: some socioeconomic determinants. J Biosoc Sci 1998 Jul;30(3):349-58

4. Ahmed SM, Adams A, Chowdhury AMR, Bhuiya A. Income-earning women from rural Bangladesh: changes in attitude and knowledge. Empowerment 1997;4:1-12*

5. Ahmed T, Sumazaki R, Shin K, Nagai Y, Shibasaki M, Fuchs GJ, Takita H. Humoral immune and clinical responses to food antigens following acute diarrhoea in children. J Paediatr Child Health 1998 Jun;34(3):229-32

6. Alam N, David PH. Infant and child mortality in Bangladesh: age-specific effects of previous child's death. J Biosoc Sci 1998 Jul;30(3):333-48

7. Alam NH, Meier R, Rausch T, Meyer-Wyss B, Hildebrand P, Schneider H, Bachmann C, Minder E, Fowler B, Gyr K. Effects of a partially hydrolyzed guar gum on intestinal absorption of carbohydrate, protein and fat: a double-blind controlled study in volunteers. Clin Nutr 1998;17:125-9

8. Albert MJ, Faruque ASG, Mahalanabis D. Association of *Providencia alcalifaciens* with diarrhea in children [note]. J Clin Microbiol 1998 May;36(5):1433-5

9. Ashraf H, Rahman MM, Fuchs GJ, Mahalanabis D. Folic acid in the treatment of acute watery diarrhoea in children: a double-blind, randomized, controlled trial. Acta Paediatr 1998 Nov;87(11):1113-5

10. Bairagi R, Ahsan RI. Inconsistencies in the findings of child nutrition surveys in Bangladesh. Am J Clin Nutr 1998 Dec;68(6):1267-71

11. Baqui AH, Black RE, Arifeen SE, Hill K, Mitra SN, Al Sabir A. Causes of childhood deaths in Bangladesh: results of a nationwide verbal autopsy study. Bull WHO 1998;76(2):161-71

12. Bardhan PK, Sarker SA, Mahalanabis D, Rahman MM, Hildebrand P, Beglinger C, Fuchs G, Gyr N. *Helicobacter pylori* infection in infants and children of Bangladesh. Schweiz Rundsch Med Prax 1998 Dec 24;87(51-52):1814-6

13. Bardhan PK, Albert MJ, Alam NH, Faruque SM, Neogi PKB, Mahalanabis D. Small bowel and fecal microbiology in children suffering from persistent diarrhea in Bangladesh. J Pediatr Gastroenterol Nutr 1998 Jan;26(1):9-15

14. Basu A, Mukhopadhyay AK, Sharma C, Jyot J, Gupta N, Ghosh A, Bhattacharya SK, Takeda Y, Faruque ASG, Albert MJ, Nair GB. Heterogeneity in the organization of the *CTX* genetic element in strains of *Vibrio cholerae* O139 Bengal isolated from Calcutta, India and Dhaka, Bangladesh and its possible link to the dissimilar incidence of O139 cholera in the two locales. Microb Pathog 1998 Mar;24(3):175-83

15. Becker S, Weng S. Seasonal patterns of deaths in Matlab, Bangladesh. Int J Epidemiol 1998 Oct;27(5):814-23

16. Bhuiyan BU, Miah RA, Rahman M, Rahman KM, Albert MJ. High prevalence of ciprofloxacin resistance amongst strains of *Neisseria gonorrhoeae* isolated from commercial sex workers in Bangladesh. J Antimicrob Chemother 1998 Nov;42(5): 675-6

17. Caldwell JC, Caldwell P, Caldwell BK, Pieris I. The construction of adolescence in a changing world: implications for sexuality, reproduction, and marriage. Stud Fam Plann 1998 Jun;29(2):137-53

18. Casswall TH, Sarker SA, Albert MJ, Fuchs GJ, Bergstrom M, Björck L, Hammarström L. Treatment of *Helicobacter pylori* infection in infants in rural Bangladesh with oral immunoglobulins from hyperimmune bovine colostrum. Aliment Pharmacol Ther 1998 Jun;12(6):563-8

19. de Francisco A, Chakraborty J. Adherence to cotrimoxazole treatment for acute lower respiratory tract infections in rural Bangladeshi children. Ann Trop Paediatr 1998 Mar;18(1):17-21

20. de Francisco A, Hall AJ, Unicomb L, Chakraborty J, Yunus M, Sack RB. Maternal measles antibody decay in rural Bangladeshi infants—implications for vaccination schedules. Vaccine 1998 Apr;16(6):564-8

21. Dewan N, Faruque ASG, Fuchs GJ. Nutritional status and diarrhoeal pathogen in hospitalized children in Bangladesh. Acta Paediatr 1998 Jun;87(6):627-30

22. Ehara M, Iwami M, Ichinose Y, Hirayama T, Albert MJ, Sack RB, Shimodori S. Induction of fimbriated *Vibrio cholerae* O139. Clin Diagn Lab Immunol 1998 Jan;5(1):65-9

23. Elliott SJ, Srinivas S, Albert MJ, Alam K, Robins-Browne RM, Gunzburg ST, Mee BJ, Chang BJ. Characterization of the roles of hemolysin and other toxins in enteropathy caused by alpha-hemolytic *Escherichia coli* linked to human diarrhea. Infect Immun 1998 May;66(5):2040-51

24. Faruque ASG, Salam MA, Faruque SM, Fuchs GJ. Aetiological, clinical and epidemiological characteristics of a seasonal peak of diarrhoea in Dhaka, Bangladesh. Scand J Infect Dis 1998;30(4):393-6

25. Faruque ASG, Teka T, Fuchs GJ. Shigellosis in children: a clinico-epidemiological comparison between *Shigella dysenteriae* type I and *Shigella flexneri.* Ann Trop Pediatr 1998 Sep;18(3):197-201

26. Faruque SM, Asadulghani, Saha MN, Alim ARMA, Albert MJ, Islam KMN, Mekalanos JJ. Analysis of clinical and environmental strains of nontoxigenic *Vibrio cholerae* for susceptibility to CTXΦ: molecular basis for origination of new strains with epidemic potential. Infect Immun 1998 Dec;66(12):5819-25

27. Faruque SM, Asadulghani, Alim ARMA, Albert MJ, Islam KMN, Mekalanos JJ. Induction of the lysogenic phage encoding cholera toxin in naturally occurring strains of toxigenic *Vibrio cholerae* O1 and O139. Infect Immun 1998 Aug;66(8):3752-7

28. Haque R, Ali IKM, Akther S, Petri WA, Jr. Comparison of PCR, isoenzyme analysis, and antigen detection for diagnosis of *Entamoeba histolytica* infection. J Clin Microbiol 1998 Feb;36(2):449-52

29. Haskell MJ, Islam MA, Handelman GJ, Peerson JM, Jones AD, Wahed MA, Mahalanabis D, Brown KH. Plasma kinetics of an oral dose of [$^2H_4$] retinyl acetate in human subjects with estimated low or high total body stores of vitamin A. Am J Clin Nutr 1998 Jul;68(1):90-5

30. Hawkes S. Why include men? Establishing sexual health clinics for men in rural Bangladesh. Health Pol Plann 1998 Jun;13(2):121-30

31. Helander A, Wennerås C, Qadri F, Svennerholm A-M. Antibody responses in humans against coli surface antigen 6 of enterotoxigenic *Escherichia coli.* Infect Immun 1998 Sep;66(9):4507-10

32. Hossain MA, Rahman M, Ahmed QS, Malek MA, Sack RB, Albert MJ. Increasing frequency of mecillinam-resistant *Shigella* isolates in urban Dhaka and rural Matlab, Bangladesh: a 6 year observation. J Antimicrob Chemother 1998 Jun;42(1):99-102

33. Hossain MI, Kabir AKMI, Khan WA, Fuchs GJ. *Acinetobacter bacteraemia* in patients with diarrhoeal disease. Epidemiol Infect 1998 Mar-Apr;120(2):139-42

34. Hossain MI, Kabir I, Fuchs GJ, McCutcheon MJ, Alvarez JO, Khaled MA. Intra- and extracellular water dynamics on rehydration in cholera and noncholera patients. Dig Dis Sci 1998 Mar;43(3):663-7

35. Hossain S, Biswas R, Kabir I, Sarker S, Dibley M, Fuchs G, Mahalanabis D. Single dose vitamin A treatment in acute shigellosis in Bangladeshi children: randomised double blind controlled trial. Br Med J 1998 Feb 7;316(7129):422-6

36. Islam MM, Al Mamun A, Bairagi R. Fertility and its proximate determinants in Bangladesh: evidence from the 1993/94 demographic and health survey. Asia-Pacific Pop J 1998 Sep;13(3):3-22

37. Islam S, Faruque ASG, Fuchs GJ, Wahed MA, Mahalanabis D. Shelf-life of pre-cooked rice oral rehydration salt packets. Southeast Asian J Trop Med Public Health 1997 Dec;28(4):862-4*

38. Jenkins C. Small but strong: cultural concepts of (Mal-)nutrition among the Kwanga (East Sepik Province, PNG). Papua New Guinea Med J 1998;39:153-4

39. Kabir I, Rahman MM, Haider R, Mazumder RN, Khaled MA, Mahalanabis D. Increased height gain of children fed a high-protein diet during convalescence from shigellosis: a six-month follow-up study. J Nutr 1998 Oct;128(10):1688-91

