



Vision

All people, especially the poor, can become healthier and can reach their full potential through the application of new knowledge

Mission Statement

To develop and promote realistic solutions to the major health, population and nutrition problems facing the poor people of Bangladesh and other settings

Guiding values

Excellence in research, training and service, high ethical standards, gender equality, responsive to change, promote partnerships, prioritize the needs of the poor and vulnerable, promote equity and diversity, transparency and accountability, effective use and development of resources, fiscal prudence

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ICDDR,B: Centre for Health and Population Research publishes a journal, one English newsletter, one Bangla health magazine, one health and science bulletin, two fact-sheets: Equity Dialogue and SUZY News, scientific reports, monographs, working papers, and special publications on subjects relating to infectious diseases, health, population, and nutrition. Details of some of these publications may be found in the section ICDDR,B Publications 2003 of this report.

The cover photograph highlights the commemorative stamp released by Bangladesh Post Office on the 25th Anniversary of ICDDR,B

Preface

This twenty-fifth Annual Report of the Centre documents many activities during 2003, including research, support for research, health services, training, dissemination, and administration.

Important findings are presented under the eight research programmes of the Centre. A list of ongoing protocols during 2003 with the names of principal investigators and funding agencies is included separately.

Scientific papers, abstracts, and other documents produced and published by Centre staff are also listed in the report. Much of the research work included here was initiated in previous years and hence documented in earlier reports. Studies that were completed during 2003 present 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 work described here, please write to the Centre at the address given on the opposite page.

Table of

Preface	3
The Centre over the years	6
Board of Trustees	7
Director's Report	9
Achievements of the Research Programmes	
Child Health	19
Integrated Management of Childhood Illness	19
Neonatal Health Interventions	21
Maternal and Infant Nutrition	22
Child Development	24
Reproductive Health	25
Provision of Basic and Comprehensive EOC Services	25
Raising Community Awareness	26
Ongoing EOC Interventions in Matlab	27
Promoting Male Involvement in Reproductive Health	36
Nutrition	38
National Nutrition Project	38
Severe Malnutrition	38
Resting Metabolic Rate Measurements	43
Operations Research under BINP	44
Role of Community Nutrition Promoters in Large-scale Supplementation Activities	44
Infectious Diseases and Vaccine Sciences	47
Enteric Diseases	49
Clinical Drug Trials	60
Typhoid	61
Acute Respiratory Infections	61
Tuberculosis	63
Malaria	64
Emerging and Re-emerging Infectious Diseases	65
Vaccine Studies	68
New Directions/Upcoming Studies	70
Health and Family Planning Systems	71
Reductions in Neonatal and Child Mortality	71
Screening for Unmet Needs	72
Use of ESP	72
Evaluation of a Six-month Pilot	73
Micronutrient Fortification of Wheat Flour	74
Determinants of Low Immunization Coverage	74
Technical Assistance	76
School-based Reproductive Health Intervention	77
Integrating Child Nutrition Services into Urban ESP Clinics	77
Hospital Exit Survey	78
Scaling up Zinc	78
Population Sciences	80
Infant and Child Morbidity and Mortality	80
Ageing of the Bangladesh Population	81
Gender and Fertility	83
Plateau in Fertility Decline in Bangladesh	83
Condom Use	84
Adolescents and Abortion	84
Social Change and Reproductive Behaviour	85
Health and Demographic Surveillance System-Matlab	86
Spatial Dynamics and Dengue Outbreak	88
Poverty and Health	89
Poverty and Health Knowledge Project	90
Poverty Measurement Tools	90
Poverty Measurement Group	91
Poverty and Health Resource Unit	93
Effects of Poverty Alleviation Programmes	95
HIV/AIDS	98
Risk of an HIV Epidemic in Bangladesh	98
Social Construction of the Non-use of Condom	102
Male Sexuality and Masculinity	103
Application of the Capture-Recapture Method	104
Voluntary Counselling and Testing	104

Contents

Studies and Services on Sexually Transmitted Infections	105
Ongoing Research Protocols	108
Policy and Planning	114
Organizational Structure	
Clinical Sciences Division	117
Clinical Research and Service Centre	118
Franchising Patient Care Services of ICDDR,B	123
Special Procedure Clinic	124
Nursing Service	124
Physiology Laboratory	125
Child Development Unit	127
Hospital Surveillance	128
Nandipara Clinic	130
Fellowship Programmes	130
Recent Changes	130
Health Systems and Infectious Diseases Division	131
Surveillance and Data Resources Unit	133
Field Sites Unit	134
Infectious Diseases Unit	135
Health Systems and Economics Unit	135
Family Health Research Project	135
Laboratory Sciences Division	143
Acute Respiratory Infections Laboratory	148
Enteric Microbiology Laboratory	148
Environmental Microbiology Laboratory	149
Immunology Laboratory	150
Molecular Genetics Laboratory	151
Nutritional Biochemistry Laboratory	151
Parasitology Laboratory	152
RTI/STI Laboratory	152
Tuberculosis Laboratory	153
Virology Laboratory	154
Clinical Laboratory Services	154
Media and Lyophilization	159
Animal Resources Branch	159
Biomedical Engineering Unit	160
Laboratory Management and Archives	161
Public Health Sciences Division	163
Child Health Unit	165
Epidemic Control Preparedness Unit	165
Health and Demographic Surveillance Unit	166
Health Economics Unit	166
Matlab Health Research Centre	168
Reproductive Health Unit	173
Social and Behavioural Sciences Unit	173
Information Sciences Division	179
Training and Education Unit	181
Dissemination and Information Services Centre	184
Information Branch	184
Publications Branch	185
Audiovisuals Unit	186
Computer Information Services Unit	187
Data Management Unit	189
Director's Division	190
Human Resources Department	191
Staff Development Office	192
Finance Department	193
Auditors' Report	195
Support Services Department	201
Committees	201
External Relations and Institutional Development Office	204
Grants and Contracts Administration	206
Visitors in 2003	208
Collaborations	209
ICDDR,B Publications 2003	211

The Centre Over the Years...

- 1960 Cholera Research Laboratory established
- 1963 Matlab field station started
- 1966 Demographic Surveillance System established
- 1968 First successful clinical trials of oral rehydration solution (ORS) done
- 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 (MCH-FP) interventions began in Matlab
- 1978 Government of Bangladesh Ordinance establishing ICDDR,B signed
- 1981 Urban Volunteer Programme initiated
- 1982 Field-testing of cereal oral rehydration solution began
MCH-FP Extension project began
- 1983 Epidemic Control Preparedness Programme initiated
- 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 into, acute respiratory infection began
- 1989 The Matlab record-keeping system, specially adapted for Government use, extended to the national family planning programme
- 1993 New *Vibrio cholerae* O139 Bengal identified and characterized
- 1994 Twenty fifth anniversary of ORS celebrated
ICDDR,B's epidemic response team goes to Goma to assist cholera-stricken Rwandan refugees, identifies pathogens, and helps reduce mortality from as high as 48.7% to <1%
- 1995 Maternal immunization with pneumococcal polysaccharide vaccine shown to be likely to protect infants up to 22 weeks
- 1996 Hon'ble Prime Minister Sheikh Hasina terms The Cholera Hospital as the best diarrhoeal disease hospital in the world
- 1998 ICDDR,B celebrates its 20th year of existence
ICDDR,B initiates national HIV surveillance in cooperation with Ministry of Health and Family Welfare, Government of Bangladesh
- 1999 Hon'ble Prime Minister Sheikh Hasina opens the week-long festivity to mark the 20th Anniversary of internationalization of ICDDR,B and calls upon all to support the Centre's protocolized management of severely-malnourished children published in the *Lancet*
- 2000 ICDDR,B assists Government of Bangladesh with control of major dengue epidemic in Bangladesh
The Centre launches theme-based programmes of six major initiatives
- 2001 ICDDR,B receives the first ever Gates Award for Global Health
The Government of Bangladesh makes an equivalent contribution to match the Prize of US\$1 million off the Gates Award
The tuberculosis initiatives began
- 2002 ICDDR,B describes mortality benefit from zinc therapy
- 2003 Twenty-fifth Anniversary of ICDDR,B celebrated
New research programmes on HIV/AIDS and Poverty and Health initiated

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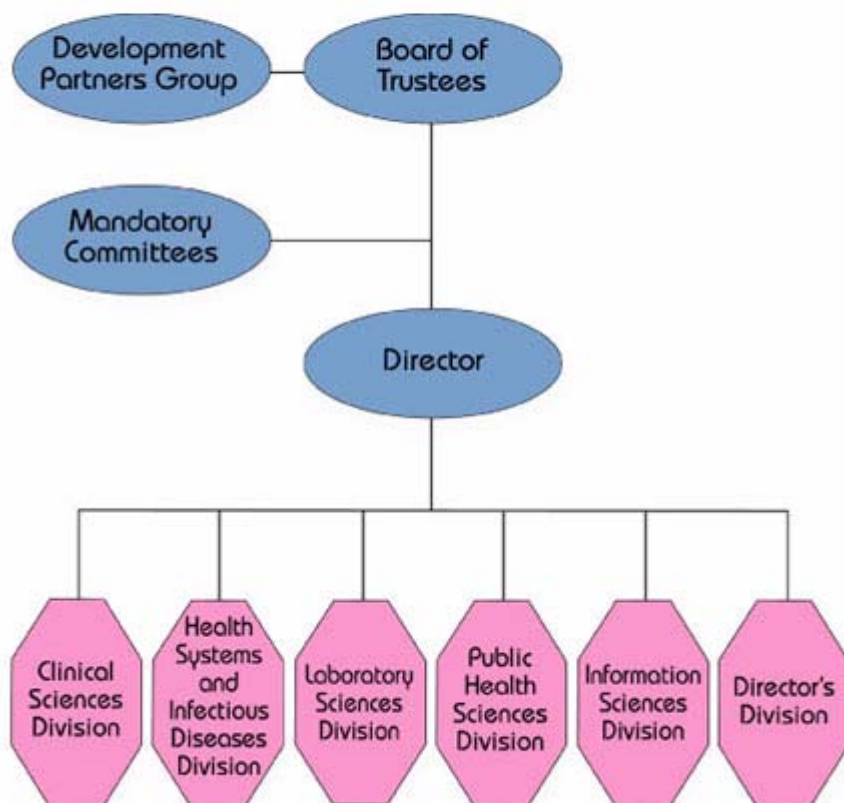
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ICDDR,B: Centre for Health and Population Research



Director
David A. Sack, MD



Director's Report 2003

The year 2003 was one for celebration as ICDDR,B completed its 25th year as an international centre. Although the institution was originally founded in 1960 as the Pakistan-SEATO Cholera Research Laboratory and continued as the Cholera Research Laboratory following the war in 1971, it was internationalized in 1978 through an ordinance of the Government of Bangladesh. Many special events highlighted the 25th Anniversary year starting with the Annual Fundraising Ball in February and continued through the highly successful Tenth ASCODD¹ and US-Japan² meetings in December. During the year, ICDDR,B continued its progress of maturation with the finalization and publication of the Centre's 'Strategic Plan to the Year 2010' and a further stabilization of the Centre's finances. In December, the Centre published a book entitled *Smriti: ICDDR,B in Memory*, which includes memories and photos of the Centre since its inception. This is not a history, but rather more of an album, with stories of events that illustrate some of the crisis times and the human side of the Centre's history and of those who make up the Centre's family.

Leadership at the Centre

Compared to other years, there were fewer changes in key scientific leadership in 2002; Dr. Lars Åke Persson, Head of the Public Health Sciences Division and Dr. Lotta Eckstrom, Consultant Scientist in Nutrition from Sweden, left the Centre in March, and Dr. Japhet Killewo, a national of Tanzania and Head of the Reproductive Health Programme left the Centre in June. Ms Hannah Lemon from the UK joined as a senior associate in the External Relations and Institutional Development Office.

Financial Situation

The Centre's budget of US\$17 million exceeded that of 2002 by more than US\$1 million, largely reflecting increased project activities. Accomplishing this increase in activity while maintaining a balanced budget was extremely difficult, but was possible with the continued support of the donors. Especially important was the addition of Canadian CIDA as a major core donor.

Human Resources

Major changes occurred in the Human Resources Department in 2003 with a finalization of the reclassification of each post in the Centre following several years of study and analysis. In any large organization, there can be some 'drift' in the classification of jobs over the years, and it was time to reassess all of these in order to insure fairness and equity across the Centre. Additionally, the Centre finalized a new promotions system for its scientists. The previous system, although fair, did not consistently reward the broad-based qualities that we seek from scientists, including contributions to the scientific literature, training, service, mentoring, and competition for external research grants. The new system will hopefully provide a more balanced method for evaluating and promoting deserving scientists as well as a better tool for junior scientists who use the promotion system to guide their career development.

Introduction of a unified management information system

The Centre had decided to implement a new management information system and by May 2003, had chosen MS Navision as the platform

¹ Asian Scientific Conference on Diarrhoeal Diseases and Nutrition; ² US-Japan Conference on Emerging Infectious Diseases in the Pacific Rim



Professor Dr. Iajuddin Ahmed, Hon'ble President of Bangladesh, inaugurating the release of the commemorative stamp by the Bangladesh Post Office on the occasion of the 25th Anniversary of ICDDR,B during the 10th ASCODD held in December 2003



for this new system. We renamed this system 'Suchona' (the Bangla word for new beginnings) since it represents a new way of doing business at the Centre. With the assistance of Price WaterhouseCoopers from Kolkata, India, the Centre staff had to define all administrative procedures in finance, HR and project management in order to custom design the new system. Using the new system, information will be available to those who need it, including the scientists and project managers. While the old system was computerized and gave an accurate recording of financial and HR information, the new system is totally integrated and will allow for real-time management of all functions within the Centre. The system was scheduled to 'go live' in February 2004.

Strategic Planning and MDGs

The Strategic Plan to the Year 2010 was published in 2003³ after several years in preparation, and now the task of the Centre is to use the Plan to guide the Centre's activities. The priorities, as set out in the Plan, are incorporated into the Centre's project monitoring plan so that these priorities will be followed closely. During the year, two new programmes have been added to those identified in the published Plan: that of 'Poverty and Health' and 'HIV/AIDS'. Hopefully, a programme on 'Safe Water' will be added soon.

Health issues facing the poorest have long been a focus of the Centre's activities; however, the new programme, headed by Dr. Abbas Bhuiya, will provide the framework to more systematically focus on the needs of the poor, to develop tools for measuring the equity of health

programmes and on measuring the health impact of anti-poverty programmes.

Projects to define the burden of HIV/AIDS and development of strategies for its control and prevention have been ongoing at the Centre since the mid-1990s; however, the threat of HIV/AIDS continues to grow, and the Centre has taken an increasing responsibility for this in Bangladesh and in the region. Starting with the establishment of a laboratory for HIV/AIDS, the programme, headed by Dr. Tasnim Azim, has grown to include studies on high-risk groups and risk behaviours, cohort studies, and establishment of a model voluntary counselling and testing unit.

The Strategic Plan provides a more detailed description of the Centre's priorities; however, the following are the key priorities for the Centre:

1. Introduce cost-effective strategies for zinc therapy for diarrhoea
2. Help reduce maternal morbidity and mortality and improve perinatal and neonatal health
3. Develop a package for the prevention of foetal growth restriction
4. Help identify a package of suitable vaccines for diarrhoea and acute respiratory infections
5. Define the burden of tuberculosis and identify effective strategies for prevention and control

³ The Strategic Plan is available upon request from the Centre, or it may be viewed on the Centre's web site at www.icddr.org.



The Centre had decided to implement a new management information system and by May 2003, had chosen MS Navision as the platform for this new system


- 6 Address stagnation of fertility decline
- 7 Help prevent epidemics of HIV/AIDS and RTI/STI
- 8 Contribute to knowledge that can impact the burden of vector-borne diseases.

In addition to the Strategic Plan, the Centre also refers to the Millennium Development Goals (MDGs) in formulating its research strategies. This set of internationally agreed-upon goals crystallizes where we all want to be and helps monitor our progress.

The Centre's scientists assist the Government of Bangladesh and its development partners by synthesizing data to guide monitoring and evaluation. The Centre's research, service and training activities also address several (7 of 8) of the MDGs directly. Some examples include:

Goal 1. Eradicate extreme poverty and hunger. The Centre is developing strategies for reducing malnutrition and is working with the National Nutrition Programme to insure its success. Currently, the Centre, along with partners, is conducting the baseline national nutrition survey and is continuing nutrition research on micronutrients and management of severe and moderate malnutrition and is attempting

Millennium Development Goals		ICDDR,B contributing to this goal
MDG 1	Eradicate extreme poverty and hunger	yes
MDG 2	Achieve universal primary education	supports
MDG 3	Promote gender equality and empower women	yes
MDG 4	Reduce child mortality	yes
MDG 5	Improve maternal health	yes
MDG 6	Combat HIV/AIDS, malaria, and other diseases	yes
MDG 7	Ensure environmental sustainability	yes
MDG 8	Develop a global partnership for development	yes



Through the Centre's newly-formulated gender policy, gender issues are highlighted in our research, training, and services as well as in our own human resources. Hiring, promotion and staff development policies are key to gender issues, but gender issues extend far beyond staffing patterns

to develop strategies for incorporation of nutrition services into the primary healthcare programmes of the country. The Centre is also conducting research on the interaction between poverty and health to insure that health services can be equitable and that poverty related to ill health can be eliminated.

Goal 3. Promote gender equality and empower women. Through the Centre's newly-formulated gender policy, gender issues are highlighted in our research, training, and services as well as in our own human resources. Hiring, promotion and staff development policies are key to gender issues, but gender issues extend far beyond staffing patterns. Key differences in rates for conditions like infant mortality, tuberculosis, and visceral leishmaniasis are but a few of the gender issues of the research.

Goal 4. Reduce child mortality. Oral rehydration solution is a product of the Centre's research that is already saving an estimated 3 million lives each year and over 40 million over the last two decades. Current research will define new child health interventions, such as the use of zinc, interventions for neonates and treatments for children with pneumonia. It is clear that the MDG for reduction of child mortality can only be achieved if strategies can be found for reducing neonatal mortality since the first month of life is when most infant deaths occur, but our research is broad-based, including reduction of mortality throughout childhood and improvement in health and development.

Goal 5. Improve maternal health. Several of the Centre's research

projects seek to reduce maternal mortality through improving services and providing options for families of pregnant women. The maternal health strategies are integrated into those for infant health, especially during the neonatal period. The improved referral services in Matlab provide a platform for future studies on reducing maternal mortality.

Goal 6. Combat HIV/AIDS, malaria, and other diseases. The Centre's HIV/AIDS Programme is a major contributor to the national HIV/AIDS control strategy. Furthermore, the Infectious Diseases and Vaccine Sciences Programme has projects to control other infectious diseases, such as pneumonia, tuberculosis, malaria, diarrhoeal diseases, dengue, visceral leishmaniasis, and other emerging diseases. Although malaria is a global concern, it has received relatively little attention in Bangladesh where we estimate that more than 10 million people live in areas that are hyper-endemic for drug-resistant *P. falciparum* malaria (more than in many African countries).

Goal 7. Ensure environmental sustainability. Safe water and improved sanitation are rare in Bangladesh. The Centre has identified ways to provide 'safer water' with sari filtration and is evaluating additional strategies that will provide options to families in need of water. Unfortunately, Bangladesh has a double threat from water: water-borne infectious diseases from surface water and arsenic contamination from well water, so our research projects address both issues. We anticipate major new findings on health dangers from arsenic exposure as well as ways to reduce these threats. Personal

hygiene has also long been a priority at the Centre, and it is hoped that new programmes to scale up the use of hand-washing can be developed.

Goal 8. Develop a global partnership for development. This goal is generally targeted to macro level development; however, the Centre is a leader in creating partnerships both within Bangladesh and internationally. By creating an institution where skilled professionals can develop their career, the Centre creates 'brain gain' instead of fostering 'brain drain'. For development, countries need such institutions to provide resources for the country and for its citizens who have high personal goals.

The partnerships are also important for the Centre, both within the country and outside. Many of the projects being reported here are only possible because of the collaboration with national institutes, non-governmental organizations, and collaborations with foreign scientists from many different countries. As an 'international centre' we value and depend on these national and international connections.

Training

Training helps the Centre to communicate its expertise, ideas, and perspectives to a larger audience. In 2003, the Centre hosted 468 trainees from 26 countries, including 15 countries in Asia, five in Africa and four in Europe. While most courses were continuing from previous years, new in 2003 was a high-level biotechnology course sponsored by the Howard Hughes Medical Institute (HHMI).

Key initiatives

This annual report provides more information on the current protocols, activities, and key scientific advances. This summary will highlight only those that are identified as key priorities as listed above.

The project to introduce cost-effective strategies for zinc therapy for diarrhoea is well underway with support from the Bill and Melinda Gates Foundation. This project is being carried out in collaboration with the Ministry of Health, the Social Marketing Company, and Nutriset, and is being coordinated with programmes of WHO and USAID. Since the project was initiated in mid-2003, much of the effort during the first year has been in making arrangements for production of the zinc tablets, formative research on management of diarrhoea in children, and making preparations for a 'roll-out' of zinc tablets during 2004.

Consistent with the new WHO/UNICEF recommendations, one 20 mg zinc tablet is to be taken daily for ten days by all children suffering with diarrhoeal illness. The tablets are distributed in blister packs and dissolve readily when they are mixed with a small amount of water in a teaspoon. Studies at ICDDR,B find that when these recommendations are followed consistently, diarrhoea rates can be reduced by 30%, pneumonia rates by 20% and overall mortality by 50%. Thus, this new treatment has the potential for a major impact on child health.



Zinc tablets, showing how they dissolve in water on the spoon

A community health worker demonstrating wrapping of a newborn baby using a doll with attached placenta



Improving maternal and neonatal health is also a priority at the Centre and is being addressed by several projects involving the Reproductive and the Child Health Programmes. All of these utilize concepts that a comprehensive approach is imperative to address the needs of both mother and the newborn. Artificially dividing interventions into programmes to lower maternal mortality without considering the needs of the infant are insufficient, and likewise, those that only address neonatal health without considering the needs of the mother will not achieve their goal. Still there is a need to identify strategies for each and to integrate them into a single package. The Matlab area now has a functioning comprehensive maternal care programme with community-based clinics, sub-centre delivery services by skilled midwives and efficient referral to the Matlab Upazila Health Complex which now has provision for caesarean sections. The Centre is also validating a new indicator for unmet obstetric need (UON) which is being applied in several districts in the country. With involvement of the key providers of obstetric care, the new indicator can guide future efforts towards making services more widely available and effective. Two new projects—one in Sylhet and one in Tangail district—are focusing on community-based interventions to lower neonatal mortality. The formative research during the first year identified several aspects of community-based delivery care that can be improved through planning, negotiation, and education. Especially important is the role of the community health worker in preparing the family for the delivery, making them aware of complications, and improving newborn care immediately after delivery.

Baseline surveys in the intervention areas have already demonstrated differences in neonatal mortality rates between upazillas, and we hope to demonstrate a significant reduction in neonatal mortality rates from our intervention at the follow-up survey.

Our priority on prevention of foetal growth restriction has concentrated on the 'MINIMat study' (multiple micronutrient intervention) being conducted at Matlab. In this study, more than 4,000 pregnant women were enrolled early in their pregnancy and were randomized to receive a specific schedule of food supplements and micronutrients during their pregnancy. The women and the newborns were then followed for subsequent birth-weight, infant health and development. Foetal sonography was used for monitoring foetal growth, and birth-weights were obtained to determine if the nutritional interventions improved birth-weight. Even more important will be the health and development indicators of the children as they grow older. We expect this cohort of carefully-monitored women and children will continue to yield valuable information in the years to come.

Several studies of new vaccines have been ongoing during 2003, including studies on diarrhoea vaccines (rotavirus, ETEC, and cholera), respiratory infections (*H. influenzae* type b and virus influenza); field sites were being developed that will be suitable for future studies of vaccines for typhoid, dengue, and tuberculosis. An important practical study of the routine EPI vaccines was carried out using the Matlab database to show the beneficial impact of these EPI vaccines on survival of children. An earlier analysis from Guinea Bissau had



The first MINIMat baby Sraboni at 11 months of age

suggested that DPT vaccine might actually have a detrimental effect on overall survival. It is reassuring that the Matlab dataset, which is much larger and more precisely collected, shows that EPI vaccines do, in fact, save lives as one would expect. Interestingly, our Matlab analysis also demonstrates the benefits of herd immunity to measles from our vaccine programme there. Another study, a large-scale effectiveness trial of the conjugated Hib vaccine, demonstrated a 15-30% reduction in pneumonia among those children receiving the vaccine, providing evidence of the potential public-health usefulness of the vaccine if it were introduced in Bangladesh. Among the experimental vaccines, a phase 2 trial of a new human live oral vaccine for rotavirus (Rix 4414) showed the vaccine to be safe in toddlers and infants in Bangladesh. Results of the immunogenicity are not yet available, but plans are underway for an efficacy study of the vaccine in Matlab. Another experimental vaccine was a live oral vaccine for cholera called Peru 15. In phase 2 studies, this vaccine was found to be safe and immunogenic in adults. Studies are ongoing in toddlers and infants during 2004, and there are plans to conduct larger-scale studies of this vaccine candidate. The Centre continues to have interest in the killed oral cholera vaccine, though no clinical trials were conducted during 2003 with this type of vaccine.

In 2004, the Centre will be cooperating with the GAVI through the 'Pneumo ADIP' to determine the burden of disease from *S. pneumoniae* in preparation for future use of a vaccine for this infection

Tuberculosis is estimated to cause 70,000 deaths in Bangladesh and leads to an estimated 300,000 new infections per year nationally.

Bangladesh ranks 4th among countries in terms of having a high burden of disease from tuberculosis. The Centre had not been involved in research in tuberculosis until 2000, but since then it has established laboratories at the Shaymoli Chest Clinic and ICDDR,B for culturing the organism and for conducting molecular studies. A prevalence survey of pulmonary tuberculosis in Matlab found the overall prevalence rates to be 96 per 100,000 with a rate in men six times higher than in women. Many of the strains were resistant to one or more antibiotics, including 5.5% that were resistant to both INH and rifampicin. Ongoing studies in Kamalapur will define the prevalence in this urban slum area of Dhaka. In these tuberculosis activities, the Centre works closely with the Ministry's Tuberculosis Control Programme and its NGO partners (BRAC and Daemen Foundation). In addition to documenting the prevalence from these urban and rural areas and their associated antibiotic sensitivity patterns, scientists have also established molecular methods for typing strains, developed a rapid test using a blood sample to differentiate active cases from inactive ones by measuring antibodies being produced from circulating lymphocytes, and are participating with the World Health Organization in establishing a global tuberculosis specimen bank to accelerate development of new diagnostic tests for TB. Since tuberculosis strikes poor people disproportionately, special emphasis is given to the interaction between this infection, poverty and health.

Regarding fertility decline in Bangladesh, the fertility rates had declined dramatically from nearly 7 to a current rate of about 3.3. To reach replacement levels, however, these rates will need to decrease further to 2.1. Unfortunately, the rate seems to have reached a plateau

Adults on the immunization day in the Peru 15 vaccine study at the Advanced Biomedical Research Unit (ABRU) at ICDDR,B



over the last decade, and the Centre's scientists are attempting to determine factors that may inhibit a further drop in fertility. As may be expected, our studies have shown that many factors inhibit further declines, including gender preference, contraceptive failures, and low age at marriage. Unfortunately, many of the pregnancies appear to be unintended but there may be interventions that can assist these families to limit their family size to the desired number. Improved family planning services, improved method mix and counselling to improve programme effectiveness will be important components, along with targeting special services to those who have reached their desired family size. An important output of the research on fertility plateau is the development of computer models that help understand the observed changes in fertility and help prioritize interventions towards those with the most impact.

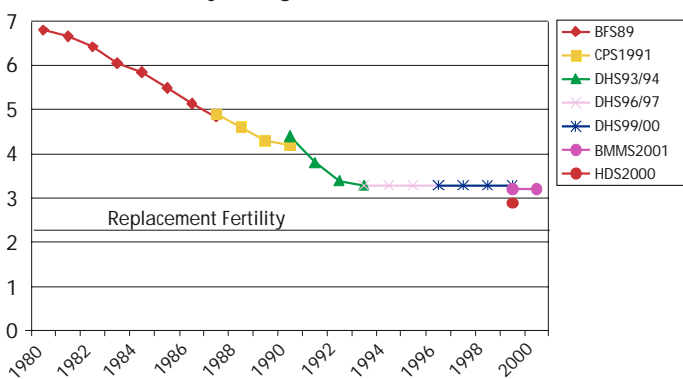
HIV/AIDS Voluntary Counselling and Testing Unit on the ICDDR,B Dhaka campus



HIV/AIDS remains a threat in Bangladesh, and the Centre continues to conduct the national HIV/AIDS serum and behavioural surveillance for the country in cooperation with the Ministry of Health. Findings from the last survey showed that Bangladesh remains a low-prevalence country overall, but that the injecting drug users in Central Bangladesh are beginning to show evidence of a concentrated epidemic with rates approaching 5%. The high rates of syphilis and gonorrhoea among sex workers and the risky behaviour of many groups suggest that Bangladesh is at high risk for spread of the virus into the general population. With the initiation of the HIV/AIDS Programme in 2003, the Centre will be increasing its efforts towards control before an epidemic has spread.

Vector-borne infections have been a new priority for the Centre during the last three years and for the Centre's research; these include:

Trends in Fertility, Bangladesh, 1980-2000, Various Sources



dengue, visceral leishmaniasis, and malaria. Dengue struck Dhaka in epidemic fashion in 2001 and cases of dengue continue each summer though at a lower rate. The Centre's scientists have learnt how to track the epidemic and the vector. Visceral leishmaniasis is endemic in certain districts, especially in North Central Bangladesh; studies in collaboration with Centers for Disease Control and Prevention have characterized this disease and established a field area for future control interventions. Similarly, malaria affects many districts of Bangladesh, especially those bordering India on the eastern side and the Chittagong Hill Tracts. Over 10 million people are at risk of contracting resistant *P. falciparum* malaria, which is more than many African countries; yet malaria receives little emphasis.

These are but a few of the activities at the Centre during 2003, and many additional exciting protocols continue from each of the programmes. Let me conclude with a story about a family that I interviewed recently in the hospital. A 30-year old mother was caring for her one-year old daughter in our Nutrition Rehabilitation Unit when I asked about her situation. She told me that she had brought her child to our hospital when she developed bloody dysentery. She and her husband had recently moved into the city to find work. Her husband was a day-labourer; they lived from day-to-day on the wages he received from his

daily work. The daughter had been very ill with severe malnutrition in addition to the shigellosis, weighing only 48% of her expected weight-for-age. This was the fourth child of this couple, but unfortunately, the first three had all died: the first from drowning at age 3 years, the second from dysentery at 18 months of age, and the third from tetanus during the first month of life. She was pregnant with her fifth child when I talked to her. It became clear that this one family demonstrated so many of the issues the Centre is now facing when dealing with the poor in Bangladesh: drowning is now the number one cause of death in children between one and five year(s), diarrhoea and dysentery continue to kill many children, and tetanus which is completely preventable with vaccine should not occur, but still does because so many mothers and children still are not vaccinated. Additionally, the unplanned and ill-timed pregnancy, and the socioeconomic pressures forcing families into the city are all the problems that we see every day. Although discouraging to think of the three previous children who died, there is now opportunity for this tiny child, through the care she is receiving from her mother guided by ICDDR,B, and there is hope for the next unborn child with the tetanus vaccine she received while her child was hospitalized.



Kala-azar Health Education Campaign Day at Fulbaria, Mymensingh— Villagers' rally holding placards stating "We want to be free from kala-azar"

We hope you will enjoy reading about the work of this Centre in Bangladesh, still the only international health research centre located in a developing country. Please feel free to contact us to be

A view of the Nutrition Rehabilitation Unit at the Dhaka hospital of ICDDR,B



placed on our mailing list for our newsletters —The Glimpse, and the Health and Science Bulletin. Also you may wish to subscribe to our peer-reviewed journal — the Journal of Health, Population and Nutrition. For those who can give, we also ask for your financial support for those service activities that cannot be supported through grants and contracts. These are very important to those we serve.

Handwritten signature of David A. Sack, MD

David A. Sack, MD
Director



Child Health

The mandate of the Child Health Programme is to contribute to the development of cost-effective child health and survival programmes by enhancing the understanding of the causes of childhood morbidity and mortality and by testing public-health interventions to improve child health and development. Activities in 2003 are highlighted below.

Integrated Management of Childhood Illness

ICDDR,B is implementing an evaluation of Integrated Management of Childhood Illness (IMCI) in part of Matlab upazila in collaboration with the Ministry of Health and Family Welfare, Government of Bangladesh. This study is part of the global multi-country evaluation of IMCI supported by WHO and USAID, and is designed to measure the impact of IMCI on child mortality.

IMCI strategy addresses the most common causes of child mortality in developing countries through skills improvement of health workers, strengthening of health systems, and improvement of community and family practices. The details were reported in earlier reports. The experiences and lessons from the second year of IMCI implementation are now briefly described. In 2003, full-scale implementation of community IMCI activities was started in the intervention area. The existing community-based field staff launched a community education intervention for improving feeding and care-seeking for childhood illness in the intervention areas. The study team

worked closely with the Government, UNICEF, WHO, and other partners in the development of a national community IMCI strategy.

To improve our understanding of childcare and care-seeking practices for the sick child, formative research was conducted. The research, designed to identify factors that may be targeted through a behavioural change-intervention strategy, focused on feeding practices and management of pneumonia.

The study design included a mix of qualitative methods, such as key-informant interviews, open-ended interviews with primary caretakers of young children, household observations of caring practices, and detailed accounts of self-treatment and sequences of healthcare-seeking behaviours from confirmed pneumonia cases. Cognitive mapping procedures were also administered, and these included freelist, rating exercises, and hypothetical case scenarios. Research findings illuminated a set of common problems and potentially harmful practices relating to childcare that may negatively affect the health and nutritional status of young children.

Results of the study on feeding practices elucidate the common perception of insufficient breastmilk, resulting in a tendency to introduce complementary foods at a dangerously early age in the child's life.

Community IMCI: Intervention Components

- Improving feeding, caring, and care-seeking practices: advertising the improved quality of care from IMCI facilities stimulates communities to seek care from trained service providers
- Training community-based workers in counselling and problem-solving: to help the mother feed her children better and seek early and appropriate care for her sick child
- Community meetings, including local theatres: to increase awareness in various population segments, help create a positive environment for good caring and care-seeking practices, involve local leadership, and promote accountability
- Improving access to community-based healthcare: engaging local village-level practitioners to avoid harmful practices and ensure referral of severe cases

Home management includes the application of mustard oil either to the child's or mother's body, and potentially harmful practices, such as oral or topical application of kerosene or wrapping the feverish child in a thick blanket or warm clothes

At the same time, care providers follow a passive approach to feeding the young child, providing foods only when the child shows interest or is willing to eat and even allowing infants to control the amount of food consumed. A focus in the behavioural change strategy is on modifying feeding styles, such as using innovative methods to encourage the young child to eat, keeping the child stationary during feeding, and ensuring that the child is served a separate portion. For children aged over 12 months, efforts are being made to improve the quality of snacks given in between meals.

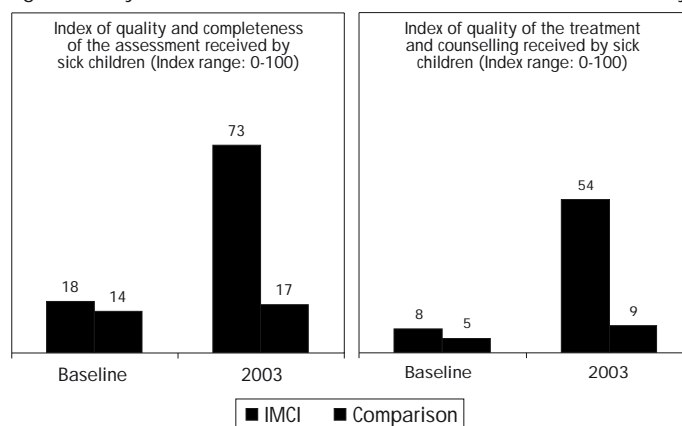
In regard to research on the management of pneumonia, causal interpretations were frequently linked to the mother's behaviour. Over 90% of explanations were related to humoral belief theories involving over-exposure of the child to cold substances or consumption of foods that possess cooling properties, causing the child to contract what is locally perceived as a 'cold' condition. For fear of being blamed for poor caring practices, mothers are reluctant to share the illness with other family members until the child's condition becomes extremely serious, ultimately prolonging the administration of home remedies designed to 'heat' the body, and delaying care-seeking. Home management includes the application of mustard oil either to the child's or mother's body, and potentially harmful practices, such as oral or topical application of kerosene or wrapping the feverish child in a thick blanket or warm clothes. The findings also illuminate distinct trends in care-seeking patterns. While initial treatment is commonly done with local, untrained healthcare providers, the type of practitioner selected varies according to such factors as the child's age, aetiologic

interpretations of the condition, and perceptions of appropriate therapeutic measures.

Positive practices or alternative approaches to providing care for the young child were identified, and a corresponding set of messages to deliver to mothers and other family members was developed. The messages were then tested in an extensive field trial to assess acceptability and feasibility in the community, and a problem-solving guidebook was developed. The guidebook is designed for the community health workers to use during one-on-one counselling sessions with care providers to young children.

The trend of increased use of the IMCI facilities seen in 2002 was sustained in 2003 with greater differentials between IMCI and comparison facilities. In 2003, a repeat health facility survey was conducted in all the intervention and comparison facilities. The following figure compares two indicators of quality of care between IMCI and comparison facilities at baseline (2000) and in 2003. There has been a substantial improvement in these indicators.

Fig.1. Quality of care in first level health facilities—IMCI evaluation study



Neonatal Health Interventions

Neonatal mortality is still high in Bangladesh and accounts for the largest number of deaths of children aged less than 5 years. The Centre is undertaking two major neonatal intervention research projects—PROJAHNMO-1 and PROJAHNMO-2—aimed at evaluating the impact of a package of pregnancy, delivery and newborn care interventions on neonatal mortality. These cluster-randomized trials are implemented in 3 upazilas (Beanibazar, Zakiganj, and Kanairghat) of Sylhet district and one upazila (Mirzapur) of Tangail district.

The Sylhet project (PROJAHNMO-1), supported by USAID and SNL/SCF-USA, is being implemented in partnership with Johns Hopkins University, Shimantik (a national NGO), Ministry of Health and Family Welfare of the Government of Bangladesh, Dhaka Shishu Hospital, Institute of Child and Mother Health, and BRAC. The study also focuses on measuring antimicrobial resistance in the community. The project targets improvement of newborn care, recognition, and management of neonatal infections by mothers, family members, and first-line health workers. The formative phase, including qualitative studies and baseline survey, is completed, and the intervention package is developed, which is being implemented in the study areas.

The Mirzapur project (PROJAHNMO-2), supported by the Wellcome Trust, UK, is being implemented in partnership with Johns Hopkins University, Oxford University, Kumudini Hospital, and Dhaka Shishu Hospital. In addition to the above general aim, the project has a specific focus on identifying aetiology of neonatal infections in the community.

The formative phase of these two studies has been completed, which includes qualitative research, baseline household surveys, and verbal autopsy. Selected findings of the baseline household survey are presented in Table 1. With regard to time of death, it was observed that about two-thirds of neonatal deaths occur in the first week of life. Some immediate newborn care practices differ between the sites, for example, cutting the cord before delivery of the placenta is a predominant practice in Mirzapur unlike in Sylhet. More than one-third of newborn babies are left alone in Sylhet, while in Mirzapur, this practice is rare. Immediate drying and wrapping is not common in either of the two areas.

Table 1. Immediate newborn care practices

Immediate newborn care	Sylhet (%)	Mirzapur(%)
First task done immediately after delivery		
Cut cord	54	95
Baby left alone	41	0
Baby not dried till delivery of placenta	87	86
Baby not wrapped till delivery of placenta	86	85
Baby kept on the floor till delivery of placenta	68	86
Feeding colostrum	61	96

A CHW demonstrating drying and wrapping a newborn to pregnant women and other family members



As in other areas of Bangladesh, institutional delivery was, on average, very low (6%) in Sylhet, while in Mirzapur, about 14% of respondents reported the baby being delivered at health facilities. In terms of birth attendants, senior female family members were more common (39%) in Sylhet. In Mirzapur, trained TBAs attended about 36% of deliveries opposed to only 14% in Syhet.

There are marked inter-upazilla differentials in neonatal mortality in Sylhet. In Zakiganj upazilla, the rate was 62 per 1,000 livebirths, while it was only 28 per 1,000 livebirths in Beanibazar. The underlying features and contributing factors for such differentials are being investigated. The neonatal mortality rate in Mirzapur is 28 per 1,000 livebirths.

Intervention components, initiated in 2003 in both the study areas, include behaviour change communication (BCC), antenatal, delivery and newborn care, recognition and management of serious neonatal infections, and health systems strengthening. The BCC activities stress birth and newborn care preparedness. These are done at both household and community levels through community health workers and community mobilizers. The community health workers also make a number of postnatal visits to ensure proper newborn care.

The most commonly-used traditional birth attendants (TBAs) have been identified and oriented on clean delivery and danger signs. Community meetings with different target groups are being conducted. Healthcare providers from family welfare centres, upazilla health

complexes, and local NGOs have been trained on essential newborn care, and these centres are being increasingly used as referral centres for maternal and neonatal complications. In Mirzapur, similar community-based interventions are being implemented, and the Kumudini Hospital is used as the referral centre to manage delivery, postnatal complications, and the sick newborn.

Maternal and Infant Nutrition in Matlab

Forty-five percent of newborn children in Bangladesh weigh less than 2,500 g (the recognized cut-off for low birth-weight). This proportion is the highest in the world. The Centre has initiated major intervention studies to understand how to improve maternal and foetal nutrition, and child growth. Maternal and Infant Nutrition in Matlab, widely known as MINIMat, is a project that will initially require 4 years to be completed and has multiple components. However, the study will continue to have rewards for at least 20 years as we learn the long-term consequences of low birth-weight and the benefits of the interventions. The project is also a unique example of collaboration with more than 40 investigators from 10 participating institutions/partners. Apart from ICDDR,B, these partners include BRAC, GoB, Cornell University, London School of Hygiene & Tropical Medicine,

Compared to previous years before the study, there had been an overall increase in the proportion of institutional deliveries (approximately 40%)

Institute of Child Health-London, Umeå University, University of California-Davis, London University, National Institute of Public Health-Mexico, Barts Hospital-London, Uppsala University, and Karolinska Institute, Sweden. This research initiative is being implemented in Matlab in the context of the National Nutrition Project interventions and with support from UNICEF, DFID, and many others.

The design and interventions of MINIMat have been described in earlier reports. Enrollment of 4,436 pregnant women to the study was completed by October 2003. On an average, the women gained about 5.65 kg by week 30 of pregnancy. However, a substantial proportion of the women actually lost weight during pregnancy (Fig. 2).