40. Kane TT, Gueye M, Speizer I, Pacque-Margolis S, Baron D. The impact of a family planning multimedia campaign in Bamako, Mali. Stud Fam Plann 1998 Sep;29(3):309-23

41. Khaled MA, Sarker SA. Changes of oxidant and antioxidant status in humans due to *H. pylori* infection. Nutr Res 1998 Sep;18(9):1463-8

42. Khan MM, Jamal AMM. Market based price support program: an alternative approach to large scale food procurement and distribution system. Food Pol 1997 Dec;22(6):475-86*

43. Koenig MA, Roy NC, McElrath T, Shahidullah M, Wojtyniak B. Duration of protective immunity conferred by maternal tetanus toxoid immunization: further evidence from Matlab, Bangladesh. Am J Public Health 1998 Jun;88(6):903-7

44. Landersjo C, Weintraub A, Ansaruzzaman M, Albert MJ, Widmalm G. Structural analysis of the O-antigenic polysaccharide from *Vibrio mimicus* N-1990. Eur J Biochem 1998 Feb 1;251(3):986-90

45. Mitra AK, Alvarez JO, Wahed MA, Fuchs GJ, Stephensen CB. Predictors of serum retinol in children with shigellosis. Am J Clin Nutr 1998 Nov;68(5):1088-94

46. Mitra AK, Alvarez JO, Guay-Woodford L, Fuchs GJ, Wahed MA, Stephensen CB. Urinary retinol excretion and kidney function in children with shigellosis. Am J Clin Nutr 1998 Nov;68(5):1095-103

47. Mitra R, Saha PK, Basu I, Venkataraman A, Ramakrishna BS, Albert MJ, Takeda Y, Nair GB. Characterization of non-membrane-damaging cytotoxin of non-toxigenic *Vibrio cholerae* O1 and its relevance to disease. FEMS Microbiol Lett 1998 Dec 15;169(2):331-9

48. Perry H, Weierbach R, Arifeen SE, Hossain I. A comprehensive assessment of the quality of immunization services in one major area of Dhaka city, Bangladesh. Trop Med Int Health 1998 Dec;3(12):981-92

49. Perry H, Weierbach R, Hossain I, Islam R. Tetanus toxoid immunization coverage among women in Zone 3 of Dhaka city: the challenge of reaching all women of reproductive age in urban Bangladesh. Bull WHO 1998;76(5):449-57

50. Qadri F, Mäkelä PH, Holmgren J, Albert MJ, Mannoor K, Kantele A, Saha D, Salam MA, Kantele JM. Enteric infections in an endemic area induce a circulating antibody-secreting cell response with homing potentials to both mucosal and systemic tissues. J Infect Dis 1998 Jun;177(6):1594-9

51. Rahman M. The effect of child mortality on fertility regulation in rural Bangladesh. Stud Fam Plann 1998 Sep;29(3):268-81

52. Rahman M, Rahman ATMA. The growing antibiotic resistance: a crisis needs rational use of antibiotics. Orion Med J 1998 Sep;1:3-4

53. Rahman M, Jonsson A-B, Holme T. Monoclonal antibodies to the epitope α-Gal-(1-4)-β-Gal-(1- of *Moraxella catarrhalis* LPS react with a similar epitope in type IV pili of *Neisseria meningitidis*. Microb Pathog 1998 May;24(5):299-308

54. Rahman MM, Alvarez JO, Mahalanabis D, Wahed MA, Islam MA, Unicomb L, Habte D, Fuchs GJ. Effect of vitamin A administration on response to oral polio vaccination. Nutr Res 1998;18(7):1125-33

55. Rahman MM, Mahalanabis D, Sarker SA, Bardhan PK, Alvarez JO, Hildebrand P, Beglinger C, Gyr K. *Helicobacter pylori* colonization in infants and young children is not necessarily associated with diarrhoea. J Trop Pediatr 1998 Oct;44(5):283-7

56. Razzaque A, Islam MM, Alam N. Contraception among limiters and spacers in Matlab, Bangladesh. Asia-Pacific Pop J 1998 Mar;13(1):65-78

57. Razzaque A, Hossain S, Rahman H, Alam N. Health behavior, perceptions, practices, and decision making: sub-national and socio-demographic differentials in Bangladesh, 1995. Southeast Asian J Trop Med Public Health 1997 Dec;28(4):865-72*

58. Ronsmans C, Vanneste AM, Chakraborty J, van Ginneken J. A comparison of three verbal autopsy methods to ascertain levels and causes of maternal deaths in Matlab, Bangladesh. Int J Epidemiol 1998 Aug;27(4):660-6

59. Ronsmans C, Campbell O. Short birth intervals don't kill women: evidence from Matlab, Bangladesh. Stud Fam Plann 1998 Sep;29(3):282-90

60. Ross JL, Laston SL, Nahar K, Muna L, Nahar P, Pleto PJ. Women's health priorities: cultural perspectives on illness in rural Bangladesh. Health 1998 Jan;2(1):91-110

61. Roy SK, Islam A, Ali R, Islam KE, Khan RA, Ara SH, Saifuddin NM, Fuchs GJ. A randomized clinical trial to compare the efficacy of erythromycin, ampicillin and tetracycline for the treatment of cholera in children. Trans R Soc Trop Med Hyg 1998 Jul-Aug;92(4):460-2

62. Roy SK, Tomkins AM, Mahalanabis D, Akramuzzaman SM, Haider R, Behrens RH, Fuchs G. Impact of zinc supplementation on persistent diarrhoea in malnourished Bangladeshi children. Acta Paediatr 1998 Dec;87(12):1235-9

63. Salam MA, Dhar U, Khan WA, Bennish ML. Randomised comparison of ciprofloxacin suspension and pivmecillinam for childhood shigellosis. Lancet 1998 Aug 15;352(9127):522-7

64. Salway S. The contraceptive potential of lactation for Bangladeshi women. Asia-Pacific Pop J 1998 Dec;13(4):3-32

65. Salway S, Nurani S. Postpartum contraceptive use in Bangladesh: understanding users' perspectives. Stud Fam Plann 1998 Mar;29(1):41-57

66. Salway S, Nurani S. Uptake of contraception during postpartum amenorrhoea: understandings and preferences of poor, urban women in Bangladesh. Soc Sci Med 1998 Oct;47(7):899-909

67. Sarker SA, Casswall TH, Mahalanabis D, Alam NH, Albert MJ, Brussow H, Fuchs GJ, Hammerstrom L. Successful treatment of rotavirus diarrhea in children with immunoglobulin from immunized bovine colostrum. Pediatr Infect Dis J. 1998 Dec;17(12):1149-54

68. Senchenkova SN, Zatonsky GV, Shashkov AS, Knirel YA, Jansson P-E, Weintraub A, Albert MJ. Structure of the O-antigen of *Vibrio cholerae* O155 that shares a putative D-galactose 4, 6-cyclophosphate-associated epitope with *V. cholerae* O139 Bengal. Eur J Biochem 1998 May 15;254(1):58-62

69. Shaikh K. The social and demographic correlates of divorce in rural Bangladesh. Asia-Pacific Pop J 1998 Sep;13(3):23-40

70. Unicomb LE, Banu NN, Azim T, Islam A, Bardhan PK, Faruque ASG, Hall A, Moe CL, Noel JS, Monroe SS, Albert MJ, Glass RI. Astrovirus infection in association with acute, persistent and nosocomial diarrhea in Bangladesh. Pediatr Infect Dis J 1998 Jul;17(7):611-4

C. Review Articles, Book Chapters, Papers in Conference Proceedings, and Monographs

1. Ahmed J, Hawkes S, Khan K, Chaklader H. Report of community-based knowledge, attitudes and practices (KAP) survey among commercial sex workers residing in Taan Bazar brothel. *In*: Akhter N, Chaklader H, Ahmed J, Sun-yat KR. BWHC study series, 1996-1997. Dhaka: Bangladesh Women's Health Coalition, 1997:22-36*

2. Ahmed SM, Chowdhury M, Bhuiya A. Two studies on health care-seeking behaviour and household sanitation practices of BRAC member and non-member households in Matlab, Bangladesh. Dhaka: BRAC-ICDDR,B Joint Research Project, 1998. iii, 19 p. (Socioeconomic development and human well-being working paper no. 22)

3. Ahmed T, Fuchs GJ. Gastrointestinal allergy to food: a review. J Diarrhoeal Dis Res 1997 Dec;15(4):211-23*

4. Chowdhury AMR, Vaughan JP, Chowdhury S, Abed FH. Demystifying the control of tuberculosis in rural Bangladesh. *In*: Marie J, editor. "Tuberculosis": an international perspective. London: Imperial College Press, 1998:393-412

5. Faruque SM, Albert MJ, Mekalanos JJ. Epidemiology, genetics, and ecology of toxigenic *Vibrio cholerae*. Microbiol Molecul Biol Rev 1998 Dec;62(4):1301-14

6. Fuchs GJ. Possibilities for zinc in the treatment of acute diarrhea. Am J Clin Nutr 1998 Aug;68(2 Suppl):480S-3S

7. Habte D. Development of mother-child health (MCH) services in Matlab, Bangladesh. *In*: Proceedings of the Symposium on Third World Children: To Be or Not To Be, Zaterdag, Amsterdam, 14 November 1992. Amsterdam: Dutch Save the Children, 1992:13-26*

8. Hoque BA, Chowdhury JTA, Chowdhury UK, Al Mahmud A, Ahmad T, Islam R, Ahmed SA, Abedin Z, Shafique SAKM. Measurement and mitigation of arsenic in drinking water: action research challenges. *In*: Hoque BA, Ahmed SA, Morshed G, Shafique SAKM, Kabir BN, editors. Measurement and mitigation strategies for arsenic in drink-

ing water at the field level: outcome of a workshop, Dhaka, 30-31 March 1998. Dhaka: World Bank, 1998:53-62

9. Hoque BA, Ahmed SA, Morshed G, Shafique SAKM, Kabir BN, editors. Measurement and mitigation strategies for arsenic in drinking water at the field level: outcome of a workshop, Dhaka, 30-31 March 1998. Dhaka: World Bank, 1998. 80 p.