By October 2003, 2,319 infants were born to the study cohort and were measured for weight after birth. Compared to previous years before the study, there had been an overall increase in the proportion of institutional deliveries (approximately 40%). The overall prevalence of low birth-weight in the study population is 37% (Fig. 3). Mean birth-weight was 2,613 g (SD=427). The study had measured gestational age using both ultrasound and last menstrual period (LMP). Figure 3 presents both the sets of estimates for gestational

Fig.3. distribution of births by birth-weight as of 31 October 2003-MINIMat study

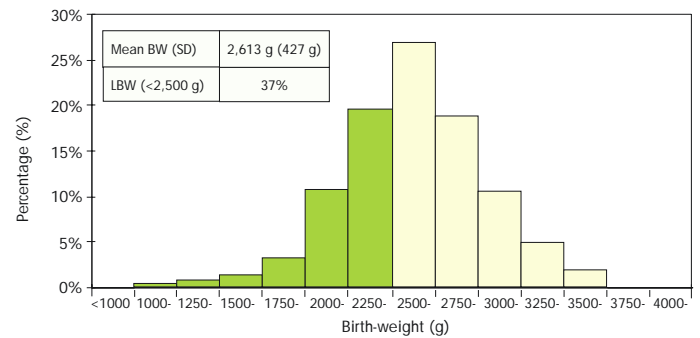
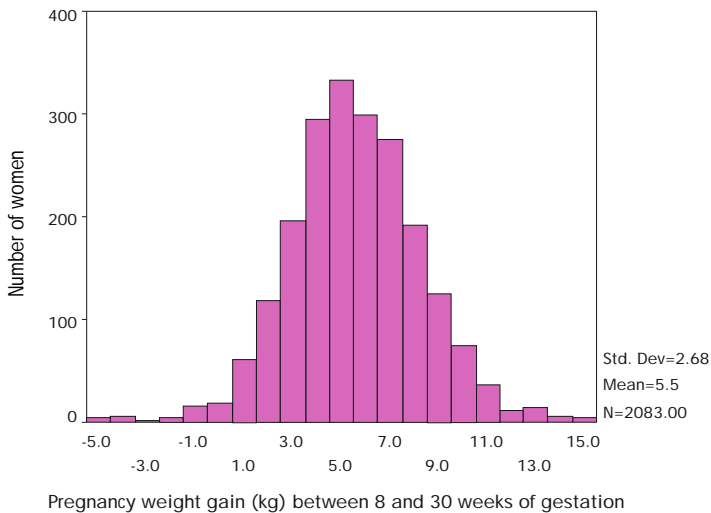
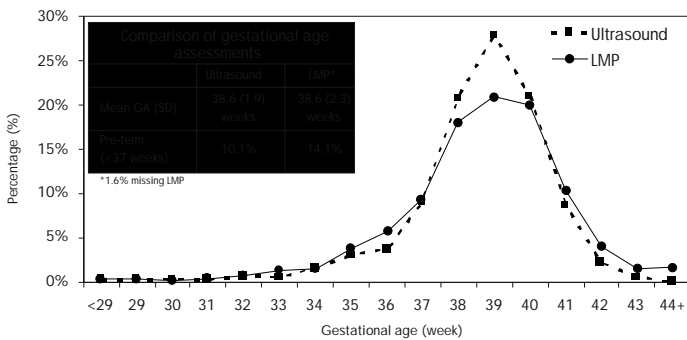


Fig.2. Distribution of pregnancy weight gain in women from 8-30 weeks of gestation-MINIMat study



age at birth. The mean gestational age is exactly the same (38.6 weeks) from the two methods, but the LMP-based methods are more variable, i.e. the distribution for the LMP-based estimates has wider

Fig.4. Distribution of births by gestational age and method of gestational-age measurements of 31 October 2003-MINIMat study



statistical distributions. A consequence of this is that the estimated pre-term prevalence is higher using LMP (14.1%) compared to ultrasound (10.1%).

Child Development

With the realization that child development is both an outcome and a determinant of child health and societal progress, the Centre has expanded its research on child development which focus on measuring the effects of nutritional deficits, poor health and deprivation on the development of children, and to design and evaluate innovative, low-cost and feasible approaches to promoting the development of children in resource-poor situations.

In a large community-based study (MINIMat) at the Matlab field site, the Centre's scientists are assessing the individual and combined effects of several interventions on infants' cognitive, motor and language development and behaviour. The interventions

being examined are micronutrient and food supplementation, and counselling for exclusive breastfeeding. The development measures include monthly motor milestone from 3 to 15 months; problem-solving capacity and Bayley PDI and Behaviour Test at 7 months of age; language development inventory, HOME inventory, and UNICEF's Family Psychosocial Care Practice measures at 12 and 18 months; and the Bayley Mental and Psychomotor Test at 18 months. Also being investigated is the relationship between these developmental measures and pregnancy weight gain, maternal exposure to arsenic, maternal anaemia, maternal depression, and foetal and infant growth. The target sample comprises 1,800 infants.

Additional studies focus testing the effects of psychosocial stimulation on the mental development and behaviour of children, in comparison with nutritional interventions. The Centre's scientists are also investigating the association between children's urinary arsenic and mental development.

Motor Milestone Assessment



1. Neck Control



2. Lifting head & upper chest



3. Sits supported



4. Picks cube



5. Transfer object



6. Sits unsupported



7. Crawls



8. Pulls stand



9. Stands supported



10. Walks assisted



11. Stands alone

12. WALKS ALONE



Reproductive Health

The mandate of the Programme is to address issues relating to reproductive health research with major emphasis on safe motherhood, family planning, and prevention and treatment of sexually transmitted infections.

Provision of basic and comprehensive EOC services

Provision of basic essential obstetric care services from upgraded government facilities and from 4 sub-centres and Matlab clinic run by ICDDR,B continued throughout 2003. Figure 1 shows the number of normal deliveries that take place per month at these union-level government facilities. While in the ICDDR,B sub-centres, the performance is better than in the government Health and Family Welfare Centres (H&FWCs). Trends of referrals are also increasing from basic to comprehensive EOC facilities. By the beginning of 2003, all preparations were there to provide comprehensive EOC services from the newly-constructed MCU (maternity care unit) of Matlab Upazila Health Complex (UHC), except that there was no trained obstetrician to do caesarean sections. ICDDR,B, at that point, lobbied with the Government and took formal permission from the Director General of Health Services (DGHS) so that comprehensive EOC services could be initiated by an ICDDR,B-employed obstetrician. Accordingly, Dr. Aminur Rahman (ICDDR,B obstetrician) performed the first c-section on 6 February 2003, when a 20-year-old mother, having her first child, presented with prolonged labour and foetal distress. Dr. Rahman, with assistance from Dr. Syed Md. Huda (the trained GoB anaesthesiologist) and Dr. Md. Shahnewaz (UH&FPO), performed a

lower uterine c-section and delivered a live, male baby weighing 3 kg. Both mother and the baby were discharged on 14 February 2003 in good condition.

In the meantime, the GoB obstetrician began work in April 2003 after the completion of one-year training on obstetrics and gynaecology from Sir Salimullah Medical College, Dhaka. Forty-nine c-sections were performed in MCU of the Matlab Upazila Health Complex during the year (Fig.2).

Fig.1. Trends of normal vaginal deliveries in GoB facilities in Matlab in 2003

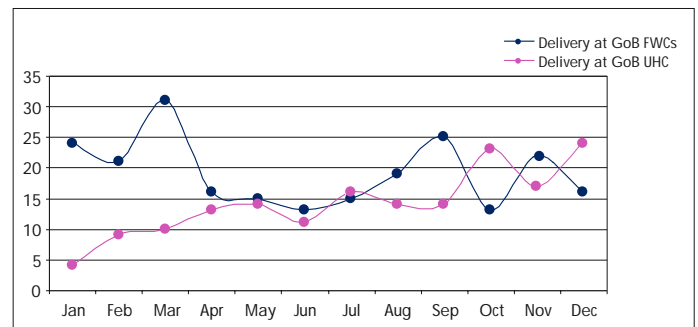
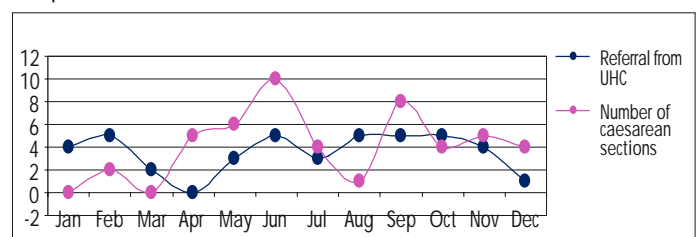


Fig 2. Number of caesarean sections in government Matlab Upazila Health Complex



Raising community awareness and conducting census in 4 unions of Matlab (outside the HDSS area)

Results of the baseline EOC survey indicate that the level of awareness about pregnancy danger signs was low, particularly among respondents from outside the Matlab HDSS area (Table 1).

fieldworkers. A communication package was developed in collaboration with Bangladesh Center for Communications Programs to impart behaviour change communication (BCC) on safe motherhood. The BCC package included a set of flip charts and pictorial cards with printed communication messages, pictures on pregnancy danger signs, pregnancy planning, nutritional needs during pregnancies, and

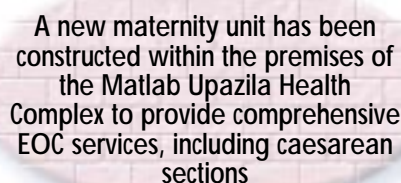
availability of EOC services in the community. Following the development of the communication package, a training of trainers was organized for implementing BCC. These trainers subsequently trained the field workers and their supervisors in Matlab, mostly from the government sector in batches. The ICDDR,B field supervisors also took part in the training sessions.

During the house-to-house visits, the field workers, in addition to BCC, monitored pregnancies using pregnancy-monitoring tools, took a census of households, and assessed care-seeking behaviour of the community for maternity services. The purpose of this additional data collection is to generate a denominator for different indicators outside the Health and Demo-

Table 1. Level of awareness about pregnancy danger signs among 2064 respondents in Matlab

Place of residence	Percent with correct knowledge of pregnancy danger signs		
	At least 1 danger sign	At least 2 danger signs	At least 3 danger signs
ICDDR,B area (n=375)	73.1	44.3	11.7
Rest of Matlab (n=1689)	60.4	23.9	4.5
Total	62.7	27.6	5.8

As part of the safe motherhood interventions in Matlab, ICDDR,B initiated awareness-raising exercises in the community about pregnancy danger signs in 2001, and the same exercise was repeated in 2002. During 2003, intensive house-to-house visits were organized in 4 of 8 government intervention unions by the government



A new maternity unit has been constructed within the premises of the Matlab Upazila Health Complex to provide comprehensive EOC services, including caesarean sections

graphic Surveillance area of Matlab. The impact of this intense awareness-raising effort will be evaluated through a community survey.

What are the ongoing EOC interventions in Matlab area?

In the ICDDR,B intervention area, maternity care services were initiated in 1987 by posting community-based trained nurse-midwives in Block C and D, supported by the ICDDR,B's Matlab clinic and strong referral linkages with comprehensive EOC facilities located in Chandpur, the district headquarters. By 1991, the community-based strategy expanded to the rest of the intervention area by posting additional midwives in Block A and B and continued till 1996. Since 1996, community-based strategy was gradually replaced by facility-based strategy, and basic EOC services are now provided from 4 sub-centres (situated in 4 blocks of ICDDR,B intervention area) by trained nurse-midwives with similar referral linkages.

In recent years (1998-2003), basic EOC services have been expanded in 8 more unions of Matlab upazila in collaboration with GoB. Eight existing union-level H&FWCs were renovated, upgraded, and equipped to provide basic EOC by trained government family welfare visitors (FWVs). In addition, a new maternity unit has been constructed within the premises of the Matlab Upazila Health Complex to provide comprehensive EOC services, including caesarean sections. Matlab area is now equipped with sufficient number of functional basic EOC facilities providing maternity services following either a programme approach (in the ICDDR,B intervention area) or a project approach (in

GoB-ICDDR,B collaboration area) supported by a functional comprehensive EOC system at the Matlab Upazila Health Complex.

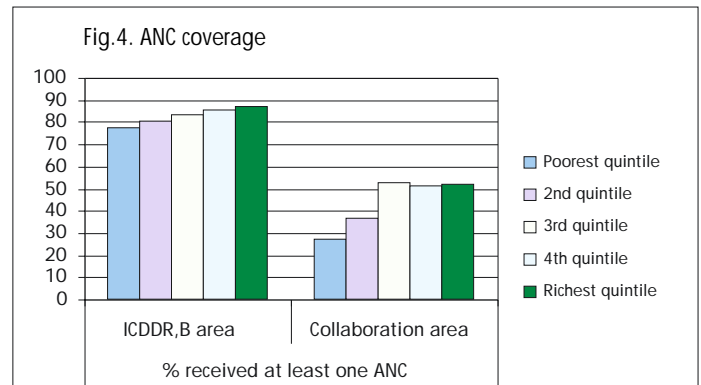
How the ongoing EOC interventions are reaching the poor?

Equity in access to, and use of, maternal healthcare services are the goal for development partners and policy planners throughout the developing world. Despite the fact that policy-makers are increasingly concerned about equity, there have been little empirical analyses of the extent to which different development projects and strategies in each country have succeeded in equity terms. In Bangladesh, few systematic studies have been conducted to address equity, particularly in the field of maternal health. During 2003, ICDDR,B conducted a poverty incidence analysis for 2 ongoing maternal health interventions in Matlab with financial support from the World Bank/Washington, to answer the following research questions:

1. To what extent are women in need using the available essential obstetric care services as provided in Matlab through the ongoing interventions?
2. To what extent are women from the poor segment of the population using those services?

Findings on distribution pattern

In the ICDDR,B intervention area, 15,041 pregnancies were recorded through HDSS during 1997-2001, but pictorial card data were avail-



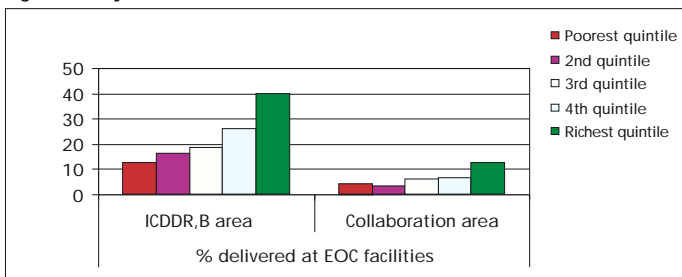
able from 12,080 (80.3%); of them, 11,559 could be linked to socioeconomic census data conducted in 1996. So, we could use these 11,555 cases only to undertake a poverty-wise incidence analysis. Again, some information was missing in the pictorial cards. The analysis was not restricted to mothers with complete data for all information, rather it was done separately for each datum. As a result, number of mothers with missing data varies throughout the results.

During 1997-2001, 22.5% deliveries in the ICDDR,B intervention area took place in some EOC facilities. Of them, 9.5% were delivered at 4 sub-centres, 9.3% at the Matlab clinic, 2.0% in public facilities and the remaining in the private facilities. Skilled midwives at home attended an additional 2.7% of births. So, in ICDDR,B intervention area, a skilled birth attendant was present for 25.2% of deliveries during the reference period. Eighty-three percent of mothers made at least one antenatal care (ANC) visit in the ICDDR,B intervention area, 51% received at least one postnatal visit, and 1.6% had caesarean section. The stillbirth rate was 2.8%, while the abortion rate was 1.0% in this area.

Fourteen percent of mothers from the poorest quintile households had skilled attendants at birth, while it was 45.7% for mothers from the richest quintile households. The rich:poor ratio was 3.2 (Fig.3).

The c-section rate for mothers from the poorest quintile was 0.5%, while it was 4.6% for mothers from the richest quintile and the rich:poor ratio was 9.2. The rich:poor ratio for facility-based delivery was

Fig.3. Facility-based deliveries in two intervention areas



3.2. Disparity prevail for accessibility to ANC or postnatal care (PNC) services as well but was less pronounced (Fig.4) than other indicators (rich:poor ratio is 1.1 for ANC and 1.2 for PNC visits).

In addition to socioeconomic status, other factors that influenced the use of services significantly are education of mother, area of residence (block), age, parity, and year of delivery.

In the GoB-ICDDR,B collaboration area, 1,895 mothers could be monitored during 2001-2003 from 4 of 8 unions using the project-designed 'pregnancy monitoring tools'. Only 6.4% of deliveries took place in some EOC facilities, while the total attendance rate of skilled service providers was 8% in this area. Forty-three percent of mothers received at least one ANC. The stillbirth and abortion rates were 2.8% and 0.8% respectively, while the caesarean section rate was 1.5% (Table 2).

The use status of maternity services is far better in the ICDDR,B intervention area than in the GoB-ICDDR,B collaboration area, although the reporting period of ICDDR,B area was earlier (1997-2001) than that of the collaboration area (2001-2003).

The rich:poor ratio was 3.2 for facility-based delivery and 3.95 for skilled attendance at birth in this area. The rich:poor ratio observed in this area is slightly higher than that in the ICDDR,B intervention area. And the rich:poor ratio in regard to accessibility to ANC services was 1.9, while it was 2.6 for caesarean section. The rich:poor ratio for

ANC is higher in the collaboration area than in the ICDDR,B area (1.9 vs 1.1), while the rich:poor ratio for caesarean section is higher (Fig. 3 and 4) in the ICDDR,B intervention area than in the collaboration area (9.2 vs 2.6).

The effect of mother's education is distinct and remarkable as observed in the ICDDR,B intervention area. Results also demonstrate that age and parity have distinct but negative influence upon use of maternity services. The more the age or parity the less the likelihood that the women will consume maternity services.

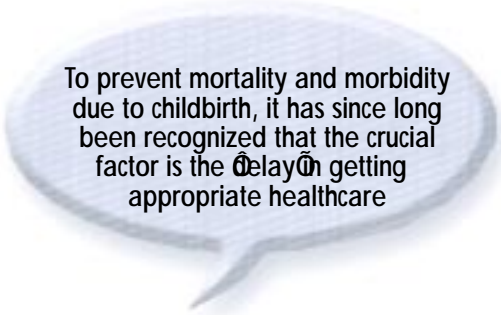
Who used the upgraded EOC facilities?

Facility-based data were used for undertaking a poverty incidence analysis, i.e. to examine who are the beneficiaries of the ongoing maternity interventions, or in other words, how the programme outputs are distributed over different socioeconomic groups. Of 3,197 births recorded in the maternity registers of ICDDR,B sub-centre and Matlab clinic, 3,054 could be linked to socioeconomic census data and were included in analysis. Results depict a similar pattern of inequality as evidenced from monitoring data: among those who used ICDDR,B facilities, 31.9% were from the richest quintile households, while only

Table 2. Use of EOC services in ICDDR,B intervention and comparison areas in Matlab

Indicator	ICDDR,B intervention area (N=11,559)	GoB-ICDDR,B area (N=1,895)	National average (N=39,525) BMMS'01*	National average in rural areas (N=32,699) BMMS'01*
% having skilled attendants at birth	25.2	8.0	11.6	8.4
% delivered at health facilities	22.5	6.0	8.8	6.1
% received ANC	82.7	43.9	47.5	44.1
Mean number of ANC	1.9	2.5	1.8 (median)	1.6 (median)
Population-based C/S rate	1.7	1.5	2.6	1.6

*BMMS'01=Bangladesh Maternal Mortality Survey 2001



To prevent mortality and morbidity due to childbirth, it has since long been recognized that the crucial factor is the delay in getting appropriate healthcare

12.5% were from the poorest quintile households. Access to services was systematically higher for wealthier mothers. The extent of disparity varied from facility to facility. It was the highest for Matlab clinic which may be due to more distance from home or for higher cost incurred for transportation or other associated costs. It implies that ICDDR,B interventions, through a programme approach, have succeeded in improving the overall indicator status for maternity care for its catchment population, but the programme output is not equitably distributed among different socioeconomic groups. In other words, the interventions are obviously efficient but the equity goal is yet to be achieved.

Unmet need for life-saving obstetric surgery (major obstetric interventions for absolute maternal indications) in Bangladesh

Maternal mortality is still high in Bangladesh. Moreover, Bangladesh has among the lowest indicators of use of maternal healthcare services in the world: until recently, around 67% of all pregnant women had no antenatal check-ups throughout their whole pregnancy, around 92% of deliveries occur at home, and approximately 87% of deliveries occur without the presence of a skilled attendant.

To prevent mortality and morbidity due to childbirth, it has long been recognized that the crucial factor is the 'delay' in getting appropriate healthcare. Barriers to accessing healthcare have been identified, i.e. geographical barrier/transport, low perceived risk, cost, perceived quality of care/patient-satisfaction, cultural barriers, such as shame,

position during delivery, decision made by in-laws, etc. Certain interventions have been tried, but the impact achieved is far less than expected.

In Matlab, the situation is a bit better, but still lower than expected. It seems that something important has been overlooked. The relative importance of each of these barriers has never been studied; No studies have been done to know who are the decision-makers in and outside the family, or what and who make the difference among those who decide to use services. There are few places in Bangladesh where use and especially non-use of services can be studied so well as in Matlab.

In a 1990-1999 delivery-cohort in Matlab HDSS, the Unmet Obstetric Needs Project is studying the unmet need for life-saving obstetric surgery through verbal autopsies and the met need for life-saving obstetric surgery through hospital data-collection. Among the complicated deliveries, some women accessed appropriate healthcare, others did not, and some women died, others survived. The Project is funded by the Belgian Government and is part of an international UON network, with its base at the Institute of Tropical Medicine, Antwerp, Belgium.

The research-part in Matlab

In Matlab, validation of the methodology of using a new indicator for life-saving obstetric surgery will be used as a tool. At the same time,

Case study 1

A woman, coming from a poor family, had no problems at the beginning of her 5th pregnancy. During early pregnancy, she did not have any check-up, but she took all the doses of tetanus vaccination. Three days before death, she developed labour pain and blood-stained watery discharge. They called a village birth attendant (*dai*) who gave 'versed water' from a village *kabiraj*. The *dai* inserted her hand in the birth-canal several times after applying oil. Baby's head was seen as soon as labour pain developed. The *dai* tried but failed to deliver the baby. The woman had no energy. In the evening, a village doctor was called in, who advised to give an injection, if the baby's head came out. However, the *dai* insisted on giving the injection because labour pain was not increasing and the baby's head could not be seen. After having the injection, she had no labour pain, and baby's head was high up on the upper abdomen. This way the whole night passed.

Next day she was taken to the Nayergaon sub-centre of ICDDR,B, where a ruptured uterus with a dead baby was diagnosed. The woman fell very sick. She was referred to Matlab hospital of ICDDR,B, and the doctors there diagnosed the same and advised caesarean section. Her husband's sister accompanied her, but they had no money. She was referred to Chandpur Sadar Hospital and transported by an ICDDR,B ambulance. Doctors and nurses there did not give any attention to her as they had no money, so she was left alone in a bed. The whole day and night passed thus, and in the early morning, head and neck of the dead baby came out. A nurse was called in to deliver the baby, but she could not deliver. Bad odour spread everywhere. Then a specialist doctor came and delivered the baby with instruments (forceps). The patient became weak and pale and was on intravenous saline. Gradually, her lower abdomen became swollen and stiff with burning sensation on the whole body. Her hands and legs became clenched several times. After delivery, she had normal vaginal bleeding, and the placenta also came out. Subsequently, she developed respiratory distress and died.

it will yield the incidence (proportion) among delivering women who have certain delivery-complications, which are fatal for a woman unless she reaches obstetric surgery. In other words, it will give the total number of women with those life-threatening complications that can only be eliminated by obstetric surgery, such as caesarean sections. This is the sum of women who died from these complications and women who survived with obstetric surgery.

This incidence will be used for calculating the number of expected cases with those complications in each district and year. Then, it will be easy to compare the number of saved cases with the number of expected cases and visualize the unmet need, i.e. women who still did not get treatment and yet survived.

In Matlab, the opportunity was taken to study other aspects, i.e. healthcare-seeking behaviour of women who survived is being compared with that of women who died. The relative importance of

barriers to accessing healthcare will be compared. The importance of different persons in and outside the family as decision-makers to seek healthcare will also be compared. Two case studies are illustrated. A woman died from delivery complications and the other one survived with obstetric surgery.

Public-health use of the epidemiological research in Bangladesh

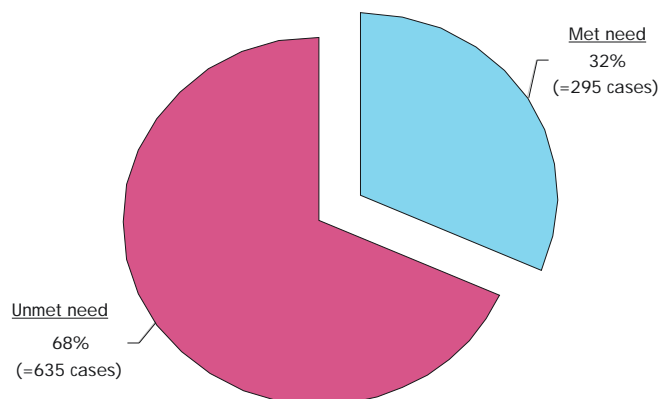
One of the aims of the above project was to introduce the new indicator in the districts of Bangladesh for use by healthcare providers themselves. It will give them an idea of the number of women who die in any given year in their district because those women were not able to be reached in time and could only have survived with the help of an obstetrician.

The new indicator has already been piloted in Tangail district, one of the best-performing model districts, for 2001.

Case study 2

A woman, at 7 months of pregnancy, developed leaking membrane. During the 8th month of pregnancy, she had excessive watery discharge and whitish discharge with foul smelling. She was then brought to the ICDDR,B's Matlab clinic where she was given tablets inside her rectum to increase labour pain. The labour pain increased but her cervix did not open. She was then referred to the Chandpur Sadar Hospital. Finding no doctor there, she was referred to the private Royal Hospital. She spent the whole night there, and in the morning of the following day, she was referred to the private General Hospital. There she had c-section, and a dead baby was born. Her uterus was removed because it was ruptured as explored after opening the abdomen, but no one could diagnose this earlier. In the long run, she survived with obstetric surgery.

Fig. 5. Met and unmet need for specialized obstetric care (obstetric surgery) in Tangail district, 2001



Overview of Tangail results

Expected number of major obstetric interventions (MOI) for absolute maternal indications (AMI): 930 per year (assuming an incidence of 1%), calculated with the following data:

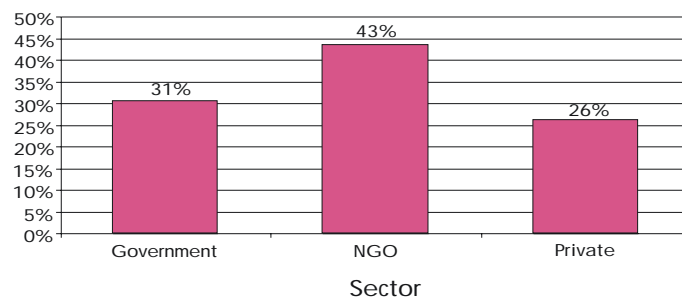
- Total population of Tangail: 3,445,203
- Crude birth rate: 27/1,000 population
- Expected number of deliveries: 93,020 per year
- Met need for life-saving obstetric surgery: 32% (295 cases)
- Unmet need: 68% (\pm 635 cases)

Note: There are 15 hospitals/clinics which could perform obstetric surgery in 2001—4 are government hospitals, 2 are NGO hospitals (of which 1 is Kumudini Hospital), and the remaining 9 are private for-profit hospitals.

After several meetings with DGHS, UNICEF, and the UON team of ICDDR,B, 6 more districts—1 from each administrative division in Bang-

ladesh—have been selected to assess the met and unmet need for life-saving obstetric surgery.

Fig. 6. Percentage of (total managed) MOI-for-AMI's, attended per-sector Tangail district, 2001

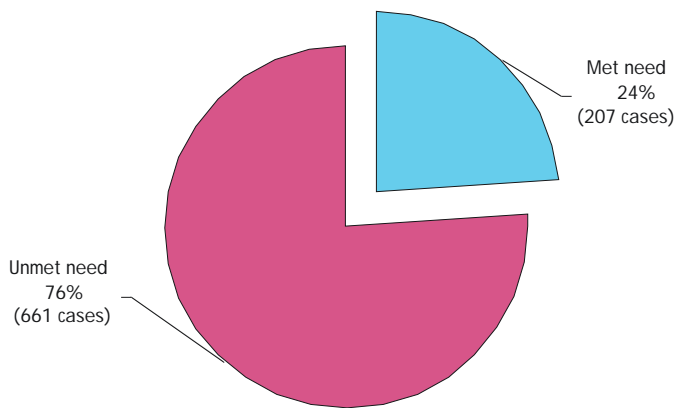


Results from Noakhali district for 2002

Expected number of MOI for AMI: (868 cases) per year (assuming an incidence of 1%), calculated with the following data:

- Total population of Noakhali: 2,903,594
- Crude birth rate: 30/1,000 population
- Expected number of deliveries: 86,850 per year
- Met need for life-saving obstetric surgery: 24% (207 case)
- Unmet need: 76% (\pm 661 cases)

Fig. 7. Met and unmet need for specialized obstetric care (obstetric surgery) in Noakhali district, 2002

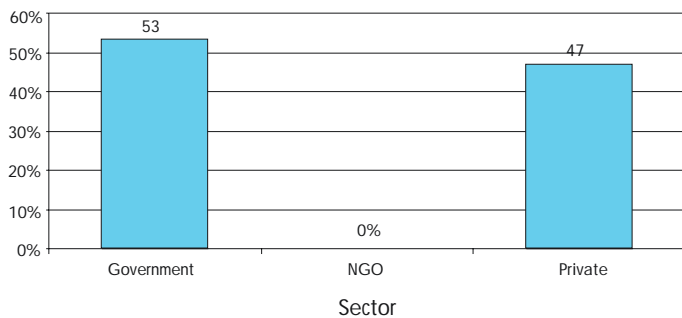


Note: There are 13 hospitals/clinics which could perform obstetric surgery in 2001--2 are government hospitals, and the remaining 11 are private for-profit hospitals.

This new indicator provides information on the extent to which the routine healthcare system of any particular district is able to address the need for specialized obstetric care of its population. It involves the healthcare providers in the process, which should facilitate policy-change. It will be complementary to currently-used indicators for safe motherhood and has the advantage that it is easily and reliably measured at a low cost. It is low-cost, quick and easy, technically solid, and only needs information from a limited number of specialized hospitals.

Acceptability, effectiveness, and cost of strategies designed to improve access to basic obstetric care in rural Bangladesh

Fig. 8. Percentage of (total managed) MOI-for-AMI's, attended per sector in Noakhali district, 2002



Amina lives in rural Matlab with her husband and 5 children. Three years ago, when she was in the final trimester of her pregnancy, she experienced unbearable pain in her abdomen. Having had 3 children previously, Amina was concerned about the severity of the pain and informed her husband who suggested that she consult one of the midwives in the ICDDR,B health facility. After examining Amina, the midwife found that her blood pressure was dangerously high; the midwife gave medication to Amina and immediately had her transported to the Matlab clinic. Once she arrived at Matlab, Amina had a seizure. The doctors recognized that she was suffering from eclampsia and could only be properly cared for in a facility offering emergency obstetric care. The ICDDR,B ambulance transported her to Chandpur, about 20 km from Matlab, where Amina had a cesarean section. Healthy twins were born, and with proper care, Amina gradually recovered.

The unique data sources collected through the Health and Demographic Surveillance System provide information on the demographic and socioeconomic profiles of users of different types of care

Most women living in rural Bangladesh do not have access to this type of referral system and, as a result, when a severe obstetric complication arises, the woman may not survive. In Bangladesh, indicators relating to the use of safe motherhood services are among the poorest in the world. Less than one half of pregnant women obtain antenatal care and almost all births (91%) occur at home, generally with an unskilled attendant (Bangladesh maternal mortality survey 2002; Bangladesh demographic and health survey 2000). Limited access to essential obstetric care contributes to high maternal mortality, recently estimated to be 320 to 400 per 100,000 livebirths (Bangladesh maternal mortality survey 2002). Thus far, no clear policies have been formulated towards ensuring basic obstetric care at the community level.

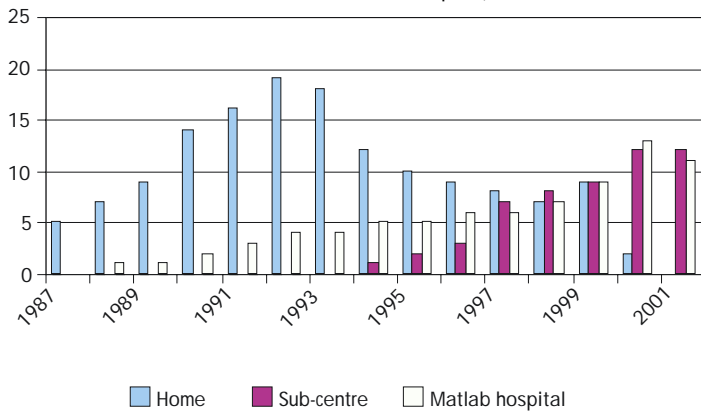
A study was undertaken to evaluate the unique experience of a maternity care programme in Matlab—the field station of ICDDR,B where different approaches of basic obstetric care have been put into place over the last 15 years. Basic EOC services were introduced in Matlab in 1987 under the Maternal and Child Health and Family Planning (MCH-FP) programme. Initially, nurse-midwives were posted in 2 of the 4 health sub-entres to offer basic obstetric care in women's homes and, gradually, the programme was expanded to cover the entire MCH-FP area. Beginning in 1996, the strategy of home birth with a midwife was progressively shifted to a strategy of births in basic EOC facilities, and women were encouraged to give birth in health centres rather than at home. Women requiring a higher level of care are referred to the Matlab Clinic, where female physicians

offer services 24 hours a day and, when the need arises, to hospitals in Chandpur providing comprehensive EOC services.

The current USAID-funded study brings a unique opportunity for secondary data analysis to explore the effectiveness of different birthing strategies offered at the community level. Specifically, the three strategies include: (1) basic obstetric care at home with a trained midwife, (2) basic obstetric care at a health centre with a trained midwife, and (3) home-care with a traditional birth attendant. During 1987–2001, about 47,000 births took place in the MCH-FP programme area. Presently, trends in the use of these categories of services are being analyzed for the 1987–2001 period and compared according to various indicators, including the percentage of births in a comprehensive facility, the percentage of births with a caesarean section, and the percentage of births with a major obstetric complication treated in an EOC facility. The unique data sources collected through the Health and Demographic Surveillance System provide information on the demographic and socioeconomic profiles of users of different types of care. These data are being analyzed to understand the determinants of use of the birthing approaches and, in future, these birthing strategies will be compared for levels of perinatal, neonatal and maternal mortality. In Bangladesh, there exists no such comprehensive database of pregnancy events.

Initial data analysis shows that, since the introduction of maternity care in Matlab, use of trained delivery attendants increased from nearly 5% in 1987 to about 25% in 2001 (Fig.9). This is in sharp contrast to national figures.

Fig 9: Trends in the use of ICDDR,B obstetric services (trained midwife at home, in sub-centre, or in Matlab hospital)



An analysis of the determinants of use revealed that women with no formal education were about 3 times less likely to use the services of trained attendants compared to women with 7 or more years of education (Fig. 10). Consistently lower proportions of older women receive maternity care from trained attendants compared to younger women. Socioeconomic variables were also examined to assess inequalities in using trained obstetric care. Data suggest that women in the poorest quintile are about 2 times less likely to obtain ICDDR,B services compared to those in the richest quintiles of the wealth index (Fig. 11).

Figure 10: Use of ICDDR,B obstetric services by maternal education (1987-2001)

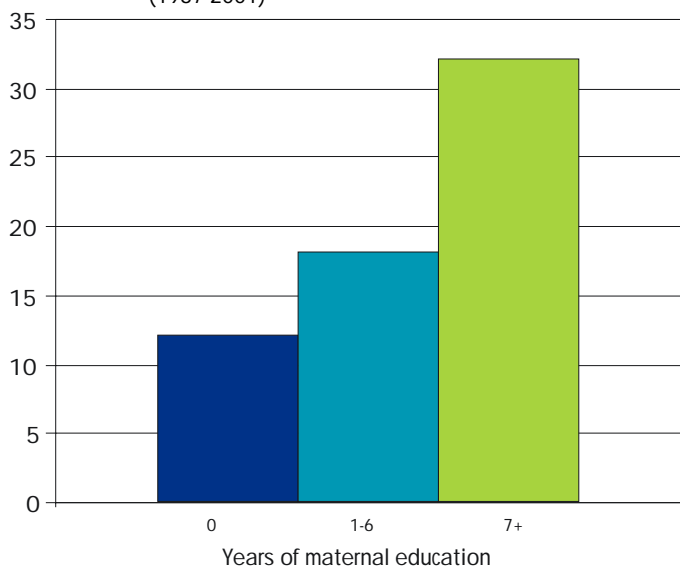
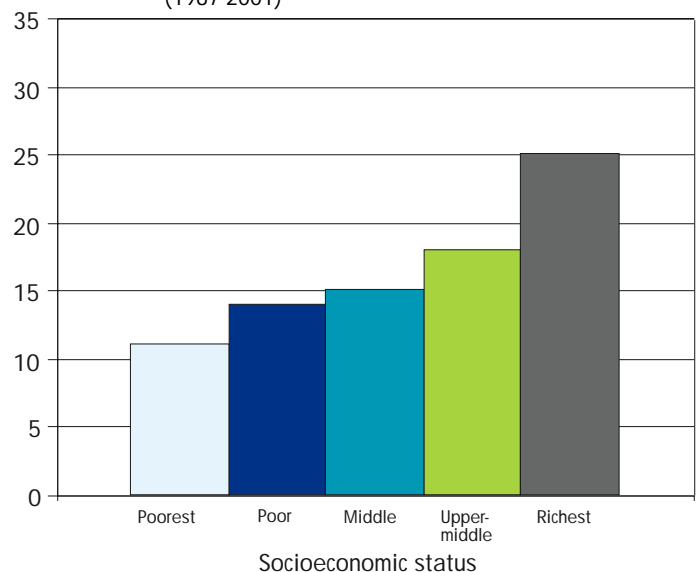



Figure 11: Use of ICDDR,B obstetric services by wealth index (1987-2001)



Another component of the study relates to the acceptability of the different types of delivery strategies offered. In-depth research has been carried out to examine beliefs relating to pregnancy and childbirth; perceptions of complications associated with pregnancy; household decision-making relating to choice of maternity care; birthing practices administered by different healthcare providers; and perceptions of the quality of care provided by different practitioners. A major objective of this component is to identify constraints that women face in accessing skilled birthing care and strategies that help them overcome these barriers. Prior studies have suggested that cultural forces shaping such factors as the location of childbirth, preference to deliver with a traditional birth attendant, and perceptions relating to the circumstances under which a biomedical intervention is warranted, are the biggest barriers to seeking skilled obstetric care. However, our results indicate that fear of referral to an emergency obstetric unit may present the biggest barrier to accessing basic obstetric care. Other salient barriers include influence of the husband, the indirect costs involved in accessing basic care, concerns about delivering on the way to the facility, distance, household responsibilities, and previous bad experiences with the skilled attendants.





An assessment of the successes and failures of contrasting basic obstetric care strategies will provide GoB with valuable information in regard to the best approach to improve obstetric care

The study also includes an economic component. Data were collected to capture direct and indirect costs incurred during pregnancy and any resources used by households or other involved agents for home and facility-based deliveries. Preliminary results show that the average household cost for delivery with a traditional birth attendant (TBA) or trained TBA is about 331 taka (58.3 taka is equivalent to 1 US dollar) compared to about 271, 326, and 589 taka for delivery with a midwife at home, in the sub-centre, and at Matlab ICDDR,B clinic respectively. In contrast, the average delivery cost for comprehensive obstetric care in the Chandpur Sadar Hospital is about 12,211 taka compared to 24,724 taka in private clinics also located in Chandpur. The final analysis will also estimate the total cost (household and provider) under the home- and sub-centre-based management. A cost minimization analysis will also be done.

The overall objective of this research is to support the GoB in its efforts to design effective strategies to increase access to basic obstetric care for all women and to monitor progress in safe motherhood. An assessment of the successes and failures of contrasting basic obstetric care strategies will provide GoB with valuable information in regard to the best approach to improve obstetric care.

Promoting male involvement in reproductive health

In Bangladesh, health and population are among the most urgent development issues. Reproductive health is given top priority in the

Essential Services Package (ESP), while the Government of Bangladesh is committed to the success of ESP. The family planning programme in Bangladesh has been an example of success since contraceptive prevalence rates increased 6 fold between 1975 and 2000, from 8% to 50%, while fertility declined from 7 births per woman to 3.3 over the same period. However, there seems to be a plateau in CPR and a levelling-off of TFR for nearly a decade. Expert opinion reveals that intervention towards male involvement (MI) can potentially contribute towards achieving further success in family-planning programme. Active participation of men as users of family-planning methods and their supportive role for women using contraceptives is an essential element in successful programmes.

Giving timely attention, a project titled "Male involvement in reproductive health" was launched in Matlab 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. The male involvement project is running at its sixth year since 1998 with primary funding support from the European Union. As part of the project activities, baseline quantitative and qualitative surveys were conducted in the Matlab study area to understand knowledge, attitudes, and practices relating to family planning and other reproductive health issues. Four male clinics were made functional in 4 sub-centres in Matlab to provide reproductive health services for male, including vasectomy operations and RTI/STI case management.

As part of the community-based intervention, IEC materials were developed and distributed in the community. IEC materials include project brochures on condoms and STD/HIV/AIDS and posters on condom and vasectomy. In addition, 260 volunteer male peer promoters were involved to increase community awareness and promote male clinic services in the community. So far, more than 3,000 male clients attended 4 male clinics for services, and 215 men were vasectomized. At the end of the fourth year, funding support from EU ended; as a result, most project activities were to conclude, including vasectomy operations. However, ICDDR,B continues to support the project with minimum service activities through the male clinics.

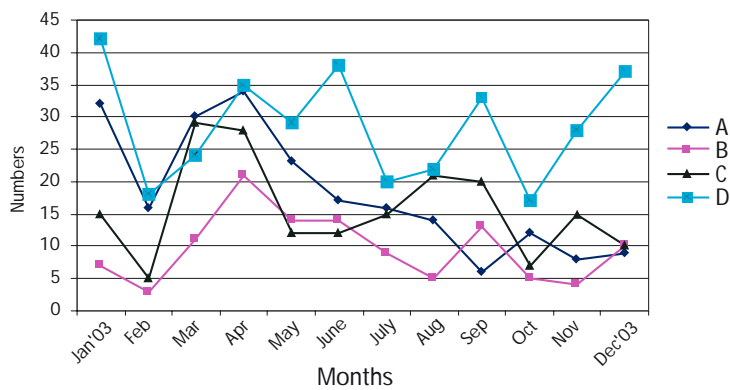
Male clinic services

The 4 clinics continued to provide routine services at a frequency of 2 days per week in all the geographical blocks of the Matlab intervention areas (Block A, B, C, and D). In 2003, 865 men visited 4 male clinics to have reproductive health services provided by trained medical assistants. Performance in Block D was the best and remained the best throughout the reporting period. Performance in Block B was the lowest, which is one of the control areas in terms of peer promoters' activities in the project. The clinic attendance remained somehow stable across the reporting months among the clinics (Fig.12).

During the early months of 2003, only 13 vasectomy operations were performed. This is because vasectomy operations were removed from the service package for funding constraints.

During the initial stage, the project invested heavily to develop/renovate physical infrastructure, including setting up of male clinics with facilities of vasectomy operation, but because of various constraints, the project could not implement all the planned activities, including evaluation of interventions as indicated in the global workplan. Given the fact that male involvement is a potential strategy towards achieving further success in almost all components of reproductive health agenda, particularly in fertility regulation, safe motherhood, etc., further research is needed to understand social norms of, and barriers to, male involvement, particularly use of male family-planning methods and extending support as partners of women using contraceptives.

Fig.12. Male clinic attendance by blocks by months



**Programme Head
(Acting)
S.K. Roy**

Nutrition

The Nutrition Programme continued to explore newer opportunities and examine various alternatives, and was able to develop a number of documents and concept papers in accordance with Centre's Strategic Plan. The Programme completed 2 protocols, and another 11 are ongoing. Scientists associated with the Programme participated in several workshops and seminars during 2003.

National Nutrition Project

In March 2003, the Centre submitted a proposal for Baseline Survey of National Nutrition Project (NNP) to its authority in August 2003, in line with the government plan. An agreement has been reached between the Government of Bangladesh and ICDDR,B whereby the Centre would provide consultancy service for NNP, and both the sides signed the contract in early November 2003. The Centre has identified Prof. Barkat-e-Khuda as Director and Dr. S.K. Roy as Deputy Director of the Project. The survey to be done in 2004 will be carried out in 44 new upazilas of NNP1, 12 control upazilas, and 53 old NNP upazilas in collaboration with the Institute of Public Health Nutrition (IPHN) and National Institute of Population Research and Training

(NIPORT), both of which are governmental institutions. The field data will be collected by Mitra & Associates with monitoring from ICDDR,B, IPHN, and NIPORT.

Cost analysis of PSKP nutrition interventions on severe malnutrition: protocol effectiveness

This study was nested in a larger study that has examined the effectiveness of a community-based, protocolized management of severe malnutrition (see Annual Report 2002). The objective of this study was to analyze cost-effectiveness of the intervention.

During 1 March 2001-31 March 2003, the study enrolled 465 children (severely underweight; weight-for-age z-scores < -3) at 3 identified intervention clinics, with the provision of 6.2 children per clinic per month, of whom 236 (50.85%) were male and 229 (49.2%) were female. Their mean age was 13.4 months (males 13.5 and females 13.3 months) with a mean weight-for-age z-score of -3.88 (males -3.99 and females -3.76). To assess the effectiveness of the intervention, management and monitoring of the children were continued for one month beyond their enrollment period, i.e. until 30 April 2003.

Of the 465 children enrolled up to 31 March 2003 and followed through 30 April, 292 (62.8%) had the mean duration of 88 days in the protocol, and 292 (62.8%) of them improved to moderate underweight. The mean z-score for improvement in weight-for-age was 0.86,



i.e. 0.29 per month. The final status at 'exit from protocol' for the remaining 173 children at the closing date of observation period is presented below:

For hospital-based rehabilitation, a weight gain of <5 g/kg.day for 3 consecutive days was defined as failure to respond to treatment for severely-wasted children. However, no such standard exists for children under home-based management. Thus, considering less well-controlled feeding and disease control regimens for underweight children in the community-based management, a weight gain of at least 3 g/kg.day was considered acceptable. By this measure, only 142 (33.4%) of all study children with weight-for-age z-scores available both at enrollment and exit from the protocol achieved this predefined daily rate of weight gain; of 292 children who improved

to moderate underweight, 126 (43.2%) improved at this rate. As an alternative measure of rates of improvement, a monthly improvement of at least 0.25 weight-for-age z-scores was adopted as minimum expected weight gain, and this was used for monthly monitoring and feedback to the clinic managers and nutrition counsellors of the intervention clinics. Using this measure, 220 (51.8%) of 425 enrolled children improved at a rate of >0.25 weight-for-age z-scores per month, 148 (34.8%) improved at less than the targeted rate, while the weight-for-age of 32 (7.5%) children deteriorated while under protocolized management (Δ weight-for-age z-score per month <0.0).

Children who improved to moderate underweight were followed up for 6 months after their discharge from protocolized management to assess whether the normal rate of weight gain is sustained. Of 418 enrolled children, 170 (40.7%) had improved to moderate underweight by 30 September 2002 and were due for 6-month follow-up at the intervention clinics by 31 March 2003. Due to the high mobility of mainly slum-resident study population and the limited follow-up capabilities of the intervention clinics, 6-monthly follow-up weights were available for only 76 (44.7%), of whom 64 (84.2%) had sustained and even further improved compared to improvements while under

Final status 'exit from the protocol'	No. of children (n=173)	Percentage
Remaining under management	30	6.5
Moved to unknown address	30	6.5
Left the clinic area	51	11.0
Discharged from Protocol unimproved on grounds of parents' non-compliance and non-cooperation	52	11.2
Died while enrolled	5	1.1
Lost to follow-up	5	1.1



Domestic problems and disruption of parental work were the most common causes of refusal to undergo nutritional rehabilitation

protocolized management, and the remainder 12 (15.8%) children regressed to severe underweight as shown below:

Outcome	Mean weight-for-age z-score			Mean difference between discharge and 6-month follow-up
	at enrollment	at discharge	at 6-month follow-up	
Weight-for-age improvement sustained or further improved: 64 children	-2.66	-2.81	-2.47	0.34
Weight-for-age improvement not sustained: 12 children	-3.66	-2.90	-3.41	-0.52

Seven of the 76 children further improved to normal weight-for-age status, achieving a mean weight-for-age z-score of -1.64 at follow-up.

Poor outcome of severely-malnourished children who refuse nutritional rehabilitation and the need for alternative means of management

Nutritional rehabilitation is an integral component of the management of severe malnutrition. As nutritional rehabilitation requires prolonged

stay in a nutrition unit, parents do not always agree to have their children undergo nutritional rehabilitation. A study investigated their compliance to outpatient follow-up and outcome of severely-malnourished children discharged from the hospital, against medical advice, without nutritional rehabilitation.

Parents of severely-malnourished children (weight-for-length <70%, bipedal oedema, or weight-for-age <50%) attending the Dhaka hospital of ICDDR,B for treatment of diarrhoea and other acute illnesses from May 2001 to June 2003 were counselled on the importance of nutritional rehabilitation. Children of parents refusing hospitalized nutritional rehabilitation were enrolled for outpatient follow-up 15 days and 1 month after discharge. During the follow-up, micronutrients were provided and intercurrent illnesses were treated. Of 1,067 eligible children, 658 (62%) underwent nutritional rehabilitation. Domestic problems and disruption of parental work were the most common causes of refusal to undergo nutritional rehabilitation. One hundred (24.4%) of the 409 children refusing nutritional rehabilitation and living within 10 km of the hospital were

Precise anthropometric measurement is necessary for assessment of nutritional status



randomly selected for follow-up. Family income of these children was around US\$2 per day; 37% were male; the median age was 18 months; weight-for-age was $67.2 \pm 6.6\%$; and 11% had bipedal oedema. Thirty-five percent of children could not be traced after discharge, and of those reporting, 62% did this voluntarily, while 38% were to be escorted from residence. Cough, fever, and diarrhoea were the most common illnesses. The median weight gains at the first and the second follow-up visits were 4.0 and 2.3 g/kg.d respectively. Three children died during the follow-up period.

The results showed that severely-malnourished children not undergoing nutritional rehabilitation had poor follow-up compliance and poor outcome, e.g. excessive morbidity, deaths, and poor weight gain. There is an urgent need to find an effective alternative for the management of such children using a health systems approach.

Use of metronidazole in improving nutritional rehabilitation of severely-malnourished children recovering from diarrhoea: a randomized controlled trial

Severely-malnourished children experience an increased incidence of anaerobic infections of the small intestine, often leading to malabsorption of nutrients, poor growth, and systemic anaerobic infections. Use of metronidazole is believed to cure the infection and help in weight gain. A double-blind, placebo-controlled randomized trial evaluated the efficacy of metronidazole in severely-malnourished children with acute illnesses, including diarrhoea and pneumonia/sepsis. The two major outcome variables were: (1) rate of weight gain, calculated from the lowest weight and weight during discharge in terms of g/kg of body weight per day, and (2) days to achieve oedema-free weight-for-length z-score of >-2 SD of the U.S. National Center for Health Statistics (NCHS) median reference. Although the code for drug/placebo blinding is yet to be broken, a preliminary analysis reveals no difference between the study ($n=70$) and the placebo ($n=70$) groups regarding rate of weight gain and days to achieve oedema-free weight-for-length z-score of >-2 SD.

The efficacy of metronidazole has been tested only in moderately-malnourished children. The WHO manual for management of severe malnutrition and also the recently-published Integrated Management of Childhood Illness (IMCI) guidelines mentioned the use of metronidazole in treating severely-malnourished children. However, due to lack of data on severely-malnourished children, the manuals

have just stopped recommending this treatment. If the preliminary analysis of the study is confirmed, severely-malnourished children can be spared from being treated with metronidazole as an additional drug. From a programme point of view, this will save a huge amount of money that can be diverted to other areas in the management of severe malnutrition. This will also help in keeping under control, to some extent, the rising levels of metronidazole resistance of *Helicobacter pylori*, which commonly infects children in developing countries.

Antioxidant status in children with oedematous malnutrition

Oedematous malnutrition or kwashiorkor is one of the most severe forms of malnutrition with a higher risk of death and morbidity. The 'free radical theory' suggests that generation of toxic free radicals inside the body during infections may cause oedematous malnutrition, indicating a possible role of antioxidants for its management. A pilot study assessed the antioxidant status of severely-malnourished children, with or without oedema, and healthy controls by measuring total antioxidant capacity (TAC) of plasma. The study screened 22 children, aged 6 months to 3 years, attending the Clinical Research and Service Centre for the treatment of diarrhoea or for follow-up visits after recovery from diarrhoea and severe malnutrition, of whom 19 were evaluated for the assessment of TAC. TAC was determined by measuring chemiluminescence after adding the sample to a mixture of 2'2'-azobis(2-amidinopropane) dihydrochloride and Luminol and

then estimating the time lag before observing an increase in chemiluminescence. The mean (\pm SD) TAC values in the control (n=7), marasmic (n=6), and oedematous (n=6) children were 298.0 ± 79.54 , 273.7 ± 71.58 , and 218.7 ± 82.01 μ mol Trolox equivalents respectively (p for ANOVA=0.2). TAC values, being the lowest in the oedematous group and the highest in healthy controls, showed a trend ($p=0.08$) that is in harmony with the 'free radical theory'. Further studies with a larger sample size would be required to assess the prevalence and magnitude of oxidative stress in this population and to determine the need for antioxidant supplementation.



Mothers/attendants of children at the CRSC are counselled on the low-cost improved diet for management of malnutrition

Validity and reproducibility of resting metabolic rate measurements in rural Bangladeshi women: comparison of measurements obtained with MedGem™ and with Deltatrac™ device

Basal metabolic rate (BMR) or resting metabolic rate (RMR) accounts for 60-70% of the total energy expenditure (TEE) under normal circumstances. Although BMR data are available for the western populations, such data are scarce for the poor developing countries. Difficulty in measuring BMR is the main limitation for collection of such data from developing countries. A small handheld device (MedGem™) has recently been developed, which can measure oxygen consumption and, thus, provide estimates of BMR and RMR. This small equipment was validated against Deltatrac™ metabolic monitor in 37 non-pregnant and non-lactating rural Bangladeshi women in Matlab. Oxygen consumption and RMR of the women were measured in triplicate with the MedGem and the Deltatrac following a cross-over design during 2 measurement sessions with interval of 2 and a half weeks. After the RMR measurements for each session, anthropometric measurements were taken, and BMR (MJ/day) was estimated for each woman using the prediction equations of WHO.

For oxygen consumption measured with the MedGem, no significant time effect within both the sessions ($p=0.727$ for session 1, $p=0.860$ for session 2) or between sessions (0.870) were observed (Table). Also no significant time effect was observed within session 1 for oxygen consumption measured with the Deltatrac ($p=0.329$), but a small time effect of 2% (highest vs lowest) was found within session 2 ($p=0.013$) and a time effect of 3% between sessions ($p=0.007$).

The coefficients of variance with MedGem for session 1 and 2 and between the sessions were 9.6%, 8.3%, and 8.2% respectively. The coefficients of variance with the Deltatrac for session 1 and 2 and between the sessions were 2.5%, 3.6%, 4.5% respectively. The differences between the variances with both the devices were significant ($p<0.05$). The difference in oxygen consumption between the two devices is dependent on the level of oxygen consumption for

Table. Oxygen consumption (mL/min) measured by Deltatrac and MedGem^a

	MedGem (n=36)		Deltatrac (n=37)	
	Session 1	Session 2	Session 1	Session 2
Measurement A	200±32 ^b	200±34	183±20	177±18
Measurement B	198±36	199±28	184±20	178±20
Measurement C	202±32	201±27	185±20	181±18
Mean	200±30	200±26	184±20	178±18

^amean±SD; ^bn=35

Although Bangladesh is not in a complex nutritional emergency, the nutritional status of its people is among the lowest in the world

session 1 ($\beta_1 = 0.51$, $p < 0.01$) and 2 ($\beta_1 = 0.45$, $p < 0.01$). The BMR values measured with Deltatrac in session 1 (5.35 MJ/day) differed significantly ($p < 0.05$) from the values estimated with the prediction equations (5.16 MJ/day). For session 2, no significant difference was present (5.17 MJ/day vs 5.16 MJ/day).

The results suggest that MedGem is not a reproducible and a valid device for measuring oxygen consumption and RMR of Bangladeshi women in rural setting. The prediction equations used by WHO for BMR provide a reasonable estimation for BMR of rural non-pregnant non-lactating Bangladeshi women aged 18-35 years.

Operations Research under BINP

In the new millennium, one might want to look back and observe that, despite some trends for improvement, the progress in the field of nutrition has been painfully slow.

Although Bangladesh is not in a complex nutritional emergency, the nutritional status of its people is among the lowest in the world. Silent hunger, associated with chronic malnutrition, is often carried through many generations, which is not due to a lack of food but deficiency of certain micronutrients. The magnitude of malnutrition among women and children in Bangladesh is posing a major development challenge in reducing poverty. To address the issue, the Government of Bangladesh decided to emphasize and broaden the activities of nutrition programme with the objective to reduce malnutrition. With

this in view, the Bangladesh Integrated Nutrition Project (BINP) identified ICDDR,B as the implementer of 14 nutrition-related operations research projects in 1996, and the Centre went in full operation with the projects in 1997. After completion of the 14 projects, ICDDR,B was awarded 4 additional projects in December 2000, which too were successfully completed in 2001. Of the total 18 projects, ICDDR,B itself conducted 4 projects, shared 2 projects with BRAC and College of Home Economics, and coordinated 3 projects with the Institute of Child and Mother Health, 3 with Institute of Nutrition and Food Science, 2 with BRAC, and 4 with other NGOs. Reports of the projects are available in publications kept in the ICDDR,B Library.

Effectiveness of large-scale supplementation activities for pregnant women: role of community nutrition promoters

Maternal malnutrition is high in Bangladesh and is associated with low birth-weight. A national food supplementation programme (BINP/NNP) benefiting pregnant women is implemented through community-based nutrition promoters (CNPs). This study, conducted by the Social and Behavioural Sciences Unit, is a sub-study to the ongoing MINIMat trial that is assessing efficacy of the supplementation programme. For a supplementation programme to be effective, sufficient participation and compliance by pregnant women needs to be assured. Little is known about the role that CNPs have been playing in achieving this. CNPs do not have a formal health training, and the social relationship between a CNP and the community, thus, depends, to a large extent, on her and her family's social status in the community.

While it is likely that the nutritional status of community-based nutrition promoters is better than that of the women in the community, many of them remain malnourished, and this may affect her job performance

While it is likely that the nutritional status of a CNP is better than that of the women in the community, many of them remain malnourished, and this may affect her job performance. Job satisfaction is also an important factor for job performance.

The specific aims of this ongoing study are to assess how the characteristics of a CNP, particularly the factors relating to her health and nutrition status, her job satisfaction, and her social status in the community, affect her job performance and the pregnant women's participation in, and compliance with, the food-supplementation activities. An evaluation of the effect on pregnancy outcome is also planned.

All 94 CNPs involved in the food-supplementation activities in Matlab HDSS area (and, thus, also in the MINIMat trial) are being invited to the study, and informed written consent is sought. Their characteristics are evaluated using: (1) anthropometric assessment (weight, height, MUAC); (2) a questionnaire to CNP focusing on aspects relating to her social status, job satisfaction, perceived health, and recalled morbidity; (3) observations of CNP at work to assess job performance, including grading of communication skills, technical competence, attitudes, and social relationships [All CNPs will be observed on 3 randomly-selected days]; and (4) a questionnaire to the CNP's supervisor for her to grade the CNPs job performance, attendance, and social status.

Collected data are being linked to data from the MINIMat trial on pregnant women's participation, compliance, and pregnancy outcome.

It is estimated that information on about 3,000 pregnant women will be used. Data will be analyzed using statistical methods that take into account the multi-level structure of data, where information on a group of pregnant women is related to characteristics of a CNP.

International Fellowship in Nutrition

Under the supervision of Dr. S.K. Roy, Acting Head of the Nutrition Programme, two Dutch students (J.L. Muijs van de Moer and DM Kusters, Academic Medical Centre, University of Amsterdam, Amsterdam, The Netherlands) completed their fellowship course on nutrition in ICDDR,B as part of their Masters theses. They studied the influence of socioeconomic status and mothers' employment on the nutritional status of children aged 6-36 months, and the knowledge, caring practices, and healthcare-seeking behaviour of mothers.

A cross-sectional survey using a pre-tested structured questionnaire has been conducted among 299 mothers of children aged 6-36 months in a clinic in Dhaka. Their anthropometric measurements have been done to determine their nutritional status. The rate of severe and moderate malnutrition was 26.9% among children of high socioeconomic group, 34.8% among middle and 54.4% among low

socioeconomic group. Mothers from the high socioeconomic group had better knowledge on good food for their children (69.2%) than the middle (64.0%) and the low socioeconomic group mothers (51.9%), resulting in the observed better feeding practice in the higher socioeconomic groups. Caring practices were similar in all socioeconomic groups, except for the time spent playing with the child, which is higher in the high socioeconomic group. Healthcare-seeking behaviour was also similar in all socioeconomic groups, except for consultation of traditional providers, which was higher in the low socioeconomic group. Of the children of working mothers, 85.7% were moderate or severely malnourished compared to 75% of non-working mothers.


It was concluded that mothers from a higher socioeconomic group have better knowledge and caring practices and consequent better nutritional status of their children. Employment of mothers had a negative influence on the nutritional status of their children.

Child Development Unit

Child Development Unit (CDU) under the Clinical Sciences Division has expanded its collaboration with more national and international organizations in the field of nutrition. The activities are detailed in the report of the Clinical Sciences Division.

Breastfeeding Counselling

Exclusive breastfeeding in infants aged below six months was promoted. Counselling on breastfeeding, along with appropriate complementary feeding, was given by trained personnel. Training to physicians, nurses, and paramedics was also arranged to promote and support breastfeeding. For details, see the report of the Clinical Sciences Division.



Mothers from a higher socioeconomic group have better knowledge and caring practices and consequent better nutritional status of their children



**Programme Head
Robert F. Breiman**

Infectious Diseases and Vaccine Sciences

The Programme on Infectious Diseases and Vaccine Sciences (PIDVS) was established in 2000. It is a Centre-wide, cross-divisional activity, housed within the Health Systems and Infectious Diseases (HSID) Division, with a mission to facilitate and focus the Centre's expanding role in the prevention and control of infectious diseases important to Bangladesh and other developing countries, with particular emphasis on epidemiology, clinical and laboratory research, and vaccine evaluation. PIDVS functions to establish priorities and identify resources, and enhance collaboration, communication, and use of the existing resources to boost the Centre's capacity to conduct investigations relevant to prevention of suffering and mortality from key infectious diseases.

As part of its mission, the Programme facilitates and focuses on the following activities: (1) evaluate promising vaccine candidates against key infectious diseases and disease syndromes; (2) define disease incidence and burden for major disease syndromes and key aetiologies; (3) define risk factors and clinical, sociologic and other epidemiologic characteristics of priority infectious diseases for use in developing cost-effective strategies for prevention and control; (4) identify, implement, and evaluate treatment and prevention strategies effective for reducing morbidity and mortality from infectious diseases; and (5) enhance capacity to investigate outbreaks of infectious diseases in Bangladesh and the region and to use scientific methods to develop and implement strategies for control of outbreaks.

The Programme coordinates ongoing investigations addressing key emerging infectious diseases in Bangladesh and the surrounding

region. These investigations include: (1) epidemiology of acute lower respiratory infection, including studies to assess the magnitude and impact of drug-resistant respiratory pathogens and the burden of pneumonia; (2) magnitude of tuberculosis prevalence, drug-resistant *Mycobacterium tuberculosis*, and the effectiveness of control programmes using directly-observed therapy; (3) surveillance for novel and emerging strains of diarrhoeal pathogens and to define the burden of disease caused by *Shigella* and *Salmonella* Typhi; (4) optimal therapy and strategies for prevention of drug-resistant sexually transmitted diseases; (5) epidemiology of leishmaniasis, including identifying ways to ensure early and complete treatment for kala-azar syndrome, and epidemiology of malaria, including drug-resistant infections; (6) impact of dengue and dengue haemorrhagic fever; and (7) epidemiology and aetiology of encephalitis. The Programme is the focal point for a multi-faceted project to address the ongoing outbreak of dengue fever and dengue haemorrhagic fever in Bangladesh, integrating expertise from around the Centre. The dengue projects involve cross-divisional efforts focused on assessing the incidence of and risk factors for disease (for use in targeted efforts to minimize the risk), vector surveillance and investigations focused on reducing *Aedes* mosquito burden, and strengthening recognition and treatment of dengue in Bangladesh.

PIDVS is facilitating the Centre's role as a resource for investigation of outbreaks of severe or novel forms of disease. In addition to the full-scale response to the dengue epidemic in 2000, PIDVS facilitated the Centers for Disease Control and Prevention's (CDC's) investigation of two outbreaks of encephalitis in the western part of Bangladesh in

Participants in the investigators' meeting in Mombassa, Kenya



2003, caused by Nipah virus, a newly-emerging and highly-lethal paramyxovirus. We are participating in a WHO-led international outbreak alert and response programme, and will assist in identifying expertise at the Centre for participation in WHO-sponsored investigations of outbreaks. PIDVS, through Dr. Robert Breiman, worked with WHO and the Ministry of Health in China to respond to the SARS epidemic in March and April 2003. In addition, we assisted the Ministry of Health and Family Welfare in preparing to combat the potential introduction of SARS in Bangladesh.

In the vaccine arena, the Programme is facilitating studies of a human-derived rotavirus vaccine, a live-attenuated nasal influenza vaccine, cholera vaccines, and an oral typhoid vaccine. PIDVS is also working with a vaccine company to develop plans to evaluate a new dengue vaccine in Bangladesh. PIDVS is leading an evaluation of the impact of vaccines currently administered to children in WHO's Expanded Programme on Immunization (EPI) using the existing surveillance data from Matlab, Abhoynagar, and Mirsarai and working with the Government of Bangladesh and WHO to evaluate the acceptability and impact of hepatitis B vaccines currently being introduced into EPI. PIDVS is proposing studies to demonstrate the feasibility and impact of the introduction of pneumococcal and *Haemophilus influenzae* type b (Hib) vaccine in Bangladesh. It is expected that data from this demonstration will provide compelling evidence to decision-makers for more rapid introduction of these vaccines into infant immunization programmes.

Part of the Programme's role is to focus Centre-wide efforts relating to

¹URL: www.icddr.org

infectious disease and vaccine and capacity development. In collaboration with the Centre's training staff, PIDVS conducts seminars, forums, and training experiences relevant to infectious disease and vaccine research. PIDVS also maintains scientific working groups on infectious diseases and vaccines to nurture collaborative efforts and stimulate cross-divisional dialogue on priorities to ensure that the available resources are ideally focused and effectively used.

The Programme takes a lead role in establishing new alliances and collaborations outside the Centre and has formed working relationships for the vector-borne diseases with staff within the Ministry of Health and Family Welfare, Directorate General for Health Services, Dhaka Medical College Hospital, Holy Family Red Crescent Hospital, Rajshahi Medical College, Mymensingh Medical College, Sir Salimullah Medical College, Chittagong Shishu Hospital, Shishu Shasthya Hospital, and Chittagong Medical College Hospital. We have also fostered ongoing, active collaborations with the Armed Forces Research Institute for Medical Sciences in Bangkok, Thailand, the University of Brisbane, and CDC (as mentioned above).

PIDVS, in November 2002, launched the Health and Science Bulletin¹, a scientific publication, styled after CDC's MMWR, to rapidly disseminate information emanating from various research projects of ICDDR,B. This bilingual quarterly publication (in English and Bangla) reaches approximately 10,000 healthcare workers, non-government organizations, staff of the Ministry of Health and Family Welfare, and scientists concerned with health in Bangladesh, South Asian and other developing countries.

PIDVS works directly with other divisions of ICDDR,B to achieve the mission of the Programme. The strong infrastructure provided by various divisions of ICDDR,B provides remarkable opportunities for the Centre to be a global leader in addressing priority research questions regarding a wide array of key infectious diseases affecting children and adults in developing countries.

Enteric Diseases

Diarrhoea

Immune response after cholera infection in patients and household contacts

The complement-mediated vibriocidal antibody response is a convenient indirect and surrogate marker used to gauge protection in cholera for both natural infections and vaccine-efficacy studies. The usefulness of this response to predict protection from cholera in household contacts of patients was studied using a prospective, observational study design. The results of the study analyzed for 125 hospitalized cholera patients and 326 household contacts suggest that the serum vibriocidal response is not the primary mediator of immunity. It is an incomplete surrogate marker and predictor of protection from infection due to *Vibrio cholerae* among household contacts of cholera patients in urban Bangladesh. Further studies are being carried out to study other immune parameters in the mucosal secretions and in the circulation, which may be more useful predictors of protection from cholera.

Increased susceptibility to killing of *V. cholerae* O139 strains isolated in the outbreak of 2002 by sera and phagocytes

Strains isolated from patients with *V. cholerae* O139-associated infection in an outbreak in the spring of 2002 from the ICDDR,B hospital in Dhaka were characterized to test their susceptibility to complement-mediated killing by serum and polymorphonuclear neutrophils (PMN). The strains appeared to be significantly more susceptible to killing by both antibody and neutrophils, which is a striking difference observed from strains that emerged about a decade ago. The earlier strains were characteristically more resistant to killing mediated by sera or PMN. The reason(s) for this difference may be deficiency of capsular material or some other factor(s) of the strains isolated in the outbreak. These properties are being investigated using immunological and ultrastructural techniques. The re-emergence of *V. cholerae* O139 with a change in phenotype of the characteristic resistance to complement-mediated killing by antibody raises questions of whether this makes the pathogen less virulent or gives some added advantage for survival in the host and the environment. The re-emergence of *V. cholerae* O139 with epidemic potential after a decade of dormancy suggests that strategies for development of bivalent O1/O139 cholera vaccine need to be given serious attention.

Immune response to the major subunit of the toxin co-regulated pilus (TcPA) after natural cholera infection

Information regarding immune responses to toxin co-regulated pilus (TcPA), a major colonizing factor in the pathogenesis of cholera is



Outbreak investigation conducted in a tea estate of Moulvibazar, Sylhet



A paramedic performing the rapid SMART test

lacking, particularly in patients infected with El Tor biotype of *V. cholerae* O1 or *V. cholerae* O139, since purified TcpA from these strains were not available for immunological assays until recently. With the availability of recombinantly-produced El Tor TcpA, scientists at the Centre have been able to carry out a detailed and comprehensive study of the mucosal and systemic immune responses to this colonization antigen in specimens obtained from patients with natural infection caused by El Tor biotype of *V. cholerae* O1 and *V. cholerae* O139. Analyses in patients showed substantial and significant increases in TcpA-specific antibody-secreting cells in the circulation at convalescence and similar mucosal responses by an alternate technique—the antibody in lymphocyte supernatant assay. Significant increases in antibodies to TcpA were also observed in sera and faeces of patients at convalescence. The majority of patients showed TcpA-specific responses in mucosal and/or systemic compartments. These results demonstrate that TcpA is immunogenic, following natural *V. cholerae*-associated infection and suggest that immune responses to this antigen should be evaluated for potential protection from subsequent life-threatening illness.

Rapid diagnosis of cholera using dipsticks developed by Institut Pasteur, France

In developing countries, outbreaks of cholera often occur in areas with limited laboratory facilities and financial resources. To confirm outbreaks of cholera in a timely fashion, a sensitive diagnostic test that can be performed by low-skilled personnel is needed. Under a collaboration, staff from ICDDR,B and CDC are evaluating diagnostic assays for *V. cholerae* O1 to identify a sensitive diagnostic test that

is effective when performed by low-skilled personnel. Every 50th symptomatic patient at a diarrhoea treatment centre in Dhaka, Bangladesh, was enrolled in the study. The SMART™, Medicos™ Cholera Dip Stick, and an immunochromatographic dipstick from the Institut Pasteur (IP) were performed on stool by high- and low-skilled staff and were compared with stool culture. The study team calculated the sensitivity, specificity, and positive and negative predictive values. Preliminary analysis of data showed that the IP dipstick had the highest sensitivity (93%), irrespective of skill level. Enrollment of patients has been completed, and data cleaning and analyses are ongoing.

Rotavirus

Genetic characterization of group A rotaviruses collected from the Dhaka and Matlab hospitals of ICDDR,B in 2002 has been carried out. Among the typeable strains, G9 was the most prevalent strain (31.5%), followed by G1, G4, G2, and mixed infections. No G3 was found in either setting. 28.4% of the strains remained untypeable or gave unusual bands in RT-PCR with the routine primer set. Fifty-five of the untypeable and unusual strains were typed by sequencing the VP7 gene, and 48 (87%) of these were G1 rotaviruses. The failure of typing of these samples was due to nucleotide sequence changes at the primer-binding sites of the VP7 gene of these strains. Therefore, other primer sets that are already available may be better suited for typing the G1 strain prevalent in Bangladesh or, alternatively, new primer sets, more suitable for the Bangladeshi G1 strains, should be developed. In addition, 2 novel strains (G11 and G12) were also isolated for the first time in Bangladesh.

So far, genetic characterization of rotavirus strains has been limited to samples collected from Matlab and Dhaka. To understand the molecular epidemiology of rotavirus in Bangladesh, it is important that samples from various parts of Bangladesh be analyzed. However, it is not easy to transport samples from the remote areas in Bangladesh and to be able to do so, a simple and inexpensive method of storage and transport was developed. This novel method uses SDS/EDTA-treated chromatography paper strips to collect unconcentrated fresh stool samples on which the stool samples can be stored for 4 months at room temperature. Rotavirus RNA could be successfully amplified from these filter paper strips using RT-PCR.

Further studies are ongoing to determine the prevalent strain in different age groups (adults and neonates), typing of untypeable VP4 genes (P untypeable strains), detection of group B rotaviruses, and development of improved rotavirus genotyping assays, i.e. reverse hybridization probe assay and microarray hybridization assay. All these efforts are crucial for the development and implementation of an effective vaccine.

Absorption of water from a liposomal oral rehydration solution (ORS): an in-vivo perfusion of rat small intestine

Oral rehydration solution (ORS) can successfully rehydrate more than 90% of patients with dehydration from acute diarrhoea. However, treatment with the present ORS formulations does not reduce the stool volume, or frequency, or the duration of diarrhoea. A study was conducted to examine if incorporation of ORS components into liposomes increases small intestinal absorption of water from ORS in an experimental animal model. In-vivo perfusion of the entire small intestine was performed in 83 adult rats. These rats were divided into 3 groups: normal rats (n=28), rats exposed to cholera toxin (n=24), and rats exposed to 5-fluorouracil (5-FU) (n=31). Net movement of water was compared between a Tapioca-based ORS with liposomes (Aquis Liposomal ORS), a Tapioca-based ORS without liposomes (Tapioca-ORS), and the recent WHO-recommended hypo-osmolar ORS (WHO-ORS). All the three ORSs resulted in significant absorption, but the Aquis Liposomal ORS provided a significantly and statistically higher level of absorption in all the 3 rat groups compared

to both WHO-ORS and Tapioca-ORS. Aquis Liposomal ORS tasted less salty. Summary results are presented in the table:

Table. Small intestinal absorption of water in normal rats and in rats treated with cholera toxin or 5-fluorouracil, expressed as mL/minute/g dry weight of small intestine

Group	WHO-ORS	Tapioca-ORS	Aquis Liposomal ORS
Normal rats	0.23±0.05 (n=9)	0.25±0.08 (7%) (n=11)	0.32±0.01 (40%)* (n=8)
Rats exposed to cholera toxin	0.22±0.05 (n=8)	0.23±0.04 (0%) (n=8)	0.33±0.01 (46%)* (n=8)
Rats exposed to 5-fluorouracil	0.33±0.1 (n=12)	0.43±0.01 (30%)** (n=10)	0.49±0.02(50%)** (n=9)

All values are expressed as mean±SD. % represents percent increase compared to WHO-ORS

*p<0.01 compared to WHO-ORS and Tapioca-ORS

**p<0.01 compared to WHO-ORS



Modified faecal occult blood test and lactoferrin latex agglutination test are not useful in differentiating invasive diarrhoea from non-invasive diarrhoea in patients with acute infectious diarrhoea

Screening of patients with acute infectious diarrhoea: evaluation of faecal occult blood test and lactoferrin latex agglutination test

Invasive diarrhoea due to *Shigella*, *Salmonella*, *Campylobacter*, and *Entamoeba histolytica* is usually associated with severe intestinal inflammation and requires a diagnosis for specific treatment. Clinical differentiation between invasive diarrhoea and non-invasive diarrhoea is difficult in most cases. A modified faecal occult blood test (FOBT) for detection of occult blood in faeces showed a good correlation with faecal leukocytes, an indicator of inflammation. Lactoferrin was used as a marker for leukocytes in stool specimens as reference for an inflammatory process, and lactoferrin latex agglutination test (LT) had the highest diagnostic performance for differentiating invasive diarrhoea from non-invasive diarrhoea. This study assessed diagnostic values of FOBT and LT in distinguishing invasive diarrhoea from non-invasive diarrhoea. Patients enrolled in the 2% systematic sampling of all who attended the Clinical Research and Service Centre (Dhaka hospital) of ICDDR,B under its diarrhoeal disease surveillance system formed the study subjects. Their stool specimens were cultured for isolation of *Salmonella*, *Shigella*, vibrios, and *Campylobacter* using standard methods, which served as the gold standard, and ELISA was performed for detection of rotavirus. Patients from whom *Salmonella*, *Shigella*, *Campylobacter*, or *E. histolytica* were isolated were designated the invasive diarrhoea group, and those from whom *V. cholerae*, rotavirus, or no known pathogen was isolated constituted the non-invasive diarrhoea group. In total, 594 patients aged 0-80 year(s) were enrolled during July-November 2002, 58% of whom

were male. Invasive and non-invasive enteropathogens were isolated from 143 (24%) and 341 (51%) patients respectively; 39% and 36% of the stool samples were FOBT- and LT-positive respectively; and 28% were positive for *V. cholerae*, 24% for rotavirus, 15% for *Campylobacter*, 6% for *Shigella*, 2% for *Salmonella*, and 1.4% for *E. histolytica*. Of the 594 patients, FOBT and LT were performed on 440 patients infected with a single enteropathogen (n=267) or with no pathogens (n=173). The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of FOBT were 53%, 64%, 19%, 90%, 63% and those of LT were 51%, 63%, 18%, 89%, 61% respectively. The results indicate that FOBT and LT are not useful in differentiating invasive diarrhoea from non-invasive diarrhoea in patients with acute infectious diarrhoea.

Trend in isolation of *Vibrio cholerae*, *Shigella*, and *Salmonella* from neonates with diarrhoea admitted to Clinical Research and Service Centre (Dhaka Hospital)

This retrospective study was carried out to determine the rates of isolation of *V. cholerae*, *Shigella*, and *Salmonella* spp. in 240 neonates admitted to the longer-stay inpatient wards of the Clinical Research and Service Centre in 2001 with acute diarrhoea, associated with or without other complicating illnesses. Relevant information collected through reviewing medical records of these neonates was entered onto personal computer. On admission, rectal swabs or stool specimens of the neonates were plated directly onto taurocholate tellurite gelatin agar (TTGA), *Salmonella-Shigella* (SS) agar, and

Staff members of Parasitology Laboratory with visiting research fellow from the CDC Katie M. Krukjian



MacConkey's agar for culture of *V. cholerae*, *Shigella*, and *Salmonella* spp. A single enteric pathogen was isolated from faecal specimens/rectal swabs of 71 (29.5%) neonates, and multiple pathogens were detected from 12 (5%) neonates. *V. cholerae* O1 was isolated from 42 (17.5%), *Shigella* spp. from 22 (9.1%), *Salmonella* spp. from 8 (3.3%), *Aeromonas* spp. from 9 (3.7%), and *Hafnia alvei* from 2 (0.8%) neonates. Stool culture of other neonates failed to identify any of these organisms. Among *Vibrio cholerae*, 37 were El Tor Inaba, 1 was El Tor Ogwa, 3 were *V. cholerae* O139, and 1 was non-O1-and non-O139 *V. cholerae*. Among shigellae, 17 were *S. flexneri* (17), 3 were *S. dysenteriae* type 2-12, and 2 were *S. sonnei*. *Salmonella* spp. included group B, C, D, E, and G. The findings suggest that *V. cholerae* and *Shigella*-associated infections are common in neonates, and the possibility of such infections should be kept in mind while managing neonatal diarrhoea.

Therapeutic effects of *Lactobacillus paracasei* ST11 in infants and young children hospitalized with acute diarrhoea

Several studies have shown that certain strains of lactobacilli, administered orally, may have antidiarrhoeal properties. However, their beneficial effect appears to be limited only to a modest reduction in duration of diarrhoea, and no information is available about their

effect on the severity of disease. A randomized, double-blind study was conducted to assess the effect of a recently-identified probiotic—*Lactobacillus* strain (*L. paracasei* ST11)—in the management of severe acute childhood diarrhoea. Two

hundred thirty male children, aged less than 2 years, presenting to the Clinical Research and Service Centre, with acute watery diarrhoea of less than 48 hours duration were admitted to the Metabolic Research Ward. They were randomized to receive 10^{10} CFU of lyophilized *L. paracasei* (ST11) or placebo twice daily for 5 consecutive days in addition to standard oral rehydration therapy (ORT) and usual feeding. The frequency, consistency, and volume of stool, urine output, and intake of ORS were recorded daily for 6 days or until cessation of diarrhoea. Excretion of rotavirus was monitored daily by ELISA. Overall, treatment with *L. paracasei* (n=115) did not result in significant reduction in daily or cumulative (day 1-6) stool output, ORS intake, or stool frequency compared to that with placebo (n=115). In children with rotavirus-associated diarrhoea (n=121; *L. paracasei* 66, placebo 55), treatment with *L. paracasei* did not result in shortening the duration of diarrhoea or duration of faecal excretion of rotavirus. However, in diarrhoea not caused by rotavirus, treatment with *L. paracasei* resulted in significant reduction in the daily and the cumulative stool output (*Lactobacillus* vs placebo: 225 ± 218 vs 381 ± 240 mL/kg, $p=0.01$), stool frequency (*Lactobacillus* vs placebo: 27.9 ± 17 vs 42.5 ± 26 , $p=0.02$), ORS intake (*Lactobacillus* vs

placebo; 180 ± 207 vs 331 ± 236 mL/kg, $p=0.02$), and a trend for shorter hospital stays (*Lactobacillus* vs placebo: 77 ± 48 vs 99 ± 51 hours, $p=0.09$). Compared to placebo, a significantly higher proportion of children receiving *Lactobacillus* had resolution of their diarrhoea by study day 6 (49% vs 76%, $p=0.04$). A similar beneficial effect of *Lactobacillus* was also observed when the analysis was restricted to children without an identified enteric pathogen. Results indicate that *L. paracasei* (ST11) is ineffective in the management of diarrhoea due to rotavirus. However, it is associated with clinically significant benefit in the management of children with diarrhoea due to causes other than rotavirus.

Effectiveness of a dietary treatment algorithm for home management of children with persistent diarrhoea

A randomized clinical trial evaluated the effectiveness of a dietary treatment algorithm, based on a successful hospital-based regimen, for home management of 274 children with non-severe persistent diarrhoea. They received either the standard regimen ($n=138$)—an initial milk-based (cow's milk, rice-powder, and sugar; 68 kcal/L) diet for 7 days followed by a rice-based (rice-powder, egg-white, soy oil, and sugar, 68 kcal/L) diet if failed to respond to the initial diet, or the control diet ($n=136$), i.e. their usual home diet without advice to change. Other aspects of management were similar, and the children were followed up every third day up to 14 days. The rates of recovery within 7 days (study diet vs control diet, 48% vs 47%) and within 14 days (study diet vs control diet, 86% vs 87%) were similar, and so were the rates of withdrawal due to complications (study diet vs control

diet, 12.5% vs 10.3%). The results indicate that effectiveness of both the regimens is similar in the management of children with non-severe persistent diarrhoea, indicating that such children could be successfully managed at home with supportive treatments (ORS, vitamins, and minerals) in addition to the usual diets as recommended for acute diarrhoea, reducing the need for hospitalization with associated benefits.

Children with severe diarrhoea have high levels of circulating endotoxin in sera from children with severe diarrhoea in Bangladesh

Endotoxin, the component of the outer membrane of Gram-negative bacteria, is spontaneously released in the circulation during cell division. Antibiotic treatments might also cause release of large amounts of endotoxin from bacteria as they are killed. Endotoxin causes excessive production of pro-inflammatory cytokines and their mediators and triggers the cascade of events leading to systemic inflammatory response syndrome, septic shock, and multiple organ dysfunctions, which might lead to death. This collaborative pilot study assessed the magnitude of endotoxaemia in children acutely ill with diarrhoea and other illnesses, including pneumonia and septicaemia, and examined the relationship among circulating endotoxin levels, antibiotic treatment, and death. Children with above characteristics admitted to the Clinical Research and Service Centre were enrolled. A new, sensitive and validated assay called endospey was used for measuring the levels of endotoxin in their sera. Significant concentrations of endotoxin were detected on admission in the sera of 52% of 59 children, but hardly in the sera of 30 healthy controls.

L. paracasei (ST11) is ineffective in the management of diarrhoea due to rotavirus. However, it is associated with clinically significant benefit in the management of children with diarrhoea due to causes other than rotavirus

Infection due to Gram-negative bacteria might be involved in nearly half of the children with severe diarrhoea and endotoxaemia is associated with severe malnutrition, septicaemia, and deaths

Compared to admission levels, there was a significant reduction in the median serum endotoxin concentration 72 hours after initiating antibiotic therapy (12.3 pg/mL vs 0 pg/mL, $p < 0.0001$). In 7 children, there was an increase in endotoxin levels 72 hours after starting antibiotics, but the increase was not due to the effect of any particular antibiotic. The median serum endotoxin levels on admission were significantly higher among those who died ($n=6$) compared to the survivors (58.8 pg/mL vs 9.1 pg/mL, $p=0.03$). All children who died were severely malnourished and had high levels of serum endotoxin. Five of them were septicaemic. The highest level of endotoxin (6003.8 pg/mL) was observed in a child who died of septicaemia due to *Haemophilus influenzae*. The results suggest that infection due to Gram-negative bacteria might be involved in nearly half of the children with severe diarrhoea and that endotoxaemia is associated with severe malnutrition, septicaemia, and deaths.

Shigella

Shigellosis is one of the major diarrhoeal diseases afflicting humans in the developing and underdeveloped areas of the world, especially in Bangladesh. Bangladesh is an endemic zone for shigellosis, and it is estimated that dysentery accounts for 20% of deaths among children.

The study on *Shigella* disease burden, funded by International Vaccine Institute (IVI), continued through its second year. During January-December 2003, stool samples were collected from 2,228 diarrhoeal

patients. Of these, 382 were *Shigella* isolates (17%), distributed among the 4 serotypes as follows: *Shigella flexneri* (54%), *S. boydii* (30%), *S. dysenteriae* non-type 1 (6%), and *S. sonnei* (10%). Although the proportion of cases due to *S. flexneri* is about what was expected, isolation of *S. boydii* continues to exceed predictions. In addition, there were 23 cases of cholera (*V. cholerae* O1), 4 *V. cholerae* non-O1 and non-O139, one each of *V. parahaemolyticus*, *V. mimicus*, and *V. fluvialis*, 22 *Salmonella* spp., and 18 *H. alvei*. Two important clinical features emerged thus far. First, 71% of children with shigellosis were aged less than 5 years. The median age for shigellosis patients was 2.7 years. Children aged less than 5 years appear to have nearly 20 times the risk (RR=19.8; 95% CI 16.0-24.6) of shigellosis of older children and adults. Second, only about a quarter (25.6%) of shigellosis cases presented with bloody stool, nearly half (45.3%) had mucoid, and 29.1% had watery stool. Overall, these data demonstrate that dysentery and diarrhoea due to *Shigella* are important causes of childhood illness and may be under-appreciated in clinical settings in which health workers are trained to look only for bloody stool.

Temporal shifts in the dominance of serotypes of *Shigella dysenteriae* during 1999-2002 in Dhaka, Bangladesh

The prevalence of *S. flexneri* serotypes in Bangladesh was described in a previous report, which showed a temporal variation in dominance of different sub-serotypes. The emergence of some atypical serotypes

More than 98% of *S. dysenteriae* type 1 strains isolated during 1999-2001 were resistant to ampicillin, sulphamethoxazole-trimethoprim, and nalidixic acid

of *S. flexneri* has also been reported. Other than serotype 1, there are no reports of outbreaks caused by the remaining serotypes of *S. dysenteriae* in Bangladesh or in any other part of the world. A detailed epidemiological study on the prevalence of different *S. dysenteriae* serotypes and their susceptibility to commonly-used antibiotics among hospital patients was conducted over the last 4 years to evaluate the current status of shigellosis caused by the *S. dysenteriae* serotypes in Bangladesh.

In total, 358 *S. dysenteriae* strains isolated from patients attending the Dhaka hospital of ICDDR,B during 1999-2002 were included. *S. dysenteriae* type 1, the dominant serotype in 1999 (76.4%), declined to 6.5% in 2002. On the other hand, *S. dysenteriae* type 2 to 12 were isolated with increasing frequency of 19%, 67%, 73.5%, and 87% in 1999, 2000, 2001, and 2002 respectively. Of these, type 2 and 4 were the most dominant serotypes, which accounted for 18.7% and 28.5% of the total isolates respectively. There was no isolation of serotype 5, 7, 8, and 13 during this period. Twenty-eight (7.8%) of the isolates were atypical and agglutinated only with the polyvalent antiserum of *S. dysenteriae*. More than 98% of type 1 strains isolated during 1999-2001 were resistant to ampicillin, sulphamethoxazole-trimethoprim, and nalidixic acid. None of the *S. dysenteriae* type 2 strains isolated during 1999-2000 was resistant to nalidixic acid, but 20% and 8% strains of this serotype isolated in 2001 and 2002 respectively were resistant to nalidixic acid. All the strains of serotype 4 were resistant to sulphamethoxazole-trimethoprim, and resistance to nalidixic acid increased from 0% in 1999 to 33% in 2002. Although

heterogeneous plasmid profiles were obtained depending on the presence or absence of a single plasmid, core plasmids were defined for particular serotypes. It was found that the same plasmid profile was shared by different serotypes. Interestingly, plasmid pattern of type 2 and 4 was almost identical except that a middle-range plasmid of 70-60 MDa was present in type 4 in addition to the core plasmids. All the strains harbouring the 140-MDa plasmid were positive for *ipaH* gene, had Congo red-binding ability, and were positive for the Sereny test, attesting their invasive properties. Overall, there appears to be a changing trend in the dominance of serotypes of *S. dysenteriae* during 1999-2002 in Bangladesh, in which type 1 was replaced by type 4 and then by type 2. The antibiotic resistance pattern and the plasmid profiles of type 1, 2, and 4 have little diversity, which underscores the necessity of an extensive study of these strains at the molecular level to get a detailed insight into the changing trends in prevalence.