10. Islam MS, Drasar BS, Sack RB. Ecology of *Vibrio cholerae*: role of aquatic fauna and flora. *In*: Drasar BS, Forrest BD, editors. Cholera and the ecology of *Vibrio cholerae*. London: Chapman & Hall, 1996:187-227*

11. Khan MM, Yoder RA. Expanded program on immunization in Bangladesh: cost, cost-effectiveness, and financing estimates. Bethesda, MD: Partnerships for Health Reform Project, Abt Associates Inc., 1998. xv, 61 p. (PHR technical report no. 24)

12. Khan MSI. Information support for the rural people. *In*: Abdullah M, compiler and editor. Proceedings of the Regional Workshop on Agricultural Information Needs, Mode, Mechanism and Information Flow in SAARC Countries, Dhaka, 31 March-2 April 1997. Dhaka: SAARC Agricultural Information Centre, 1998:53-66

13. Khan WA, Bennish ML, Seas C, *et al.* Randomised controlled comparison of single-dose ciprofloxacin and doxycycline for cholera caused by *Vibrio cholerae* O1 or O139. *In*: Keusch GT, editor. The year book of infectious diseases. St. Louis, MO: Mosby, Inc., 1998:21-24

14. Mahmud S, Huda S. Participation in BRAC's rural development programme and the impact of group dynamics on individual outcomes. Dhaka: BRAC-ICDDR,B Joint Research Project, 1998. ii, 25 p. (Socioeconomic development and human well-being working paper no. 24)

15. Majumder AK, Islam SMS, Bhuiya AU. Health behaviour and practice in a rural community in Bangladesh. Chittagong: University of Chittagong, 1993. vii, 151 p.*

16. Petri W, Jr., Haque R. Molecular diagnosis of amebiasis: distinguishing pathogenic *Entamoeba histolytica* from nonpathogenic *Entamoeba dispar*. *In*: Tada I, Kojima S, Tsuji M, editors. Proceedings of the 9th International Congress of Parasitology, Chiba, 24-28 August 1998:353-8

17. Rabbani GH, Islam A. Giardiasis in humans: populations most at risk and prospects for control. *In*: Thompson RCA, Reynoldson JA, Lymbery AJ, editors. *Giardia*: from molecules to disease. Wallingford: CAB International, 1994 (reprinted 1997):217-49*

18. Rabbani GH. Foodborne cholera. *In*: Foodborne infections and intoxications; proceedings of the 4th World Congress, Berlin, 7-12 June 1998. Berlin: Federal Institute for Health Protection of Consumers and Veterinary Medicine, 1998:107-19

19. Roy RD, Hyder SMZ, Chowdhury M, Adams A. Does involvement of women in BRAC influence sex bias in intra-household food distribution? Dhaka: BRAC-ICDDR,B Joint Research Project, 1998. ii, 19 p. (Socioeconomic development and human well-being working paper no. 25)

21. Salam MA. Antimicrobial therapy for shigellosis: issues on antimicrobial resistance. Jpn J Med Sci Biol 1998;51(Suppl 1):S43-62

22. Salam MA. Management of multidrug resistance in chemotherapy of shigellosis. *In*: Singhal RL, Sood OP, editors. Drug resistance: mechanisms and management; proceedings of the Fourth Annual Ranbaxy Science Foundation Symposium, New Delhi, 13 November 1997. New Delhi: Ranbaxy Science Foundation, 1997:73-85*

23. Three studies on HIV/AIDS: I. AIDS knowledge in rural Bangladesh / EL Fulton, N Kamal, SM Ahmed, MI Khan. II. Providing AIDS awareness education through village based women's organizations / Hashima-e-Nasreen, M Chowdhury, SM Ahmed, A Bhuiya, AKMM Rana. III. Communication network in reproductive health information dissemination to the adolescents/Hashima-e-Nasreen, M Chowdhury, A Bhuiya, SM Ahmed, A Aziz, AKMM Rana. Dhaka: BRAC-ICDDR,B Joint Research Project, 1998. 20+24+15 p. (Socioeconomic development and human well-being working paper no. 21)

24. Two studies on nutrition: I. Effect of BRAC's rural development programme on calorie consumption: evidence from Matlab/M Khatun, SMZ Hyder, A Bhuiya, M Chowdhury. II. Prevalence of chronic energy deficiency in the elderly population of Matlab/S Rasheed, SMZ Hyder, M Khatun, M Chowdhury. Dhaka: BRAC-ICDDR,B Joint Research Project, 1998. 14+18 p. (Socioeconomic development and human well-being working paper no. 26)

D. Letters, Editorials, Annotations, and Abstracts in Journals

1. Ahmed S, Yousuf HKM, Mondal HN. Effect of lathyrus protein concentrate on the growth of children (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):40

2. Ahmed S, Sobhan F, Islam A. Neonatal morbidity and care-seeking behaviour in two rural areas of Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):136

3. Ahmed T, Ali M, Ullah M, Choudhury IA, Begum B, Haque ME, Shameem I, Das RC, Zaman B, Wares S, Mondal PK, Khan AM, Alam NH, Salam MA, Rabbani GH, Suskind R, Fuchs GJ. Standardized management reduces mortality among severely malnourished children with diarrhoea (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):42-3

4. Akhtar M, Selim KI, Huq KM, Majumder MK, Roy SK, Rahman MF. Bangladesh-Australia Child Health Project: a child-to-child and child-to-parent approach for nutrition and health education (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):123-4

5. Alam DS, Yunus M, Aziz KMA, de Francisco A, Haque E, van Raaij JMA, Fuchs GJ. Birth weight and its association with maternal nutrition and socioeconomic variables in rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):21

6. Alam DS, Yunus M, Rahman A, Chowdhury HR, Vaughan JP. Impact of community-based intervention on diarrhoea through oral rehydration therapy on hospitalization of children aged less than five years in rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):140

7. Alam NH, Faruque ASG, Dewan N, Sarkar SA, Fuchs GJ. Risk factors for severe persistent diarrhoea [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):254

8. Alamgir SU, Tunon C, Arifeen SE, Baqui AH, Bhuiyan MA, Uddin J. Improving availability of and access to an essential health services package in urban Dhaka, Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):137-8

9. Ali D, Khan MM. Evaluating the alternative strategies for hepatitis A and B vaccination in Bangladesh: an economic analysis (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):143

10. Al Mamun A, Juncker T. Health conditions of pregnant women and perinatal mortality in a slum of Dhaka city, Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):99-100

11. Amin S, Tunon C, Arifeen SE, Baqui AH, Khanam R, Manaf S. Implementation of the essential services package through standardized service delivery protocols (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):131-2

12. Arifeen SE, Black RE, Antelman G, Nahar Q, Alamgir S, Mahmud H, Baqui AH. Determinants of infant growth in the slums of Dhaka city: size and maturity at birth and breast-feeding (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):21-2

13. Arifeen SE, Black RE, Antelman G, Nahar Q, Mahmud H, Alamgir S, Baqui AH. Effect of birth weight, intrauterine growth retardation and prematurity on infant survival: a prospective study in the slums of Dhaka city (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):25

14. Arifeen SE, Black RE, Antelman G, Baqui AH. Exclusive breast-feeding reduces ARI and diarrhoea deaths among infants in Dhaka slums (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):38-9

15. Arifeen SE, Black RE, Antelman G, Baqui AH. Infant growth patterns in the slums of Dhaka in relation to birth weight, intrauterine growth retardation, and prematurity (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):119-20

16. Azad AK, Islam M, Islam R, Salam MA, Hoque SS, Alam AN, Butler T. Aetiology and pathogenesis of chronic diarrhoeal illness in adults (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):104

17. Azim SMT, Mookherji S, Baqui AH. Incorporation of checklists in clinic information system supports the delivery of quality essential health services (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):133

18. Bairagi R, Ahsan RI. Inconsistencies in the findings of the Bangladesh child nutrition surveys (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):47

19. Brooks WA, Fuchs GJ. Recent advances in research on zinc and child health in developing countries [editorial]. Indian Pediatr 1998 Dec;35(12):1173-6

20. Chowdhury S, Chowdhury TA, Roy SK, Nessa A, Ali S. Impact of lactational performance on calcium metabolism through bone mass density in marginally nourished Bangladeshi women (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):57

21. de Francisco A, Chakraborty J, Ahmed F. Comparison of anthropometrical indicators between malnourished children admitted to a Nutrition Rehabilitation Unit and their counterparts in a community (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):26