Ciprofloxacin-resistant *Shigella dysenteriae* type 1 strains belong to a new clone different from those associated with previous epidemics

Epidemic shigellosis caused by multidrug-resistant *S. dysenteriae* type 1 is considered to be a recurrent challenge in the developing world. Periodic lapse and emergence of strains, resistant to newer drugs, have further complicated the treatment of infection caused by this pathogen. In Bangladesh, at least 3 large epidemics have occurred since 1973, and each was associated with a high mortality rate, particularly in children aged less than 4 years. In each epidemic, *S.*

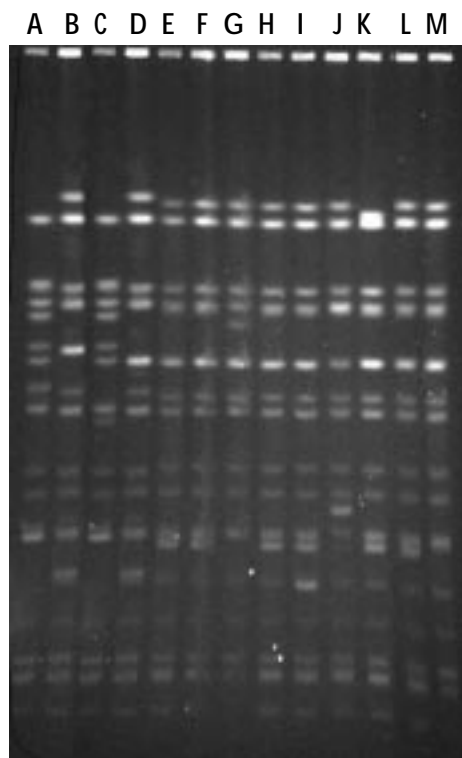
dysenteriae type 1 strains emerged showing resistance to commonly-used antimicrobials. For example, in 1973-1974, 1983-1984, and 1993-1994, strains were resistant to ampicillin, sulphamethoxazole-trimethoprim, and nalidixic acid respectively. Ciprofloxacin-resistant strains of *S. dysenteriae* type 1 have recently been isolated in Bangladesh and Nepal. These strains were also resistant to tetracycline, ampicillin, sulphamethoxazole-trimethoprim, nalidixic acid, norfloxacin, and ofloxacin but were susceptible to mecillinam, azithromycin, and ceftriaxone. Plasmid patterns of ciprofloxacin-resistant strains from different countries were similar to those of past epidemic isolates, except for a new plasmid of approximately 2.6 MDa, which was found in one recent ciprofloxacin-resistant strain in Bangladesh. Genomic analysis of these strains isolated from different countries was carried out using pulsed-field gel electrophoresis (PFGE) and compared with the strains collected from previous epidemics. PFGE showed that ciprofloxacin-resistant strains in Bangladesh, India, and Nepal belonged to a new PFGE type (type C), which was different from that of ciprofloxacin-sensitive epidemic strains. PFGE type C was further divided into 5 subtypes (C1-C5), all of which were found in India, but in Bangladesh and Nepal, only C1 existed (Fig).

Ciprofloxacin-resistant strains of *S. dysenteriae* type 1 were found in different

countries within a short span of time, suggesting possible rapid spread to other regions globally. The genetic data suggest clonal expansion of a type of *S. dysenteriae* type 1, probably following the same path as the previous epidemic strains. This suggests that a heightened level of alertness for an *S. dysenteriae* type 1 epidemic should be maintained.

Rapid diagnosis of *Shigella*

Epidemic dysentery in the developing world is almost always caused by *S. dysenteriae* type 1. Epidemics due to *S. dysenteriae* type 1 can be prolonged, often leading to devastating public-health consequences. Validation of a rapid diagnostic test for *S. dysenteriae* type 1 would be useful for the timely identification of an epidemic due to *S. dysenteriae* type 1. Given the occurrence of epidemics approximately every 10 years in Bangladesh and recent reports of fluoroquinolone-resistant *S. dysenteriae* type 1-associated infections in Kolkata, India, it is anticipated that Bangladesh will experience an epidemic of shigellosis in the near future. Currently, government health clinics in Bangladesh are monitoring their patients for an outbreak of bloody diarrhoea. In late November 2003, ciprofloxacin and ofloxacin-resistant *S. dysenteriae* type 1 was isolated from diarrhoeal stool specimens from



PFGE patterns of *Xba*-1 digested chromosomal DNA of representative strains of *S. dysenteriae* type 1

residents of a tea estate in northeastern Bangladesh. Surveillance is ongoing to detect an *S. dysenteriae* type 1-associated epidemic. Once an epidemic has been confirmed by the ICDDR,B laboratories, the patients will be asked to provide stool samples for the study. The ICDDR,B and CDC scientists will compare the results of the rapid Shiga toxin ELISA test with PCR and with routine microbiologic stool culture to evaluate its effectiveness.

Increasing spectrum in antimicrobial resistance of *Shigella* isolates in Bangladesh: resistance to azithromycin and ceftriaxone and decreased susceptibility to ciprofloxacin

By studying *Shigella* isolates in Bangladesh during 2001-2002 and comparing them with those isolated in 1991-1992, a significant increase in resistance to sulphamethoxazole-trimethoprim (from 52% to 72%, $p < 0.01$), nalidixic acid (19% to 51%, $p < 0.01$), high resistance to tetracycline (79%), ampicillin (56%), and chloramphenicol (42%), and emergence of resistance to azithromycin (complete resistance 16% and intermediate 62%), mecillinam (complete resistance 3%,

and intermediate 3%), and ceftriaxone/cefixime (2%) were observed. Overall, 63% of 266 isolates (2001-2002) were resistant to ≥ 3 (multidrug-resistant) of the following antimicrobials: ampicillin, sulphamethoxazole-trimethoprim, tetracycline, nalidixic acid, mecillinam, ciprofloxacin, azithromycin, and ceftriaxone compared to 52% of 369 strains ($p < 0.01$) in 1991-1992. Seventy-one percent of 154 available isolates (2001-2002), tested by E-test, had decreased ciprofloxacin-susceptibility (MIC ≥ 0.064 -0.38 $\mu\text{g}/\text{mL}$), which was detected as ciprofloxacin-susceptible and nalidixic acid-resistant by the disk method, and was associated with MDR traits ($p < 0.01$). High modal MICs were observed to azithromycin (MIC 6 $\mu\text{g}/\text{mL}$) and nalidixic acid (MIC 128 $\mu\text{g}/\text{mL}$) and low to ceftriaxone (MIC 0.023 $\mu\text{g}/\text{mL}$). Ceftriaxone resistance was due to extended-spectrum beta-lactamase production, encoded by a 50-MDa R-plasmid, transferable to *E. coli* K12 and wild *S. sonnei* by conjugation. These findings are worrying and mandate monitoring of resistance and new guidelines for antimicrobial therapy of shigellosis. When indicated, pivmecillinam or ciprofloxacin might be considered for treating shigellosis.

Extended-spectrum β -lactamase-mediated third-generation cephalosporins resistance in *Shigella* isolates in Bangladesh

Of 160 clinical isolates of *Shigella* studied during 2001-2002 in Dhaka, 96 (56%) were ampicillin-resistant, and 4 sporadic isolates among these exhibited resistance to third-generation cephalosporins (ceftriaxone, cefotaxime, cefixime,

***Shigella* and zinc**

In 2003, data from a study conducted during 2000-2002 on a short course of supplementation of zinc as an adjunct therapy for treatment of acute shigellosis given to 50 hospitalized children aged 2-5 years were analyzed. The analysis showed a significant induction of IpA-specific IgA antibodies, increased lymphocyte proliferation response, and *Shigella* spp.-specific serum bactericidal activity. Thus, use of zinc during acute illness may result in enhancement of protective immunity leading to early recovery and possibly a better protection.

The use of improved diagnostic tests for amoebiasis enabled, for the first time, analysis of the contribution of *E. histolytica* to total diarrhoeal illness

and ceftazidime) and to multiple antimicrobial agents. As suggested by resistance phenotypes and double-disc synergy test results, 3 third-generation cephalosporin-resistant isolates (2 *S. sonnei* and 1 *S. boydii*) produced Class A (Bush group 2) extended-spectrum β -lactamase, and the remaining *S. flexneri* strain encoded amoxicillin-clavulanate-, ceftazidime-, and cefoxitin-resistant AmpC β -lactamase (Class C/Bush group 1). Production of extended-spectrum β -lactamase and β -lactam resistance was self-transferable to *E. coli* K12 and wild *S. sonnei* and was mediated by 50-MDa conjugative R-plasmid in 3 isolates, whereas ampC β -lactamase was mediated by a 94-MDa R-plasmid in *S. flexneri* representing an impending new threat of β -lactam resistance in the community.

Amoebiasis

In 2003, the epidemiology, clinical features, nutritional status, and causative agents of diarrhoea were studied in 289 Bangladeshi children (147 males and 142 females) aged 2-5 years, who lived in an urban slum. The use of improved diagnostic tests for amoebiasis enabled, for the first time, analysis of the contribution of *E. histolytica* to total diarrhoeal illness in this community setting. The average incidence of diarrhoea was 1.8 episodes per child-year, and the average number of diarrhoeal days was 3.7 days per child-year over an average observation period of 2.8 years per child. Seventy-five percent of diarrhoeal episodes were of ≤ 2 days duration. Persistent diarrhoea was relatively uncommon (0.2% of children), and chronic diarrhoea was observed in only one episode. Compared to malnourished and/or stunted children, better-nourished children

experienced significantly fewer diarrhoeal episodes. The most frequent bacterial pathogens isolated from diarrhoeal stools were enterotoxigenic *Escherichia coli* (ETEC) (9%) and *Aeromonas* species (9%), followed by *Plesiomonas shigelloides* (4%) and *S. flexneri* (3.8%). Rotavirus was the most common viral agent isolated from diarrhoeal stool samples (5%). *Giardia lamblia*, *Cryptosporidium parvum*, and *E. histolytica* were identified respectively in 11%, 8.4%, and 8% of stool samples. Dysentery was observed in 7.7% of all diarrhoeal episodes. The most common pathogens isolated from dysenteric stools were: *S. flexneri* (11.6%), *Aeromonas* sp. (10%), *E. histolytica* (8.7%), *Campylobacter jejuni* (5.8%), *P. shigelloides* (4.3%), and *Aeromonas caviae* (4.3%). The overall incidence rate of *E. histolytica*-associated diarrhoea was 0.08 per child-year. Loss of visible and haemoccult test-detected blood was found respectively in 7% and 25% of cases of *E. histolytica*-associated diarrhoea. The use of modern diagnostic tests demonstrates that *E. histolytica* contributes to the overall burden of diarrhoeal disease among children in the urban slum. This understanding should aid in the design of interventions to reduce the burden of diarrhoeal disease and improve child health.

Immunity to infection due to *E. histolytica* in Bangladeshi children

It is not known if acquired immunity to infection due to *E. histolytica* exists. It is impossible to interpret previous data on immunity as *E. histolytica*-specific tests have not been routinely used. The Centre scientists conducted a prospective cohort study of children in Mirpur, Dhaka. The study found that acquired immunity to infection due to *E.*

Acquired immunity to infection due to *E. histolytica* was linked to intestinal IgA against the carbohydrate recognition domain (CRD) of the Gal/GalNAc lectin of *E. histolytica*

histolytica was linked to intestinal IgA against the carbohydrate recognition domain (CRD) of the Gal/GalNAc lectin of *E. histolytica*, and resistance to infection was observed despite the fact that children were infected with genetically diverse strains of *E. histolytica*. A detailed study of specific immune response found that the median duration of protection after a stool being positive for anti-CRD IgA response was 744 days (95% CI 586-902). The median duration of protection after the first infection due to *E. histolytica* was 616 days (95% CI 490-741). There was also an apparent protective association with the Class II allele DOB1*601 and the DOB1*601-DRB1*1501 haplotype with infection due to *E. histolytica* among the cohort children. These results suggest that, along with mucosal anti-CRD IgA antibodies, human genes underlie susceptibility to intestinal infection with *E. histolytica*. This study has several implications for vaccine development to prevent amoebic disease and infection. Follow-up of children in this cohort is continuing to better understand the immune response to infection due to *E. histolytica*.

Clinical Drug Trials

Single-dose ciprofloxacin therapy is as effective as 12-dose erythromycin therapy in childhood cholera: results of a randomized, controlled trial.

In endemic areas, cholera primarily affects children. Although a single-dose antimicrobial therapy has been possible for the management of cholera in adults, this has not been possible in children. A previous study demonstrated the effectiveness of a single-dose ciprofloxacin therapy in the treatment of cholera in adults. With this background,

this open, randomized study compared the efficacy of a single-dose ciprofloxacin therapy with the standard 3-day erythromycin therapy for severe childhood cholera. Children, aged 2-15 years, with diarrhoea of ≤ 24 hours duration, presenting with severe dehydration and a purging rate of ≥ 20 mL/kg of body weight during a 4-hour observation period, and with evidence of infection due to *V. cholerae* on dark-field microscopy, were enrolled. They were randomly assigned to receive either a single 20-mg/kg dose of ciprofloxacin or 12.5 mg/kg dose of erythromycin suspension every 6 hours for 3 days. Children were hospitalized for 5 days, stool volume was measured every 6 hours, and a stool culture was performed daily. Therapy failed clinically and bacteriologically if watery stools continued and if *V. cholerae* O1 or O139 was isolated respectively after study day 2. Children were followed 10-14 days and 6 weeks after discharge to observe development of arthropathy. Of 180 children enrolled in the study, 162 (90%) were eligible for analysis—78 in the ciprofloxacin group and 84 in the erythromycin group. Therapy was clinically successful in 47/78 (60%) of ciprofloxacin and 46/84 (55%) of erythromycin-treated children ($p=0.584$). Children receiving ciprofloxacin were less likely to vomit (58% vs 74%, $p=0.046$) and had fewer stools (median 15 vs 21, $p=0.050$) and lesser stool volume (median 152 vs 196 mL/kg, $p=0.048$) than those receiving erythromycin. Bacteriological failure was more frequent in ciprofloxacin-treated patients (58% vs 30%, $p<0.001$). Arthropathy was not observed in any study children. The results indicate that a single-dose ciprofloxacin therapy is safe and clinically effective as an alternative to the 12-dose erythromycin therapy, which could be potentially used for the management of severe childhood cholera during epidemics.

Typhoid

Typhoid fever disease burden, risk factor analysis, and rapid diagnosis

Longitudinal surveillance for typhoid fever was initiated by ICDDR,B in 2001 in Kamalapur, Dhaka and was continued in collaboration with CDC, with additional support from IMI, Seoul, Korea. The data continue to indicate higher-than-expected rates among pre-school children, who make up over 50% of the cases in the community. The early data from 2001 were published in the *Health and Science Bulletin* (HSB) in 2003, thus sharing these new findings with the wider stakeholder community in Bangladesh. The early data indicated that 53% of typhoid fever cases in the community were children aged less than 5 years, with 85% of cases occurring among children aged 1-4 year(s). The overall incidence of typhoid fever was 3.9/1,000 persons per year, but in young children, it was 18.7/1,000 persons per year. The relative risk for children aged less than 5 years compared to older persons for typhoid fever was, thus, 8.9 (95% CI 4.9-16.4).

Additionally, young children appeared to be clinically more ill compared to older persons. These data provide evidence in support of vaccine development against typhoid fever that is appropriate for children aged less than 2 years. Longitudinal surveillance



Evaluation of rapid diagnostic test for typhoid fever

continued through 2003. During 7 January–31 December 2003, 69 blood cultures were positive for *S. Typhi* (7.2%), of which 62% were aged less than 5 years. The case-control study is nearly complete, and the data will soon be analyzed and published. The rapid diagnostic tests of Typhidot, and Tubex™ have both shown higher-than-expected positive rates in this endemic community, likely reflecting the high prevalence of circulating antibody. These studies will conclude in early 2004, and the data will then be analyzed. The site plans to continue monitoring typhoid fever as part of its ongoing bacterial surveillance among febrile children.

Acute Respiratory Infections

In Bangladesh, acute lower respiratory infection (ALRI), primarily pneumonia, is a leading cause of morbidity and mortality among children aged less than 5 years. About 25% of all deaths among children aged less than 5 years and about 40% of deaths in infancy in Bangladesh, are associated with pneumonia. *Streptococcus pneumoniae* and *H. influenzae* frequently cause pneumonia. The

present hospital-based surveillance in urban Dhaka was carried out to study the epidemiology of pneumonia and antibiotic resistance among bacterial pathogens of pneumonia in children aged less than 5 years for better case management, to disseminate relevant information in a timely manner, and finally to im-

prove the use of such data for policy decisions, particularly in the ARI-control programmes of the Government of Bangladesh.

Antibiotic susceptibility and serotypes distribution of invasive and carrier isolates of *S. pneumoniae* from paediatric patients with pneumonia and meningitis in Bangladesh: a collaborative work with Aachen University Hospital, Aachen, Germany

A prospective study was conducted in 3 hospitals in Dhaka city to study the epidemiology, serotype patterns, and antimicrobial resistance of invasive and carrier *S. pneumoniae* isolates from children, aged less than 5 years, hospitalized with pneumonia, meningitis, and septicaemia during April 1999–May 2002. Clinical data were collected, and all patients had blood cultures done. Cerebrospinal fluid (CSF) of meningitis cases was analyzed by Gram-stain, cytology, and biochemical tests. A nasopharyngeal swab was collected from every 7th child enrolled in the study. *S. pneumoniae* antigen was detected by latex agglutination (LA) in culture-negative pyogenic CSF, and PCR was performed for *lytA* in culture and LA-negative CSF samples. Antibiotic susceptibility and serotyping of *S. pneumoniae* were determined by broth dilution test and Quellung reaction (capsular swelling) using antipneumococcal sera (Statens Serum Institute, Copenhagen, Denmark). Rough strains were detected by DNA probe. Seventy-three (4%) of 1,834 children with *S. pneumoniae*-associated diseases had pneumococcal infections; 35 (48%) *S. pneumoniae* strains were isolated from 1,493 (isolation rate of 2.34%) pneumonia cases. Of 293 (13%) meningitis cases, 38 had pneumococcal

infections, but none from 48 (0%) septicaemia cases. The detection rate was 31.14% (38 of 122) for pyogenic meningitis cases. Most (81%) pneumococcal infections clustered in infants. The overall case-fatality rate was 15%. In total, 255 nasopharyngeal swab specimens were collected from 218 pneumonia and 37 meningitis patients, and 104 (41%) *S. pneumoniae* strains were isolated. The rates of resistance to penicillin, chloramphenicol, sulphamethoxazole-trimethoprim, erythromycin, azithromycin, clindamycin, ciprofloxacin, and levofloxacin were 9%, 16%, 64%, 4.5%, 1.5%, 1.5%, 6%, and 1.5% respectively for invasive isolates and 10%, 2.6%, 70%, 4%, 4%, 10%, 4.5%, and 2.2% respectively for carrier isolates, but none was resistant to amoxicillin, ceftriaxone, moxifloxacin, gatifloxacin, telithromycin, teicoplanin, and vancomycin. Multidrug resistance (resistant to ≥ 3 drugs) was detected in 1.5% invasive and 5.5% carrier isolates. The 12 most common serogroups, representing 84% of the invasive isolates, were: 6, 14, 19, 12, 5, 1, 7, 18, 45, 2, 9, and 23 (in descending order) and showed >66% correlation with 12 (80%) most common serogroups of carrier strains: 19, 14, 23, 9, 7, 13, 15, 21, 22, and 37. *S. pneumoniae* is a leading cause of life-threatening infections, predominantly in infants. Penicillin and other conventional antimicrobials, except sulphamethoxazole-trimethoprim, could be used as an empirical therapy. Surveillance of carrier strains for antimicrobial resistance of patients with invasive infections is useful for therapy. Serotype results showing new patterns and correlation between invasive and carrier strains would serve as baseline data for formulation of an effective vaccine.

***S. pneumoniae* serotype results showing new patterns and correlation between invasive and carrier strains would serve as baseline data for formulation of an effective vaccine**



Pneumococcal team in Kumudini Hospital at Mirjapur, Tangail

In-vitro susceptibilities of *Streptococcus pneumoniae* and *Haemophilus influenzae* isolates to moxifloxacin and gatifloxacin in Bangladesh

The incidence and spectrum of antimicrobial resistance to useful drugs among *S. pneumoniae* and *H. influenzae* strains are increasing, resulting in treatment failures, increased duration of hospitalization and treatment cost, and mortality. Fluoroquinolones, such as moxifloxacin and gatifloxacin, were found to be effective against these resistant pathogens. In-vitro susceptibilities of 60 *S. pneumoniae* (44 invasive, 16 carrier isolates) and 50 *H. influenzae* (34 invasive, 16 carrier isolates) strains to moxifloxacin, chloramphenicol, amoxicillin, erythromycin, and ceftriaxone were studied by E-test (AB Biodisk, Solna, Sweden). MIC 90 (concentration at which 90% of the isolates are inhibited) of moxifloxacin, chloramphenicol, amoxicillin, erythromycin, and ceftriaxone were: 0.19, 8, 2, 0.094, and 0.19 µg/mL for *S. pneumoniae* and 0.047, 12, 256, and 0.016 µg/mL respectively for *H. influenzae*. Resistance rates for moxifloxacin, gatifloxacin, chloramphenicol, amoxicillin, erythromycin, and ceftriaxone were: 0%, 0%, 14%, 2%, 14%, and 6% for *S. pneumoniae* and 0%, 0%, 70%, 64%, 85%, and 0% respectively for *H. influenzae*. Moxifloxacin concentration less than 0.38 µg/mL is enough to inhibit growth of both resistant and susceptible *S. pneumoniae* and *H.*

influenzae isolates. Thus, moxifloxacin could be used for the treatment of pneumonia caused by these organisms.

Tuberculosis

Scientists from each of the scientific divisions of the Centre have joined together to study the incidence of tuberculosis in Matlab and drug susceptibility of *M. tuberculosis* isolates from Matlab and the government-run Shyamoli Chest Clinic in Dhaka. In 2003, surveillance was expanded to the Kamalapur urban site to determine what proportion of patients with chronic cough, who are negative for evidence of tuberculosis on initial acid-fast bacilli smear testing, might have tuberculosis and transmit the disease to others. The Tuberculosis Laboratory of ICDDR,B provides quality control for the laboratory at Shyamoli and performs drug-susceptibility testing of isolates. Related research is underway within the Laboratory Sciences Division of ICDDR,B evaluating potential new diagnostic tests and molecular diagnostic approaches.

Epidemiology and surveillance of multidrug-resistant *Mycobacterium tuberculosis* and assessment of directly-observed therapy short course programme in selected areas of Bangladesh

In 2003, Bangladesh was ranked the fourth highest in tuberculosis disease burden among 210 countries in the world. ICDDR,B established a surveillance for tuberculosis in rural Matlab and in urban Dhaka to characterize the epidemiology of tuberculosis and drug-susceptibility

The high burden of tuberculosis in the rural population of Bangladesh warrants appropriate measures to control the disease

patterns. Identification of suspected tuberculosis cases, patient referral, and follow-up are done by trained field workers. In total, 57,726 persons aged ≥ 15 years living in the Matlab Health and Demographic Surveillance System (HDSS) area were interviewed. The overall prevalence of cough for more than 21 days was 7% and was significantly higher among males than among females (9.1% vs 5.6%). Fifty-two (1.4%) of 3,826 persons examined for acid-fast bacilli (AFB) were smear-positive, which is more common among males (2.1%) than among females (0.6%). The overall population-based prevalence of smear-positive cases was 96/100,000, significantly higher among males (191/100,000) than among females (32/100,000). Of 641 *M. tuberculosis* strains tested, resistance to streptomycin, isoniazid, rifampicin, and ethambutol was observed respectively in 45.1%, 14.2%, 6.5%, and 8.6% of the cases. Multidrug-resistant tuberculosis, defined as resistant to both isoniazid and rifampicin, was observed in 5.5% of the cases. The high burden of tuberculosis in the rural population of Bangladesh warrants appropriate measures to control the disease. A higher prevalence of persistent cough and AFB-positive sputum among males and the emerging drug resistance need further exploration. Surveillance data from the urban site are currently being evaluated.

Malaria

Malaria study in Chakaria, Cox's Bazaar district

Malaria is a major public-health problem in South Asia, made worse by the emergence of multiple drug resistance. In Bangladesh, 90% of malaria episodes are due to *Plasmodium falciparum* and occur in

and around forest areas of 13 districts in the northeast and southeast, whereas 70% of cases are reported from just 4 districts. Ten to fifteen million people are estimated to live in areas with high risk for malaria transmission.

Surveillance was done to characterize the epidemiology of malaria in a high-incidence area (Kakara union within Chakaria upazilla in Cox's Bazaar district) where ICDDR,B operates the Chakaria Community Health Project. All 12,590 people living within the high-risk area were assigned unique identification numbers, and each family was visited every 2 weeks and monitored for fever. Patients were diagnosed either at the village health post (VHP) or at one of 2 malaria posts. 'Clinical malaria' was defined as an illness with at least one of the following criteria: parasitaemia, reported history of fever, and prescription of one or more antimalarial drug(s) by a physician or a paramedic. Patients meeting the case definition for clinical malaria had blood evaluated by the Paracheck[®] dipstick (a rapid diagnostic test to detect *P. falciparum* [the Paracheck[®] "dipstick", Orchid Biomedical Systems, India] with a specificity of >90%).

During June-September 2002, 1,543 clinical malaria cases were identified from a census completed in 2003, of which 575 (37.3%) came either to VHP or malaria post and were evaluated with the dipstick test, and 95 (16.5%) were confirmed to have *P. falciparum*-associated infection. All cases were treated with a 3-day course of quinine and one dose of sulphadoxine/primethamine (national second-line drugs for *P. falciparum*-associated infection). About one-half (47.4%) of the cases with confirmed *P. falciparum*-associated infection were in children aged less than 18 years (10.5% were aged

less than 5 years), whereas official hospital statistics show that more than 70% of cases are adults. There were 3 deaths. *P. falciparum*-confirmed cases occurred most commonly during July. Assuming a 16.5% *P. falciparum* prevalence among those with clinical malaria, the estimated incidence of *P. falciparum* malaria was 2,025 per 100,000 population for the 3-month period. If the incidence in the other 9 months was even 50% lower, the annual incidence would be 5,063 per 100,000 population per year, or more than 140 times higher than the officially-reported figures from the World Health Organization.

Additionally, 31,051 mosquitoes were collected by the human-landing aspiration technique during the study period: 37.0% of the mosquitoes were *Anopheles* spp., and 57.4% were *Culex* species. Among *Anopheles*, *Anopheles minimus* (50%) and *A. dirus* (15%) were most common. Biting by Anopheline mosquitoes was observed throughout the evening and night hours, peaking at 18:00-00:00 hours. These findings suggest that insecticide-treated mosquito nets would be effective if successfully introduced. Household cost analysis relating to malaria is ongoing and will be completed in 2004.

Emerging and Re-emerging Infectious Diseases

Dengue

Dengue fever and dengue haemorrhagic fever continue to be a priority research area for PIDVS. Commencing with the recognition of the epidemic of the summer of 2000 and the launching of an emergency response consisting of standardized hospital, vector and community-

based surveillance, the work evolved in 2002 into clinical studies on case presentation, continued vector surveillance around greater metropolitan Dhaka, and epidemiological studies on serotype prevalence, disease incidence, and risk factors for dengue haemorrhagic fever. In the hospital study, 163 suspected dengue cases were identified at the Dhaka Medical College Hospital and Holy Family Red Crescent Hospital. Data indicate that patients with dengue haemorrhagic fever are more likely than febrile controls to have platelet count ≤ 100 thousands, positive tourniquet test, severe weakness, rash, abdominal pain, pruritus, and subconjunctival haemorrhage. This study demonstrated that ultrasonography, a non-invasive procedure, could be used in hospital for detecting ascites (accumulation of fluid in serous cavities) and, therefore, for detecting likely cases of dengue haemorrhagic fever. It also demonstrated that dengue haemorrhagic fever was nearly 3 times more common among patients with at least one prior dengue infection than among first-time dengue patients.

Three abstracts, based on the hospital surveillance data, were presented in the 10th Asian Conference on Diarrhoeal Diseases and Nutrition, held in Dhaka, on 7-9 December 2003.

The vector surveillance component was designed to complement the hospital surveillance by assessing the vector density of specific species among households located in areas where hospitalized cases of dengue fever/dengue haemorrhagic fever resided. Thus, vector surveillance was limited to patients attending the 2 participating hospitals: Dhaka Medical College Hospital and Holy Family Red



Data collection for dengue disease burden study at Kamalapur

Every year since the dengue surveillance began, the virus has been isolated in both hospital and community settings, verifying that Bangladesh has endemic dengue and dengue haemorrhagic fever

Crescent Hospital. Trained field research assistants visited 100 randomly-selected houses in 6 wards that have been under surveillance in previous years. The purpose was to characterize the vector density using the standard WHO indicators. *Aedes* mosquitoes were found in 39 (6.5%) of 603 wet containers (containers with standing water). Of these, 21 containers (53.8%) were located indoors, and 18 (46.2%) were located outdoors. Of 972 *Aedes* mosquitoes found, 680 (70.0%) were *A. aegypti*, and 292 (30.0%) were *A. albopictus*. The overall Breteau Index was 6.5, which was substantially lower than that observed in 2000 and 2001, while it was greater than 20 in both the years. Ward 49 (Dhanmondi) area had the highest vector density, followed by Ward 53 (Maghbazar) and Ward 50 (Hatirpool). The lowest densities were found in Ward 75 and Ward 30 (Ramkrishna Mission Road and Kamalapur). This apparently shorter season might be due to the shorter rainy season last year. The areas of high vector density were geographically more focused compared to the distribution during the rainy season. This may suggest a possible strategy of targeted vector control in these areas at the beginning of the rainy season.

In Kamalapur, a community-based study on the burden of dengue disease, funded by the National Institutes of Health, USA, began in October 2002. Pre- and post-season sero-surveillance was successfully completed in 2003. Longitudinal fever surveillance continued throughout the year and complemented the findings of the hospital-based surveillance of a slightly lower incidence of dengue and dengue haemorrhagic fever in 2003. There were 841 suspected cases among 21,000 people under surveillance, but as of this report,

confirmation is not yet available. What is important, however, is that, every year since the dengue surveillance began, the virus has been isolated in both hospital and community settings, verifying that Bangladesh has endemic dengue and dengue haemorrhagic fever. In 2004, pre- and post-season single-dilution neutralizing assays will be performed on the 2,003 sero-survey samples.

A dengue infection surveillance study was conducted during 2000-2003 in Dhaka city (urban study) and in 4 rural areas of high- and low-endemic areas (Abhoynagar, Bajitpur, Chhatak, and Rangamati) of Bangladesh. Blood was collected from each patient: one sample was used for PanBio immunochromatographic test (ICT), and another was transported to the laboratory for RT-PCR to detect viral RNA from patients having fever less than 4 days. In total, 1,311 (753 urban and 558 rural) suspected dengue cases were enrolled in this study. Of them, 206 (15.7%) were positive by PanBio ICT; 93 (45%) of them had primary and 113 (55%) had secondary dengue infections. The prevalence of dengue infection in urban and rural areas was 4.7% and 23.9% respectively. RT-PCR was conducted on 388 urban samples (92 from Shishu Hospital and 296 from National Hospital), and 27 (7%) were positive for dengue viral RNA. Serotypes detected were: Den 3 (19/31), Den 2 (6/31), and Den 4 (1/31). One sample was positive for both Den 3 and Den 4. Rapid PanBio ICT has a potential to detect dengue infections within 30 minutes that could be used in rural areas with minimum laboratory facilities. RT-PCR revealed that 3 serotypes of dengue virus are co-circulating in Bangladesh with a risk of causing more severe diseases, such as dengue haemorrhagic fever.

Encephalitis

In Asia, particularly in Bangladesh, epidemiology and aetiology of encephalitis are still unknown. The scientists of ICDDR,B and CDC are collecting epidemiological and clinical information, cerebrospinal fluid, and blood from patients with encephalitis at 3 main government hospitals in Bangladesh to create a profile of aetiology and epidemiology of the disease in the country. This information will be used locally for preventing and managing the disease, documenting emerging pathogens, and establishing priorities for further research. Approximately, 170 patients have been enrolled in this surveillance project. Some samples have already been sent to CDC for testing, and the results are expected to be available in early 2004.

Visceral Leishmaniasis

In recent years, Bangladesh has experienced a major resurgence of visceral leishmaniasis (kala-azar), a lethal disease caused by transmission of the parasite *Leishmania donovani* through sandflies. This project represents collaboration among scientists of ICDDR,B and the Division of Parasitic Diseases of the U.S. National Center for Infectious Diseases assignee in Bangladesh and the National Center for Chronic Disease Prevention and Health Promotion (NCDC). The collaborative team has been working to identify risk factors for visceral leishmaniasis in 3 communities in Fulbaria, Mymensingh, and to assess the epidemiologic and entomologic dynamics of its transmission, laying the foundation for a sustainable strategy for prevention, diagnosis, and treatment of the disease. In 2001, the study team completed

preparations for a population-based survey of approximately 2,200 people living in 500 households in a high-incidence community in Bangladesh. A multidisciplinary team consisting of epidemiologists, immunologists, entomologists, clinicians, and behavioural scientists was formed. Community-based surveillance was conducted in 2002 and 2003.

Data were collected on 2,348 individuals in 492 households in 3 paras (cluster of households) from January to April 2002, and data on kala-azar status were updated from January to April 2003. Investigators were able to categorize 2,228 individuals (95%) with respect to past or current kala-azar. In total, 189 people had kala-azar, 56 with onset of illness before 2000, and 133 between 2000 and 2002. During 2000-2002, the average annual incidence was 2%. Thirteen residents died from kala-azar during 2000-2002. Seven of these deaths occurred in women aged 15-45 years, while 4 occurred in children aged less than 15 years and only 2 occurred in adult men. The case-fatality rate among adult women was 19%—3 times the rate among other groups ($p=0.06$ by 2-tailed Fisher's exact test). For 89 kala-azar patients with sufficient data, the median duration of illness before treatment was 4 (range 0.5-19) months. Female patients were ill significantly longer than males (median duration 5 vs 3 months; $p=0.03$ by Wilcoxon rank sum). The qualitative assessment complemented the epidemiological data by providing the community's perspective on the social, emotional and economic impact of kala-azar. Community members reported many effects of the epidemic from untimely death of family members to major economic loss, much of which was associated with lack of access to timely and

In recent years, Bangladesh has experienced a major resurgence of visceral leishmaniasis (kala-azar), a lethal disease caused by transmission of the parasite *Leishmania donovani* through sandflies

appropriate treatment, resulting in prolonged morbidity or death. These survey data confirm that kala-azar has re-emerged as an important public-health problem in Bangladesh. The higher incidence over the last 3 years is marked and mirrors the increase as documented in the national surveillance data since the mid-1990s. The study also underscores the importance of removing barriers to timely diagnosis and treatment, particularly among women of childbearing age.

Nipah virus

In Bangladesh, 2 outbreaks of fatal encephalitis that occurred over 3 to 4-week periods in Meherpur district in May 2001 and Noagaon district in January 2003 were investigated to determine whether Nipah was the causative agent. To obtain clinical data and to identify risk factors, a team comprising investigators from ICDDR,B and the U.S. National Center for Infectious Diseases interviewed and collected sera from encephalitis survivors, household and other close contacts, other village residents, and hospital workers who had contact with encephalitis cases. Information was collected from proxy for fatal cases. Sera were collected from domestic animals, birds, and bats and were tested for Nipah virus antibodies using ELISA. In total, 254 interviews were conducted and 234 blood samples collected (119 in Meherpur, 89 in Noagaon, and 46 from hospital workers). Twenty-five cases were identified, with 23 requiring hospitalization. Nine cases were fatal in Meherpur and 8 were fatal in Noagaon. Four survivors were

antibody-positive in each location. Nipah antibodies were positive in 2 *Pteropus* bats in Meherpur. Nipah virus is the most likely source of these outbreaks, identified in humans for the first time in Bangladesh. This project served as the basis for beginning surveillance of encephalitis at 3 large hospitals in Bangladesh to characterize aetiologies and epidemiology of encephalitis.

Vaccine Studies

Phase I/II safety and immunogenicity studies of Peru 15, a live-attenuated oral vaccine candidate for *V. cholerae* O1 in Bangladeshi children and adults

The first study in Bangladesh on a live oral cholera vaccine, Peru 15, was initiated at ICDDR,B in a dose-escalating and age-decreasing design. A facility, 'Advanced Biomedical Research Unit', was set up to meet the stringent requirements of the good clinical practice (GCP)-monitored study for the inpatient Phase I parts in different age groups,



Pteropus giganteus, badur, the natural host of Nipah virus in Bangladesh

Adults on the immunization day in the Peru 15 vaccine study at the Advanced Biomedical Research Unit (ABRU) at ICDDR,B



A randomized, placebo-controlled study of the safety, reactogenicity, and immunogenicity of an orally-administered human rotavirus vaccine (RIX4414) in healthy children of Bangladesh

Rotavirus is the most common aetiological agent of severe diarrhoea in young children. In Bangladesh, about 20,000 deaths occur per year, and an estimated 1 in 200 Bangladeshi children dies from diarrhoea due to rotavirus by 5 years of age. ICDDR,B has started a study on rotavirus vaccine in urban Dhaka to assess the reactogenicity and immunogenicity of a live, attenuated human-derived rotavirus vaccine (RIX4414) among young children. In total, 90 toddlers received a single-dose vaccine (viral concentrations of $10^{5.8}$ ffu or $10^{6.7}$ ffu) or placebo. The vaccine was safe among toddlers, and reported solicited symptoms were in general mild and of short duration. The second part of the study enrolled 340 infants who received either 2 doses of $10^{6.7}$ ffu (136 subjects), 3 doses of $10^{6.7}$ ffu (136 subjects), or placebo. Stool and blood samples were collected for detection of rotavirus antigen and to measure rotavirus IgA antibody titres. The study will form the foundation for conducting Phase III studies of effectiveness and safety in Bangladesh. The ultimate goal is primary prevention of rotavirus infection with a practical, safe, and effective vaccine.

including the formation of a data safety monitoring board (DSMB). The adult component of the study, completed in 70 healthy men and women, was unblinded in December 2003, and results showed that the vaccine was safe and without any major adverse effects. Immunogenicity of the vaccine in Bangladeshi volunteers was also very encouraging with vaccine-specific antibodies in a majority of vaccinees. Studies in toddlers aged 2-5 years are being completed, and the testing among infants will be initiated in early 2004.

CAIV-T P522: a prospective, randomized, double-blind, placebo-controlled, multi-centre trial to assess safety, efficacy, tolerability, and immunogenicity of influenza virus vaccine, trivalent, types A and B, live cold-adapted, liquid formulation (CAIV-T), administered concomitantly with a combination live, attenuated mumps, measles, and rubella vaccine in healthy children aged 11–24 months

The second multi-centre good clinical practices (GCP) influenza vaccine study, begun in October 2002, continued data collection through May 2003. The study included a DSMB. The field site successfully enrolled and vaccinated its target of 150 study subjects in October and completed the second round in November on 138 subjects (92.0%). The study continued to collect surveillance data on the incidence of flu-like disease on all enrolled children, irrespective of vaccination status. In all, there were 27 withdrawals (18.0% of the original vaccinees), 5 serious adverse events, including 2 deaths (which were judged not related to the vaccination), and 123 children (82.0%) successfully completing the study. Results on immunogenicity and efficacy are pending.

New Directions/Upcoming Studies

Pneumonia studies will play a prominent role in the upcoming year. In 2003, the foundation was laid for several new studies on pneumonia and febrile disease that will begin in 2004. The first study will be conducted in Kamalapur in collaboration with CDC to identify viral agents associated with pneumonia and febrile illness. This study will increase the understanding of the relative importance of respiratory viruses in childhood febrile disease burden in general and pneumonia in particular. In preparation for this study, personnel of the Virology Laboratory of the Centre participated in training exercises at CDC.

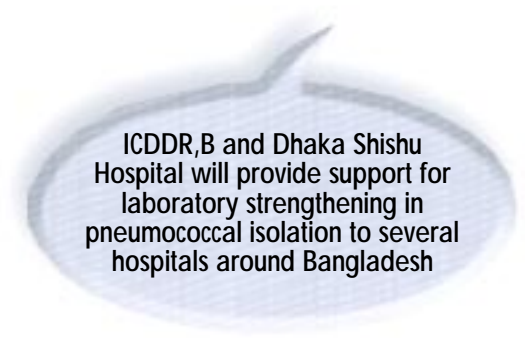
In September 2003, scientists from the Centre participated in an investigator's workshop to launch a study to be conducted with funding from GAVI's Accelerated Development and Introduction Plan (ADIP) for pneumococcal conjugate vaccines. In this study, ICDDR,B and Dhaka Shishu Hospital will provide support for laboratory strengthening in pneumococcal isolation to several hospitals around Bangladesh, while conducting surveillance for burden of disease in peri-urban Mirzapur and urban Kamalapur.

In Kamalapur, the respiratory virus study and the pneumococcal disease burden study in 2004 may combine to give the clearest urban community-based up-to-date picture to the relative contributions of these different pathogens to the burden of community-acquired childhood pneumonia and invasive disease. These two studies will be integrated with a third study on the efficacy of zinc in the treatment

of community-acquired pneumonia among children aged less than 2 years, as a follow-on to a similar hospital-based study done on this same age group in Matlab hospital. Since the hospital-based study showed promising results, the community-based study may provide the basis for a substantial improvement in pneumonia case management. Discussions were initiated in 2003 with biotechnology and pharmaceutical companies to conduct typhoid vaccine studies. These are planned for 2004.

Collaborative Work

The U.S. National Center for Infectious Diseases provides general support for the Programme on Infectious Diseases and Vaccine Sciences at ICDDR,B, including the secondment of Dr. Robert Breiman and funding for administrative staff. Dr. Breiman has facilitated CDC-ICDDR,B scientific collaboration. Since 2000, approximately 40 CDC scientists and 9 EIS officers have worked directly with CDC-ICDDR,B projects.



ICDDR,B and Dhaka Shishu Hospital will provide support for laboratory strengthening in pneumococcal isolation to several hospitals around Bangladesh



Health and Family Planning Systems

The aim of the Health and Family Planning Systems Programme (HFPS) is to promote Centre-wide participation in research that will generate knowledge applicable to evidence-based health policy, programme development, and delivery of health services in Bangladesh and in other developing countries. A summary of the HFPS research completed during the year follows. These investigations support one or more of the priority research themes established in the Centre's strategic plan for the Programme. These include: (1) identification of alternative, evidence-based health and family-planning services, (2) identification of disparities in health within populations, (3) participatory research strategies, (4) improved quality and utilization of health information systems, and (5) integration of research findings into public and private delivery systems.

Reductions in neonatal and child mortality in a rural NGO programme *Effectiveness of an NGO primary healthcare programme in rural Bangladesh: evidence from the management information system on coverage and death rates*

Many NGOs throughout Bangladesh have provided basic maternal and child health (MCH) services in rural areas under a programme managed by the Bangladesh Population and Health Consortium (BPHC). Equitable provision of MCH services for the poor has been a major objective. This study, completed in 2003, reviewed data from the management information system on coverage of selected MCH services and death rates among the registered catchment population of about 2 million. Data collected by the community health workers in

2002 were analyzed for 27 NGO areas combined and for areas where 12 NGOs had worked from 1996 to 2002. Neonatal mortality rates in these 12 areas were disaggregated for the poorest one-third and others (based on per-capita household expenditure). Estimates of coverage of MCH services in the 27 NGO areas combined in 2002 were relatively high; for the poorest and others: 3 antenatal care visits (69.4% and 75.5% respectively); 2 tetanus toxoid vaccinations for pregnant women (85.7% and 92.0%); and 1 postnatal care visit within 42 days of delivery (70.2% and 74.4%); measles vaccination (76.1% and 79.4%); and treatment for reported cases of acute respiratory infection (90.2% and 88.4%). Rates of child death in 2002 for the poorest and others were: neonatal, 21.1 and 20.6 per 1,000 livebirths; postneonatal, 13.5 and 10.8 per 1,000; and children aged 1-4 year(s), 11.0 and 8.8 per 1,000. For the 12 areas where NGOs had worked from 1996 to 2002, rates of neonatal and postneonatal death and death among children aged 1-4 year(s) at the beginning of the period were about the same as the estimates for Bangladesh as a whole for 1995-1999 from the Demographic and Health Survey (2001). However, by 2002, the rates of child death had fallen by more than 50%: neonatal mortality from 39.0 to 15.9 per 1,000 livebirths; postneonatal mortality from 25.3 to 12.3 per 1,000; and mortality of children aged 1-4 year(s) from 22.4 to 9.4 per 1,000. The neonatal death rates in 2002 for the poorest (15.1) and others (13.2) were well below the rates for the other 15 areas where NGOs started their work more recently. A study is planned to identify programmatic and other factors that might explain the relatively low neonatal mortality in these 12 areas.

Screening for unmet needs in primary healthcare clinics
Evaluation of a strategy to address missed opportunities for provision of services at ESP clinics

Many clients attending primary healthcare facilities in developing countries are unaware of the services available and of their own needs. This study, completed in 2002, developed a screening tool to identify need for the Essential Services Package other than those requested by clients. The screening tool was evaluated by comparing changes in needs identified and services provided in selected intervention and comparison clinics in Bangladesh. Systematic screening significantly increased the amount of checking for additional needs, the number of additional needs identified, and the proportion of those needs that were met through services. Use of the screening tool resulted in 13 additional needs per 100 services requested in a government intervention area and 30 per 100 in an NGO intervention area. The proportion of additional needs that were met improved from 4.6% to 14.0% in the government area and from 24.3% to 80.3% in the NGO area. The total number of additional services provided per 100 services requested increased from 3 to 10 in the government area and from 12 to 28 in the NGO area.

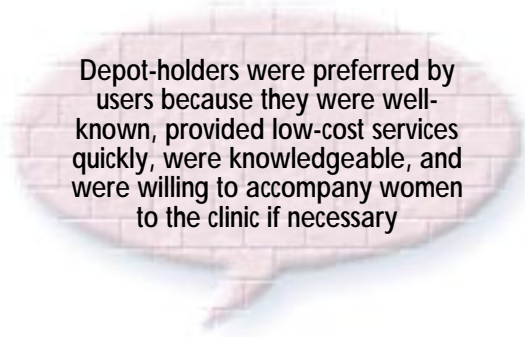


A depot-holder on her way to the household of the clients'

These improvements were statistically significant and significantly greater than those in the respective comparison areas. The results suggest that introducing a screening tool more widely in primary healthcare clinics is feasible in Bangladesh and could significantly increase the coverage of reproductive and child health services.

Use of ESP in the transition to a static clinic system
Comparison of trends in key ESP coverage indicators in areas with and without community clinics in two rural surveillance areas: 1998-2002

Under the Health and Population Sector Programme (HPSP) 1998-2003, it was planned to provide an extended range of services, ESP, through static Community Clinics (CCs), rather than through domiciliary visits and satellite clinics. This study, commenced in 2003, was designed to identify changes in use of ESP in two ICDDR,B surveillance areas (Abhoynagar and Mirsarai). The quarterly trends in selected ESP indicators were compared for the 1998-2002 period for wards that have reached different stages in the transition to provision of static clinic service. Preliminary findings indicate that use of ESP was not adversely affected by the transition, and important changes in healthcare-seeking behaviour have been identified. During 1998-2002, in both CC and non-CC wards, the contraception prevalence rates (CPRs) were 55-60% in Abhoynagar and increased from about 42% to 45% in Mirsarai. As the proportion of women obtaining contraceptives in the home declined, CCs quickly became a major source of supply in 2001 and 2002. In both CC and non-CC areas, married



Depot-holders were preferred by users because they were well-known, provided low-cost services quickly, were knowledgeable, and were willing to accompany women to the clinic if necessary

couples also switched to shops and pharmacies for contraceptive supplies as domiciliary visits declined. There was no discernible decline in the coverage of children with measles or BCG vaccination when CCs were opening from 2000 to 2002, and the trends were very similar for CC and non-CC wards as a whole. There was an increase in the coverage of pregnant women with antenatal care during 1998-2002, and in 2002, a significant proportion of women was having antenatal care at CCs (5-15% in Abhoynagar and 40-55% in Mirsarai). Further analysis is being conducted on trends in the use of facilities and service coverage, including disaggregation by two socioeconomic sub-groups of women. Fieldwork on surveys of users and providers has been completed, and data are being analyzed to assess their experience of the changes in the service-delivery system. As HPSP has been extended through 2004 and plans for the next sectoral programme are yet to be completed, the results of this study to be completed in early 2004 will provide valuable evidence as a basis for further modifications in the service-delivery system.

Evaluation of a six-month pilot to introduce community health volunteers (depot-holders) in three types of urban areas in Bangladesh *Introduction of community health volunteers in urban areas*

The NGO Service Delivery Programme (NSDP) supports 41 local NGOs to deliver ESP in Bangladesh through urban and rural static and satellite clinics. It has about 8,700 female community health volunteers (depot-holders) working as service providers and promoters in rural areas. This study was designed to evaluate a pilot trial of introducing them

in 3 types of municipal areas to address the needs of the urban poor. A baseline survey was conducted among all 60 depot-holders trained in 3 pilot areas. In-depth interviews were conducted on a sub-sample of depot-holders, supervisors, and service providers. In addition, 4,800 women of reproductive age (15-49 years) were interviewed to ascertain the patterns of their healthcare-seeking behaviour. Most volunteers were married, had 1-2 child(ren), at least 8 years of schooling, a mean age of 28 years, and a mean residence of 20 years in the area. Only 8 (13%) of the depot-holders dropped out, although some asked for more commodities to sell to increase their incentives (50% of sales revenue). Findings from the survey of women included: better-off people in some non-slum areas were not interested in using the volunteers' services; some people preferred to use other NGO or government facilities because costs are lower; about 20% of those surveyed in the intervention areas (2,428) knew about the volunteers; and some (185) had already received services in the first 3 months (mainly oral contraceptive pills and also referral for family planning, ORS packets, condoms, and healthcare information). Depot-holders were preferred by users because they were well-known, provided low-cost services quickly, were knowledgeable, and were willing to accompany women to the clinic if necessary. Service statistics indicated that, in general, use of ESP services at static and satellite clinics had increased since the introduction of the volunteers. A further survey is planned to assess the short-term impact of depot-holders on coverage of services, and a longer-term follow-up will allow an assessment of their cost effectiveness.

Micronutrient fortification of wheat flour

Fortification of wheat flour with micronutrients as a strategy for improving vitamin A and iron status in school-age children in rural Bangladesh

Food fortification is among the most cost-effective and sustainable strategies to prevent or correct micronutrient deficiencies. The objective of this efficacy study was to assess the impact of consuming fortified chapati on school-age children by their vitamin A and iron status over a 6-month period. This randomized, double-blind, controlled trial was conducted in a rural area of Chittagong district in Bangladesh. Three hundred fifty-two apparently healthy school-age (6-15 years) children, were enrolled from 43 randomly-selected baris (a few adjoining households) to consume daily two chapatis of 100-g non-fortified or fortified wheat flour containing about 20-60% of the recommended daily allowance for multiple micronutrients for 6 months. Blood samples were collected prior to the start of feeding, 3 months later, and 6 months later when the feeding was stopped. The mean serum retinol level at 6 months was significantly higher in the fortified group (1.06 vs 0.94 $\mu\text{mol/L}$, $p < 0.01$), and the proportion of subclinical vitamin A deficiency (serum retinol $< 0.70 \mu\text{mol/L}$) was significantly reduced in the fortified group compared to the control group at 6 months (7.4% vs 22.5%, $p < 0.05$). There was no demonstrable effect of consumption of



Children are eager to have Chapati in a typical rural village at Mirsarai

fortified chapati on iron status or on average haemoglobin levels at 3 or 6 months, nor was there any reduction in the proportion of children who had anaemia. This is the first study in Bangladesh that tested the efficacy of consuming fortified chapati, which clearly demonstrated a significant improvement in the vitamin A status of school-age children in rural Bangladesh.

Programmatic and non-programmatic determinants of low immunization coverage in Bangladesh

Remarkable success in increasing immunization coverage among children has been achieved since the mid-1980s. For example, initiating immunization (first dose) rose from 2% to 95%. Unfortunately, only one-half of these children become fully immunized. There are several barriers that must be overcome to achieve optimal protection and to reduce the left-outs, drop-outs, and invalid doses. The most common reasons parents give for not completing vaccination of their children have been reviewed in every coverage survey conducted by EPI since 1991. The responses have been consistent and relate to what is classified in the surveys as "lack of information and knowledge", i.e. being unaware of the need for immunization and for subsequent dose(s) and the importance of completing the entire schedule. What is less well-understood is why this lack of knowledge

still exists, despite years of efforts to provide information on immunization through education and communication via mass media and through inter-personal contacts. This and other explanations for incomplete coverage, programmatic (supply-side) and non-programmatic (demand-side), were investigated in this study. The findings will assist programmes in incorporating strategies to reduce immunization drop-outs, left-outs, and invalid doses. The study was conducted in 6 upazilas across Bangladesh, covering high- and low-performing areas. A cross-sectional survey of 10-20 randomly-selected children, aged 12-23 months, from each of 6 selected upazilas was conducted, and fully immunized, drop-outs, left-outs, and invalid dose cases were identified. In-depth interviews of mothers from each category, service providers, and programme managers were also conducted. Prospectively, newborns aged 0-4 week(s) were identified and followed up until the expected date of DPT3. Service statistics were reviewed, and an inventory of vacancies and logistics prepared. Interviews

Is poison ingestion becoming an important public-health problem in rural Bangladesh?

Twenty years (1983-2002) of demographic and programmatic surveillance data from Abhoynagar/Keshobpur, collected by ICDDR,B, often permit us to identify emerging public-health problems. Recent analysis of admissions (n=2,539) into the Upazila Health Complex (UHC) of Abhoynagar from 2000 to 2003 shows that 13% were due to either poisoning or assault. Of those, 26% (n=668) were poisoning-related. Many of these are suspected to be suicide attempts. More than half (51%) of poison victims were aged less than 25 years, with the highest number of poisoning ingestion cases occurring among females aged 10-19 years. Suicide is the fifth most common cause of death in those aged over 10 years in Abhoynagar and ranks number one among adolescents aged 10-19 years. Relationship between poisoning and suicide attempts or suicide warrants further study.

The table shows the gender and age distribution of poisoning cases admitted into Abhoynagar Upazila Health Complex from 2000 to 2003*

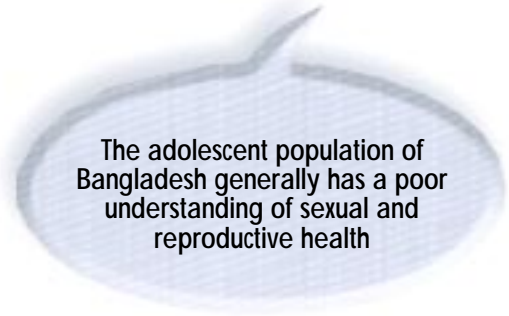
Age group (years)	Total no. of poisoning cases admitted		
	Male	Female	Total
10-19	61	119	180
20-24	75	86	161
25-29	68	65	133
30-34	32	31	63
35+	92	39	131
All ages	328	340	668
All admissions	8,694	10,836	19,530
% of all admissions	3.7	3.4	3.4

*In patient register

were completed with 2,700 randomly-selected mothers of children aged 12-23 months from 6 selected upazillas. Immunization coverage at 12 months of age varied widely by upazila. Rates of full immunization coverage ranged from 47% in Golapganj to 89% in Abhoynagar. Drop-outs varied from 43% in Nokla to 11% in Abhoynagar. Invalid doses varied from 5% to 9% in upazillas. Reasons associated with complete immunization included these: parents were convinced about benefits of EPI, the vaccination site was in close proximity, and the community had an influence. Multiple factors were documented for drop-outs, notably irregular EPI sessions, experience of side-effects, lack of effective supervision, and insufficient dialogue regarding subsequent doses. Left-outs resulted from dependence on fate and living in hard-to-reach areas. Provider's inadequate knowledge of valid doses resulted in subsequent vaccination being given ahead of schedule and also injecting measles vaccine with the third dose of DPT. Gross differences in record-keeping and reporting were observed at different tiers of the EPI service-delivery system. Non-compliance with EPI-recommended procedure of record-keeping and reporting by the concerned providers and virtual absence of monitoring and supervision by the managers at different levels contributed to such differences. The majority of the determinants of low immunization coverage appeared to be programmatic. Programmes need to ensure the regular provision of vaccine sessions, with diligent supervision by the managers at all levels for proper reporting and record-keeping. Refreshers training for providers and effective managerial supervision will help reduce invalid doses and facilitate better communication with clients.

Technical assistance to design and implement a health-management information system in two municipalities of northern Bangladesh

In Bangladesh local government institutions, such as city corporations and municipalities governed by the Ministry of Local Government, Rural Development, and Cooperatives (LGRD), are responsible for providing basic services to urban populations. Municipalities have been given these responsibilities without any systematic preparation and resource allocation. Employees of many municipal health offices have no formal training or public-health background. As a result, the Ministry of LGRD relies heavily on the resources of, and seeks expanded collaboration with, the Ministry of Health and Family Welfare, NGOs, and the private sector to provide basic services. Health-management information systems (HMISs) that can be used for developing local action plans do not exist. CONCERN has been providing technical assistance to strengthen the capacity of the municipal authorities to deliver specific child-survival interventions of good quality and to improve the health status of mothers and children. To do this, CONCERN has embarked on the development of an HMIS for municipalities with support from ICDDR,B. With financial support of CONCERN, personnel of the Health Systems and Infectious Diseases Division of ICDDR,B have undertaken a situation analysis, designed, and assisted CONCERN in field-testing an HMIS during May-November 2003. HSID staff will continue to provide technical assistance in the dissemination of HMIS to concerned policy-makers and programme implementers.



The adolescent population of Bangladesh generally has a poor understanding of sexual and reproductive health

Ongoing safety monitoring of zinc tablets at the Centre's Dhaka hospital



Effectiveness of a school-based reproductive health intervention for adolescents in rural Bangladesh

The adolescent population of Bangladesh generally has a poor understanding of sexual and reproductive health. This is associated with early marriage, adolescent pregnancy, and increasing occurrence of high-risk sexual practices. To address these concerns, effectiveness of a school-based intervention was studied, which combined community sensitization with the distribution of 3 booklets addressing (i) puberty, (ii) fertility and family planning, and (iii) STDs/AIDS. Secondary schools located in two rural sub-districts—Abhoynagar and Mirsarai—were designated as intervention or controls based upon the union in which they were located. All attending students in Grade 8 and 9 were eligible. Group meetings were held with parents, teachers, and local decision-makers. These groups participated in the development of the booklets. At approximately 3-month intervals, the 3 booklets were distributed to all students. Based upon both univariate and multivariate analyses, significant improvements in knowledge favouring students attending the intervention schools were found. Among girls, this included methods of modern contraception ($p < 0.002$), what diseases are transmitted sexually ($p < 0.001$), and how to prevent these ($p < 0.001$). Among boys, this included methods of modern contraception ($p < 0.001$), knowledge about birth control pills ($p < 0.001$), their side-effects ($p < 0.001$), and what diseases are transmitted sexually ($p < 0.001$) and how to prevent these ($p < 0.001$). With respect to practices, too few students reported high-risk behaviours or attended health services to permit a statistical analysis

of group differences. This study has demonstrated that an intervention that combines community sensitization with the distribution of booklets to school-attending teenagers can effectively improve knowledge about sexual and reproductive health. Changes in practices could not be demonstrated and suggest the need for longer-term follow-up and more discrete, confidential methods of reporting.

Cost of integrating child nutrition services into urban ESP clinics *Cost analysis of protocolized management of severely-malnourished children at PSKP clinics*

ICDDR,B, in collaboration with Progoti Samaj Kallayan Sangstha (PSKP), has examined the feasibility and effectiveness of integrating protocolized management of severely-malnourished children into the ESP delivery system at selected urban NGO clinics. The key activities under the protocol included assessment of nutritional status, counselling of mothers on feeding, supplementation of micronutrient provision of food supplement (multi-mix) for children of very poor households, and management of infectious disease among severely-underweight children. Based on the results, USAID/Dhaka supported an add-on component to analyze the costs of this intervention. Results of the costing study showed that the provider's unit cost (irrespective of outcome) was US\$ 41. However, the unit cost could be lowered with active outreach and increased enrollment. The interventions were 'self-targetted' on the poorest supporting equity objectives. With some fine-tuning, the protocol is replicable in similar urban ESP clinics.

*The zinc blister packs
for diarrhoeal treatment*



Exit survey among users of the Cholera Hospital in Dhaka
An assessment of quality of care and willingness to pay from the user's perspective

To ascertain patient satisfaction with the quality of ICDDR,B hospital care and to assess their willingness and ability to pay for services, a survey was conducted through exit-interviews with 188 discharged patients, observations of patient-provider interactions, and review of records. To assess willingness to pay, the contingent valuation method was applied. The key findings suggested that most patients were fairly satisfied with the quality of hospital care. Of the respondents, 15% had a relatively high income (Tk 8,000-20,000), 36% had a medium income (Tk 4,000-8,000), and 49% had a low income (Tk 2,000-4,000). More than half of the respondents had spent Tk 100-500 on healthcare during the month prior to the survey, while more than one-third spent Tk 1,000 or more. Most (98%) respondents were willing to pay for higher registration fees, if introduced, and 55% would pay a maximum of Tk 41-50, while 27% would pay Tk 21-40 for registration. The majority indicated willingness to pay for medicine and food/lodging when different price options were explained, although they were less willing to pay for diagnostic tests. Responding to a question on franchising of ICDDR,B hospital services, 72% indicated that they would prefer an ICDDR,B-run facility near their home, and 57% said they would still come to the hospital if outpatient facilities were provided near their home.

Scaling Up Zinc for Young Children (SUZY) Project

The SUZY Project, funded through the Bill and Melinda Gates

Foundation, is a new initiative of ICDDR,B. The Project aims to provide zinc as a treatment to all preschool children in Bangladesh when they suffer from diarrhoea. The goal is to reach all children regardless of their gender, where they live, and explore the income status of their parents, or the circumstances under which they grow up. Zinc is an effective treatment for childhood diarrhoea. Zinc treatment reduces the severity and duration of diarrhoea, the likelihood of future episodes of diarrhoea, and the need for hospitalization. Most importantly, zinc treatment can save a child's life. It has been estimated that zinc treatment could save 30,000-70,000 lives of young children only in Bangladesh each year. Worldwide, the lives of more than 400,000 children could be saved each year if zinc was available to them as a treatment at times when they suffer from diarrhoea.

Zinc has never been scaled up before in a large population or a country as a whole. With this new project, new challenges arise, which are being addressed by the SUZY Project:

- The scaling-up process requires a well-designed marketing campaign to inform the target population about this new treatment and its advantages, and the availability of zinc. We are working closely with Social Marketing Company, which will be taking the lead on this.

■ We want to produce a dispersible zinc tablet formulation in Bangladesh. For this purpose, we are working with Nutriset, a French humanitarian relief company which developed our zinc premix formula, to find a suitable partner here in the country and transfer the technology.

■ We are developing distribution systems in cooperation with government organizations, with the help of NGOs, and in cooperation with the private sector to reach out with our zinc campaign even in the remotest areas of Bangladesh.

■ Comprehensive training programmes are being developed to enhance knowledge and skills about zinc among health professionals, e.g. doctors, pharmacists, drug sellers, sales people, and all others involved in the distribution process.

Updated information can be seen at <http://www.icddr.org/activity/SUZY>.

Several investigations in support of the scaling up of zinc were initiated in 2003. These include:

1. Longitudinal incident case study of caretakers and providers: an adequacy performance evaluation of scaling up zinc in rural and urban populations of Bangladesh.
2. Behavioural studies of caretakers' practices in relation to knowledge and beliefs about childhood diarrhoea.
3. National coverage surveys of diarrhoeal illness management practices and expenditure.
4. Hospital and out-patient surveillance for zinc safety.
5. Randomized trial of tablet vs syrup formulations for acceptance, tolerance, and adherence to treatment instructions.

Caretakers' knowledge and practices: early findings

This investigation was carried out to understand the key issues affecting the treatment of diarrhoeal diseases in children aged less than 5 years. Primary topics that are being explored include: identification of local categories of diarrhoeal illnesses, differentiation of signs and symptoms and causal explanations associated with these illnesses, home management of diarrhoea, perceptions of appropriate care providers for diarrhoeal cases, treatment expectations, barriers to treatment compliance, and concepts relating to prevention and treatment. The findings will be used for developing culturally-relevant and appropriate messages to promote the use of zinc for treatment of diarrhoeal diseases in children aged less than 5 years.

The study design encompasses a mix of methods, such as key-informant interviews, household observations of management of diarrhoeal cases, narratives of recent diarrhoeal cases, semi-structured interviews with mothers and other childcare providers and various health practitioners, cognitive mapping procedures involving free-listing and rating exercises, and group discussions. Data collection is being carried out in one urban and one rural research site.

Through free-listing, 29 diarrhoeal illnesses have been identified in each research site. Each illness has different terminology, associated signs and symptoms, and perceived causes and appropriate treatment. Preliminary findings suggest that the management of diarrhoeal illnesses first involves dietary remedies designed to counteract the internal heat associated with most diarrhoeal illnesses. Diarrhoeal illnesses are commonly linked to the excessive intake of 'hot' foods, referring to the hot/cold humoral theories that are followed in many regions of Asia. These humoral traditions still influence causal interpretations and often guide therapeutic interventions during times of illness.

Although respondents are familiar with the term vitamin, they have limited knowledge of zinc. Findings suggest that vitamins are given during post-diarrhoeal episodes to provide strength to the young child who was 'weakened' by the illness. Vitamins are believed to increase the frequency of stool output and are, therefore, avoided during diarrhoeal episodes. Interviews with health practitioners revealed that village 'doctors' or shopkeepers commonly distribute zinc, which is generally prescribed by a trained physician, in a syrup form. In fact, in the urban research setting, 12 brands of zinc were identified, whereas in the rural site, 22 brands are presently on the market. At present, practitioners prescribe zinc to increase growth, reverse weakness, increase appetite, and improve digestion.



**Programme Head
Peter K Streatfield**

Population Sciences

Population remains a central issue in Bangladesh. The country has experienced a major decline in fertility and mortality, especially mortality of children aged less than 5 years, although recently the decline (especially in neonatal mortality) has slowed. Fertility has also plateaued at around 3 children for the last decade.

To reinvigorate the declines in fertility and mortality, new approaches to promote social changes, especially in education, employment and empowerment of rural women, might be needed. The Population Sciences Programme has been exploring the dynamics of the recent fertility plateau, and mortality trends through studies based on Matlab health and demographic surveillance, in other research sites of the Centre, and using national-level data sources.

In 2003, several studies were undertaken to examine the issues surrounding ageing, poverty and health, gender and equity, socioeconomic status, and poverty monitoring. Some of them, especially studies on verbal autopsy (VA) for diagnosis of causes of death, are to strengthen our capacity to better understand the complexity of disease patterns.

Infant and Child Morbidity and Mortality

About 10 million children die each year in developing countries before reaching their fifth birthday. Despite a substantial decline in morbidity and mortality of infants and children over the last 30 years, the rate is still high. Each year, about 30% of total deaths in Matlab and a

similar proportion at the national level represent deaths of children aged less than 5 years. Most of these deaths occur in the first year of life. Seven out of 10 infant deaths are due to infectious diseases or diseases related to poverty. In other words, most deaths occur due to pneumonia, diarrhoea, measles, malaria, and malnutrition. However, mortality decline due to controlling diarrhoea is faster than for other diseases, and pneumonia is now the number one killer of infants.

Studies using the Matlab service area as a model of the efficient healthcare system found that people preferred home management of diarrhoea and preferred going to the field workers in the service area and to the village doctor in the non-service areas, implying that rural people tend to go for treatment to trained service providers if available. In their absence, they opt for a village doctor. It is true in the case of pneumonia. For acute respiratory disease, half of the people in the non-service areas preferred village doctors, while people in the service area either go to the trained healthcare providers or hospital for the treatment of respiratory diseases.

Verbal Autopsy and Causes of Death

In the past, primary emphasis has been on infectious diseases among children, which led to a substantial gain in life-expectancy. Lack of attention to non-infectious diseases more often resulted in undiagnosed cause of death. With slow improvement in neonatal survival and a growing recognition of the importance of ill health of

Fertility decline and improvements in mortality levels will change the population structure with a heavy load in the upper part of the population pyramid

adults as a precipitating cause to the impoverished state of many families, greater attention is now being given to the understanding of more complex causes of death, i.e. death among neonates, adults, and the elderly.

In the past, fieldworkers used to collect an open-ended death history, and a medical assistant relied on this information to make the diagnosis of causes of death. To strengthen the diagnosis of the causes of death, Health and Demographic Surveillance System (HDSS) has designed new VA instruments, based on WHO's International Classification of Diseases (ICD-10), which have been modified by a working group representing many surveillance systems of the INDEPTH Network. There are separate verbal autopsy instruments with algorithms, or series of questions in flowchart sequences, to be asked for cases of (1) neonatal, (2) child, and (3) adolescent and adult deaths. Major sections of the instruments are questions related with risk behaviour, symptoms and signs, and treatment history of the diseased.

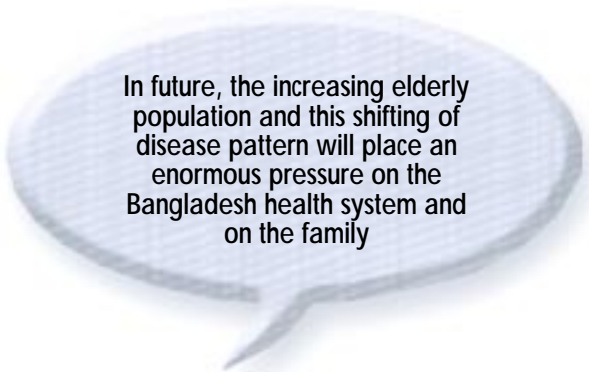
After considerable pre-testing and refining of the questions and algorithms during 2002, the new VA system was introduced in Matlab from January 2003. The Community Health Research Workers (CHRWs) detect events and ask several basic questions to complete the HDSS death form. This triggers off a visit by the field research supervisors of the VA team within 2-6 weeks following the event, and the full verbal autopsy instrument is used for the family members who were present at the time of death of the individual concerned. An experienced medical assistant and a committee of 3 physicians carry

out diagnosis of the causes of death and review the VA questionnaire as part of the VA team. Both old and new systems were followed in parallel for the first year to permit further fine-tuning of the new systems and to elucidate whether changes in patterns of causes of death are due to the change in data-collection systems rather than being changes in the actual causes.

In Abhoynagar and Mirsarai, information on causes of death is collected on the basis of ICD-9. An analysis based on Abhoynagar and Mirsarai data indicates that suicide is the fifth most common cause for all and the most common cause of death among adolescents aged 10-19 years. The ICD-10 will start at these sites in 2005.

Ageing of the Bangladesh Population: Mortality and Morbidity

Fertility decline and improvements in mortality levels will change the population structure with a heavy load in the upper part of the population pyramid. This trend necessitates a change in the health policy focusing on older population rather than the continuing policy emphasizing the problems of young people. At present, elderly people, i.e. aged 60 years plus, account for only 5% of the population, but they account for one-third of the total deaths. During the present century, the elderly age group will increase almost 10-fold to 65 million, accounting for more than 1 in 4 of the total population compared to 1 in 20 today.



In future, the increasing elderly population and this shifting of disease pattern will place an enormous pressure on the Bangladesh health system and on the family

The consequences of this change have major policy implications. It is further aggravated by the fact that disease patterns have also been changing from infectious and poverty-ridden diseases to so-called 'life-style' diseases. A study examining the socioeconomic differentials and causes of death of the elderly (60+ years), using Matlab HDSS data, identified that the major causes of death of elderly people are cardiovascular diseases, malignant neoplasms, respiratory and diarrhoeal diseases, showing a definite deviation from past trends.

Results also confirmed that better social and economic status gives a better chance of survival among elderly people. Risk of dying is much lower among married elderly than widows/widowers; staying with children positively contributed to the survival of elderly people, as did the role of the extended family in a traditional society where support for the elderly comes primarily from the family.

In future, the increasing elderly population and this shifting of disease pattern will place an enormous pressure on the Bangladesh health system and on the family. The cost of prevention and treatment of these degenerative and lifestyle diseases is expensive. In the absence of healthcare insurance, most burden of caring for the elderly will fall on the immediate family members. In the course of social change, if the present family system breaks down, healthcare for the elderly will be endangered.

Another study of 597 elderly people aged 60 years and above examined the complex interrelationship among biological,

environmental and social factors and how these factors affect ageing. Data on morbidity and functional status of the study population were collected to identify determinants of good/ill health in the elderly population in a rural area of Bangladesh. Data on cognitive functioning were collected from 460 respondents. These 460 respondents also underwent physical examination, including laboratory tests, by a medical doctor. Data collection and processing are almost completed.

Preliminary analyses suggest that the most common self-reported morbidity among elderly people, irrespective of their sex, is micturition problems and pain in the waist and joints. A common complaint of cloudy vision, a possibility of cataract, was documented in the analysis.

Age has an inverse relationship with physical functioning and activities of daily living for both sexes. Elderly people contribute substantially to household work, and one-third of them are economically active. Ninety-four percent of the elderly were living in some form of extended family, and more than 18% of the study population receive financial help regularly from a family member, and only 5% never receive any support.

Nature of ageing and care for the elderly in rural Bangladesh

This study is a part of the PhD programme of Mr. Ashraful Alam Neeloy, Senior Research Officer of the Social and Behavioural Sciences Unit of the Centre. He is doing his doctoral work in anthropology at the

Australian National University. The primary aim of the study is to investigate the issues surrounding the situations faced by the elderly people in a village of Matlab and the role of families as caregivers. The research also focuses on the main factors that contribute to better or worse conditions for the elderly people and on the differences of experience within gender groups. Ethnographic methods are being used for data collection. During 2003, in-depth interviews with 47 older persons (60 years and above) and 9 caregivers, 2 group discussions with older persons, and 7 follow-up interviews were conducted. The fieldwork is expected to be completed by January 2004. The informants reported poverty as one of the main problems of caring for the elderly people at the family level. High levels of health problems and over-the-counter treatment were also found. Situation varies significantly according to gender.

Gender and Fertility

Gender preference is a very common phenomenon and affects virtually every aspect of social behaviour in Bangladesh. However, supportive evidence exists that an effective health service management can, in the long term, reduce the effect of gender preference on mortality. In recent analyses, Matlab data show that differential mortality among male and female children is almost eroded in the Matlab service area. However, a study conducted in 3 areas of Bangladesh suggests a strong gender preference, which seems to have had an impact on determining both demand for children and contraceptive-use behaviour. Two-fifths of women having 2 daughters but no sons did

not want any additional children. Demand for no additional children was much higher--about four-fifths--if women had 2 sons but no daughters. More importantly, if couples have children of both sexes, almost none expressed any demand for additional children, and most used effective contraception. In the same study, qualitative analysis suggests that old-age security and support determines their preference for a particular gender preference of the family.

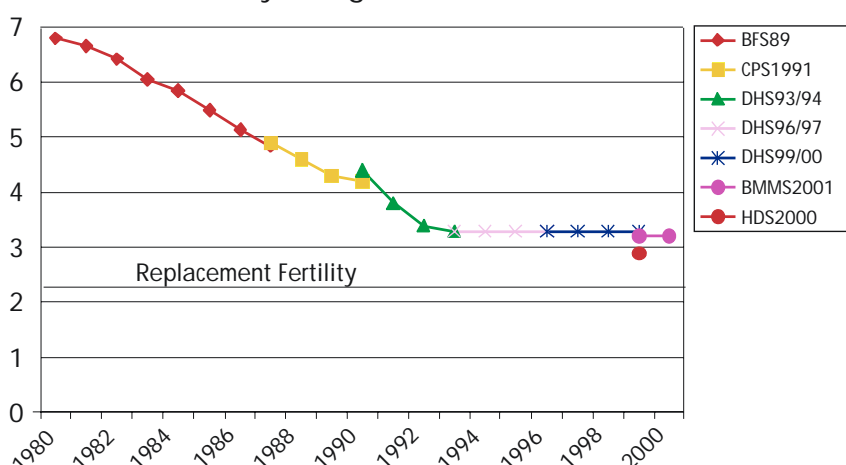
Persistent gender preference sustains fertility at a high level despite a substantial rise in contraceptive use. This plateaued situation is critically examined by another study.

Plateau in Fertility Decline in Bangladesh

Recent analyses of the decade-long plateau in fertility in Bangladesh at one child above replacement level have generated concern and a search for ways to re-initiate the encouraging fertility decline of the 1980s. A detailed examination of the 'tempo effect' has indicated that the steep fertility decline of the 1980s shifted the birth distribution from higher orders down towards first order. While mean age at childbearing has been rising among higher order births, it has not been rising among first or second order births. This shift effectively dampened the tempo effect and reduced the steep gradient of the fertility decline.

Child survival has greatly improved during the 20th century such that 90% of newborns now survive to adulthood compared to 40% earlier

Trends in Fertility, Bangladesh, 1980-2000, Various Sources



Although HIV seems remarkably low in Bangladesh, annual sentinel surveillance has reported widespread high-risk behaviours for AIDS and high levels of STDs among risk-groups

in the century. So, the insurance effect of high fertility is playing a less important role now. Son preference, on the other hand, is still a factor, though declining. It seems that the most popular combination of children is two sons and a daughter—only 20% of couples with this combination go on to have another child within 5 years compared to 40% of those with two sons, or 60% of those with two daughters.

So-called 'wanted fertility' is still one child above actual fertility, and unmet need for family planning is still substantial (15% in 2000); so, there are possibilities of further reducing the fertility level if certain actions are taken. Further efforts are undoubtedly needed to improve the quality of family planning services and increase contraceptive prevalence, especially between marriage and first birth. In addition, the prevention of unwanted births, especially among high-parity couples, will be beneficial, but social changes to reduce residual son preference will also be required.

Compliance with Condom Use: Implication for HIV/AIDS

A study on compliance with condom use has been carried out at a time when the country is exposed to the deadly disease, HIV/AIDS. The official figure of total deaths due to AIDS is 300 since the disease incidence was reported in Bangladesh. Although HIV seems remarkably low in Bangladesh, annual sentinel surveillance has reported widespread high-risk behaviours for AIDS and high levels of STDs among risk-groups. WHO estimates 15,000-20,000 cases of HIV/AIDS in Bangladesh. There is controversy about the number of HIV/AIDS

cases, but Bangladesh is exposed to HIV/AIDS, and a full study of condoms and their use is an emerging issue as successful prevention of HIV/AIDS and other STDs is possible through the effective use of condoms.

The study documented that the use of condoms has not increased during the last 15 years. Use rate is even lower than traditional methods (4.3% vs 10.3%). However, 75-90% of those who use condoms do so correctly, but the discontinuation of condom use in the first year is very high (67%). Dissatisfaction and fear of bursting are the two major causes of improper use and discontinuation of the method.

Condom use is the major method to involve males in reproductive health issue, an agendum promoted in the 1994 ICDP and 1995 Beijing declarations. An effective programme popularizing condom use can face the emerging challenge of STDs and HIV/AIDS.

Adolescents and Abortion

The total number of abortions in Bangladesh during 1995 was estimated at 730,000 leading to an abortion rate of 28 per 1,000 women of reproductive age (15-44 years). Traditional service providers induced more than 50% of abortions among adolescents. Although abortion is permitted in some special cases (saving the woman's life), sociocultural factors force young adolescents towards unhealthy practices. They are dying due to abortion and abortion-related complications.

Results of a study conducted in Matlab suggest that the incidence of abortion is 35 times higher among unmarried than among married adolescents. Risk of abortion is higher among educated women. Equal numbers of adolescents used modern and unsafe methods for abortion.

This study reiterated an urgent need for the integration of high-quality abortion and contraceptive services for adolescents to be set up in the framework of a comprehensive reproductive health system as envisioned in the 1994 ICPD and 1995 Beijing declarations.

Social Change and Reproductive Behaviour, 1984-1996

Bangladesh has achieved a remarkable change in reproductive behaviour for an economically-impooverished state in a very short period. Changes in reproductive behaviour in rural Bangladesh over a 13-year period were studied.

Analysis suggests that changes in reproductive behaviour (measured by demand for additional children, current contraceptive use, and fertility trends) have resulted primarily from biosocial factors (age, number of living children, sex composition of the family) and biomedical factors (improved survival, health interventions). Impact of the social and economic factors (education and occupation at the individual and household levels) was much weaker than the biosocial and biomedical factors. However, the biosocial and biomedical factors operate in the context built up by broader aspects of social change, for example, land crises and NGO programmes. All these changes have affected

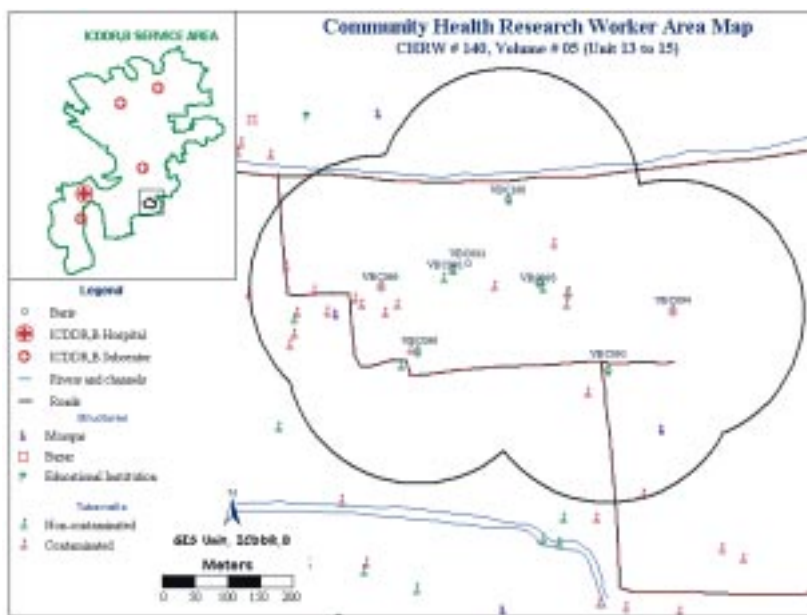
both macro- and community-level social structures that are related to those factors that shape the 'patriarchy' (i.e. son preference, spousal communication) which, in turn, influence the proximate determinants: demand for no additional children and the current use of contraceptives.

However, the strong relationship between biosocial and cultural factors and reproductive behaviour changed over the period studied. The study also demonstrated a change in some important aspects of the normative social structure. The evidence of these was the changing effects of son preference, spousal communication, and women's freedom of movement. Of these, change in the effect of spousal communication was larger.

Results of the study also suggest that women of reproductive age in all the 3 study areas shared a similar notion of desired family size and the same level of demand for no more children prior to the fertility decline of the 1980s. During the period studied, desired family size reduced further but it reduced equally in all the 3 areas. With this same level of desired family size, the Matlab family planning intervention, with efficient supply logistics, shows an extremely successful mechanism for increasing contraceptive use, thereby reducing fertility levels in the mid-1970s, while high fertility in the other 2 areas began to decline in the 1980s.

Analysis of the present study reveals that a seemingly irreversible fertility transition is in place in Bangladesh. However, studies have found several factors critical to policy concern. These are: (a) there is

The biosocial and biomedical factors operate in the context built up by broader aspects of social change, for example, land crises and NGO programmes



an observed plateau in the contraceptive prevalence and total fertility rates since the early 1990s in rural areas under national services and from the early 1990s in the Matlab area under ICDDR,B interventions: (b) there was still a large unmet need among those who have children; and (c) gender preference, though starting to change, is still strong.

The present study shows that plateau in total fertility rates is clearly related to the patterns of timing and spacing of births among young women in the 3 study areas. At this stage, an upward shift of age at childbearing is essential if there are to be further declines in fertility level.

Health and Demographic Surveillance System-Matlab

Over the past 4 years, a major initiative was undertaken to modernize the Health and Demographic Surveillance System (HDSS)-Matlab. Significant changes were being undertaken in field management and communication to improve the quality of data. A few of them were: abolition of the so-called geographic distinction, names of 'treatment' and 'comparison' areas, introduction of health record-keeping for the whole HDSS area, creation of an independent quality-control team, and shifting of a mini-database to Matlab.

In 2003, the RKS service book was printed incorporating information on arsenic contamination. Refresher training on the basis of evaluation by the quality-control team was arranged for the HDSS field staff. Vital events forms

were checked, relevant information was added, and redundant information was omitted from the forms.

In its usual routine support, HDSS is giving considerable effort to mapping (with GIS coordinates) all the tubewells from which residents take drinking-water. As part of a major arsenic study, including mitigation and research, each of 14,000 plus wells is being tested for arsenic content, followed by screening of residents where water sources are contaminated. HDSS has been playing a vital role in detecting the early pregnancies for inclusion in the MINIMat study of intrauterine growth retardation, prematurity, and low birth-weight. Birth outcomes are being monitored for the determination of absolute obstetric indicators for the estimation of 'unmet obstetric need' and also the safe motherhood study involving upgraded emergency obstetric care (EOC) facilities. Pregnancies and births are also being monitored by HDSS as input to the IMCI study. A new study on the ecology of *V. cholerae* is being undertaken in Matbaria and Bakergonj upazillas. HDSS will provide effort in mapping the location of households and water bodies in the study area to detect the possible source of *V. cholerae*.

Despite the usual assumption that the society in Matlab is homogeneous, differential mortality among children between social classes (though unexpected in an efficient health service management) is evident from a study using Matlab longitudinal data. A long-standing demand, thus, is to identify or classify different social classes and monitor poverty. Surveillance data in Matlab will be strengthened in 2004 by the next round of a socioeconomic survey of the total population. A set of questionnaires was modified and developed with an interactive correspondence with the poverty and health research group. This will introduce many new measures of economic status and will permit testing of various simple proxy measures to identify the poor, and the so-called 'poorest of the poor', or ultra poor. HDSS will also be institutionalizing a number of community-level measures, monitoring food production and prices, wage rates and employment trends, and land prices. Planning is initiated for screening and monitoring the ultra poor in some selected village of the HDSS area. It is planned to have a more comprehensive system of monitoring economic factors in the Matlab area by mid-2004.

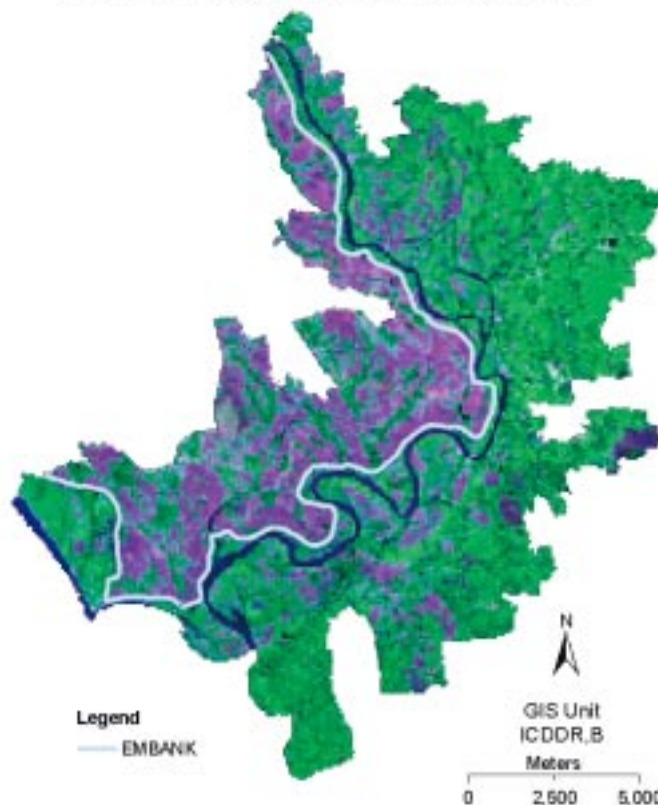
Surveillance at Other Sites

The Health Systems and Infectious Diseases Surveillance

System is located in the Division with the same name. It includes 2 rural surveillance areas -Mirsarai in the Chittagong district and Abhoynagar/Keshobpur in the Jessore district- where data are collected every 3 months. In each of these 2 areas, the surveillance covers a sample of about 30,000 people. In 2003, the demographic surveillance was started in Kamalapur, a part of Dhaka city with about 200,000 inhabitants, many of them living in slums. Previously, surveillance for special studies took place among a sample of the population of this area; now the total area is covered by an annual demographic surveillance. This is currently our only urban health and demographic surveillance in Bangladesh.