22. de Francisco A, Azim T, Hawkes S, Alam N, Hall AJ. Perinatal transmission of hepatitis B in rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):92

23. Desmet M, Bashir I, Sohel N. Effects of ill health on income-earning capacity among urban poor in Bangladesh [abstract]. J Epidemiol 1998 Jan;8(1 Suppl):63

24. Dhar U, Ryan ET, Khan WA, Faruque ASG, Salam MA, Calderwood SB, Fuchs GJ, Bennish ML. Risk factors for death from cholera [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):248

25. Eubanks AC, Lyerly DM, Haque R, and Petri WA. Evaluation of a new second generation ELISA specific for *Entamoeba histolytica* [abstract]. Am J Trop Med Hyg 1998 Sep;59(3 Suppl):202

26. Faruque ASG, Hamadani JD, Hoque SS, Mahalanabis D. A picture calendar to promote oral rehydration therapy at home for illiterate mothers: a motivational tool [letter]. J Trop Pediatr 1998 Jun;44(3):182-3

27. Faruque SM, Asadulghani, Alim ARMA, Siddique AK, Mekalanos JJ, Albert MJ. Molecular analysis of toxigenic *Vibrio cholerae* strains isolated in Bangladesh during 1961-1996: relationship between continual emergence of new toxigenic clones and epidemics of cholera (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):95

28. Fuchs GJ, Tienboon P, Khaled MA, Nimsakul S, Linpisarn S, Faruque ASG, Suskind RM. Nutrition support and growth in thalassemia major [abstract]. FASEB J 1996 Mar 8;10(3):A788*

29. Fuchs GJ, Mahalanabis D, Alnwick D. Symposium and Workshop on Zinc and Health in South Asia; report and recommendations. Indian Pediatr 1998;35:1193-4

30. Haider R, Ashworth A, Kabir I, Huttly SRA. Initial breast-feeding practices of urban mothers can be influenced by peer counselling (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):37-8

31. Haider R, Ashworth A, Kabir I, Huttly SRA. Peer counsellors improve early postpartum breastfeeding practices in an urban community in Dhaka, Bangladesh [abstract]. Proc Nutr Soc 1998 Feb;57(1):63A

32. Hall A, Nahar Q. Albendazole as a treatment for infections with *Giardia intestinalis* in children in Bangladesh [abstract]. *In*: Thompson RCA, Reynoldson JA, Lymbery AJ, editors. *Giardia*: from molecules to disease. Wallingford: CAB International, 1994:373*

33. Hamadani JD, Dewan N, Faruque ASG. Clinical and etiological characteristics of patients readmitted into a diarrhoeal hospital [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):247

34. Hoque BA, Ahmed SA, Chowdhury UK, Chowdhury JTA, Morshed G, Maynard DM, Frisbie SH. Arsenic in drinking water: an emerging environmental health challenge (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):108

35. Hossain MI, Kabir AKMI, Khan WA, Fuchs GJ. An uncommon bacteraemia in diarrhoeal patients by *Acinetobacter* spp. [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):263

36. Hossain S, Salam MA, Fuchs GJ, Rabbani GH, Biswas R, Mahalanabis D. Clinical and laboratory features of severe cholera due to *Vibrio cholerae* O139 Bengal: a descriptive study [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):264

37. Iftekhar NT, Qadri F, Rahman M, Amin MR, Rahman KM. Immunoblot analysis as a diagnostic tool for detection of visceral leishmaniasis in Bangladesh (abstract of 7th

ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):97

38. Islam IS, Hossain MZ, Sack RB, Albert MJ. Detection of nonculturable *Shigella dysenteriae* from artificially contaminated volunteers's fingers using fluorescent antibody and PCR techniques [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):248

39. Islam S, Rahman A, Fuchs GJ, Chowdhury AK, Wahed MA, Rabbani GH. Intestinal transport of different electrolyte solutions across small intestine of rabbit *in vivo* (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):144

40. Islam S, Kabir I, Wahed MA, Goran MI, Mahalanabis D, Fuchs GJ, Khaled MA. Multifrequency bioelectrical impedance analysis (BIA) to assess human body composition [abstract]. FASEB J 1997 Feb 28;11(3):A652*

41. Islam S, Fuchs GJ, Chowdhury AK, Rahman A, Miller M, Rabbani GH. Role of nitric oxide in the pathogenesis of shigellosis and cholera in children (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):109

42. Kabir AFMI, Mannan MA, Faruque AJMO, Roy SK, Rahman KM, Amanatullah AZ, Rahman MF. Nutrition initiative in Bangladesh: is it a blessing or human right? (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):49

43. Kabir I, Rahman MM, Haider R, Mazumder RN, Mahalanabis D. Effects of a high-protein, high-energy diet on serum protein, vitamin A, and other micronutrients in malnourished children [abstract]. FASEB J 1998 Mar 17;12(4):537

44. Kabir I, Rahman MM, Haider R, Mazumder RN, Mahalanabis D. Serum zinc and vitamin A status of malnourished children fed a high-protein diet during recovery (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):42

45. Khaled MA, Sarker SA, Chowdhury AK, Islam S. *H. pylori* induced oxidative stress in human [abstract]. Gastroenterology 1997 Apr;112(4 Suppl):A171*

46. Khan AM, Bhattacharya MK, Rabbani GH, Fuchs GJ. Potential invasive properties of *Vibrio cholerae* O139 Bengal in a rabbit model: a preliminary study (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):125

47. Khan MM, Sayeed A, Mamun AA, Ferdousy Z, Ali D, Islam I, Lahiry S, Samira HH. Economic benefits of diabetes control in Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):142

48. Khan MM, Hawkes S, Ali D. Economic evaluation of MCH-FP clinic-based syphilis screening in rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):108-9

49. Khan WA, Dhar U, Salam MA, Bennish M. Ciprofloxacin suspension in the treatment of multi-resistant *Shigella* infections in children: a randomized double-blind trial [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):265

50. Khan WA, Dhar U, Salam MA, Bennish ML. Neurologic manifestations of childhood shigellosis (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):106

51. Khan WA, Salam MA, Griffiths J, de Breucker S, Marchand A, Dinarello C, Acheson D, Keusch G, Bennish ML. Plasma endotoxin, plasma and stool PRO and inflammatory

cytokines and stool *Shiga* toxin in patients with shigellosis [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):249

52. Khanum PA, Ahmed S, Islam A, Parveen SD. Maternal morbidity in rural Bangladesh: where do women go for care? (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):135-6

53. Khatun F, Roy SK, Malek MA, Wahed MA, Sarkar NR, Saifuddin NM, Islam QE, Fuchs GJ. Effect of zinc and vitamin A supplementation in undernourished children with persistent diarrhoea in Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):44-5

54. Khatun J. Factors contributing to low immunization coverage among urban slum children in Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):134-5

55. Khatun M, Bhuiya A, Chowdhury AMR, Hyder SMZ. BRAC's rural development programme and child nutrition (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):39

56. Khatun M, Bhuiya A, Chowdhury AMR, Hyder SMZ. Effect of BRAC's rural development programme on calorie consumption (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):24-5

57. Mahalanabis D, Faruque ASG, Hoque SS, Fuchs GJ, Habte D. Zinc supplementation reduces the rate of prolonged diarrhea in children with acute diarrhea with no additional benefit from vitamin A [abstract]. FASEB J 1998 Mar 17;12(4):A538

58. Mazumder RN, Ashraf H, Hoque SS, Kabir I, Majid N, Wahed MA, Fuchs GJ, Mahalanabis D. Effect of energy dense diet on clinical course of acute shigellosis in undernourished children [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):261

59. Mitra A, Stephensen CB, Alvarez JO, Wahed MA, Fuchs G. Depressed serum concentration and urinary excretion of retinol during acute shigellosis [abstract]. FASEB J 1996 Mar 8;10(3):466*

60. Mozumder ABMKA, Barkat-e-Khuda, Kane TT, Hill K. Determinants of infant and child mortality in rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):102

61. Nahar Q. Use of antenatal care in an urban area of Dhaka city (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):132-3

62. Nahar S, Byun R, Katouli M, Kuhn I, Ansaruzzaman M, Albert MJ, Mollby R. Clonal groups of enteropathogenic *Escherichia coli* isolated in case-control studies on diarrhoea in Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):141-2

63. Osendarp S, Wahed MA, Baqui AH, Arifeen S, Mahmud H, van Raaij J, Fuchs GJ. Determinants of haemoglobin level during pregnancy and relationship with pregnancy outcome in Bangladeshi urban poor (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):55

64. Osendarp SJM, Baqui AH, Wahed MA, Mahmud H, Arifeen SE, van Raaij JMA, Fuchs GJ. Zinc supplementation during pregnancy in Bangladeshi women had no effect on birth weight (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):35-6. *Also published in:* FASEB J 1998 Mar 20;12(5):A647

65. Petri WA, Haque R, and Ali IKM. Natural history and immune response to *Entamoeba histolytica* infection in children in Bangladesh [abstract]. Am J Trop Med Hyg 1998 Sep;59(3 Suppl):201-2

66. Quayyum Z, Amin S, Baqui AH, Manaf S. Reducing drug costs through rationalization of diarrhoea and ARI case management in urban areas (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):134