The HSID Surveillance System was originally set up for operations research. Apart from the routine surveillance, the rural sites are presently used for health systems research, while the urban site is more targeted at diseases surveillance and vaccine trials. In future, migration and urbanization research will also take place in the urban site. The objective of the HSID surveillance is to provide reliable background data needed to translate the results of theoretical research in better and more equitable healthcare for everyone, but especially in Bangladesh.

Satellite Image of Matlab Study Area



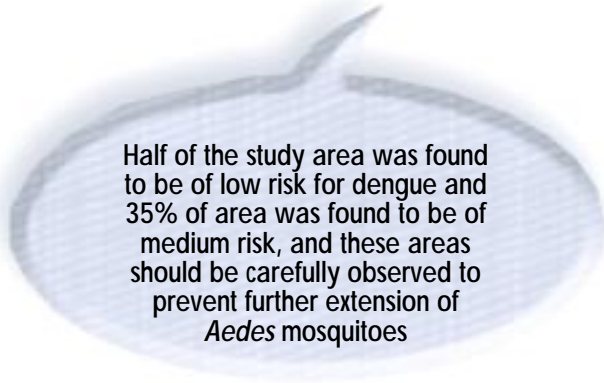
Spatial Dynamics and Dengue Outbreak

Prediction of dengue risk based on socioeconomic factors and its possible spatial relationships was investigated in the dengue epidemic area of Dhaka city in 2000. Among the city dwellers, 95% knew that mosquito bites transmit dengue; 68% knew the *Aedes* mosquito breeds in the wet containers, and they spent 210 taka per family to purchase insecticides during the outbreak. Half of the city dwellers used the most susceptible container—the overhead tank to store water. In the multinomial logistic regression model, 8 variables were selected to assess the combined effect of the disease spreading. To assess the socioeconomic risk factor for spreading *Aedes* mosquito, the combined risk score was calculated, and different scores were distributed among the variables according to their criteria. Individual risk factors were added to the positional databases, and the inverse distance-to-weight method was used for identifying the most vulnerable areas of Dhaka city. According to scores, low-, medium- and high-risk areas were measured, and 14% of Dhaka city was found to be a high socioeconomic risk area and needed more effort to control *Aedes* mosquitoes. Half of the area was found to be of low risk and 35% of area was found to be of medium risk, and these areas should be carefully observed to prevent further extension of *Aedes* mosquitoes.

Collaborations with international partners

In collaboration with the other 14 INDEPTH surveillance sites, the Health and Demographic Surveillance Unit (HDSU) contributed to 4 workshops

and training for capacity-building of the INDEPTH partners. A week-long workshop was held in South Africa in October 2003 to audit the ongoing work on adult health and ageing at INDEPTH sites and a multi-site grant proposal and a core module to be applied to every INDEPTH site were developed. Two other collaborative workshops—one in South Africa and another in Kenya—were organized to share knowledge of relational databases and Structured Query Language (SQL) in the context of health and demographic surveillance, multi-level modelling for demographic and health surveillance and cross-sectional survey data, and to enable participants to analyze their own hierarchical dataset using a software named MLwiN. Before the 10th ASCODD, a pre-registration one-day workshop entitled "Health and demographic surveillance and GIS as tools for health research" was held in Dhaka. About 20 participants from different countries attended the workshop.



Half of the study area was found to be of low risk for dengue and 35% of area was found to be of medium risk, and these areas should be carefully observed to prevent further extension of *Aedes* mosquitoes



Poverty and Health

The Poverty and Health Programme, established in early 2003, embraces all divisions and relevant research at ICDDR,B. Its mandate is to include poverty as a focus in all research activities throughout the Centre. The Programme, housed in the Social and Behavioural Sciences Unit of the Public Health Sciences Division, places special emphasis on studying the barriers facing the poor in accessing health and other services under development activities. The vision, mission, conceptual framework, and guiding values of this new programme are highlighted below.

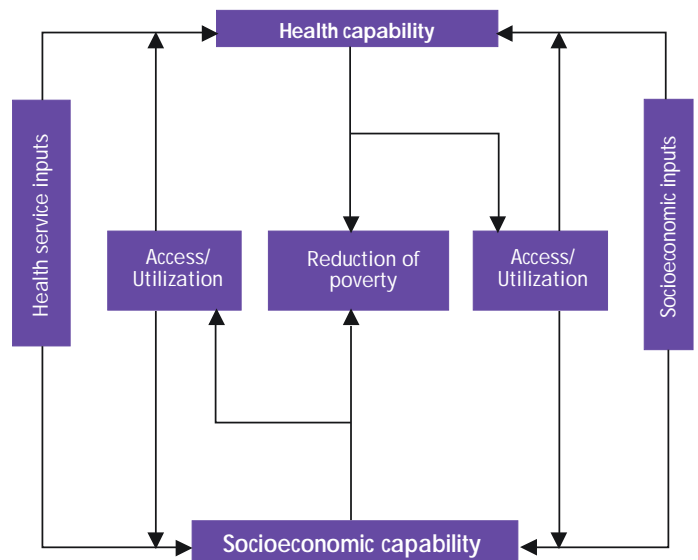
The vision of the Programme is to have a positive tangible impact in the reduction of poverty and inequity in Bangladesh on a large scale by improving the health of the poor. The mission of the Programme is to understand the interrelationship of poor health and poverty in their multidimensionality to improve the health of the poor (economically, gender or otherwise) and to reduce the gap between the rich and the poor.

The goals of the programme are to : (a) reinforce 'health improvement of the poor and poverty reduction' as the guiding value of all ICDDR,B activities; (b) identify solutions for major health problems facing the poor; (c) discover ways to ensure access to modern health services by the poor; (d) pursue others to incorporate poverty dimensions in all relevant data-collection systems, and in reporting health and other development outcomes by socioeconomic groups; (e) emphasize monitoring of the access and utilization of health and other services of the development programmes by the poor and the impact of the services on health and development outcomes of the poor, and

reduction of disparities; and (f) develop ICDDR,B's capacity to become a unique resource centre for conducting research and training on poverty and health.

The conceptual framework connecting poverty to ill health is a 2-way relationship that seeks to understand the following major questions: (1) How much does poverty contribute to ill health?; (2) How much does ill health contribute to poverty?; (3) How much of poverty can be reduced through health interventions?; (4) How much improvement in health can be achieved through reduction of poverty?; (5) How much improvement in health and/or economic condition is needed to trigger change in both health and economic conditions?

The proposed analytical framework linking programmatic inputs and poverty reduction is as follows:



The Poverty and Health Knowledge Project

The DFID-supported poverty and health project "Building the knowledge base for attaining equitable health in poor countries" is a major activity coordinated by this programme. This project seeks to identify cost-effective solutions for the prevention and management of major health problems facing the poorest segment of the population in Bangladesh by studying their interrelation with poverty.

The issues being researched include: (a) safe motherhood, (b) neonatal health, (c) childcare and development, (d) adult health and the burden of the elderly's diseases, (e) reducing the burden of tuberculosis, and (f) measuring poverty and health. Figure 1 and 2 show some findings from the research on tuberculosis:

Fig.1. Prevalence of smear-positive TB cases by age sex, Matlab, 2001-2002

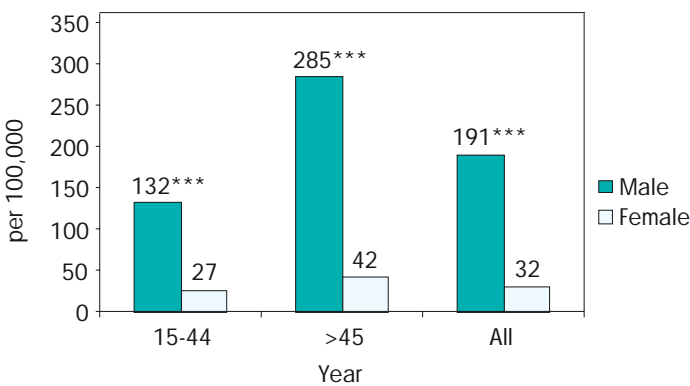
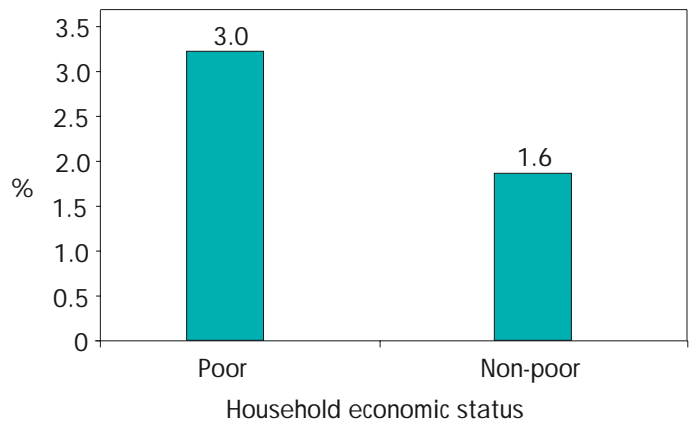


Fig.2. Proportion of sputum-positive TB cases by SES, Matlab, 2001-2002



The Centre, as it takes its first steps in exploring a new area of research, has already gained from interactions among different project components and the inter-institutional knowledge exchange in the Poverty and Health project. Of significance is the interaction with other partners of the Bangladesh Health Equity Watch (BRAC, Bangladesh Institute of Development Studies, Bangladesh Bureau of Statistics) and the Well-being in Developing Countries Project at the University of Bath, UK. These interactions have served to conceptually clarify the meaning of poverty-focused research and illuminate the pathways of interaction between poverty research and different health and development programmes.

Poverty-measurement tools

A rapid assessment tool for poverty measurement has been extensively tested and finalized. The tool, based on non-fulfillment of basic needs, such as food, clothing, education, etc., is a new way of measuring and analyzing poverty. Various indicators were used for developing a scale to measure the degree of shortage of basic needs

by following a psychometric approach. The scale, unlike traditional measures of poverty, uses a multidimensional approach and gives ratings for poverty status in terms of specific dimensions. These are:

- Food
- Shelter
- Clothing
- Education
- Health
- Social participation

Each of these dimensions consists of 4 items with 3 options in each item. A score ranging from 1 to 3 for each item allows the highest possible score for a household to be 72 and the lowest to be 24 when the whole scale is used. The higher the score for the household, the poorer is the household. The tool also aimed at measuring the absolute or extreme level of poverty in each of the 6 dimensions.

The tool was administered to a nationally-representative sample in 12 districts of Bangladesh in collaboration with the Bangladesh Health Equity Watch and BRAC. The poverty score obtained by using this tool was found to correlate very strongly with the asset score and other indicators that are traditionally used in assessing socioeconomic status (Fig. 3). The tool is easy to apply and enables programme/policy-makers to identify priority areas of basic human needs to reduce poverty. Based on the rapid tool, HDSS will adopt indicators to assess starvation, homelessness, and social isolation in its regular data-collection system (Table 1).

Poverty measurement group

A poverty and health measurement group consisting of young and mid-level researchers with wide representation from throughout the Centre has been formed. Its aim is to identify indicators and measures of health and poverty, test their appropriateness, and advise on inclusion of indicators in HDSS in Matlab and other data-collection efforts in the Centre. The group has been meeting regularly. A half-day workshop in mid-May 2003 deliberated on effective and appropriate indicators for measurement of poverty and health for inclusion in the forthcoming HDSS socioeconomic survey. The HDSS socioeconomic survey will adopt the revised indicators identified through the exercises of the measurement group. Small-scale pilot studies are being planned to test indicators for which consensus was not reached. Preparation for the census is currently underway.

Fig.3. Scatter plot: Asset Index-Poverty Index, Chakaria, 2002

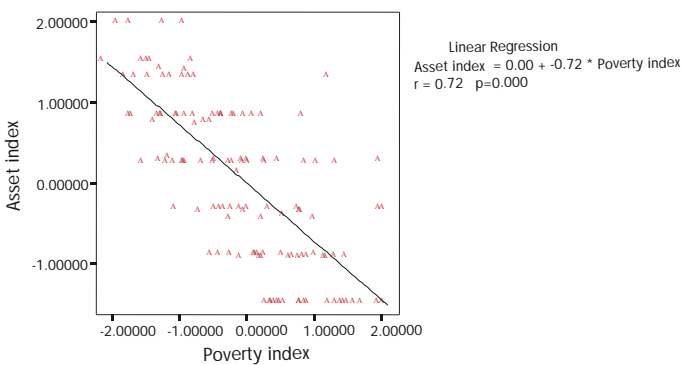


Table 1. Percentage of households in absolute poverty using rapid tool in Chakaria* and sites of the Bangladesh Health Equity Watch (BHEW)

Dimension	Chakaria (n=129)		BHEW sites (n=10,612)	
	No.	%	No.	%
Food				
How frequently during the last 12 months could at least some of the household members not have 3 (breakfast, lunch, dinner) meals (rice/ruti) a day due to shortage of food?				
Quite commonly (4 or more days in a month)	10	7.8	306	2.9
Shelter				
Does this household own any shelter anywhere?				
No land no house	1	0.8	153	1.4
Clothing				
Do all the members of the household have 3 or more sets of clothes? Less than half have	8	6.2	882	8.3
Health				
How frequently do the household members on average suffer from illness or ill health?				
Quite frequently (once or more in a month)	57	44.2	3859	36.4
Education				
How common is writing ability of the household members aged 10 years and over?				
None can write	19	14.7	849	8.0
Social Exclusion				
How intensely does any member of the household participate in the samajik/community activities? Not active at all	46	35.7	3028	28.5

* Area where the tool was tested

University of Bath, UK, and Dr. Binayek Sen from the Bangladesh Institute of Development Studies. The topics discussed included Health and Culture; Quality of Life: Challenges in Setting up Cross-cultural Research; and the Interface between Poverty and Health: A Survey of Issues. The round-table discussion meetings were initiated to generate a continuing dialogue between researchers and policy-makers.

Research fellows

Five Poverty and Health Fellows from Bangladesh have been recruited for the purpose of building research capacity

Round-table seminar series

The Poverty and Health Programme has started a round-table seminar series on poverty and health in collaboration with TEU. The first three speakers were Dr. Sarah White and Dr. Suzanne Skevington from the

and promoting poverty-focused research in Bangladesh and internationally. They have been working at the Centre since February 2003 on assignment with the Centre's researchers in different programmes and areas. The topics they have been working on include: Arsenic mitigation options in Matlab; Socioeconomic status and

childhood morbidity in rural Bangladesh; Safer motherhood; Child health; and the Health and Demographic Surveillance System. Under the Regional Fellowship programme, a candidate from Pakistan has been selected. Fellows recruited in the future will be chosen to build institutional links and foster future collaborations with other research institutions.

Poverty and Health Resource Unit

The Poverty and Health Programme maintains a poverty and health resource unit at the ICDDR,B Library. This resource unit was built to facilitate poverty, health, and equity-related research work both within and outside ICDDR,B by providing a strong knowledge base with the most recent books, articles, and papers published on poverty-related issues. The collection of books, articles, etc. at the unit covers a wide range of topics, including writings on various methods of poverty measurement, rural-urban poverty status within the country, and the poverty situation in different parts of the world. The materials are made available to all members of the library, including national and international students, to encourage current or future research work in this area. Much of the material will be posted online for easy and wider access in the near future. The resource unit is growing everyday, and it intends to enhance its collection through acquiring more noted writings and research papers of the time relating to the issue of poverty and health.

The poor are most likely to face the menace of tobacco consumption in a rural area of Bangladesh

This study is aimed at generating knowledge on tobacco consumption with special emphasis on the identification of socioeconomic groups who are more prone to tobacco consumption vis-à-vis tobacco-related health consequences in a remote rural area of Bangladesh. Information on the tobacco consumption status of 6,618 individuals aged over 15 years (52.1% male, 47.9% female) was collected in 1994. Both univariate and multivariate analyses were carried out. Individuals were categorized as consumers if they consumed tobacco in any form at all, i.e. smoking or chewing. The independent variables included various characteristics of individuals and households.

Overall, 43.4% of the study subjects were tobacco consumers. Males were over 9 times more likely to consume tobacco than their female counterparts. Individuals with no education were 2.49 times more likely to consume tobacco than those who had completed 6 or more years of schooling and those engaged in day labour were almost twice as likely to consume tobacco than others. Education of the household head also had a significant relationship with consumption of tobacco. High rates of tobacco consumption in the socioeconomically-disadvantaged groups and by women have far-reaching consequences. Tobacco consumption in the form of both smoking and chewing has been a part of household consumption in Bangladesh from time immemorial. Only through aggressive anti-tobacco programmes on various fronts may there be a chance of

Only through aggressive anti-tobacco programmes on various fronts may there be a chance of salvaging the poorest from the menace of tobacco consumption in Bangladesh

Village health posts are now preferred health facilities for the poor in Chakaria, Cox's Bazar



salvaging the poorest from the menace of tobacco consumption in Bangladesh.

Do participatory health interventions reduce disparity in child immunization? Experience from a project in Chakaria, Bangladesh

Despite tremendous progress in childhood immunization coverage in Bangladesh, socioeconomic disparity in coverage rates still persists. To examine the prevailing conditions, an evaluation study was done on the impact of a community-based participatory health-intervention programme on the reduction of socioeconomic disparity in immunization coverage in Chakaria, a remote coastal area of Bangladesh. The study was conducted under the auspices of the Chakaria Community Health Project of ICDDR,B, with support from the Swiss Red Cross.

The project incorporated a quasi-experimental design. Three unions (the lowest administrative unit of the country) were mobilized for health interventions, and 2 unions were kept as referent. The pre- (1994) and post- (1999) intervention study design was used for assessing the socioeconomic dependence of the change in the immunization coverage among children aged 12-23 months. Multiplicative logistic regression model was used for analyzing the data. In total, 2,753 children were included in the study; of them, 1,121 were from the intervention and 1632 were from the referent communities.

It was found that the intervention had a significant effect ($p < 0.01$) in increasing immunization coverage over time. The odds of increasing

vaccination were 1.9 times higher in the intervention community than in the referent community between 1994 and 1999. Inequity gap between 1994 and 1999 remained similar in the referent community and reduced in the intervention community. Intervention effect was observed mostly among children of the lower socioeconomic group.

Monitoring the disparity in health status and access to, and use of, health services: Bangladesh Health Equity Watch (BHEW)– Phase I

Bangladesh Health Equity Watch is a collaborative effort of ICDDR,B, Bangladesh Bureau of Statistics (BBS), Bangladesh Institute of Development Studies (BIDS), and BRAC. The Social and Behavioural Sciences Unit of ICDDR,B hosts the secretariat of the project. It mainly works with the following 4 objectives:

- Incorporation of equity dimensions in the existing data-collection system in various organizations
- Establishment of a new system in a nationally-representative sample, which can eventually be adopted by the national system
- Regular dissemination of findings among policy-makers, researchers, NGO leaders, and members of civil society to facilitate actions to minimize inequity
- Development of national capacity to carry out research and analysis with a focus on equity

The current activities of BHEW include a regular survey of a nationally-representative sample, publication of working papers, newsletters and advocacy, and dissemination.

Findings from BHEW survey

The BHEW survey collects information on the use of safer motherhood services, poverty status, immunization coverage, etc. The findings from the recent survey show that there exists significant difference in the use of antenatal care and postnatal care services, and delivery services at the hospital in between different socioeconomic groups (Table 2).

on the well-being of rural people, especially of women and children, and to study the pathways through which this impact is mediated. Since its inception, the Project has been conducting research on various issues. By December 2003, the research work has been reported in 32 working papers. One of the recent studies of the Project examined the impact of BRAC's women-focused development interventions on neonatal mortality in Matlab. The study examined various causes of neonatal death, association between BRAC interventions and neonatal

Table 2. Safe motherhood services used during last pregnancy by women from households of different socioeconomic status in rural areas of Bangladesh

Socioeconomic status	N	Antenatal care (%)	Postnatal care (%)	Delivery at hospital (%)	TT coverage (%)
Low	688	32.7	14.4	2.6	75.9
Medium	398	42.2	21.4	5.5	78.1
High	96	40.6	32.3	8.3	71.9
p value		0.005	0.000	0.015	ns

Effects of poverty alleviation programmes on health: BRAC/ICDDR,B-Phase III

In 1992, this joint research project between ICDDR,B and BRAC started with an aim to study the impact of BRAC's socioeconomic interventions

death, and risk factors for neonatal death. It was found that neonates of BRAC non-members were at 1.9 times increased risk of dying compared to neonates of BRAC members.

This association works through two intermediate variables, including

There exists significant difference in the use of antenatal care and postnatal care services, and delivery services at the hospital in between different socio-economic groups

antenatal care and family planning (Table 3). Mother's age and father's occupation acted as confounders in this association. Physical violence against mothers and psychological stress, pre-maturity and low birth-weight were among the higher risk factors for neonatal death. However, BRAC membership did not have any influence over these factors.

It contained 12 articles from around the world presenting different approaches to the topic and was edited by Dr. Abbas Bhuiya, the Head of the Poverty and Health Programme.

The Poverty and Health Programme web pages are a part of the Centre's new website released in early April 2003. It is a dynamic

Table 3: Distribution of risk factors with respect to exposure to BRAC membership

Risk factor	Category	BRAC non-member (%)	BRAC member (%)	X ²
Antenatal care	Yes	287 (80.8)	101 (89.4)	p= 0.036
	No	68 (19.2)	12 (10.6)	
Family planning	Yes	49 (13.8)	26 (23.0)	p= 0.020
	No	306 (86.2)	87 (77.0)	

The BRAC-ICDDR,B joint project ended in December 2003. The final report is being written.

Publications and website

The September 2003 issue of the Centre's quarterly Journal of Health, Population and Nutrition, was a special issue devoted to Health Equity.

site allowing information posted to be updated easily. The information in the site provides the following:

- News on ongoing poverty research projects and collaborative ventures of ICDDR,B
- Bibliographical data of current articles on related topics from world literature

- Other resource sites on health equity research, such as Bangladesh Health Equity Watch website
- Online links to various sources of poverty research, such as Eldis and International Society for Equity in Health.

Training courses and workshops

The programme contributes to developing the capacity of researchers within and outside ICDDR,B to carry out poverty and health-related research. This is done through organizing training courses and workshops and by establishing collaborations with relevant organizations within and outside Bangladesh. A course on the measurement of economic dimensions of poverty and a workshop on benchmarks of fairness for healthcare reforms were organized. The measurement course provided an overview and hands-on-training on different poverty measures commonly used in poverty research, programme design, and evaluation of poverty-alleviation programmes. The workshop provided an introduction to the benchmarks of fairness policy tool and its use in assessing the overall fairness of health-sector reform proposals, or recently implemented reforms.



One of the many round-table discussions on poverty and health during 2003

Members of the Poverty and Health Programme participated in a workshop on the Well-being in Developing Countries (WeD) Research Project held at the Proshika Centre in Koitta, Manikganj. The WeD research programme at the University of Bath, UK, offers a significant new approach to the understanding of poverty, inequality, and well-being in developing countries. Collaboration with the WeD research team is being planned for the coming years.

Educational collaboration

The Centre has signed a Memorandum of Understanding with BRAC University in connection with joint activities at BRAC's James P. Grant School of Public Health, to commence in 2004. The Centre has been named as the provider of a module on Measuring Poverty (in collaboration with BHEW), which is to make up part of an elective course on Community Health as a requirement for the degree of Master of Public Health. It is hoped that the experiences derived from the poverty measurement courses will form the basis of the course to be offered at the BRAC School of Public Health.



HIV/AIDS

The mandate of the Programme is to contribute to the understanding of the dynamics of HIV/AIDS epidemic in Bangladesh, to provide data for directing and improving interventions for the prevention of AIDS, to provide services to people living with HIV/AIDS, and to conduct research on the virus and human behaviour.

Risk of an HIV epidemic in Bangladesh

Bangladesh remains a low-prevalence nation for HIV/AIDS as is apparent from various available data. The key source of this information is the serological surveillance conducted by ICDDR,B on behalf of the Government of Bangladesh (GoB). The serological surveillance conducted in 2002 revealed that, of all the vulnerable population groups sampled (sex workers, injecting drug users [IDUs], men who have sex with men, clients of sex workers, etc.), IDUs in central Bangladesh had the highest prevalence (4%) of HIV, and this rate has risen dramatically since 2000 (Fig. 1).

Since the first round of surveillance, it was apparent that IDUs were the population group most at risk of an HIV epidemic. For this reason, a prospective study among IDUs from Dhaka city was initiated. The study is being conducted in collaboration with CARE Bangladesh and is using their two coverage areas. It is aimed at developing a cohort of IDUs to assess the incidence of HIV and the risk factors that will lead to an HIV epidemic. This study confirmed the fears that IDUs may experience an HIV epidemic. Of 561 IDUs covered during the baseline survey, 5.6% had HIV infection, 66.8% had hepatitis C infection, and approximately one-third shared their needle/syringe. Concept of sharing needle/syringe among IDUs varied, with some believing that sharing with a family member or someone who appeared healthy did not amount to sharing, while others believed that jerking the needle/syringe in-between sharing partners lowered the risk of sharing. These IDUs were also sexually active; 3.4% had active syphilis, 9.7% bought sex from sex workers last month, and 30.2% never used a condom. At the same time, 35.9% were married; 8.6% had sold blood at least once in their life, of whom 50% had sold blood in the last year. Given these behaviours, it seems likely that HIV will spread among IDUs and also, over time, among their partners. Similarly, data from the behavioural surveillance showed that none of the sub-population groups sampled was isolated with IDUs buying sex from sex workers, and being married at the same time, each of the sex worker groups having multiple partners, with men having sex with men, women, and hijras (Fig. 2). Condom use in all groups remained low.

Fig. 1. Prevalence of HIV among injecting drug users in Bangladesh

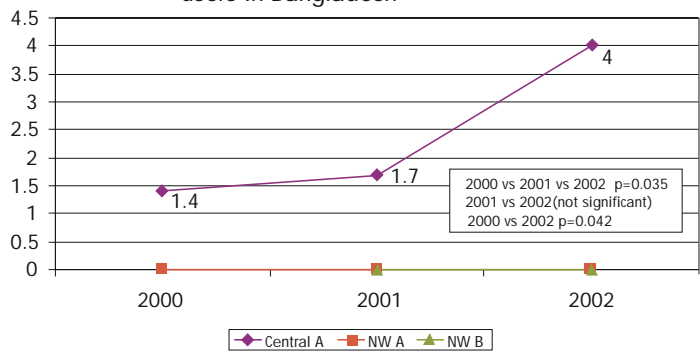
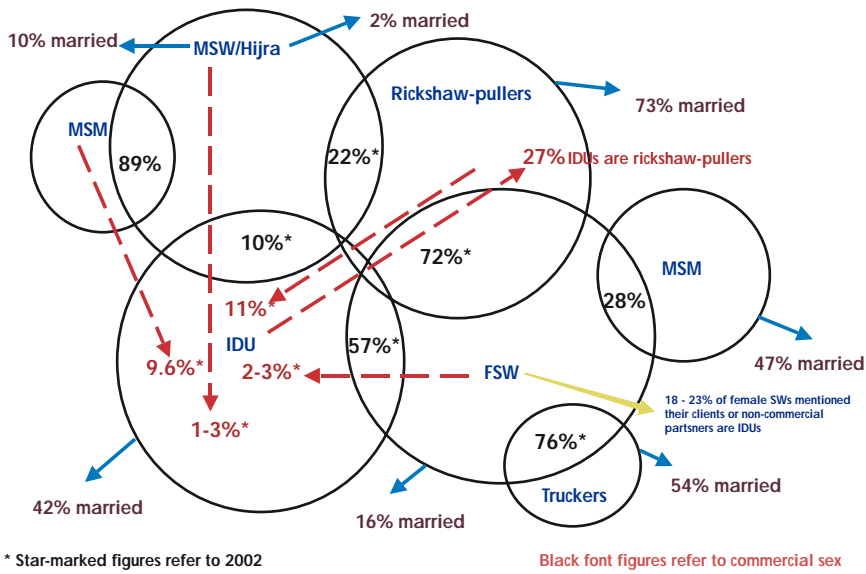


Fig.2, Potential spread of HIV from high-risk groups to the general population in Central Bangladesh



* Star-marked figures refer to 2002
 IDU= Injecting drug user; MSM= Men having sex with men; MSW= Male sex worker
 FSW= Female (street-based) sex worker

and Testing Unit—Jagori. Of the 26 positive cases who reported during 2003 in Jagori, 16 were migrants who had returned from different countries. It has been recognized for sometime now that external migrants travelling to areas of high HIV prevalence are vulnerable to HIV as has been observed in other countries.

The link between IDUs and sex workers is further exemplified through interviews with 10 female IDUs, of whom all but one had sold sex in their lifetime, 7 identified themselves as sex workers, 6 had not used a condom in the last sex act, and all had shared their needle/syringe in the last 6 months. Female IDUs are especially vulnerable as they are very hidden and difficult to access for interventions.

The surveillance data showed that, although sex workers are very vulnerable because of their high numbers of partners and low use of condoms, HIV has not penetrated their community yet in high enough numbers and, fortunately, HIV has remained below 1% in all the other sub-population groups sampled. The prevalence of HIV and syphilis in the 4 rounds of surveillance conducted so far is shown in Table 1.

Other than the groups sampled in the surveillance and studies on IDUs, HIV passive case reporting suggests that migrants travelling abroad for work are a very vulnerable group. On 1 December 2003, GoB announced that there are 363 HIV-positive cases in the country. ICDDR,B contributes to the GoB data through its Voluntary Counselling

and Testing Unit—Jagori. It is apparent from the data collected so far that there is an impending HIV epidemic among IDUs in Bangladesh, and that an important population group which is vulnerable to HIV infection and which needs attention for prevention intervention comprises external migrants.

Tasnim Azim, Md. Shah Alam, Ezazul Islam Chowdhury, Motiur Rahman, Arunthia Zaidi, Md. Zahiruddin, Md. Moshtaq Pervez, Md. Repon Khan, Giasuddin Ahmed, and Md. Safiullah Sarker—all from the Laboratory Sciences Division were involved in the study.

Many institutions, GoB, NGO, and community-based organizations collaborated in providing access to vulnerable population groups. CARE Bangladesh was an active participant in the IDU study. The other collaborating institutions (in alphabetical order) were: APOSH, Bandhan Hijra Sangha, Bandhu Social Welfare Society, CARE Bangladesh, Durjoy Nari Sangha, Family Planning Association of Bangladesh, Gonoshasthya Kendra, Jagroto Jubo Sangha, Karmajibi Kallyan Sangstha, M.A.G. Osmani Medical College and Hospital (Sylhet), Marie Stopes Clinic Society, Mukti Mahila Samity, Nari

Table 1. Overall prevalence rates of HIV

Surveillance round	No. tested in main population groups	Non-active syphilis (%)	HIV (%)
1 st round	Vulnerable groups	3,483	24.4
	Bridging groups	403	6.7
	Total	3,886	<1% (0.4)
2 nd round	Vulnerable groups	4,634	18.4
	Bridging groups	0	ND
	Total	4,634	<1% (0.2)
3 rd round	Vulnerable groups	4,640	19.6
	Bridging groups	2,423	5.9
	Total	7,063	<1% (0.3%) 0 <1% (0.2)
4 th round	Vulnerable groups	7,073	16.9
	Bridging groups	804	6.0
	Total	7,877	<1% (0.4%) 0 <1% (0.3)

Maitree, Nari Mukti Sangha, Paricharja, PIACT Bangladesh, Prochesta, Rural People's Development Sangstha, Save the Children Fund-Australia, Srishti, Sustha Jibon, The Salvation Army, Voluntary Paribar Kallyan Association, and World Vision.

The studies from which data are presented here were funded by GoB/IDA/DFID, WHO, and AusAID

Incidence of HIV, hepatitis and syphilis infection and risk behaviour among injecting drug users in Dhaka, Bangladesh

Five hundred sixty-one IDUs were enrolled in this prospective 2-year study from 2 intervention areas of CARE Bangladesh—Area A and Area B. IDUs were all male, were known injectors for at least 2 months,

were registered in CARE Bangladesh's needle/syringe exchange programme (NEP), and were not very mobile (not changed their address in 6 months). A baseline behavioural survey was conducted during August-October 2002, and clinical examination of collected blood was done during January-March 2003. Of the 561 IDUs, 33 (5.9%) were HIV-positive, and the number of HIV-positive IDUs was higher in Area A (8%) than in Area B (4%). Comparisons were made between HIV-positive and HIV-negative IDUs to assess the risk factors for HIV infection; 51.5% of HIV-positive IDUs were living alone, and 72.7% were living on the street, whereas 19.9% of the HIV-negative IDUs were living alone, and 22.5% were living on the street. The differences between the HIV-positive and HIV-negative IDUs for these variables were significant ($p < 0.001$ for both). The HIV-positive IDUs were younger (mean \pm SD: 32.7 \pm 4.8 years) and started injecting drugs at

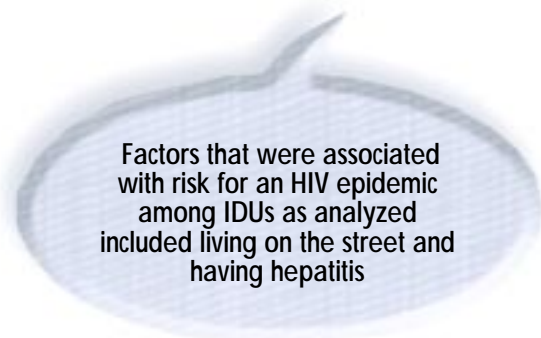
a younger age (mean \pm SD: 27.1 \pm 5.4 years) than HIV-negative IDUs (mean age \pm SD: 35.1 \pm 7.7 years; mean age of starting injecting \pm SD: 29.6 \pm 7.1 years) ($p=0.011$ and $p=0.014$ respectively). When sharing of needle/syringe was compared, no significant differences were found in the sharing pattern during the last injection and in the last week. However, more HIV-positive IDUs had a history of sharing needle/syringe sometime in their life (97%) compared to HIV-negative IDUs (83%) ($p=0.029$). Hepatitis C infection, which serves as a surrogate marker for sharing injection equipment and drugs, was higher among HIV-positive IDUs (93.9%) compared to HIV-negative IDUs (65.2%) ($p=0.003$). Other risk behaviours, including sexual behaviour and history of selling blood, were also investigated. No differences were found in these behaviours between HIV-positive and HIV-negative IDUs. Overall, factors that were associated with risk for an HIV epidemic among IDUs as analyzed by logistic regression analysis included living on the street (OR 4, $p=0.008$) and having hepatitis C (OR 5.5; $p=0.025$).

Tasnim Azim, Ezazul Islam Chowdhury, Arunthia Zaidi, Md. Zahiruddin, Md. Moshtaq Pervez, and Motiur Rahman were involved in the study. The study was funded by AusAID, and CARE Bangladesh was the collaborating institution.


An in-depth investigation of condom-use patterns during the last sex act in an urban area of Bangladesh

Condom use among sex workers and their clients in Bangladesh are among the lowest in Asia as measured in the behavioural surveillance

in Bangladesh. However, very little qualitative information is available on condom use. The policy of condom intervention is based on achieving ejaculation inside a condom—a narrowly-focused ‘mechanical goal’ of condom use which is a social behaviour. Most research on condom use has focused on a simplistic reliance on survey results of condom use during the last sex act. A focused qualitative study with 20 hotel-based female sex workers and 15 male clients was conducted to explore patterns of their claimed condom use during the last sex act in a city of Bangladesh. Three different patterns of condom use were identified which include late wearing of condom, removing condoms before ejaculation, and correct and consistent use of condom. The clients’ perceptions of dominating sexuality and “the male’s right” to enjoy sexual intercourse in commercial settings increased the probability of partial use of condom. The meaning of condom-using behaviour is socioculturally constructed, reaching far beyond one’s cognitive domain of perceived cost-benefit analysis. Condom use takes place between at least 2 persons with an unequal distribution of power, including physical, mental, social, economic and gender relations and acquired knowledge. Therefore, knowledge of condom and its consistent use are not a straightforward calculation. Asking a person whether he used a condom during his last sex act is not a simple question. Based on our research findings, we suggest that claimed condom use during the last sex act might have potential hidden threats that impose critical challenges for condom-promotion programmes. The limitation of traditional surveys can be diminished if questions are designed on the basis of in-depth findings of condom-using complexities. The conventional framework of condom-promotion strategy denies the complexity and importance of male/female



Factors that were associated with risk for an HIV epidemic among IDUs as analyzed included living on the street and having hepatitis



In the era of globalized media culture, understanding of men about condom and sexuality is not exclusively locally constructed

relationship in sexual intercourse. Women, as sex workers, are targeted as being accountable to ensure that men 'behave' properly by wearing condom, which makes women responsible for ensuring men's protective behaviours by further accentuating the power relation as an essential human condition. It also ignores sex workers' real life situations and diverse vulnerabilities. The strategy assumes that individuals listen, learn, and perform according to whatever information is delivered to them. This focus at the individual level usually neglects the fact that men are guided by collective sociocultural norms and gender relations of their social environments where the risks are embedded. Condom promotions need to be contextualized in real-life situations of men and women.

Sharful Islam Khan was involved in the study which was funded by Swiss Agency for Development and Cooperation (SDC), and the collaborative organizations were: Bandhu Social Welfare Society and The Health and Education for the Less-Privileged People (HELP).

Social construction of the non-use of condom: implications for condom-promotion interventions in Bangladesh

Despite studies on condom use, meanings of non-use of condoms are not adequately understood. A qualitative study was conducted to explore men's views in Bangladesh on reasons for non-use of condom. Fifty men, aged 18-55 years, from diverse sociodemographic backgrounds and 5 key-informants were interviewed. Findings suggest

that refusal to use condom is not simply a personal choice, but a social decision deeply embedded in relational context. Reasons, such as bad smell, problems of storage, disposal or purchase, the size of a condom, reduced pleasure, and problems in closeness, could not be considered individual problems since these reasons are embedded in sociocultural realities. Even the free size of a condom threatens men's 'big-dick' sexual potency, which conventionally goes unnoticed by interventionists or condom manufacturers. Non-use of condom is closely associated with men's understanding of their bodily (or genital) pleasure of sex acts. The perception of pleasure revealed in this study is socioculturally constructed and deeply influenced by intermingled factors originating in society where men and women live together. Reference to pornographic movies as sources of learning non-condom sex as "real men's" sexual skill demonstrates that, in the era of globalized media culture, understanding of men about condom and sexuality is not exclusively locally constructed. This study offers a broader understanding of the complexities of meanings men attach to non-use of condoms with a hope that policy planners, programme managers, and condom manufacturers re-conceive the paradigm of condom interventions. Innovative messages need to be designed to motivate acceptance of condoms in the framework of relationships, masculinity, and sexual enjoyment of men and women. Findings of this study support the concept that sex education must promote safe sex as pleasurable to be effective and change public attitude towards condoms.

Sharful Islam Khan, A.S.M. Jamal Uddin Rana, Mahbub ul Islam Bhuiya, Ashraful Islam Konok, Khokon Mullah, and Royal were involved in the study. The study was funded by AusAID and Edith Cowan University, and the collaborating organizations were Bandhu Social Welfare Organization and DMSS, Khanjanpur, Jaipurhat.

Heterosexual relations of men who have sex with men in Bangladesh: a cultural understanding

Studies on men who have sex with men (MSM) have tended to focus on measuring risk behaviours, with less attention given to the understanding of the meanings of their heterosexual relations. This results in missed opportunities for HIV interventions. A focused qualitative study was conducted to broaden the understanding of the relationships of MSM with females within a gender and masculinity framework. In total, 44 MSM with men were interviewed. Tape-

recorded interviews were transcribed, and content, contextual and thematic analyses were performed. The normative masculine behaviour for men is to marry, maintain a family, have children, inherit property, and pass the inheritance as responsibility of men in the patriarchal society. It encourages MSM having sexual relationships with women. Notions about marriage, epitomising a traditional masculine identity, are further driven by the religious resolution for marriage. Notions of tradition, religion, society, and nation have provided the platform of perfect manhood for MSM, forcing some women to become silent sufferers of one of the negative consequences of hetero-normative patriarchal societies. However, MSM also consider sex with females a form of 'real sex' in the framework of 'masculine sexual potency', irrespective of preference, desire, or eroticism. The double sex life has implications for STI/HIV transmission among MSM and their male and female partners. Current interventions do not include MSM's entire sex life, instead stigmatise

MSM by separating them from 'other' men. Thus, understanding the breadth and meanings of sexual life of men is the key to reach MSM and their female partners. The task is difficult but achievable if the complexity of relationships is recognized in the local context.

Sharful Islam Khan was involved in the study funded by AusAID and Edith Cowan University, and the collaborating organization was Bandhu Social Welfare Society.

Male sexuality and masculinity: implications for STD/HIV and sexual health interventions in Bangladesh

A project was designed by the Social and Behavioural Sciences Unit to explore how sexuality is constructed in the framework of masculinity among Bangladeshi men's lives. The broader sociocultural, socioeconomic, political and environmental factors shaping male sexuality in both urban and rural societies of Bangladesh were examined.

Although sexual interactions take place between 2 or multiple individuals by involving human bodies, these are social behaviours, with close connections and interactions with peoples' sociocultural and socioeconomic realities of life and gender-imbalanced social relations with women in the patriarchal society of Bangladesh. The eroticism, desire, pleasure, and pains of sex have deeper social meanings beyond physiological or psychological dimensions. Thus, any efforts for HIV interventions and improving sexual health of men and women can be threatened, if we fail to conceptualize dimensions of male sexuality and its linkages to masculinity in a broader framework of social constructions. The challenge for public-health professionals and policy planners is to recognize these linkages for designing effective interventions. It is expected that the project will contribute to the field of sexuality research in Bangladesh with new insights and cues to actions. Data collection, processing, and analysis have been completed. The report is expected to be completed by June 2004.

Sexuality and risky heterosexual behaviour in rural Bangladesh

To address the risk of HIV/AIDS in rural areas, a study was conducted by the Social and Behavioural Sciences Unit of the Centre, in an attempt to: (1) identify the sub-groups that engage in risky sexual behaviour in rural area; (2) identify the locales where these behaviours take place; (3) explore why and how these sub-groups get involved in such behaviour and the duration of such behaviour in men and women; (4) explore insiders' vocabularies which will, among other things, help in finding appropriate language for developing tools and for communication during data-collection. It is basically an exploratory study and not geared towards testing hypotheses. The study employed qualitative research methods. Interviews with fifteen male and female key-informants were conducted. In addition, in-depth interviews of 8 men engaged in risky heterosexual behaviour were conducted. Some rating exercise has been carried out as well. Data collected in Matlab are now being analyzed.

capture-recapture method is a simple technique for reliably estimating an unrecognized population with limitations, which could be minimized by shortening the time gap between surveys and creating an enabling environment to encounter harassment of MSWs and safety to peer-staff.

Sharful Islam Khan was involved in the study funded by SDC, and the collaborating organization was Bandhu Social Welfare Society.

Application of the capture-recapture method for estimating the number of mobile male sex workers in a port city of Bangladesh

Current HIV interventions for male sex workers (MSWs) require expansion in major cities which warrant scientific estimations of the number of MSWs. Although the two-sample capture-recapture surveys are suitable for closed populations, this method was applied to indirectly estimate the number of mobile MSWs in a conservative social setting, a port city of Bangladesh. We estimated that there are 248 MSWs (95% CI, 246-250) who picked up clients only at open and known contact venues. Thus, this estimate does not reflect the total number of MSWs as we could not reach MSWs who worked in unknown hidden venues. Experience suggests that the two-sample

Voluntary counselling and testing services for HIV

A Voluntary Counselling and Testing (VCT) Unit for HIV was set-up in ICDDR,B in January 2002 under the Virology Laboratory of the Laboratory Sciences Division with financial and technical support from UNAIDS. The Unit is named Jagori. Two psychologists, trained in India for one month, serve as HIV counsellors at Jagori. They established the first VCT unit in Bangladesh following the international guidelines. Jagori is mandated not only to provide counselling services to clients seeking tests but also to train staff of other organizations and orient them to VCT and to develop linkages between VCT and other support services, such as access to HIV-positive support groups and clinicians. In 2003, Jagori was expanded to 2 more cities: Chittagong and Sylhet. In both the cities, Jagori has been set up in collaboration with the

Marie Stopes Clinic Society (MSCS) so that the VCT unit is located in the premises of the MSCS clinic, and the clinic staff also assists in drawing and separating blood. At the outpatient facilities of Jagori at Dhaka, a clinician provides clinical support through clinical examinations and referral to a consultant physician who has expertise in dealing with HIV-positive people. The physician of Jagori was also recently trained in diagnosis of opportunistic infections and staging of AIDS. The number of HIV-positive people diagnosed at Jagori is reported to GoB before the World AIDS Day each year. Jagori's data, therefore, are linked to the national figures of passively-reported cases of HIV/AIDS every year. During 11 November 2002–19 November 2003, 155 clients attended Jagori, of whom 26 were HIV-positive. Of these 26 people, 4 were children, 18 were male (mean age: 27.9 years, SD=11.6 years), and 23 were referred to HIV-positive support groups, of whom 19 joined the support group. During this period, there were 2 known deaths. Of the HIV-positive adults, 16 were migrants returning from different countries. In addition to the clients who attended Jagori, the HIV counsellor also counselled 35 HIV-positive IDUs diagnosed through a prospective cohort study on IDUs during this period. The counsellors also provided orientation on VCT to different organizations in response to specific requests.