67. Rahman ASMH, Al-Mahmud KA, Islam AWMS, Mondal MMH, Rahman A. *Cryptosporidium* diarrhoea in dairy calves and their attendants in Bangladesh [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):247

68. Rahman M, Latif AHMM, DaVanzo J. Contraceptive use and maternal weight among the poor in rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):56

69. Rahman M, Bhuiyan B, Nahar S, Miah RA, Islam N, Rahman M, Albert MJ. Molecular epidemiology and antimicrobial susceptibility of *Neisseria gonorrhoeae* isolated from commercial sex workers in Dhaka city (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):106-7

70. Rahman M, Albert MJ. Multiresistant *Salmonella* infections: an emerging health problem in Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):92-3

71. Rahman MM, Fuchs GJ, Ali M, Mazumder RN, Wahed MA, Mahalanabis D. Absorption of macronutrients and nitrogen balance in children with dysentery fed an amylase treated energy-dense porridge [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):261

72. Rahman MM, Barkat-e-Khuda, Kane TT, Reza M, Mozumder ABMKA. Determinants of safe delivery practices in rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):100

73. Rahman MM, Akramuzzaman SM, Mahalanabis D, Mitra AK, Fuchs GJ. Effect of long-term oral iron supplementation on growth in children [abstract]. FASEB J 1998 Mar 17;12(4):A537

74. Rahman MM, Akramuzzaman SM, Mahalanabis D, Mitra AK, Fuchs GJ. Effect of long-term oral iron supplementation on growth in malnourished Bangladeshi children [abstract]. J Trace Element Exp Med 1998;11(4):457

75. Rahman QK, Ahsan CR, Ahmed K, Rabbani GH. Evaluation of the plant extract (hirtacin) in a rabbit model of shigellosis (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):145

76. Raqib R, Ekberg C, Lindberg A, Andersson J. Fas-mediated apoptosis and perforin-induced cell death in shigellosis [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):249

77. Raqib R. The role of cytokines in the pathogenesis of shigellosis [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):244

78. Rasheed S, Bhuiya A, Hyder SMZ, Chowdhury AMR. Effect of women-focused development programme on nutritional status of rural women (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):116

79. Rasheed S, Khatun M, Hyder SMZ, Choudhury AMR, Bhuiya A. Prevalence of chronic energy deficiency in the elderly population of Matlab (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):118

80. Razzaque A, Ahmed K, Alam N, van Ginneken J. Desire for children and subsequent abortion in Matlab, Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):131

81. Rice AL, Stoltzfus RJ, de Francisco A, Chakraborty J, Kjolhede CL, Wahed MA. Effects of vitamin A and β-carotene supplementation to lactating mothers and their infants in Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):31

82. Rice AL, Stoltzfus RJ, de Francisco A, Chakraborty J, Kjolhede CL, Wahed MA. Maternal vitamin A or β-carotene supplementation in lactating Bangladeshi women: effects on mothers and infants [abstract]. FASEB J 1998 Mar 20;12(5):A648

83. Routh S, Jahan SA, Thwin AA. Target-specific home-based motivation: test case with family planning (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):101-2

84. Roy NC, Mozumder ABMKA, Ahmed S, Barkat-e-Khuda. Teenage pregnancy and its consequences: evidence from rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):100-1

]85. Roy SK, Islam A, Ali R, Islam E, Khan RA, Ara SH, Saifuddin NM, Fuchs GJ. Efficacy of erythromycin, ampicillin, and tetracycline in the treatment of cholera in children (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):130-1

86. Roy SK, Mannan MA, Tomkins AM, Behrens RH, Haider R, Akramuzzaman SM. Serum vitamin A level and physical growth of children during catch up growth after acute diarrhoeal episode [abstract]. J Trace Element Exp Med 1998;11(4):425

87. Roy SK. The role of zinc in childhood diarrhoea: are we yet there [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):246

88. Roy SK, Tomkins A, Fuchs G. Zinc and other micronutrients in regulation of intestinal function in developing countries perspectives [abstract]. J Trace Element Exp Med 1998;11(4):460-61

89. Sack RB, Siddique AK. Corpses and the spread of cholera [commentary]. Lancet 1998 Nov 14;352(9140):1570

90. Salam MA, Dhar U, Khan WA, Bennish ML. Efficacy and safety of ciprofloxacin suspension in the treatment of childhood shigellosis (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):98-9

91. Sarkar SA, Alam NH, Mahalanabis D, Fuchs GJ. Evaluation of rice-based reduced osmolarity oral rehydration solution in children with severe persistent diarrhoea (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):143-4

92. Sarkar SA, Rahman MM, Mahalanabis D, Bardhan PK, Fuchs GJ, Hilderbrand P, Beglinger C, Gyr K. *Helicobacter pylori* colonization in infants and young children is not associated with acute diarrhoea [abstract]. J Pediatr Gastroenterol Nutr 1998 Aug;27(2):253

93. Shaheen R, Yunus M, de Francisco A, Tonkinson M, Vaughan JP. Reported morbid symptoms and conditions of pregnant, intrapartum and postpartum women: experience from three villages (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):98

94. Shahid NS, Wahed MA, Aziz KMA, Rahman M, Steinhoff MC. Breastmilk retinol levels in Bangladeshi mothers: reflection on the serum retinol level of infants (abstract of 7th

ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):37

95. Shrestha PS, Ahmed S, Islam MN, Jalaluddin M, Bhuiyan A, Rahman AMSM. Waning of maternal measles antibody in the offsprings (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):103-4

96. Stoltzfus RJ, Chakraborty J, Rice A, de la Biere B, de Francisco A. Effectiveness of an iron supplementation programme for pregnant and postpartum women in rural Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):34

97. Talukder KA, Albert MJ. Molecular analysis of *Shigella dysenteriae* type 1 strains by using pulsed-field gel electrophoresis (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):141

98. Tarannum S, Hyder SMZ, Choudhury AMR, Bhuiya A. Pre-lacteal feeding practices in Matlab, Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):111

99. Tunon C, Quaiyum MA, Begum N, Amin S. Health promotion campaigns and urban women in Bangladesh (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):138

100. Uddin J, Bhuiyan MA, Alamgir SU, Tunon C. Perceptions and involvement of members of zonal health and family planning coordination committees of Dhaka City Corporation (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Jun;16(2):136-7

101. Wahed MA, Haque R, Rahman H, Jahan F, Ahmed T, Albert MJ, Alvarez JO. Biochemical evidence of selected micronutrients deficiencies in children living in urban slum [abstract]. FASEB J 1998 Mar 17;12(4):A212

102. Wahed MA, Haque R, Rahman ASMH, Talukder SR, Albert MJ, Alvarez JO. Subclinical vitamin A deficiency in pre-school children living in urban slums of Dhaka city (abstract of 7th ASCON of ICDDR,B, Dhaka, 14-15 February 1998). J Diarrhoeal Dis Res 1998 Mar;16(1):31-2

**Not listed in earlier annual reports*

INDEX

(Entries in Committees, Hospital Endowment Fund Contributions-1998, Inter-division Scientific Forum, Names of persons in captions, Names of persons listed under Personnel Branch [Departure, Retirement, Obituary, Long Service Award], Publications, Trainees' names, and Visitors are not included.)

Abortion, Induced 73, 74, 85, 86
Abt Associates 91
Acquired immunodeficiency syndrome 11, 87, 89, 90
Adhikary S 18
Administrative Services Unit 74
Administrative Support Services 69
Adolescent health 41, 73, 74
Aeromonas 57
Ahmed J 66
Ahmed MU 41, 42
Ahmed NSU 112
Ahmed S 41, 42, 43, 65, 66, 93
Ahmed SA 27, 49, 50
Ahmed T 18, 24, 29, 32, 35, 61
Ahmed W 96
Ahsan SS 7
Akhter N 66
Akramuzzaman SM 27
Alam AN 104
Alam ASJ 111
Alam DH 27
Alam DS 78
Alam M 59, 112
Alam N 84
Alam NH 21, 61, 63, 64
Alamgir AM 112
Alamgir S 39, 40, 41
Albert MJ 25, 56, 57, 58, 59, 60, 62, 63, 64, 65, 66
Algae 60
Ali M 84
Al Mahmud A 49
Alvarez JO 20
American Express Bank 103
American Life Insurance Co. 103
American Society of Clinical Nutrition 35
Amoebiasis 62
Anaemia 9, 25
Andersson J 64
Animal Experimentation Ethics Committee 115
Animal resources 70
Ansar and Village Defense Party 50
Ansari A 111
Ansaruzzaman M 57
Antibiotic resistance 59, 75, 76, 81
Antioxidants 35
ANZ Grindlays Bank 103
Ara H 49, 50
Arifeen SE 80, 81
Arsenic contamination 50, 51
Ashraf A 40
Asian Development Bank 44
Audiovisual Unit 111
Auditors' report 101
AusAID 103
Autopsy 82
Azim T 26, 27, 39, 43, 58, 61, 62, 64, 65, 90
Aziz KMA 27, 78, 90

Bacterial vaccines 55, 63, 64, 65, 81
BADC 66, 76, 84, 91, 92, 103, 104, 106
Bairagi R 82, 85
Banana 19
Bangabandhu Sheikh Mujib Medical University 58, 68, 104
Bangladesh AIDS Prevention and Control Programme 58
Bangladesh Bureau of Statistics 93
Bangladesh Integrated Nutrition Project *see* BINP
Bangladesh Rural Advancement Committee *see* BRAC
Bangladesh Women's Health Coalition 66
Baqui AH 59, 63, 73, 80, 81, 82
Barer M 61
Barkat-e-Khuda 37, 38, 39, 40, 41, 43, 44, 45, 46
Bay of Bengal 90
Begum M 24
Begum N 66
Begum S 39
Belgian Administration for Development Cooperation *see* BADC
Beta-carotene 65
Bhuiya A 73, 87, 88, 89, 90
BINP 13, 28, 32, 33, 65, 80, 93
BINP-ICDDR,B Operations Research Fund 65
Biomedical engineering 70
Birth-weight 28, 80
Black RE 49, 50, 63, 80
Blastocystis hominis 62
Blood transfusion 67
Board of Trustees 113
Bogaerts J 58, 66, 90
Bondhu Social Welfare Society 89
BRAC 12, 41, 74, 87, 90
BRAC-ICDDR,B Joint Project 74
Bresee J 77, 81
British Geological Survey 103
Brooks A 58
Brooks V 96, 100
Brooks WA 20, 29

Cadmium 65
Cairn Energy Plc. 103
Caloric intake 28
Canadian High Commission 103
Canadian International Development Agency *see* CIDA
CARE 103
Case management research 18
Casswall T 23
Causes of death 82, 85
CDC 62, 64, 65, 77, 81
Centers for Disease Control and Prevention *see* CDC
Chakaria Community Health Project 12, 73, 89, 93
Chakraborty J 78, 79

Child growth 20, 24, 74, 80
Child health 18, 27, 32, 77, 80, 81, 91
Child Health Programme 32, 77, 80, 81
Child mortality 38, 74, 82
Child nutrition 9, 12, 33, 65
Child nutrition disorders 18, 21, 24, 28, 33, 65
Chittagong Port 90
Chlamydia trachomatis 66
Cholera 9, 17, 30, 47, 48, 49, 55, 56, 57, 60, 61, 63, 78
Cholera toxin 25
Cholera vaccine 63
Chowdhury AQ 92
Chowdhury D 52
Chowdhury JTA 52
Chowdhury MR 88, 90
Chowdhury RR 62
Chowdhury S 28
Chowdhury UK 52
Christensson B 58, 64
CIDA 103
Ciprofloxacin 23, 24
Clemens J 63
Clinical Biochemistry Laboratory 68
Clinical Laboratory Services Programme 67, 68
Clinical Microbiology Laboratory 67
Clinical Pathology Laboratory 67
Clinical Research and Service Centre 8, 17, 30
Clinical Research Unit 74
Clinical Sciences Division 8, 17
Clinical Study Ward 31
Coliform bacteria 52
College of American Pathologists 67
Colostrum 23
Colwell RR 61
Commercial sector 46
Committees 113
Communicable diseases 13, 56
Community health 89
Community Health Research Unit 74
Community participation 12, 89
Computer Information Services 111
Concerned Women for Family Planning 41, 49
Contraceptive usage 12, 43, 74, 76, 87
Cost-effective tiered system 12, 39, 40
Cost recovery 45, 46
Costs and cost analysis 46, 91, 92, 93
Curtis T 61
CWFP *see* Concerned Women for Family Planning
Cytokines 63
Cytos Pharmaceuticals 25, 35, 103

DANIDA 90
Das R 112
Data collection 74
de Francisco A 27, 73, 78, 79, 80
De La Salle University 87
Demographic and health surveys 82, 85
Demographic surveillance system 12, 74, 82
Department for International Development *see* DfID
Department of Public Health Engineering 49
Departure 96
Depot-holders 40
Desire for children 86, 87
Desmet M 91, 92
Development Office 96
DfID 12, 49, 51, 52, 61, 74, 79, 84, 91, 103, 111
DGHS *see* Directorate General of Health Services
Dhaka City Corporation 40, 44, 51
Dhaka City ESP Committee 40
Dhaka Medical College Hospital 59
Dhaka Urban Community Health Programme *see* DUCHP
Diarrhoea 8, 9, 10, 11, 12, 23, 48, 56, 57, 58, 59, 60, 62, 63, 73, 74, 77
Diarrhoea, Acute 20, 22, 63
Diarrhoea, Infantile 17, 18, 19, 20, 21, 22, 23, 29, 30, 58, 62, 64, 77, 78, 80, 81
Diarrhoea, Persistent 17, 19, 21, 22
Diet 18, 19, 20, 21, 27, 28, 65
Directorate General of Health Services 39, 40, 41, 42, 43, 44, 45, 46, 49, 50, 103
Directorate of Family Planning 39, 40, 41, 42, 43, 44, 45, 46
Director's report 7
Disease outbreaks 47, 48
Disease reservoirs 61, 89
Dissemination 37, 47, 110
Dissemination and Information Services Centre 110
Donor support 7, 8, 103
Donors 103
Downer A 115
DPHE *see* Department of Public Health Engineering
Drug resistance, Microbial 55, 56, 59, 67, 74, 81
DUCHP 91
Dumuria 42
Duodenal ulcer 58
Duplo-sachet system 29
Dysentery 10
Dysentery, Bacillary 9, 17, 23, 24, 25, 26, 35, 55, 60, 61, 64, 81

East-West Center 85
EHP *see* Environmental Health Programme
ELISA kit 24
Emergency obstetric care *see* Obstetric care
Endowment funds 97, 98, 99
Engineering and Support Services Department 112
Engineering Branch 112
Engstrand L 58
Entamoeba histolytica 62
Enteropathogens 34, 59
Environmental health 37, 49, 50, 52
Environmental Health Programme 12, 13, 37, 38, 49, 52
Environmental Microbiology Laboratory 60
Epidemic Control Preparedness Programme 12, 38, 47
Eppler P 89
Escherichia coli 9, 17, 24, 26, 29, 55, 57, 63
ESP *see* Essential services package
Essential obstetric care *see* Obstetric care
Essential services package 12, 37, 38, 39, 40, 43, 44, 45, 46, 79
Estate Office 112
Ethical Review Committee 114
European Union 11, 12, 78, 79, 98, 103
Expenditures 8, 95, 100, 102

External Relations and Institutional Development Office 8, 96

Family planning 9, 11, 37, 38, 41, 74, 76, 79, 84
Family Planning Association of Bangladesh 50
Faruque ASG 28, 29, 30, 33, 57, 59, 62, 63
Faruque SM 57, 59, 60, 64
Fat 27
Fellowships 84, 106
Fertility 84, 85, 86
FHI 90, 103
Fibre 21
Finance Department 100
Financial statement 102
Flip chart 40
Flood relief 13, 96, 98
Floods 7, 8, 12, 17, 48, 52
Fogarty fellowship 84
Fogarty Foundation (National Institutes of Health) 108
Ford Foundation 11, 67, 88, 89, 103
Fuchs GJ 17, 18, 19, 20, 21, 23, 24, 25, 27, 28, 29, 32, 33, 59, 63, 92, 95

GARNET *see* Global Applied Research Network
Gastric cancer 58
Gazi R 40, 41, 44
General Ward 31
Genes 57
Gentamicin 24
Gentsch J 64, 65
George Mason Foundation 103
Geographic information system 12, 77, 82, 84
Glass R 62, 65
Global Applied Research Network 52
Global Health Equity Initiative 87
Gonoshasthya Kendra 92
Göteborg University 63
Greenough WB, III 99
Gyr K 21, 51

Haemolytic-uraemic syndrome 26, 61
Haemophilus influenzae 13, 58, 59, 61, 74, 81
Hafiz QMS 114
Hamadani JD 21
Hammarstrom I 23
Hanif M 61
Haq F 114
Haque R 62, 65
Hasan Y 39, 40
Hasan Z 62
Hasina S 7, 115
Health 37, 82
Health and Demographic Surveillance Programme 12, 77, 82
Health and demography surveys *see* Demographic and health surveys
Health and Population Extension Division 12, 37
Health and Population Sector Programme 39, 45
Healthcare 7, 38, 86, 91, 92
Health Economics Programme 74, 91
Health education 49, 89
Health expenditures 91
Health planning 41, 43, 44
Health promotion 41, 43, 44, 88, 89
Health services 37, 38, 39, 40, 41, 43, 44, 76, 84
Helen Keller International 28, 92, 103
Helicobacter pylori 9, 25, 58
Hepatitis B 67
HIV 10, 11, 55, 56, 58, 66, 67, 73, 87, 89, 90
Hoffman J 100
Home-gardening 28, 92
Hoque BA 49, 50, 51, 52
Hospital Endowment Fund 97, 98, 99
Hospital Surveillance Programme 33
Hossain A 59
Hossain HI 49, 50, 52
Hossain I 65
Hossain KS 112
Hossain S 49, 50, 59, 115
HPSP *see* Health and Population Sector Programme
Huddinge Hospital 56
Human resources review 8, 95
Huq A 61
Hygiene 49, 50