Tasnim Azim, Arunthia Zaidi, Md. Zahiruddin, and Moshtaq Parvez were involved in the study. The service was funded by WHO, and the collaborating organization in Chittagong and Sylhet was Marie Stopes Clinic Society.

Assessment of laboratory capacity for testing for HIV in Nepal

A team from ICDDR,B conducted a survey of 17 laboratories in different regions of Nepal to assess their capabilities for conducting HIV tests for the purposes of surveillance and diagnosis through voluntary counselling and testing. The 17 laboratories were surveyed during 12–15 October 2003 and included those of His Majesty's Government of Nepal Ministry of Health (HMGMOH) and the Nepal Red Cross Society. Sixteen laboratories were surveyed as sentinel laboratories, while one—the National Public Health Laboratory—was surveyed to assess its capacity as a reference laboratory. The team was divided into 5 groups, which travelled to different regions of Nepal and conducted the assessment using a pre-set questionnaire. It is expected that the recommendations arising from the assessment will be used by HMGMOH to increase the capacity of its laboratories.

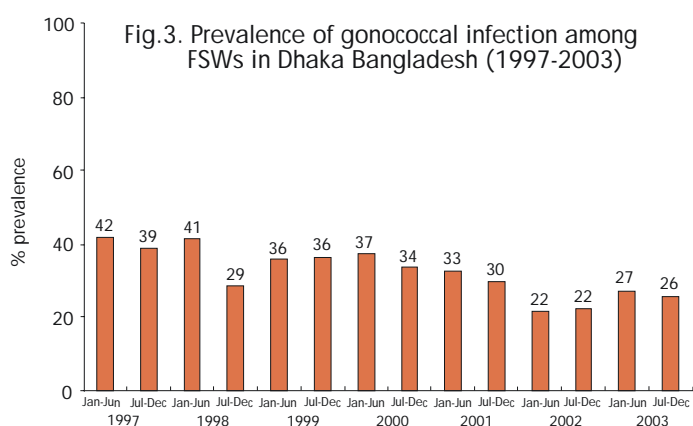
G. Balakrish Nair, Tasnim Azim, Anowar Hossain, Motiur Rahman, Dilruba Ahmed, Ghiasuddin Ahmed, M. Safiullah Sarker, N. Amin Bhuiyan, and Dipak K. Mitra were involved in the surveillance funded by USAID/Washington.

Studies and services on sexually transmitted infections

Longitudinal survey on the prevalence of RTI/STI among female sex workers in Bangladesh

The RTI/STI Laboratory of LSD has been monitoring the prevalence of RTI/STI among street-based sex workers in Dhaka since 1997. Despite concerted efforts from all concerned, there have been no significant decreases in the prevalence of gonococcal infection among the study population (Fig. 3).

The study was funded by ICDDR,B, USAID, and SDC, and the collaborating organizations were Bandhu Social Welfare Society, CARE Bangladesh, Concern, Bangladesh, Dhaka Medical College Hospital, Family Health International, M.A.G. Osmani Medical College Hospital (Sylhet), Momota, Paricharja, The Salvation Army, Social Marketing Company, and Srishti.



and males having sex with males, have been tested for antimicrobial susceptibility to penicillin, tetracycline, ciprofloxacin, ceftriaxone, spectinomycin, azithromycin, and cefixime using the NCCLS-recommended agar dilution method. Less than 5% of isolates from 2002 were susceptible to penicillin, tetracycline, or ciprofloxacin (Table 2); $\geq 98\%$ of isolates were susceptible to ceftriaxone and cefixime. AMR Surveillance data of 2003 indicate that more than 15% of isolates showed reduced susceptibility to azithromycin compared to 1.5% during 2002 (Table 2).

The study was funded by ICDDR,B, USAID, and SDC, and the collaborating organizations were: Bandhu Social Welfare Society, CARE, Bangladesh, Concern, Bangladesh, Dhaka Medical College Hospital, Family Health International, M.A.G. Osmani Medical College Hospital (Sylhet), Momota, Paricharja, The Salvation Army, Social Marketing Company, and Srishti.

Antimicrobial susceptibility monitoring for *Neisseria gonorrhoeae*

The RTI/STI Laboratory of LSD has been monitoring antimicrobial resistance (AMR) of *N. gonorrhoeae* since 1997. Since then, more than 1,300 gonococcal strains, isolated from males and females from the general population, street-, hotel-, and brothel-based sex workers, male truckers,

Diagnostic services for RTI/STI in Bangladesh


The RTI/STI Laboratory offers diagnostic and quality control support (on cost-recovery basis) to different national and international

Table 2. Antimicrobial susceptibility to *N. gonorrhoeae*

Antimicrobial agent	Susceptibility (%)	Reduced susceptibility (%)	Resistance (%)
Azithromycin	85.3	14.7	0
Cefixime	100	0	0
Ceftriaxone	99.7	0.3	0
Ciprofloxacin	4.4	3.4	92.2
Penicillin	14.0	38.6	47.4
Spectinomycin	99.7	0	0.3
Tetracycline	2.4	11.3	86.3

initiatives in the field of RTI/STI. In addition to providing support to institutions in Bangladesh during 2003, the Laboratory has provided diagnostic support to the HIV and STI surveillance project conducted by the Family Health International, Nepal and quality control support to USAID-funded STI projects in Nepal.

Motiuur Rahman, Shama A. Waris, Dipak K. Mitra, Zafar Sultan, Faisal Arif Hasan Chowdhury, Mohsina Haq, Shirajun Monira, Anadil Alam, and Shamsun Nahar were involved in the study.



The RTI/STI Laboratory has provided diagnostic support to the HIV and STI surveillance project conducted by the Family Health International, Nepal and quality control support to USAID-funded STI projects in Nepal

Ongoing Research Protocols 2003

Clinical Sciences Division

Aboud F. Evaluation of early childhood initiatives of Plan Bangladesh
Starting date: 1 September 2003
Funded by: Plan Bangladesh

Ahmed T. Identification and validation of an optimum clinical scoring system for diagnosis of tuberculosis and estimation of prevalence of multiple drug resistance in children
Starting date: 1 May 2003
Funded by: Department for International Development (DFID), UK

Alam NH. Efficacy of Benefiber-added reduced-osmolarity WHO-ORS in the treatment of adult cholera
Starting date: 1 May 2003
Funded by: Novartis Nutrition, Switzerland

Alam NH. Introduction of new hypo-osmolar ORS to routine use in the management of diarrhoeal disease
Starting date: 1 October 2002
Funded by: United States Agency for International Development (USAID)/ Dhaka

Alam NH. Oral rehydration solution containing amylase-resistant starch in severely-malnourished children with watery diarrhoea due to *Vibrio cholerae*
Starting date: 1 July 2001
Funded by: Nestlé Foundation, Switzerland

Ashraf H. Daycare-based management of severe pneumonia in under-5 children when hospitalization is not possible due to the lack of beds
Starting date: 1 January 2003
Funded by: University of Basel, Switzerland

Hossain MJ. Epidemiology and aetiology of encephalitis and other arboviral diseases in Bangladesh
Starting date: 1 March 2003
Funded by: Centers for Disease Control and Prevention (CDC), USA

Hossain S. Modelling the impact and incremental cost-effectiveness of introducing vaccines against hepatitis B, *Haemophilus influenzae* type b, and rotavirus into routine infant immunization programmes in Bangladesh and Peru
Starting date: 1 May 2001
Funded by: London School of Hygiene & Tropical Medicine (LSHTM), UK

Jamil KMA. A pilot study to assess antioxidant status in healthy and malnourished Bangladeshi children
Starting date: 1 January 2002
Funded by: University of California at Davis, USA

Jamil KMA. Estimation of the average vitamin A requirement of adult males
Starting date: 1 January 2003
Funded by: University of California at Davis, USA

Nahar B. Effect of psychosocial stimulation and parental counselling on cognitive function of severely-malnourished children in a nutritional rehabilitation unit
Starting date: 1 October 2002
Funded by: Sida/SAREC

Rabbani GH. Clinical trial of L-histidine in childhood shigellosis
Starting date: 1 March 2002
Funded by: Thrasher Research Fund (TRF), USA

Rabbani GH. Effects of plant polyphenols on arsenic-induced toxicity in rabbits
Starting date: 16 August 2003
Funded by: Bangladesh Arsenic Control Society

Saha D, Khan WA. Calcium homostasis, cramping and tetany in-patients infected with *V. cholerae* O1 or O139
Starting date: 15 April 2002
Funded by: GlaxoSmithKline (GSK), UK

Salam MA. Randomized, double-blind, controlled clinical trial to compare the efficacy of a single-dose of azithromycin versus a single-dose of ciprofloxacin in the treatment of adults with clinically severe cholera due to *V. cholerae* O1 or O139
 Starting date: 1 January 2003
 Funded by: New England Medical Center, USA

Sarker SA. The usefulness of ferrous fumarate and ferric pyrophosphate as food fortificants in developing countries
 Starting date: 1 January 2003
 Funded by: Micronutrient Initiative (MI), USA

Health Systems and Infectious Diseases Division

Alam ABMK. Levels, trends and determinants of unwanted births in rural Bangladesh: evidence from the ICDDR,B FHRP areas
 Starting date: 1 December 2002
 Funded by: USAID/Dhaka

Ashraf A. Changes in use of health and family planning services in two rural upazilas during the transition to a new system of service-delivery: 1998-2002
 Starting date: 15 February 2003
 Funded by: DFID, LSHTM, UK and USAID/Dhaka

Breiman RF. A prospective, randomized, double-blind, placebo-controlled, multi-centre trial to assess safety, efficacy, tolerability and immunogenicity of influenza virus vaccine, trivalent, types A&B, live cold-adapted, liquid formulation (CAIV-T), administered concomitantly with a combination live, attenuated mumps, measles, and rubella vaccine in healthy children aged 11-24 months
 Starting date: 1 September 2002
 Funded by: Wyeth-Lederle Vaccines, USA

Breiman RF. Burden of pneumococcal disease in children in Bangladesh: a project to enhance laboratory capacity and create awareness, and to prepare for introduction of a pneumococcal vaccine
 Starting date: 1 December 2003
 Funded by: Pneumo ADIP through Johns Hopkins University (JHU), USA

Breiman RF. Emergency epidemiological study of dengue and dengue haemorrhagic fever in Dhaka, Bangladesh
 Starting date: 16 August 2000
 Funded by: Duncan Brothers and Amex Foundation, Dhaka

Brooks WA. Surveillance for influenza and the viral aetiologies of influenza-like febrile illnesses in an urban slum in Dhaka, Bangladesh
 Starting date: 21 October 2003
 Funded by: CDC, USA

Gazi R. Evaluation of a six-month pilot to introduce depot-holders in three types of urban areas
 Starting date: 15 March 2003
 Funded by: USAID

Islam Z. Cost of illness of cholera in a rural area of Bangladesh
 Starting date: 1 October 2003
 Funded by: International Vaccine Institute (IVI), Seoul, Korea

Islam Z. Economic evaluation of shigellosis in an urban area of Dhaka, Bangladesh
 Starting date: 1 November 2001
 Funded by: International Vaccine Institute (IVI), Seoul, Korea

Larson C. Scaling up zinc as a treatment for childhood diarrhoea in Bangladesh: monitoring the impact of public, private and NGO delivery strategies
 Starting date: 19 June 2003
 Funded by: Bill & Melinda Gates Foundation Award, USA

Naheed A. Establishment of laboratory-based community surveillance for typhoid fever to define incidence of typhoid fever and to identify modifiable risk factors which may be useful in subsequent interventions to reduce the burden of disease
 Starting date: 1 September 2003
 Funded by: CDC, USA and International Vaccine Institute (IVI), Seoul, Korea

Naheed A. Evaluation of laboratory assays for the rapid diagnosis of *Shigella dysenteriae* type 1 infection in Bangladesh
 Starting date: 1 September 2003
 Funded by: CDC, USA

Naheed A. Evaluation of laboratory assays for the rapid diagnosis of *Vibrio cholerae* infection in Dhaka, Bangladesh
 Starting date: 1 January 2003
 Funded by: CDC, USA

Quaiyum MA. Programmatic and non-programmatic determinants of low immunization coverage in Bangladesh
 Starting date: 1 June 2002
 Funded by: USAID/Dhaka

Wagatsuma Y. Community-based epidemiologic study of visceral leishmaniasis in Bangladesh
 Starting date: 1 January 2002
 Funded by: CDC, USA

Laboratory Sciences Division

Ansaruzzaman M. Phenotypic and genotypic analysis of clinical and environmental *Vibrio cholerae* non-O1 non-O139 to identify pathogenic clones and their pathogenic mechanism
 Starting date: 1 January 2002
 Funded by: USAID/W and ICDDR,B

Azim T. Incidence of HIV, hepatitis and syphilis infections and risk behaviour in injecting drug users in Dhaka, Bangladesh
 Starting date: 1 May 2002
 Funded by: AusAID, Australia

Banu S. Study on molecular epidemiology of tuberculosis and molecular mechanism of drug resistance of *Mycobacterium tuberculosis* in Bangladesh
 Starting date: 1 April 2002
 Funded by: World Health Organization (WHO), Geneva

Faruque SM. Analysis and genetic modification of *Vibrio cholerae* strains carrying atypical combination of virulence genes and phenotypes to develop potential vaccine candidates
 Starting date: 1 September 2002
 Funded by: Gates/GoB Award

Faruque SM. Characterization of environmental and clinical strains of toxigenic and non-toxigenic *Vibrio cholerae* as an aid to predict the emergence of new epidemic strains
 Starting date: 1 January 2000
 Funded by: USAID/W and Ellison Medical Foundation

Faruque SM. Genetic variants of *Vibrio cholerae* O139 and development of a vaccine against O139 cholera
 Starting date: 1 March 2002
 Funded by: Sida/SAREC

Faruque SM. Molecular epidemiology and evolution of clinically significant *Shigella* species in Bangladesh
 Starting date: 1 September 2000
 Funded by: Government of Japan

Faruque SM. Phage and genomic variation in *Vibrio cholerae* evolution
 Starting date: 1 September 2003
 Funded by: NIH through Harvard University, USA

Haque R. Antimalarial drug resistance in Bangladesh
 Starting date: 1 July 2003
 Funded by: Armed Forces Research Institute of Medical Sciences, Thailand

Haque R. Field studies of human immunity to amebiasis in Bangladesh
 Starting date: 1 May 2003
 Funded by: NIH through University of Virginia

Haque R. Field validation of diagnostic tests of some Category B enteric pathogens and correlation of protozoal genotype with virulence
 Starting date: 1 December 2003
 Funded by: NIH through University of Virginia, USA

Haque R. Mechanism of acquired immunity to *E. histolytica* infection and disease in Bangladesh
 Starting date: 1 September 2000
 Funded by: University of Virginia, USA

Hossain A. Population-based evaluation of *Shigella* infections in urban area of Dhaka, Bangladesh
 Starting date: 1 July 2001
 Funded by: International Vaccine Institute (IVI), Seoul, Korea

Islam SM. Cholera risk management in Mozambique and Bangladesh, Phase-I
 Starting date: 1 January 2003
 Funded by: Northumbria University

Islam MS, Taylor RK. Environmental persistence of *Vibrio cholerae*
Starting date: 1 October 2001
Funded by: Dartmouth College, USA

Qadri F, Faruque ASG. Immune response to *V. cholerae* in Bangladesh
Starting date: 5 September 2000
Funded by: NIH through Massachusetts General Hospital, USA

Qadri F. Pathogenesis of enterotoxigenic *Bacteroides fragilis* (ETBF) infection
Starting date: 21 September 2002
Funded by: NIH through JHU, USA

Qadri F. Phase III: Safety and immunogenicity studies of Peru 15, a live attenuated oral vaccine candidate for *Vibrio cholerae* O1 in Bangladeshi volunteers—both adults and children
Starting date: 1 January 2003
Funded by: International Vaccine Institute (IVI), Seoul, Korea

Qadri F. Studies to evaluate vaccines against watery diarrhoea suitable for use in Bangladesh: Part I—Studies to facilitate ETEC vaccine efficacy trials. Part II—Cholera and ETEC vaccine studies
Starting date: 1 January 2002
Funded by: Sida/SAREC and ICDDR,B

Rahman M. Epidemiology and aetiology of sexually transmitted infections and antimicrobial susceptibility of surveillance of *N. gonorrhoeae* in Bangladesh
Starting date: 1 January 2001
Funded by: USAID/W

Rahman M. Molecular analysis of virulence genes of *Helicobacter pylori* and identification of genotypes associated with overt disease in Bangladeshi population
Starting date: 1 January 2002
Funded by: Sida and ICDDR,B

Raqib R. Assessment of active tuberculosis infection by T-cell responses to purified antigens in tuberculosis patients: a comparative study between patients and household contacts
Starting date: 1 July 2002
Funded by: Gates/GoB Award

Raqib R, Andersson J. Innate and adaptive immune response in *Shigella* infection
Starting date: 1 January 2002
Funded by: Sida/SAREC

Talukder KA. Molecular epidemiology of *Shigella dysenteriae* type 1 strains associated with haemolytic-uraemic syndrome and other complications
Starting date: 1 December 1999
Funded by: USAID/W and ICDDR,B

Wahed M. The efficacy of vitamin A-rich small fish in improving vitamin A status in children in Bangladesh
Starting date: 1 October 2001
Funded by: Thrasher Research Fund (TRF), USA

Public Health Sciences Division

Alam DS. Prenatal exposure to Bangladesh famine (1974-75): association with blood pressure, glucose tolerance, lipid profile, and coronary heart disease among young adults
Starting date: 15 September 2003
Funded by: DFID, UK

Alam DS. Validity and reproducibility of basal metabolic rate measurements in rural poor Bangladeshi women: comparison of measurements obtained by MedGem™ and by Deltatrac™ device
Starting date: 1 March 2003
Funded by: DFID, UK

Alam N, Davies L. Time since pregnancy and mortality in women of reproductive age in Matlab, Bangladesh
Starting date: 1 December 2002
Funded by: DFID, UK

Anwar I. Inequalities around childbirth and related maternal healthcare services in rural Bangladesh (A proposal for reaching the poor programme of the World Bank)
Starting date: 1 January 2003
Funded by: World Bank, Washington, DC

Arifeen SE. The Bangladesh arsenic calamity and reproduction: does arsenic contamination of drinking-water result in foetal wastage, intrauterine growth retardation, neonatal deaths, and impaired cognitive development, and to what extent can nutrition interventions reduce risk?

Starting date: 1 November 2002

Funded by: USAID/Dhaka, Sida/SAREC, and ICDDR,B

Arifeen SE. Combined interventions to promote maternal and infant health: effects over a pregnancy cycle and on children of 0-24 months

Starting date: 1 October 2002

Funded by: UNICEF

Arifeen SE. An effectiveness study of *Haemophilus influenzae* type b vaccine

Starting date: 1 April 2000

Funded by: Asian Development Bank (ADB), Manila, and Government of Bangladesh

Arifeen SE. An evaluation of the health and economic impact of integrated management of childhood illness (IMCI), Matlab, Bangladesh: a randomized experimental study

Starting date: 1 July 1999

Funded by: WHO, Geneva

Arifeen SE. Combined interventions to promote Maternal and Infant Health

Starting date: 1 November 2000

Funded by: UNICEF

Arifeen SE. Community-based interventions to reduce neonatal mortality in Bangladesh

Starting date: 1 March 2002

Funded by: USAID/Dhaka

Bhuiya A. Improvement of health through community development-oriented programme in rural Bangladesh

Starting date: 1 January 1994

Funded by: Swiss Red Cross, Bern, Switzerland

Bhuiya A. Monitoring the disparity in health status and access to, and utilization of, healthcare services: Bangladesh Health Equity Gauge—Phase I

Starting date: 1 July 2001

Funded by: Rockefeller Foundation, USA

Blum LS. Socio-cultural and behavioural component for dysentery disease burden

Starting date: 1 June 2001

Funded by: International Vaccine Institute (IVI), Seoul, Korea

Boby Sik. Male sexuality and masculinity: implications for STD/HIV and sexual health interventions in Bangladesh

Starting date: 1 October 2001

Funded by: AusAID, Australia

Dieltiens G. Unmet need for major obstetric interventions in Bangladesh

Starting date: 1 March 2001

Funded by: Belgian Development Cooperation

Hasan KZ, Perez-Perez GI. Longitudinal study of events associated with *H. pylori* acquisition in Bangladeshi children

Starting date: 1 July 2002

Funded by: Thrasher Research Fund (TRF), USA

Nahar P. Infertility: a lens to see women's situation in the context of Bangladesh

Starting date: 1 July 2003

Funded by: Monash University, Australia

Naved RT. Effectiveness of large-scale supplementation activities for pregnant women: the role of community nutrition promoters

Starting date: 1 October 2003

Funded by: Sida/SAREC

Naved RT. Sexuality and risky heterosexual behaviour in rural Bangladesh

Starting date: 1 July 2003

Funded by: Cornell University, USA

Neloy AA. Nature of ageing and family care for the elderly in rural Bangladesh

Starting date: 1 June 2003

Funded by: Australian National University (ANU), Australia and ICDDR,B

Rahman M. Arsenic in tube-well water and health consequences. Phase 2: Continued activities 2003-2006: understanding the dynamics of arsenic exposure, arsenic-related diseases, and the shift to arsenic-free drinking-water

Starting date: 1 September 2003

Funded by: Sida/SAREC

Rahman M. Arsenic in tube-well water and health consequences

Starting date: 1 November 2001

Funded by: SIDA, WHO, and USAID/Dhaka

Rahman M. Efficacy of flocculent technology as an arsenic mitigation strategy

Starting date: 15 December 2002

Funded by: Proctor and Gamble, USA

Santosham M, Arifeen SE. Aetiology, prevalence, and treatment of neonatal infections in the community

Starting date: 1 November 2002

Funded by: Wellcome Trust, UK

Siddique AKM, Rahman M. Surveillance of dengue viral disease in Bangladesh

Starting date: 1 May 2001

Funded by: USAID/W and ICDDR,B

Streatfield PK. Essential Obstetric Care

Starting date: 1 October 1999

Funded by: European Commission, Belgium

Streatfield PK. Health profile of the elderly in Matlab, rural Bangladesh

Starting date: 1 July 2003

Funded by: DFID, UK

Streatfield PK. Male involvement in reproductive health

Starting date: 1 December 1999

Funded by: European Commission, Belgium

Streatfield PK. Plateauing of the Bangladesh fertility decline

Starting date: 1 July 2003

Funded by: USAID/Dhaka

Zaman K. Epidemiology and surveillance of multidrug-resistant *Mycobacterium tuberculosis* and assessment of directly-observed therapy short course (DOTS) programme in selected areas of Bangladesh

Starting date: 1 March 2001

Funded by: USAID/W, DFID, and ICDDR,B

Zaman K. A randomized, placebo-controlled study of the safety, reactogenicity, and immunogenicity of an orally-administered human rotavirus vaccine (RIX4414) in healthy children in Bangladesh

Starting date: 1 March 2002

Funded by: USAID/W, National Vaccine Program Office, USA, and WHO

Zaman K. Epidemiology of hepatitis E virus infections in rural Bangladesh at Matlab (revised)

Starting date: 1 April 2003

Funded by: NIH through JHU, USA

**Associate Director and Head
Barkat-e-Khuda**



Policy and Planning

In June 2000, the Board of Trustees created the post of Associate Director and Head of Policy and Planning. The major responsibilities of the post include:

- working closely with the Centre Director and staff, Board of Trustees, Government of Bangladesh, NGOs as well as the donor community to develop the Centre's Strategic Plan to the Year 2010. The Strategic Plan has been developed and approved by the Board in its November 2002 meeting and is now under implementation by the Centre;
- developing tools to monitor implementation of the Strategic Plan for use by the principal investigators and their supervisors, including the Centre Director, to monitor implementation status of their protocols;
- working with the Centre Director, Finance Department, Human Resources Department, staff, and PricewaterhouseCoppers (PwC), Kolkata, to develop an integrated MIS (Suchona) for the Centre, linking project monitoring with Human Resources and Finance departments, which will 'go live' on 1 February 2004;
- assisting the Director by contributing to the Centre's human resources and external resources agenda, especially related to working closely with the Government of Bangladesh;
- participating and directing relevant project activities (e.g. zinc scale-up project and the NNP Baseline Survey);
- representing the Centre at various national and international meetings; and
- assuming the role of Acting Director in his absence.

National Nutrition Project Baseline Survey

The Policy and Planning office of the Centre, together with colleagues from ICDDR,B, IPHN, and NIPORT personnel, developed the National Nutrition Programme (NNP) Baseline Survey Proposal. The Associate Director had a number of meetings with NNP, Ministry of Health and Family Welfare (MoHFW), and the World Bank to discuss and finalize the draft proposal. The proposal was presented at a meeting in Washington, organized by the World Bank, and subsequently at a workshop jointly organized by MoHFW, the World Bank, and Save the Children-UK. The Associate Director also participated at meetings of the NNP Appraisal Mission, organized a workshop to finalize the draft questionnaire, and prepared the workshop report. With the signing of a contract with NNP and subsequent sub-contracts with IPHN and NIPORT, the Associate Director participated, together with colleagues from ICDDR,B, IPHN and NIPORT personnel, in the process of developing the TOR

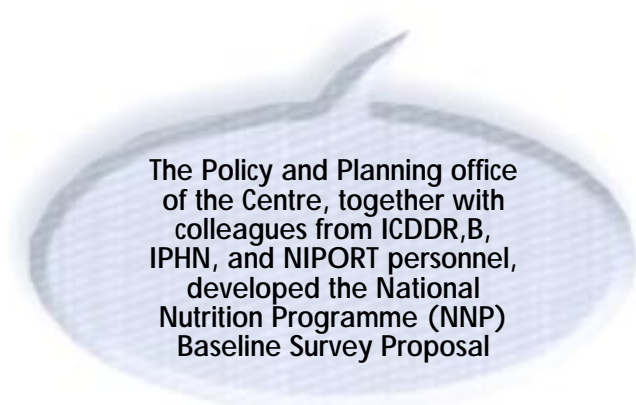
for potential data-collection agencies and in the selection of the finalist.

Suchona

As part of an integrated MIS for the Centre, linking Human Resources Department, Finance Department, and projects, the Policy and Planning office worked with the PwC team on the project component, both at Dhaka and Kolkata.

25th Anniversary of ICDDR,B

The Associate Director served as the Chair of the 25th Anniversary Committee and assisted the Director in a number of activities relating to the 25th Anniversary Celebration. These included working with the MoHFW in inviting the President and the Health Minister of Bangladesh to attend the 10th ASCODD as Chief Guest and Special Guest respectively at the inaugural session, and the State Minister for Health as Chief Guest at the closing ceremony. For the US-Japan Meeting on Infectious Diseases, the Associate Director served on the Local Organizing Committee and also worked on the *Smriti* Project.



The Policy and Planning office of the Centre, together with colleagues from ICDDR,B, IPHN, and NIPORT personnel, developed the National Nutrition Programme (NNP) Baseline Survey Proposal

Centre Scientific Forum list 2003

Ahmed T, Hossain S. Severe pneumonia in children: issues on management and antimicrobial resistance

Anwar I. Inequalities around childbirth and related maternal healthcare services in Matlab, Bangladesh

Anwar I, Killewo J. Poverty and safe motherhood in a rural area of Bangladesh

Arifeen SE. Child health programme: an update

Arifeen SE. The MINIMat study: an update from the MINIMat study team

Azim T. HIV/AIDS programme at ICDDR,B: present and future directions

Azim T, Alam S. HIV in Bangladesh: is time running out?

Breiman RF. SARS in China: relevance for preparedness in Bangladesh

Brooks WA. Typhoid disease burden in urban slum

Chowdhury MEK. Detection of anaemia during pregnancy using a combination of history-taking, pallor assessment, and a colour scale

Hamadani J. Psychosocial stimulation of rural malnourished children results in improvement of their mental development and behaviour

Hasan KZ, Arifeen SE. Assessment of safe injection practices in Bangladesh (key findings)

Haseen F, Huq NL, Larson CP. Evaluation of a school-based adolescent reproductive health intervention: impact on knowledge and practices

Jamil KM. Release of toxins from *Shigella dysenteriae* type 1 in response to different antibiotics

Kalluri P. Evaluation of serologic screening for identification of chronic *Salmonella* Typhi carriers in Vietnam

Khan WA. Single-dose effective antimicrobial treatment for childhood cholera: is it a reality?

Koenig M. Recent research findings from Matlab on measles and tetanus immunization: implication for the national programme

Larson CP. HFPSP: an overview of current and planned research followed by presentation of "Missed opportunities" study findings

Naved RT, Azim S. Domestic violence against women in Bangladesh

Portugill J. An overview of the NGO Service Delivery Project (NSDP) in Bangladesh

Rahim Z. Pathogenic potential of *Aeromonas Spp.* distributed in the aquatic environment of Bangladesh

Rahman S. Use of fortified wheat flour in improving micronutrient status of children: results from a randomized trial in rural Bangladesh

Sack DA. Self-sustaining Centre

Sack DA. Board of Trustees meeting update

Sack DA, Persson LA, Walton AG. Scientific ranking policy

Sack RB, Siddique AK, Islam MS. A 4-year study of the epidemiology on *Vibrio cholerae* in four rural areas of Bangladesh

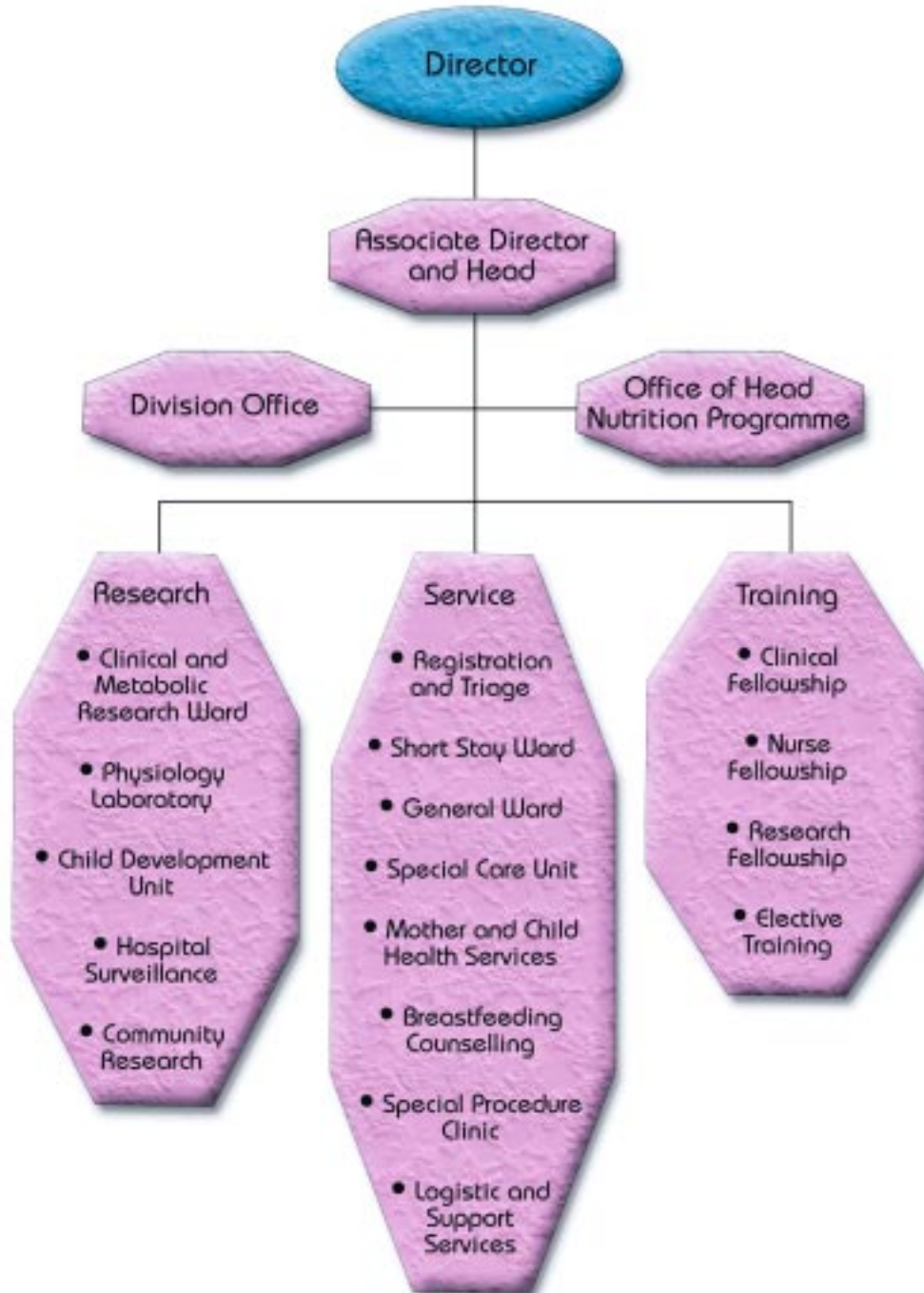
Sack DA, Walton AG. Draft gender policy

Streatfield PK, Mercer A. Status of HPSP performance indicators

Wahed MA, Roy SK. Vitamin A deficiency and anaemia in children in Bangladesh: co-existence and risk



Clinical Sciences Division



**Associate Director and Head
Mohammed A. Salam**



Clinical Sciences Division

The mission of the Clinical Sciences Division (CSD) is to develop, evaluate, and promote practical and cost-effective clinical strategies and interventions for efficient prevention and management of diseases most severely affecting the children and adults in Bangladesh and other impoverished settings.

The Division continued its research, patient care, and training activities in 2003 with the support of 2 international professional staff, 202 fixed-term core staff, and 66 fixed-term project staff. Another 73 health workers, 131 employees on contractual service agreement (CSA), 15 trainee doctors, and 10 trainee nurses significantly contributed to the activities of the Division. One consultant paediatrician continued to facilitate training of the staff and clinical fellows in 2003.

External Review

The Clinical Sciences Division was reviewed on 28-30 October 2003 by an external team headed by Dr. Claudio F. Lanata, member of the ICDDR,B Board of Trustees. Other members of the team were: Prof. Azad Khan, Mr. Abdul Mueyed Chowdhury, Prof. William B. Greenough III, Dr. Dilip Mahalanabis, and Dr. Ahmed Al-Kabir. The team critically appraised the activities, identified strengths and weaknesses, and investigated availability of resources to recommend future directions. The review also included assessment of performance of the Division since the last review in 1995 and verification of the relevance of activities in relation to the Centre's and the Division's strategic plans. The reviewers made constructive criticism and provided suggestions

for improving the volume and quality of performance, and also suggested possible strategies to accomplish them.

Clinical Research and Service Centre

PI: Mohammed A. Salam

Funded by: ICDDR,B

In total, 90,344 patients attended the Clinical Research and Service Centre (CRSC) for treatment of their diarrhoeal diseases alone or in association with other health problems, of whom 278 (0.3%) died. In total, 33,798 (37.41%) patients with mild diarrhoea were referred to the PSKP clinic, and 2,914 (8.6%) of them were referred back to CRSC for hospitalized management.

Of the total patients, 58,697 (65%) were admitted to the Short Stay Ward, and 25,709 (43.8%) were discharged within 12 hours, 39,519 (67.3%) were discharged within 24 hours, and 7 (0.01%) died. Another 6,758 (7.5%) patients required admission to the longer-stay General Ward, Special Care Unit, Research Wards, and Nutrition



A nurse examining a child in the Triage Desk of CRSC

Rehabilitation Unit. Of them, 338 (5%) were admitted to the Research Ward under 5 different research projects conducted by CSD alone or jointly with the Laboratory Sciences Division. Of the remainder 6,420 patients, 1,534 were admitted to the Special Care Unit with very severe disease, of whom 264 (17.2%) died. Of the 4,886 patients treated solely in the General Ward, 8 (0.16%) died. Of the 6,758 patients admitted to the longer-stay wards, 209 (3.1%) absconded, 167 (2.5%) took discharge against medical advice, and 49 (0.7%) were referred to other hospitals for management of complications. In total, 89,141 litres of intravenous fluids (1.5 litres per patient), and 362,796 litres of ORS solutions (4.02 litres per patient) were used at the CRSC in 2003.

Mother and Child Health Services

Coordinator: T. Ahmed
Funded by: ICDDR,B

The Nutrition Rehabilitation Unit (NRU), operational at the Dhaka hospital of ICDDR,B since the early eighties has a formal and comprehensive preventive healthcare-delivery system established in 1988 under the name of Child Health Programme. The programme was renamed in August 2003 as 'Mother and Child Health Services' (MCHS). Thirty-seven personnel, including two medical doctors, paramedics, and health workers operate its activities.

Most children and mothers who visit the Dhaka hospital for treatment of diarrhoeal diseases had not received any preventive health services in the past. MCHS offers these services, free of charge, based on the

concept of 'missed opportunities.' The services combine curative and preventive health activities, a blend that is not commonly available in hospitals in developing countries. The services are provided in the following areas:

1. Nutritional rehabilitation of severely-malnourished children
2. Growth monitoring and promotion of severely-malnourished children
3. Health and nutrition education
4. Immunization
5. Vitamin A supplementation
6. Promotion of oral rehydration therapy
7. Childhood tuberculosis programme
8. Family-planning counselling and services
9. Training of health professionals



Nutrition Rehabilitation Unit, CRSC

Shefayet's mother brings him for nutritional follow-up all the way from Faridpur. People from other districts of Bangladesh similarly come to seek help from the Nutrition Rehabilitation Unit of ICDDR,B Hospital.

Shefayet is an 11 months old boy living in a remote sub-district of Faridpur, about 130 km from Dhaka. His father, like many others in Bangladesh, never went to school and is the lone wage earner in a family of 7 members that includes his mother and 5 siblings. The father works as a labourer in the paddy fields and earns US\$ 26 per month. With this income, the parents have a hard time providing food to the children let alone medicines that are required for common illnesses.



The vicious cycle of food deprivation and repeated bouts of infections left Shefayet severely malnourished. When he was struggling for life because of a severe bout of pneumonia along with diarrhoea, his parents brought him to 'Cholera Hospital' in Dhaka at the advice of neighbours.

Within a few days of stay in the hospital, he recovered from pneumonia, diarrhoea, and acute severe malnutrition. Thanks to the standardized protocol for the management of severe malnutrition and diarrhoea, which has enabled doctors and nurses of the 'Cholera Hospital' to reduce the case-fatality rate by about 60%. Shefayet was then treated in the Nutrition Rehabilitation Unit run by MCHS for recovery from severe malnutrition. People from other districts similarly come to seek help from MCHS.

Nutritional rehabilitation of severely-malnourished children

Research done at ICDDR,B has shown that severely-malnourished children are more likely to die after discharge from hospital following treatment for acute illnesses, such as diarrhoea. To prevent such deaths, nutritional status of these children needs to be improved by an appropriate and sustainable nutritional rehabilitation programme. This is done in NRU run by MCHS. Rapid catch-up growth is achieved by following a standardized diet protocol using low-cost, culturally-appropriate, nutritious food based on locally-available ingredients. Essential micronutrients are also provided. In 2003, NRU successfully rehabilitated 257 very severely-malnourished children.



Shefayet had a steady weight gain of 2.5 kg over a follow-up period of 3 months

Growth monitoring and promotion of severely-malnourished children

The Nutrition Follow-up Unit (NFU) of MCHS monitors growth of severely-malnourished children rehabilitated and discharged from NRU and of children with less severe malnutrition discharged from the hospital with advice. Illnesses are treated and health and nutrition education re-enforced. In total, 1,661 severely-malnourished children were treated at NFU in 2003.

Health and nutrition education

Group discussions on health and nutrition are held at specified times and places in the hospital. Each discussion, led by trained health workers, typically involves 5-6 mothers and female caretakers of children. Discussions are led along specific topics, including preparation of low-cost nutritious food, home management of diarrhoea,

importance of immunization, and promotion of birth-spacing. During the year, 16,118 health-education sessions were conducted with mothers and female caretakers of children, covering an estimated 96,708 individuals.

Immunization

ICDDR,B runs the largest fixed-site immunization centre in the country and provides vaccines against the 6 EPI diseases. In total, 3,367 doses were given to children, while 13,402 doses of tetanus toxoid were given to women of childbearing age in 2003.

Vitamin A supplementation

Vitamin A supplementation reduces both morbidity and mortality among children. The health workers of MCHS routinely administer high-potency vitamin A capsules to children who need it. In 2003, vitamin A was given to 2,197 children who would not have received it otherwise.

Promotion of oral rehydration therapy

Oral rehydration is the cornerstone for the treatment of diarrhoea. The MCHS staff routinely assists mothers in providing oral rehydration solution to children and also demonstrate correct and hygienic preparation of home-made rehydration solutions using locally-available ingredients.

Addressing childhood tuberculosis

Unfortunately, childhood TB is a neglected disease. Diagnosis and management of TB in children attending the hospital and in their close contacts (e.g. parents) is a regular activity of MCHS. MCHS has treated more than 500 children with TB till date. Anti-TB medicines are provided free of charge to patients. Fifty-one new patients were diagnosed last year.

Birth-spacing counselling and services

This unit of MCHS provided birth-spacing counselling and materials to 113 parents of children attending the hospital during 2003, and efforts were made to further improve the use of these services by the eligible couples.

Training of health professionals

The success of MCHS as a model for dissemination of knowledge and practice of healthcare in the community has made its activities and role a part of the training courses for national and international health professionals. In 2003, institutions that received help in the form of technical advice included Chittagong Medical College Hospital (CMCH) and Centre for Rehabilitation of the Paralyzed (CRP) in Savar, Dhaka. CMCH has already established a nutrition service block in its Paediatrics Department with assistance from MCHS. The nutrition block will not only provide service to a large number of children

The success of the Mother and Child Health Service as a model for dissemination of knowledge and practice of healthcare in the community has made its activities and role a part of the training courses for national and international health professionals

Like all children admitted to Nutrition Rehabilitation Unit (NRU) of CRSC (Dhaka hospital), Farzana was severely malnourished too. She was an adopted child, but her foster mother was keen to get the tips on child-rearing, always occupied thinking how could she do the best for her daughter and followed all instructions with full concentration. At the NRU, he was taught how she could care, interact, talk, feed, and play with her child while busy with her day-to-day activities.



Materials used for psychosocial stimulation of children

brought to the hospital for treatment but will also serve as a training platform for medical and nursing students and postgraduate doctors. A large number of children suffering from severe malnutrition, secondary to physical and mental handicaps, receive treatment at CRP, which is renowned countrywide for its services. The standardized dietary protocol developed at MCHS for catch-up growth will be used for the nutritional management of these children.

Research

MCHS is the hub of the Centre's research on severe malnutrition. Ongoing research includes studies on simplifying diagnosis and treatment of TB in children, effect of psychosocial stimulation on outcome of treatment of severely-malnourished children, and finding out ways of improving outcome of children who refuse nutritional rehabilitation or those who default on follow-up. A number of important articles based on research done under MCHS have been published in prestigious journals, including the Lancet and the American Journal of Clinical Nutrition.

Soon she noted a great change in irritable, nagging, introverted and unsocial Farzana who turned into a cheerful, lively, friendly, and playful child. She became very friendly with the staff at NRU and enjoyed being with them. Fourteen days of stay at NRU brought a new life for Farzana. All these became possible by introducing an age-specific stimulation programme at the NRU with nutritional rehabilitation and mother's strong will-power.

Farzana is now discharged from NRU but she regularly attends the monthly follow-up visit at ICDDR,B. Since her mother has motion sickness and cannot travel by bus, she comes with her father who is also attending the teaching sessions on psychosocial stimulation at the follow-up unit of NRU. He has realized the value of stimulation at home for his daughter's optimum development and has advised all his family members to cooperate with Farzana's mother to carry on the positive interactions.

Despite many obstacles, Farzana's family continued to visit CRSC and learn the age-specific curriculum of psychosocial stimulation; when her mother could not come, the father took that responsibility. This is how we can dream about the sustainability of a constructive programme.