IDRC see International Development Research Centre
IMCI *see* Integrated management of childhood illness
Immune response 9, 28, 58, 62, 63, 64, 65, 77, 81, 82
Immunization 9, 12, 65, 77, 87, 90, 92
Immunoglobulins 23
Immunology Laboratory 60
Income 8, 100, 102
Infection 24, 27
Infectious Disease Research Programme 56
Information dissemination 110
Information services 110
INSERM 35
Institute of Food Research 20
Institutional development 98
Institutional linkages 117
Integrated management of childhood illness 73, 74, 91
Inter-division scientific forum 119
International Atomic Energy Center 103
International Center for Research on Women 88
International Development Research Centre 91, 92
International Health Solutions Trust 100
International Medical Center of Japan 61
Intestinal secretions 17, 25
Iron 9, 24
Iron deficiency 24, 25
Isenbarger D 81
Islam A 18, 42, 43
Islam D 58, 63, 64
Islam KE 27
Islam MS 29, 57, 60, 61
Islam N 50, 58, 90
Islam R 52
Islam S 35
Isotope 20

Jahan SA 42
Jansson P-E 56
Japan, Government of 11, 18, 26, 61, 73, 76, 103, 104
Japan International Corporation of Welfare Services 104

Jenkins C 58, 89, 90
JHU *see* Johns Hopkins University
Johns Hopkins University 49, 57, 60, 77, 80, 81
Johns Hopkins University School of Hygiene and Public Health 63
JSI Urban Family Health Partnership 9
Juncker T 79

Kabir I 19
Kabir SM 50, 52
Karolinska Institute 23, 56, 57, 58, 64, 65
Khan AM 22, 24, 30
Khan F 52
Khan M 28, 92, 93
Khan MM 91, 92, 93
Khan SH 92
Khan SI 89, 90
Khan TA 112
Khan WA 23, 24
Khanum PA 42
Khatun J 40, 44
Khatun R 43
Khun I 57
Kowsar A 58
Kranzlin I 51

L-glutamine 19
L-histidine 25
Laboratory Sciences Division 9, 41, 55
Lead 65
Library services 110
Logistics support 69
London School of Hygiene & Tropical Medicine 92, 109
Long service awards 96
LSH&TM *see* London School of Hygiene & Tropical Medicine

Macro International, Inc. 82
Magnesium 18
Mahalanabis D 27
Mahbub A 7
Mahidol University 87
Mahmud J 28
Malaria 67
Manaf S 41
Management information systems 12, 37, 43
Manuals 43
Marshall P 23
Martin JO 113
Maternal health 18, 27, 42
Mathan VI 55, 59, 65, 114
Matin MA 114
Matlab Clinical Laboratory 69
Matlab Field Laboratory 69
Matlab Health Research Programme 74, 77, 81
Matlab International Training Centre 73
Mazumder KA 66
Mehjabin N 58
Meier R 21
Menstrual regulation 74
Metabolic Study Ward 31
Microbiology and Tumor Biology Centre 57, 58
Ministry of Health and Family Welfare 38, 39, 43, 45, 46, 49, 50
Ministry of Local Government, Rural Development and Cooperatives 49
Mirsarai EOC model 42
Mithapukur 42
MLGRD&C *see* Ministry of Local Government, Rural Development and Cooperatives
Model ESP Clinic 40
MOHFW *see* Ministry of Health and Family Welfare
Molecular Genetic Laboratory 60
Mollah SI 113
Möllby R 57
Morbidity 20, 28, 76, 80, 84
Morshed G 50, 52
Mortality 38, 74, 76, 82, 84, 85
Mostafa G 85
Mozumder KA 41
Mozumder MA 45, 46

Nahar L 86
Nahar Q 41
Nair GB 56
Nari Maitree 41
Narsingdi 42
Nasreen S 58
National health and population programme 38
National Institute of Child Health and Human Development 63
National Institute of Cholera & Enteric Diseases 56
National Institute of Population Research and Training 85
National Institutes of Health 25, 48, 60, 61, 62
National Integrated Population and Health Programme 12, 38, 39, 40, 41, 45, 47, 107
National Nutrition Programme 93
National Sentinel Surveillance 90
National Vaccine Program Office 81
Neisseria gonorrhoeae 66
Nepal 55, 59
New England Medical Center 23, 24, 103
Night-blindness 66
NIH *see* National Institutes of Health
NIPHP *see* National Integrated Population and Health Programme
NIPORT *see* National Institute of Population Research and Training
Nitric oxide 35
NORAD 47, 103
Normark S 58
North Field Laboratories Pty Ltd. 23, 103
Norwalk virus 60, 62
Norway 103
Norwegian Agency for Development Cooperation *see* NORAD
Novartis 21, 103
Nursing Programme 31
Nutrition 11, 13, 56, 65, 93
Nutrition Centre of Excellence 13, 17
Nutrition disorders 17, 18, 29, 65, 80
Nutrition education 33, 73, 74
Nutrition Working Group 13
Nutritional Rehabilitation Ward 18
Nutritional support 18, 65, 80

Nutritional therapy 18
see also Diet

Obituary 96
Obstetric care 11, 42, 43, 73, 74, 79
Occidental of Bangladesh Ltd. 103
Oil Companies 49, 52
OMNI 27
Operations research 11, 12, 32, 37, 38, 39, 40, 42, 43, 45, 49, 50
Operations Research Project 12, 37, 38, 39, 42
Oral rehydration solutions 9, 21, 22, 29, 35, 77, 78
ORP Working Group 39, 43
Osendarp S 28, 33, 35
Outpatient Services Project 67

Paralytic ileus 18
Parasites 60
Pathfinder International 44
Pathophysiology research 18, 24
Patiya 38
Pectin 19
Performance evaluation 84
Personnel Department 96
Peterson J 25
Petri WA, Jr. 62
Physiology Laboratory 34
Pictorial card 76
Pivamdinocillin 24
Plesiomonas shigelloides 30
Pneumococcal vaccine 11, 29, 73, 82
Pneumonia 13, 81
Podder G 62, 64, 65
Polymerase chain reaction 55, 58, 60
Pond 51
Population Council 103
Poverty alleviation 12, 88
Primary healthcare 50, 87
Primary Healthcare Programme 50
Proctor & Gamble 103
Procurement Branch 112
Programme Coordination Committee 114
Prostitutions 66
Protocols 43
Providencia alcalifaciens 57
Public Health Sciences Division 11, 73
Publications 111, 121

Qadri F 56, 58, 60, 61, 63
Quaiyum MA 42
Quality Improvement Partnership 43
Quayyum Z 45, 46

Rabbani GH 19, 25, 34, 115
Rahman H 25
Rahman M 27, 43, 44, 56, 57, 58, 59, 62, 66
Rahman MM 20
Rahman S 41, 43
Rand Corporation 103
Raqib R 58, 61, 63, 64
Razzaque A 86, 87
Reactive oxygen species 25, 35
Record keeping system 12, 77, 82
Red Crescent Society of Bangladesh 89
Reorganizations 7, 8
Reproductive health 38, 74, 76, 78, 79, 88
Reproductive Health Programme 78, 79
Reproductive tract infections 10, 56, 66
Research Review Committee 114
Respiratory infections 9, 10, 11, 12, 20, 29, 56, 58, 66, 73, 76, 77, 80, 81
Retirement 96
Rhesus rotavirus vaccine 12, 74, 77, 81
Rice 22, 35, 78
Rockefeller Foundation 87
Rotavirus 11, 12, 17, 23, 34, 64, 65, 73, 74, 77, 81
Routh S 39, 40, 45, 46
Roy SK 20, 27, 28, 29, 33
The Royal Netherlands Government 28, 103
Royal Tropical Institute 87, 90
Rural Service-delivery Partnership 40, 41, 42, 43, 44, 45, 46

SAARC 106
Sack D 7, 25, 95
Sack RB 49, 57, 60
Safe-delivery kits 77
Safe motherhood *see* Reproductive health
Saha BR 109
Saha SN 49
Salam MA 17, 18, 23, 24, 26, 30, 58, 61, 62, 63, 64, 65
Salmonella 34, 69, 75
Salmonella typhi 67
Sanitation 49, 50
SAREC 23
see also SIDA-SAREC
Sarker S 39, 58
Sarker SA 21, 22, 23, 25
Saudi Arabia 103
Schneider H 21
Schneider-Sliwa R 51
SDC 29, 49, 51, 103, 109
Seal A 29
Seminars 109
Sen A 87
Sewage disposal 61
Sex behaviour 87, 89
Sexually transmitted diseases 10, 11, 12, 38, 55, 58, 66, 67, 73, 87, 89, 90
Sexually transmitted infections 41, 66
Shaharasti 28, 43, 80
Shaheen R 80
Shahid NS 82
Shahriar A 39
Shams I 42, 43
Shell Bangladesh Exploration & Dev. B.V. 103
Shigella 11, 12, 26, 34, 61, 64, 67, 69, 74, 75
Shigila dysenteriae 23, 24, 61, 75
Shigella flexneri 65, 75, 81
Short-chain fatty acids 17, 25
Short Stay Ward 31
SIDA 104
see also SIDA-SAREC

SIDA-SAREC 56, 57, 58, 63, 64, 103
Siddique AK 47, 48, 57, 60
Siddiqi M 91
Silva JD 59, 62
Singair 49
Slums 17, 62, 91
Sobhan F 42, 43
Social and Behavioural Sciences Programme 87
Social Marketing Company 46
Social Mobilization for Sanitation Project 50
Social Science and Immunization Project 90
South Asian Association for Regional Cooperation *see* SAARC
Special Care Unit 31
Specimens 67, 68, 69
Staff Welfare Association 115
Staphylococcus 59
Staff development 109
Steinhoff M 82
Streptococcus pneumoniae 13, 58, 59, 74, 81
Support services 113
Suskind RM 7, 95
Svennerholm A-M 63
Swedish Academy of Research and Cooperation *see* SAREC
Swedish International Development Cooperation Agency *see* SIDA
Swiss Agency for Development and Cooperation *see* SDC
Swiss-Dutch and German Red Cross Societies 89
Swiss Red Cross 89, 103
Syphilis 10, 55, 58, 66, 90

Tait SF 20
Takeda Y 61
Technical assistance 47, 59
Teka T 19
Tetramune 29
Thana Functional Improvement Pilot Project 45
Thrasher Foundation 103
Thrasher Research Fund 20, 63, 65, 78, 82
Tomkins AM 20, 29
Training 13, 48, 87, 95, 104, 105, 108
Training and Education Department 104
Training courses 11, 87, 104, 105, 107, 108
Travel Services Office 112
Trichomonas vaginalis 66
Tünón C 40, 41, 43, 44

UCB Osmotics Ltd. 29
UCB/Sidac 103
Uddin J 41, 44,
Uddin N 43, 44
UFHP *see* Urban Family Health Partnership
Ullah M 31
UNAIDS 58, 90, 103
UNDP/Japan 103
UNICEF 52, 91, 103
Unicomb L 62, 64, 65
University of Alabama 103
University of Amsterdam 87
University of Dhaka 35, 104
University of Leuven 67
University of Liege 109
University of Loughbourg 103
University of Maryland Biotechnology Institute 61
University of Newcastle 103
University of Newcastle upon Tyne 61
University of North Carolina 44
University of Pennsylvania 103
University of Virginia 62, 103
UNOCAL 103
UNOPS 61
Urban Family Health Partnership 41, 43, 45, 46, 103
Urban Primary Healthcare Project 44
USAID 10, 11, 12, 13, 18, 19, 20, 22, 24, 25, 27, 28, 29, 30, 33, 38, 39, 49, 57, 58, 59, 60, 62, 64, 65, 66, 80, 81, 82, 90, 92, 103, 104, 107
USAID/CARE 103
USAID/FHI 90, 103
U.S. Govt. Department of Defence 103
U.S. Office of the Foreign Disaster Assistance 103, 104

Vaccines 10, 11, 55, 56, 62, 63, 64, 65, 77, 81
Vahter M 65
van Ginneken J 73, 82
van Raiij J 27
Vaughan JP 7, 73, 114
Vegetables 27, 28, 74, 92
Vibrio 34, 69
Vibrio cholerae 9, 17, 30, 34, 48, 49, 55, 56, 57, 60, 61, 67, 69, 75
Viral vaccines 64, 65, 77, 81
Visitors 115
Vital statistics 83
Vitamin A 9, 20, 27, 63, 65, 92
Vitamin A deficiency 27, 28, 66

Wageningen Agricultural University 27
Wahed MA 20, 27, 64, 65, 66
Walker D 92
Walter Reed Army Institute for Research 81
Wander Ag 103
Water, Engineering and Development Centre 52
Water filtration 61
Water supply 49, 50, 51
WEDC *see* Water, Engineering and Development Centre
Weintraub A 56
WHO *see* World Health Organization
Winkelmann JF 100
Women's empowerment 86
Workshops 41, 105, 106, 108
World Bank 7, 11, 13, 32, 49, 50, 52, 93, 98, 103
World Health Organization 21, 64, 67, 74, 77, 78, 81, 85, 103, 104
Wyeth-Ayerst International 77, 81

Yamasaki S 61
Yousuf O 100
Yunus M 27, 59, 60, 74, 77, 78, 81

Zaman B 19
Zaman IA 96
Zaman K 78
Zinc 9, 12, 17, 20, 27, 28, 29, 63, 74, 77, 80, 81
Zinc deficiency 27, 29, 80

REORGANIZATION PLAN !
Nov '98

(from inside of the front cover)

The **Laboratory Sciences Division** (LSD) has scientists with expertise in enteric and respiratory microbiology, molecular genetics, environmental microbiology, immunology, parasitology, reproductive tract infections, sexually transmitted diseases, and nutritional biochemistry. The Division undertakes research on a thematic basis on emerging and re-emerging infectious diseases, vaccine evaluation, control of diarrhoeal diseases, nutrition, and reproductive tract infections. The Division also provides laboratory services to scientists of the Centre and to patients who are referred.

The **Public Health Sciences Division** (PHSD), with staff comprising public health professionals, epidemiologists, social scientists, and economists, focuses on the evaluation of population-based interventions to improve child health, reproductive and sexual health, and public health programmes. Research includes reproductive health; high-risk sexual behavioural patterns, family planning; safe motherhood, child health at the community level, epidemiological patterns and transmission of infectious diseases (especially diarrhoeal, acute respiratory and nutrition-related illnesses); healthcare delivery services; illness prevention, behaviour modification, and vaccine trials. The Division has the responsibility of conducting field studies at Matlab involving 210,000 people under the Demographic Surveillance System (DSS).

The **Director's Division** provides support to the scientific divisions. As part of an infrastructural reorganization of the Centre, the Director's Division was newly created through merger of the Administration and Personnel Division, the Finance Division, and all offices under the Director's Bureau. (External Relations and Institutional Development Office, Training and Education Department, Dissemination and Information Services Centre, Audiovisual Unit)

What is the Centre's Plan for the Future?

In the 38 years of its existence, ICDDR,B has evolved into a multidisciplinary research centre whose scientists have wide-ranging expertise. Future research will be directed toward development of cost-effective and sustainable solutions to the health and population problems of the most disadvantaged people in the world. The Centre's Strategic Plan: "To The Year 2000" outlines work in the following key areas:

Child Survival: Priority areas for research in child survival include: improvement of the case management of diarrhoea, acute respiratory infections; determination of risk factors for low birth rate and potential interventions; nutritional deficiency (including micronutrients), immunization-preventable infectious diseases, and strategies for prevention, including modifications in personal and domestic hygiene behaviours, provision of appropriate water supply to and sanitation for households, and the development of effective vaccines.

Population and Reproductive Health: The Centre played a key role in conducting pioneering research in the areas of population and family planning. Contraceptive use rate among women of reproductive age in Bangladesh has raised to almost 45% through its technical assistance and operations research. The 1994 Cairo Conference hailed Bangladesh as a family planning success story, using Matlab as the model for MCH-FP programmes throughout the world. The Centre continues its research in maternal health and safe motherhood and has initiated community-based research on reproductive health and STD/RTI/HIV infections.

Application and Policy: The Centre recognizes and gives a high priority to, the need to transform research findings into actions by replicating the successful interventions piloted in its projects and through its research and training activities. The Centre will increase its communication, dissemination and training in its efforts to influence international and national health policies in the areas of its expertise.

New Initiatives and Approaches to Research: As a means of addressing the new initiatives in child survival and population and health research and structuring our existing programmes into Centrewide initiatives, interdivisional scientific research work and training courses have been proposed. The key areas include: Nutrition; Emerging and Re-emerging Infectious Diseases, Integrated Management of Childhood Illnesses; Vaccine Evaluation; and Reproductive Health. The interdivisional research themes will be multidisciplinary with scientists from each of the four scientific divisions engaged in formulating startegies and work plans, developing research protocols, and conducting clinical, laboratory- and hospital- and community-based trials. Outputs will include research findings, policy development and training capacity that will be used nationally and internationally and can be applied regionally and globally.

ICDDR,B: Centre for Health and Population Research is currently supported by the following countries, donor agencies, and others which share its concern for the health and population problems of developing countries:

Aid Agencies of the Government of:
Australia, Bangladesh, Belgium, Canada, Japan, Norway, Saudi Arabia, Sri Lanka, Sweden, Switzerland, United Kingdom, United States of America
and
European Union

UN Agencies
International Atomic Energy Agency (IAEA), UNAIDS, UNICEF, World Bank
and
WHO

International Organizations
CARE Bangladesh, International Centre for Research on Women, International Development Research Centre, Population Council, and Swiss Red Cross

Foundations
Aga Khan Foundation, Ford Foundation, George Mason Foundation, Novartis Foundation, Rockefeller Foundation and Thrasher Research Foundation

Medical Research Organizations
International Life Sciences Institute, National Institutes of Health, New England Medical Center, Northfield Laboratories and Walter Reed Army Institute for Research-USA

Universities
Johns Hopkins University, Karolinska Institute, Loughborough University, London School of Hygiene & Tropical Medicine, University of Alabama at Birmingham, University of Goteborg, University of Maryland, University of Newcastle, University of Pennsylvania and University of Virginia

Others
Abt. Associates Inc., ALICO, Arab Gulf Fund, American Express Bank, ANZ Grindlays Bank, British Geological Survey, Cairn Energy Plc, Cytos Pharmaceuticals LLC, Department of Defence-USA, Family Health International, Helen Keller International, Macro International Inc., National Vaccine Programme-USA, Occidental of Bangladesh Ltd., Proctor and Gamble, Rand Corporation, Rhone-Poulenc Rorer, Save the Children Fund-USA, Shell Bangladesh Exploration & Dev. B.V., UCB Osmotics Ltd., Urban Family Health Programme, UNOCAL and Wander A.G.