Regional training on management of severe malnutrition

Malnutrition is implicated in more than half of all childhood deaths globally. In Bangladesh, about 8 million children aged less than 5 years are underweight, while 3 million are wasted. A similar scenario prevails in most countries of South-East Asia, a region that has a very high burden of childhood malnutrition. The severe form of malnutrition—in children with "skin and bones" or swelling of feet—is associated with a high death rate that has remained unchanged over

ICDDR,B has implemented a standardized protocol for severely-malnourished children with diarrhoea based on the WHO guidelines for management of severe malnutrition in children

the last five decades. ICDDR,B has implemented a standardized protocol for severely-malnourished children with diarrhoea based on the WHO guidelines for management of severe malnutrition in children. Centres that have implemented the guidelines have experienced dramatic reduction in case-fatality rates among severely-malnourished children. It is now imperative that the guidelines be implemented across healthcare facilities in Asia and Africa to reduce the excessively high case-fatality rates among children with severe malnutrition in these regions. A training course has been developed based on 6 instructional modules by WHO. The modules were field-tested in ICDDR,B in December 2000. The MCHS staff organized/directed courses based on these modules in Dhaka, Afghanistan, and very recently, in Cambodia. The course in Cambodia was a regional one, participated by doctors and nurses from Laos, the Philippines, and Cambodia. Dr. Tahmeed Ahmed, Coordinator of MCHS also conducted a training workshop on severe malnutrition in Mulago Hospital, Kampala, Uganda

Franchising Patient Care Services of ICDDR,B

Coordinators: S. Hossain, H. Ashraf, and M.A. Salam

To strengthen the quality of management of diarrhoeal diseases at the Essential Services Package (ESP) clinics, operated by NGOs, and also to improve their use by the community, collaborative arrangements were made between ICDDR,B and Progoti Samaj Kallyan Protisthan (PSKP), a health-related NGO supported by the National Service Delivery Programme (NSDP). An ESP clinic, established within

the campus of ICDDR,B to franchise ICDDR,B's management services for diarrhoeal diseases and malnutrition, is expected to serve as a model for future expansion of the programme to other ESP clinics in Dhaka city in phases. ICDDR,B provided requisite training to the PSKP clinic staff following management protocols used at the CRSC (Dhaka hospital), and supervised the quality of treatment offered by the clinic. A system is in place for referral of patients requiring hospitalized management to CRSC. The clinic offers services from 6 am to 10 pm.

During the reporting year, 33,798 (37.4%) of the 90,344 patients attending CRSC were referred to the Franchising ESP clinic, and 2,914 (8.6%) of them were referred back to CRSC (Refusal of parents of a few patients to go home was a reason for referring them back to CRSC).

Promotion of Breast-feeding at CRSC

Coordinator: I. Kabir

Funded by: ICDDR,B

Several clinic- and community-based research conducted by the ICDDR,B scientists have consistently demonstrated the effectiveness of breast-feeding counselling in promoting and sustenance of exclusive breast-feeding to infants aged less than 6 months. The results were compelling for the establishment of 'Breast-feeding Counselling Services' at the Clinical Research and Service Centre. The aims of the services are to encourage and help mothers in exclusive breast-feeding to their infants, promote appropriate complementary feeds, provide

training to physicians, nurses, paramedics, and nursing and clinical fellows to promote breast-feeding at CRSC, and also to provide training to others interested in receiving such training.

In total, 4,423 mother-infant pairs were included in the breast-feeding counselling sessions conducted in 2003. Of those, 1,147 mothers of infants aged less than 6 months were counselled to re-establish exclusive breast-feeding, and 3,276 mothers of infants aged 6-24 months were counselled to continue breast-feeding for 2 years and beyond and to introduce appropriate complementary foods to their infants and young children. At discharge, 71% of mothers were exclusively breast-feeding their babies, and 36% of 158 babies, non-breastfed on admission, were being reverted to partial breast-feeding.

Special Procedure Clinic

Coordinator: P.K. Bardhan
Funded by: ICDDR,B

This clinic processes specimens submitted by various individuals and clinics within Dhaka city for clinical pathology, microbiological and biochemical tests and performs upper gastrointestinal endoscopic and sigmoidoscopic examinations. In addition, the Clinic offers vaccination against poliomyelitis, diphtheria, pertussis, tetanus, measles, mumps, rubella, varicella, hepatitis A, hepatitis B, *H. influenzae* type b, and typhoid and BCG vaccine. In total, 2021 persons used the services of the Clinic in 2003. The nurse-cum-receptionist of the Clinic has recently rejoined her position after successfully completing her MPH course in Australia. Discussions are going on for possibilities of modification

and expansion of the services of the Clinic. As part of capacity-building, video-endoscopic facilities, procured as gifts from the University of Basel, Switzerland, became operational in November. Plans are also underway to establish an ultrasonography unit for use at the Clinical Research and Service Centre, which will also be offered to the public on payment basis.

Nursing Service

Nurse Manager: Mohammad Ullah
Funded by: ICDDR,B

Each year, around 100,000 patients visit the Clinical Research and Service Centre with uncomplicated and complicated diarrhoeal diseases and associated health problems, including malnutrition and pneumonia. The Nursing Service in CRSC provides care for these patients and render services to patients enrolled in different research protocols conducted at CRSC. It plans, organizes, directs, coordinates, supervises, and monitors nursing care, including supervision, motivation, guidance, and performance appraisal of the nursing personnel.

The Nursing Service organizes in-service training for nursing and other health professionals, facilitates training programmes of the Training and Education Unit (TEU) of the Centre, and promotes nursing/health research at CRSC. It requires collaboration and consultation with other healthcare professionals to provide effective and efficient care and to meet the complex needs of patients and their family members. In addition to patient care, the Nursing Service participates actively in the non and research activities of the Centre.

The Nursing Service organizes in-service training for nursing and other health professionals, facilitates training programmes of the Training and Education Unit (TEU) of the Centre, and promotes nursing/health research at CRSC

Research in the field of nursing is a new area in Bangladesh and within the Centre. During 2002-2003, the Nursing Service participated in conducting a DFID-funded nursing research project titled "The identification of factors influencing and determining nurses' behaviour in the delivery of hands-on patient care" in collaboration with the Ministry of Health and Family Welfare and Health Systems and Infectious Diseases Division (HSID) of the Centre.

The Nursing Service also developed collaboration with the State University of Bangladesh and College of Nursing, University of Dhaka, to teach undergraduate nursing students and facilitate their clinical practicum in CRSC.

The Nursing Service is headed by Nurse Manager, 4 nursing officers, 38 senior staff nurses, 4 aid nurses, and 4 assistant staff nurses. In addition, 10 trainee nurses also received practical training on nursing management of diarrhoeal diseases and contributed to the patient care services of CRSC.

X-ray Unit, CRSC

In 2003, the two radiographers of the X-ray Unit, CRSC, have performed 11,553 X-ray examinations that included 9,269 chest X-rays, 1,438 abdominal X-rays, and 846 X-rays of other body parts. In total, 489 EKG examinations were performed during the year. A consultant radiologist conducts training sessions for Clinical Fellows and interested CSD staff.

Physiology Laboratory

Coordinator: G.H. Rabbani

The Physiology Laboratory is equipped for clinical and animal experimentations providing opportunities to the CSD and LSD scientists to conduct pathophysiological studies on intestinal and metabolic disorders in selected fields with direct relevance to clinical research. Understanding pathophysiological mechanisms of enteric infections, electrolyte transport, development of antisecretory agents, and environmental toxicity studies are among the research activities of the Laboratory. Current activities include the following:



*External reviewers visiting
the Physiology Laboratory,
October 2003*

Arsenic trioxide was administered to rabbits for one week, which resulted in a decrease in the concentration of whole-blood GSH, along with increase in the serum level of thiobarbituric acid and nitrite and nitrate compared to the normal levels

Short-chain fatty acids

Short-chain fatty acids analysis in stool samples: Short-chain fatty acids (SCFAs) are derived from the bacterial fermentation of unabsorbed carbohydrate in the colon. The Physiology Laboratory has facilities for measurement of total SCFA in extracted stool using high-performance liquid chromatography set-up in collaboration with the Nutritional Biochemistry Laboratory of ICDDR,B. Examination of the relationship between formation of SCFA in the colon and intestinal inflammation is being explored, and SCFA of stool samples from the study titled "clinical evaluation of green banana (amylase-resistant starch) in the management of childhood shigellosis" is currently being analyzed. Preliminary observation showed good correlation between consumption of green banana and production of SCFA in the colon. These data will be useful in understanding the mechanisms of amylase-resistant starch-mediated improvement in gastrointestinal diseases.

Myeloperoxidase

Myeloperoxidase in stool is a biomarker of gut inflammation. The spectrophotometric assay method for measuring the concentration of myeloperoxidase in stool samples has been established, which is being used in several clinical and animal studies.

Oxidant-antioxidant biomarkers

Whole-blood GSH assay, thiobarbituric acid-reactive substances assay, total antioxidant status, and nitrite/nitrate assays: These assays

collectively indicate the oxidative and antioxidative status of the body and are useful in clinical and animal studies. Currently, these biomarkers are measured in blood samples of the following studies:

1. Effects of antioxidants in arsenic toxicity
2. Clinical trial of L-histidine in childhood shigellosis
3. Role of nitrite and reactive oxygen species in the pathogenesis of experimental shigellosis

In the first study, arsenic trioxide was administered to rabbits for one week, which resulted in a decrease in the concentration of whole-blood GSH, along with increase in the serum level of thiobarbituric acid (TBARS) and nitrite and nitrate compared to the normal levels. Treatment with antioxidants reverses these effects of arsenic. The results have been published recently. Data of other studies are being analyzed.

Plant polyphenols: An animal study is in progress in collaboration with the University of Dhaka to examine the effects of plant polyphenols in reducing arsenic-induced toxicity in rabbits.

Absorption of water and electrolytes from liposomal oral rehydration solution: This is an in-vivo perfusion study of rat small intestine. Its main objective is to determine whether delivery of ORS in liposomes would further improve the efficacy of oral rehydration therapy. The study is recently concluded. Data are being analyzed

Child Development Unit

Coordinator: J.D. Hamadani
 Funded by: DFID

Since its establishment within CSD in 1996, the Child Development Unit (CDU) experienced many challenges and underwent changes to establish itself as an active and visible unit of the Centre. The Unit is working to achieve its aims to examine the effects of nutritional deficits, poor health, and deprivation on the development of children and to design and evaluate innovative, low-cost and sustainable interventions to improve the situation.

CDU continued to expand its collaboration, and apart from its cross-divisional activities within the Centre and long-term collaborations with the Institute of Nutrition and Food Science (INFS) of University of Dhaka and the Institute of Child Health (ICH) of University College-London, it is now collaborating with the Cornell University (USA), Uppsala University, the Karolinska Institute (Sweden), and

PLAN-Bangladesh. It is also associated with the Child Development Network called 'Shishu Bikash Network', a forum of multidisciplinary professionals working in the field of child development.

Despite difficulties in attracting research fund, the Unit succeeded in receiving funds from UNICEF, DFID-UK, USAID, SAREC, and Sida.

Professor Frances Aboud from the Psychology Department of McGill University, Canada, joined the Unit as an Adjunct Scientist in 2002. She conducted the first of a series of studies under the project "Evaluation of early childhood initiatives of Plan-Bangladesh."

Story of Monohardi

When we started our stimulation project in Monohardi, there was a young malnourished boy of 22 months who was participating in the project but could not utter a single word. Parents thought he was deaf. We checked his ears, and he could hear very well. We also checked his intelligence and found him to be delayed in his mental and psychomotor development. As part of our stimulation programme we taught the mother to regularly chat with the child even while she was busy doing household work. In addition, she learned how to play with the child in a developmentally-appropriate way using home-made toys. We visited the child regularly on monthly basis, and on each visit, the mother reported that the child could speak a few words. At the end of the year-long psychosocial stimulation, we found that he was able to talk, and his intelligence level had markedly increased. By giving very simple instructions to the mother at no cost, the child was able to develop considerably.



Right lower: a play leader is playing with a child and also teaching mother how to make a boat out of leaves. Three others: group sessions with mothers of malnourished children in which a play leader is giving them instructions on how to improve their children's intelligence

**Child Development Unit
organized a number of seminars
and training workshops on child
development for the Centre staff
and staff from other national
organizations**

The Unit is currently involved in the 'Child Development Component' of MINIMat, a large community-based project in Matlab, Bangladesh. Data collection on mental development of the infant cohort of the project is nearing completion, and Dr. Fahmida Tofail would use them for her PhD thesis. Preparations for developmental measurements in childhood have been completed, and data collection will begin in January 2004.

Another ongoing study is examining the association between children's urinary arsenic content and their mental development.

Dr. Baitun Nahar is conducting a study to compare the existing child-development activities at NRU of CRSC with a systematic, culturally-appropriate and low-cost programme of psychosocial stimulation and parental counselling.

Two new projects have been developed in collaboration with the Institute of Child Health, UK, Pennsylvania State University, and University of Dhaka. The first study is designed to assess the effects of iron supplementation and/or psychosocial stimulation on mental development and behaviour of children with iron-deficiency anaemia. This would be followed by another study to assess the effects of bio-fortified rice intake with or without psychosocial stimulation on child development.

The scientists of the Unit received training in different capacities. Jena D. Hamadani, Head of CDU, successfully defended her PhD thesis, and Fahmida Tofail is conducting her PhD research work in rural

Bangladesh. Two psychologists are undergoing their M. Phil course. CDU participated in a multi-country cognitive testing of the "psychosocial care indicators" designed by UNICEF. In response to request from UNICEF, CDU conducted extensive field interviews to assess if the respondents could understand the questionnaire that has been developed. The instrument is now ready for use in the MINIMat study. Following extensive field-testing and re-testing of Mac Arthur's Communicative Development Inventory, CDU has developed a 'Language Inventory' suitable for use in Bangladesh. This inventory assesses language ability of children at 12 and 18 months of age and would also be used for study under the MINIMat project. It will be validated with Bayley Scales of Infant Development-II.

CDU organized a number of seminars and training workshops on child development for the Centre staff and staff from other national organizations, including those from Bangladesh Home Economics College, Bangladesh Rural Advancement Committee, National Institute of Social Medicine, and Institute of Nutrition and Food Science, University of Dhaka.

Hospital Surveillance, CRSC

Diarrhoeal Disease and Enteric Infection Surveillance

Principal Investigator: A.S.G. Faruque

Funded by: ICDDR,B

Over 100,000 patients visit the Clinical Research and Service Centre (CRSC) and the Matlab hospital of ICDDR,B each year seeking

Table. Surveillance for aetiology of diarrhoea, Dhaka and Matlab, 2003

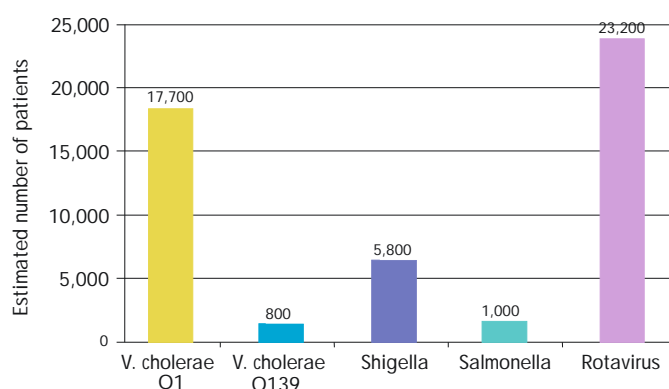
Pathogen	Dhaka (n=1,765)		Matlab (n =1,484)	
	No.	%	No.	%
<i>Vibrio cholerae</i> O1	354	19.6	152	10.2
<i>Vibrio cholerae</i> O139	16	0.9	8	0.5
<i>Shigella</i>	116	6.6	180	12.1
Rotavirus	464	25.7	302	20.3
<i>Salmonella</i>	20	1.1	36	2.4
<i>Entamoeba histolytica</i>	20	1.1	25	1.7
<i>Giardia lamblia</i>	32	1.8	51	3.4

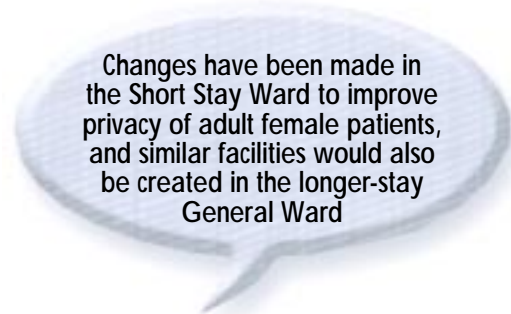
treatment of their diarrhoeal illnesses and associated health problems. A Diarrhoeal Disease Surveillance System, established at the Dhaka hospital in 1979 and extended to the Matlab hospital 6 years ago, collects information on clinical, epidemiological and demographic characteristics of patients. A systematic 2% sub-sample of patients attending CRSC and all patients from the Health and Demographic Surveillance System (HDSS) area attending the Matlab hospital are enrolled into the surveillance programme (Fig.). Trained personnel interview the patients and/or their attendants to obtain information on socioeconomic and demographic characteristics, housing and environmental conditions, feeding practices, particularly among infants and young children, and on the use of drugs and fluid therapy at home. Clinical characteristics, anthropometric measurements, treatments received at the facility, and outcomes of patients are also recorded. Extensive microbiological assessments of faecal samples

(microscopy, culture, and ELISA) of patients are performed to identify diarrhoeal pathogens and to determine antimicrobial susceptibility of bacterial pathogens.

The programme makes valuable information available to the hospital clinicians for providing care to patients and enables the Centre to detect the emergence of new pathogens and respond to early identification of outbreaks and their locations to suggest the Government of Bangladesh to take preventive and other control measures and to monitor the changes in the characteristics of patients and antimicrobial susceptibility of bacterial pathogens. Collected information is representative of the population. Hence, it provides an important database for conducting epidemiological studies, validation of results of clinical studies, helps develop new research ideas and study design, and introduce improved patient-care strategies and preventive programmes. The table shows diarrhoeal pathogens isolated in 2003.

Fig. Estimated number of patients according to aetiologic agents enrolled into the ICDDR,B's hospital surveillance, Dhaka, 2003





Nandipara Clinic

Coordinator: S.A. Sarker

Nandipara clinic, situated in peri-urban Dhaka, 7 km Northeast from the Centre, continued to provide opportunities to the CSD scientists in carrying out community-based studies. Over the past several years, the study area was expanded to the adjacent localities of Trimohani, Mathertek, and Dakhingaon and currently covering an area of 4 sq km with a population of 5,000. In this particular area, the role of *H. pylori*-associated infection as a cause of impaired reduced gastric acid output in children and young women was demonstrated. The usefulness of ferrous fumarate and ferric pyrophosphate as food fortificants in preventing iron-deficiency anaemia in children is currently being assessed at this community-based clinic. The clinic also provided outpatient services to nearly 8,000 children and women for common medical problems.

Fellowship Programme

For over a decade, CSD has established case-management training programmes for medical doctors and nurses. The objective of the Clinical Fellowship programme is to provide further training to young medical graduates with demonstrated initiatives for postgraduate studies in paediatrics and internal medicine. In total, 15 fellows receive hands-on training for 1-2 year(s) on case management of diarrhoeal diseases and associated problems. The University of Dhaka and the Bangladesh College of Physicians and Surgeons (BCPS) recognize

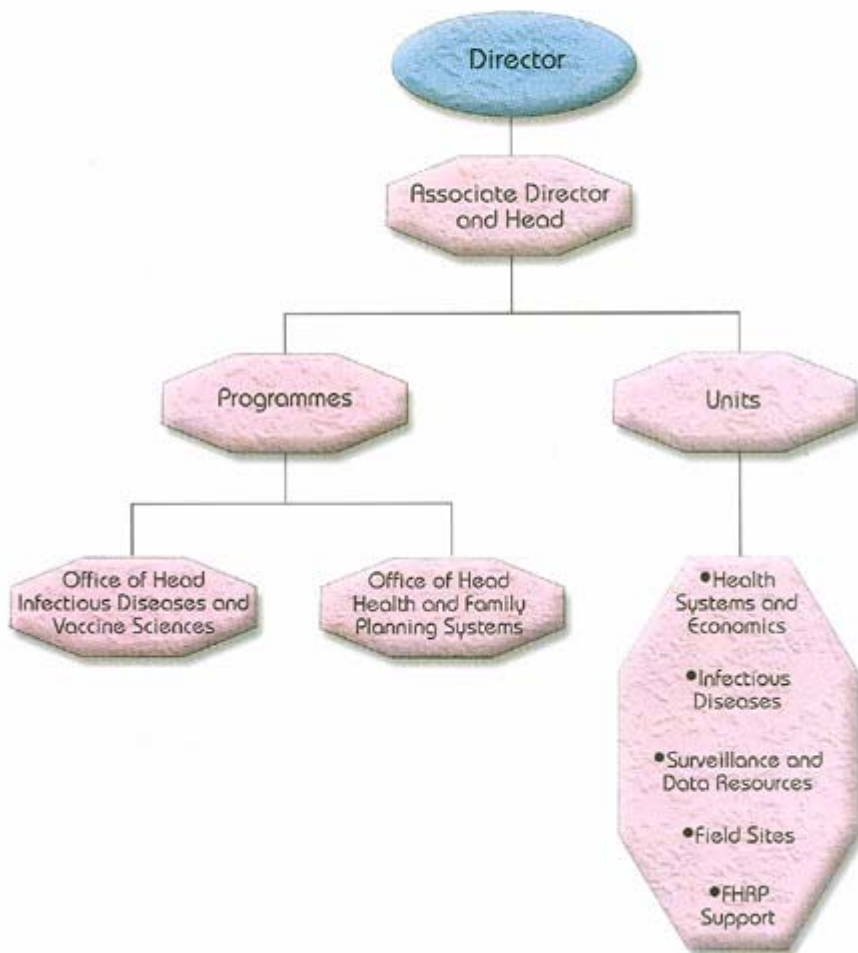
the training programme for higher studies in paediatrics and internal medicine.

Similarly, there is a programme for provision of hands-on training to 10 nurses at CRSC.

Recent Changes

CSD is working to improve the hospital environment, including improvement of the physical and hand-washing facilities for improving hospital hygiene and control of hospital-acquired infections. The Infection Control Committee has been revitalized. Changes have been made in the Short Stay Ward to improve privacy of adult female patients, and similar facilities would also be created in the longer-stay General Ward. The Clinical and the Metabolic Research wards have been merged into one to improve efficiency. Work is in progress to improve the Special Care Unit with central oxygen supply and suction facilities with its relocation into former Metabolic Research Ward with increased space, along with establishment of a Procedure and an Isolation Room that were lacking at the hospital. With this, the former Special Care Unit would be converted into an ARI Ward with the objectives to isolate patients with pneumonia and acute lower respiratory infections. This will improve the quality of services and create better opportunity for research on ARI, an effort that has also been suggested during the external review of the Division in October 2003. Additionally, a new research room is being established to facilitate research on body composition and energy expenditure of humans under varied disease conditions.

Health Systems and Infectious Diseases Division



**Associate Director and Head
Robert F. Breiman**



Health Systems and Infectious Diseases Division

The mandate of the Health Systems and Infectious Diseases Division (HSID) is to strengthen the national health systems through operations research. The researchers in HSID design, test, and facilitate replication of cost-effective and sustainable research outcomes for rural and urban settings with particular emphasis on infectious diseases. The Division provides expertise to the Centre in the areas of operations and health-systems research, emerging infectious diseases, and evaluation of new vaccines.

The objective of the Division is to apply research tools to accelerate the evolution of optimal health policy which saves lives and prevents suffering and economic loss. It takes findings of research from field-work conducted within the Centre and elsewhere and provides a testing ground to determine what adaptations are needed to make positive findings from artificially-controlled research studies applicable to real-world settings.

The Division uses its own 'real-world' field sites. In contrast to Matlab where health services are delivered by ICDDR,B staff in a manner unlike the way services are delivered in Bangladesh, HSID operates two rural field stations in Mirsarai upazila of Chittagong district and Abhoynagar upazila of Jessore district, and also an urban slum setting at Kamalapur in Dhaka city. In all three settings, people depend upon health services provided by government and non-government organizations (NGOs).

HSID provides infrastructure and expertise for Centre-wide operations research with adaptation and implementation of benefits of interventions identified in 'research work' into 'real-world' applications. The Division focuses on a multi-disciplinary approach of inquiry through both quantitative and qualitative methods. It partners with the Ministry of Health and Family Welfare (MoHFW) of the Government of Bangladesh (GoB) and NGOs to facilitate the testing of interventions in the research sites of the Division.

HSID houses three Centre-wide cross-divisional activities: (a) Programme on Infectious Diseases and Vaccine Sciences, (b) Programme on Health and Family Planning Systems, and (c) Family Health Research Project.

HSID has 6 international-level staff members. In addition to Division Head Dr. Robert F. Breiman, who is on secondment from the Centers for Disease Control and Prevention (CDC), Atlanta, USA, Dr. Charles Larson, on secondment from the McGill University, Canada, heads the Health and Family Planning Systems Programme. Dr. W. Abdullah Brooks holds a faculty position at the Johns Hopkins University and heads the Infectious Diseases Unit. Dr. Carel van Mels from the Netherlands heads the Surveillance and Data Resources Unit. Mr. Alec Mercer from the United Kingdom heads the Health Systems and Economics Unit, and Ms Mary Hadley from the United Kingdom is coordinator for the Family Health Research Project. Thirty-eight national of-

ficers and 179 general services and field-level staff members work in the Division. Seven HSID personnel were studying abroad during 2003 for their Masters and PhD programmes (5 PhD and 2 Masters).

Surveillance and Data Resources Unit

This unit has two sections: Data Resources Section and Demographic Research Section. The Data Resources Section is responsible for receiving, cleaning, checking, entering, and archiving surveillance data collected by the Division. These come from two rural surveillance areas—Mirsarai in the Chittagong district and Abhoynagar/Keshobpur in the Jessore district, where data are collected every 3 months. In 2003, demographic surveillance was started in Kamalapur, a part of Dhaka city, with about 200,000 inhabitants, many of them living in slums. Previously, surveillance for special studies was already taking place among a sample of the population of this area; now the total area is covered by an annual demographic surveillance. This is the only urban health and demographic surveillance in Bangladesh.

The Data Resources Section is responsible for data management for the other units of the Division. This includes assis-

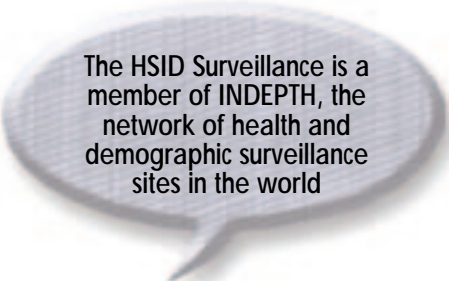
tance in questionnaire design and preparation of data entry and editing programmes for surveys, as well as tabulation and provision of statistical analysis expertise to different protocols. In addition, the Section has a computer engineer who provides hard and software assistance to the staff of the Division.

Work has started on creating a user-friendlier version of the surveillance databases. Presently, the 4 most important tables have been created. When this work is completed, the Section will be able to provide researchers their requested data in a much shorter time. It will also allow, under strict conditions, researchers themselves to access the surveillance database directly.

The Demographic Research Section is responsible for the "Levels, trends and determinants of unwanted pregnancies in rural Bangladesh" protocol. This USAID-funded protocol was started in December 2002 and will end in mid-2004. Staff members of the Section also participate in the USAID-funded "Plateauing of the Bangladesh fertility decline" study of the Centre's Population Programme, while the Section gives technical support to this protocol. During the year, the results of the demographic surveillance of 2000 and 2001 were analyzed, and a report has been prepared.



Field Research Assistant of the HSID Surveillance System interviewing household members in the Mirsarai surveillance area



The HSID Surveillance is a member of INDEPTH, the network of health and demographic surveillance sites in the world

The HSID Surveillance is a member of INDEPTH, the network of health and demographic surveillance sites in the world. Researchers from the Section or other units of the Division have taken part in INDEPTH workshops on health equity, twice in Ghana; migration and urbanization in South Africa; HIV surveillance in South Africa; multi-level analysis in Kenya; adult health and aging in South Africa; surveillance databases also in South Africa; and the annual scientific conference of INDEPTH in Ghana. A protocol on health insurance has been submitted to the Health Equity Working Group of INDEPTH.

Field Sites Unit

Kamalapur

The Kamalapur urban site is located in the southeast quadrant of Dhaka city, approximately 30 minutes' drive from ICDDR,B. Kamalapur, with an estimated population of 200,000 as of 2000 census (40,000 covered in the surveillance), has an integrated research infrastructure that supports a mosaic of research questions designed to identify the most important public-health needs of the emerging urban environment. These research questions may provide new insights in that these are both community-based and urban-centred. The research infrastructure includes: mapping and demographic surveillance (enumeration), active surveillance, clinical services, training, monitoring and evaluation. The specific research questions progress along two fronts: the first is the definition of disease burden and identification of risk factors, and the second is the conduction of specific interventions designed to assess the impact on those diseases.

Abhoynagar

Abhoynagar is located on the industrial belt of the Dhaka-Khulna highway in south-western Bangladesh. This is one of the oldest HSID rural sites, opened in 1982, where selected programmatic data are collected, and vital registration is carried out on a population of 22,259 in 4,752 households in 5 of 8 unions. Twelve personnel are involved in the surveillance and management of data collection, and 9 research and field support staff facilitate and support targeted research.

Mirsarai

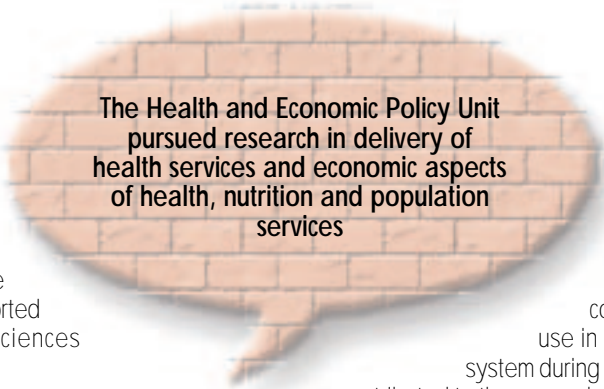
Mirsarai is located on the industrial belt of the Dhaka-Chittagong highway in south-eastern Bangladesh. Since its inception in 1994, a number of intervention studies have been completed. Mirsarai is one of the HSID rural field sites where selected programmatic data are collected, and vital registration is carried out on a population of 38,249 in 7,045 households in 7 of 16 unions. Twelve personnel are involved in the surveillance and management of data collection, and 10 research and field support personnel facilitate and support targeted research. During the year, several research projects were conducted in Mirsarai and/or Abhoynagar. These are: Flour fortification with vitamin A and iron in healthy school-age children; Meeting additional health needs of clients by addressing missed opportunities at the ESP clinics; Programmatic and non-programmatic determinants of low immunization coverage in Bangladesh; and Diarrhoea incidence case studies in support of scaling up zinc.

Infectious Diseases Unit

The Unit focuses its work at the Centre's field sites. During 2003, most infectious diseases work was carried out in Kamalapur. There are plans for expansion to other HSID field sites in the future. Highlights of the activities of the Unit are reported under the Infectious Diseases and Vaccine Sciences Programme.

Health Systems and Economics Unit

In 2003, the Health and Economic Policy Unit pursued research in delivery of health services and economic aspects of health, nutrition and population services. In December, the Unit was expanded through the transfer of staff from the Health Economics Unit in PHSD. It was renamed as the Health Systems and Economics Unit and consists of 20 researchers. The Unit will pursue health systems research which is broadly concerned with how people get access to healthcare, use, coverage, and health outcomes, and measurement of these through information systems, surveillance and surveys. Other key themes are ways of organizing, managing and financing delivery of health services. The Unit has also interests in demand-side financing strategies. Recent work on a hospital patient survey falls within the broad health systems research agenda of patient-provider relations and quality of care. The Unit continues to focus on projects under the Health and Family Planning Systems Programme, particularly those related to the Centre's priorities of evaluating alternative service strategies, economic analysis of programmes, improvement of health and



The Health and Economic Policy Unit pursued research in delivery of health services and economic aspects of health, nutrition and population services

family-planning services, information systems, and evidence-based planning of health systems. A particular example is a study conducted in 2003 on service use in the transition to a static clinic system during 1998-2002. The Unit has also contributed to the research of the Health and Family Planning Systems Programme (HFPS) on the effectiveness of specific interventions and programmes, for example, through evaluating a pilot of community health volunteers in urban areas, and use of a screening tool for identifying service needs in clinic settings. In the coming year, the Unit will seek to build on previous research, for example, by evaluating strategies for improving EPI coverage and assessing health service use in urban areas among slum dwellers and the homeless. Research on economic aspects of health was conducted in 2003, for example, on costs relating to illness due to shigellosis. The incorporation of new health economics staff in the Unit will enhance its capacity for research activities and for supporting research with an economics component in the Centre as a whole.

Family Health Research Project

The mission of the Family Health Research Project, within the context of the overall vision and mission of ICDDR,B is to improve the health of the people of Bangladesh by improving the effectiveness of the essential services package (ESP) that provides basic medical ser-

vices to the families with emphasis on improving services to vulnerable populations and on developing new, more cost-effective methods for using resources. This lies within the context of the National Integrated Population and Health Programme (NIPHP) goal to enhance the quality of life of poor and underprivileged members of the society by helping to reduce fertility and improve family health.

The scope of the research falls within the following broad headings:

- Population sciences
- Child health
- Reproductive health
- Nutrition
- Communicable diseases and vaccines
- Essential Services Package
- Improving equity

The main achievements in 2003 are described here under 4 broad headings: provision of research-generated information for policy-makers and

programme implementers, ongoing research projects, new concepts developed, and dissemination and administrative activities.

Provision of research-generated information for policy-makers and programme implementers

From the completed studies, evidence-based information was provided to policy-makers and programme implementers in the areas of RTI/STD diagnosis in women, improving reproductive health knowledge of adolescents, increased uptake of services to clinic clients, costs of treating malnutrition in children in the community, and improving performance of mid-level managers.

RTI/STD diagnosis

Recently completed studies demonstrated that neither the screening processes currently in use nor the use of blood tests performed by low-skilled workers were able to determine women with RTIs/STDs in need of treatment or referral from those who are not. As these diagnostic tests are used extensively both in NGO and government sectors of Bangladesh, the findings implicate that a major change in policy and programme management is required. This is particularly pertinent since a new treatment package for RTI/STDs in women has been introduced in NGO clinics making accurate diagnosis more important than ever. The Centre is working with the Government of Bangladesh and NGO Service Delivery Programme (NSDP) to pilot a rapid diagnostic test for syphilis.

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Adolescent boys receiving booklets in a rural Bangladeshi school



Reproductive health knowledge of adolescents

A working group developed a databank of frequently-asked questions relating to reproductive health issues. Results of an evaluation of the impact of the booklets on school-going young persons showed that the booklets *do* increase knowledge on certain reproductive health issues, especially in boys. Furthermore, the study generated information on the process of implementation of a culturally-sensitive initiative that is of key importance for the Government of Bangladesh as it expands the use of booklets countrywide.

Screening tool used for addressing unmet needs

Use of healthcare facilities by those in need is a major barrier to improving the health status of the population of Bangladesh. A screening tool was developed and tested that proved successful in increasing the services provided to clients based on need. Providers of services found the tool easy to use. The implications of the study are that, without additional staff, both government and NGOs can improve service provision at the sub-district level.

Community-based treatment of severely-malnourished children

An analysis of the costs incurred through a successful community-based intervention designed and evaluated to rehabilitate severely-underweight children was undertaken. The results of the analysis provide policy-makers with the information required to make decisions on the feasibility of community-based rehabilitation of severely-undernourished children.

A rapid assessment tool

At present, mid-level ESP managers are lacking in the tools required to allow them to be instrumental in identifying low-performing areas below upazilla level where action is required to increase the use of health services. A study demonstrated that a proposed assessment tool can provide accurate information to identify the low-performing areas that can be used by mid-level ESP managers.

Ongoing research projects

Nine studies were being conducted in 2003. A brief description of the relevance of each study is provided here:

Identifying determinants of plateauing of the fertility decline

Various sets of projections for Bangladesh indicate that the population will double even after reaching replacement fertility level. The recent stalling of the fertility decline throws doubt on when replacement level will be reached and, thus, on the intermediate and final population size. This study is being conducted to understand if this fertility plateau is 'real', and if so, what factors underlie it. It is also urgent to understand what social policies and programmatic options are available to minimize the massive future population growth built into the momentum resulting from the young age structure.

Acceptability, effectiveness, and cost of three delivery strategies

Despite adoption of a strategy by GoB to train the existing paramedics to ensure basic obstetric care to the majority of women, over 90% of deliveries take place at home and under unskilled attendance. In addition, it is unclear whether the paramedics should conduct deliveries at home or in facilities. It is, therefore, crucial to establish whether providing such care in facilities is feasible, acceptable, and more cost-effective



Depot-holder is providing family planning services to a client

than maintaining a system whereby community midwives are visiting women in their homes. It is also important to assess the validity of the tools currently being used for monitoring and evaluating safe motherhood strategies.

Community-based component of the evaluation of the health and economic impact of the IMCI strategy in Bangladesh

Integrated Management of Childhood Illness (IMCI) is a global strategy, also adopted in Bangladesh, which targets the major causes of ill health and death of children in developing countries. In addition to improvement of skills of clinical service providers and health systems, IMCI also focuses on improving key family and community practices. ICDDR,B is implementing with GoB an evaluation of IMCI in Matlab as

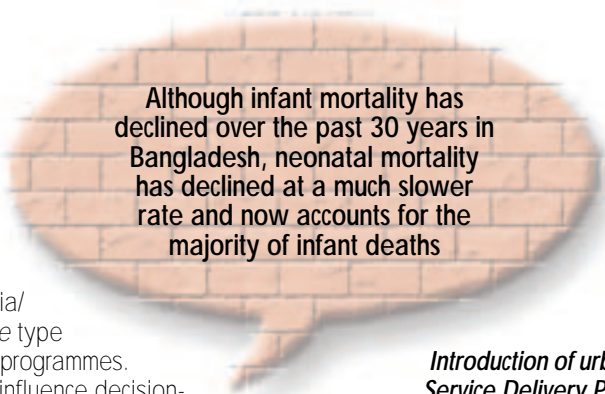
part of the Multi-country Evaluation of IMCI supported by WHO and USAID. As part of this effort, USAID/Dhaka is supporting the development and evaluation of the community component of IMCI. A preliminary strategy has been developed and is being implemented. This strategy now also forms the basis of the national community-IMCI strategy to be further developed and implemented by GoB and NGOs.

An effectiveness study of *Haemophilus influenzae* type b vaccine

Infants in developed countries have the opportunity to be protected against pneumonia/meningitis caused by *Haemophilus influenzae* type b (Hib) through integrated, routine vaccination programmes. This study will provide a vital contribution to influence decision-making in both national policy and programme in the introduction of Hib vaccine in Bangladesh as a worthwhile use of scarce resources. As part of GAVI, resources are potentially available to Bangladesh to introduce the Hib vaccine. Good data on need and cost-effectiveness are essential, which this study is designed to provide.

Community-based interventions to reduce neonatal mortality in Bangladesh

Although infant mortality has declined over the past 30 years in Bangladesh, neonatal mortality has declined at a much slower rate and now accounts for the majority of infant deaths. The vast majority of newborns spend their first days in the home environment and are not easily reached by health services. Effective strategies will require a mix of safe delivery and safe newborn care practices with a strong emphasis on provision of good quality care and communication. This research, a collaborative effort with Saving Newborn Lives Initiative and Johns Hopkins University, Shimantik (an NSDP NGO), and other



Although infant mortality has declined over the past 30 years in Bangladesh, neonatal mortality has declined at a much slower rate and now accounts for the majority of infant deaths

partners, aims to provide information required to significantly reduce neonatal mortality through community-based interventions.

Introduction of urban depot-holders under the NGO Service Delivery Programme

The NGO Service Delivery Programme (NSDP) supports 41 local NGOs to deliver ESP in Bangladesh through urban and rural static and satellite clinics and uses about 8,700 female service providers/promoters, known as depot-holders, in rural areas. This study will provide a baseline evaluation of depot-holders as they are being introduced in urban areas, which will allow for monitoring of changes in practice over time.

Programmatic and non-programmatic determinants of low immunization coverage

While Bangladesh has improved coverage of the 5 childhood immunizations, there is still room for improvement. It is of particular concern that a large proportion of those who receive initial doses do not continue to become fully vaccinated. The findings of this study will provide information required for the design of new interventions, or adaptation of the existing systems, to increase the proportion of fully vaccinated children.

Introduction of new hypo-osmolar ORS to routine use

A new, improved oral rehydration solution (ORS) has been tested at the Centre and is now recommended by the World Health Organization and UNICEF. However, along with the recommendation for its widespread use was the recommendation that the risk, if any, of symptomatic hyponatraemia in patients with diarrhoea treated with the new hypo-osmolar ORS be examined. By the end of the study, over 60,000 patients will have received ORS under close supervision for symptoms of hyponatraemia (especially seizures). Furthermore, any unexpected problems with the routine use of the new ORS will have been identified.

Levels, trends, and determinants of unwanted pregnancies in rural Bangladesh

An assessment of unwantedness status of pregnancy based on the information available from surveillance data collected over the past 20 years can help estimate the levels and trends in unwanted childbearing over this period and help investigate factors associated with unwanted childbearing among women/couples in the study areas.



A large family in rural Bangladesh

This information, to be available in early 2004, will provide preliminary evidence on the health and social consequences of unwanted childbearing. Preliminary data suggest that more than 30% of pregnancies are not intended. If effective contraception was used by these families, the fertility rate could drop significantly. Furthermore, the study is exploring the possibility that these 'unwanted children' may suffer from higher morbidity and mortality and slower development.

Changes in use of health and family-planning services in two rural upazilas during transition to a new system of service-delivery, 1998-2002

The main objective of the 5-year Health and Population Sector Programme (HPSP) for 1998-2003 and the static clinic system of service-delivery was to improve access to ESP in rural areas. This study will investigate changes in use and coverage of selected ESP and facilities in two rural upazillas in relation to changes that occurred in the service-delivery system from 1998 to 2002. Findings will be available to

inform policy decision-making for Health, Nutrition and Population Sector Programme.

New concepts developed

New concepts were developed that adhered to the guidelines of the Cooperative Agreement (CA). Of the 34 concepts submitted, 7 are under consideration for funding. The mechanism for development of concepts is moving towards a demand-led approach, feeding into policy. The establishment of an agreed mechanism with both government health programme planners and USAID-supported NGO service-delivery is planned for early 2004.

Dissemination activities

A broader approach to dissemination was introduced in 2003. Technical Interest groups, built on the notion of a technical advisory committee in CA, were an integral part of each study. The group members comprise those likely to use the findings of research. These meetings provide advice on how to best link the study results to the development of health policy and clarify their



The HSB team at work

implications for further research. Furthermore, the interest groups were instrumental in the design of and participation in the dissemination seminars. The work of the project areas of research and findings were disseminated through a desk calendar and through participation in the America Week promotion event. More detailed information on the findings of research was provided to GoB and relevant persons and organizations through articles in the Health and Science Bulletin and through the continued publication of working papers.

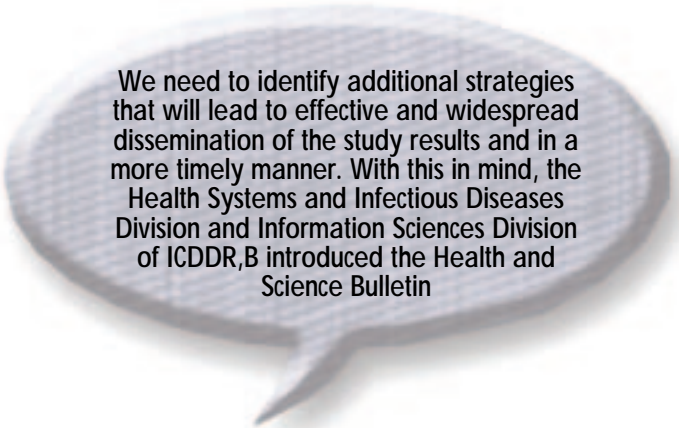
Health and Science Bulletin

A significant proportion of research carried out over the past 25 years at ICDDR,B has produced findings of direct relevance to health practitioners and decision makers in Bangladesh. Unfortunately, the results of this research do not readily reach them. Typically, research findings are published in international scientific journals or are presented at conferences with limited local participation. These forums do not reach the vast majority of health practitioners, policy makers, public health professionals and non-government organizations working for the people of Bangladesh. It was concluded that we need to identify

additional strategies that will lead to effective and widespread dissemination of the study results and in a more timely manner. With this in mind, the Health Systems and Infectious Diseases Division and Information Sciences Division of ICDDR,B introduced the Health and Science Bulletin (HSB) in late 2002. This is a quarterly publication that is sent out to over 7,500 professionals in Bangladesh, but is also distributed internationally. In 2003, each of the HSB issues came out on time and was distributed as planned.

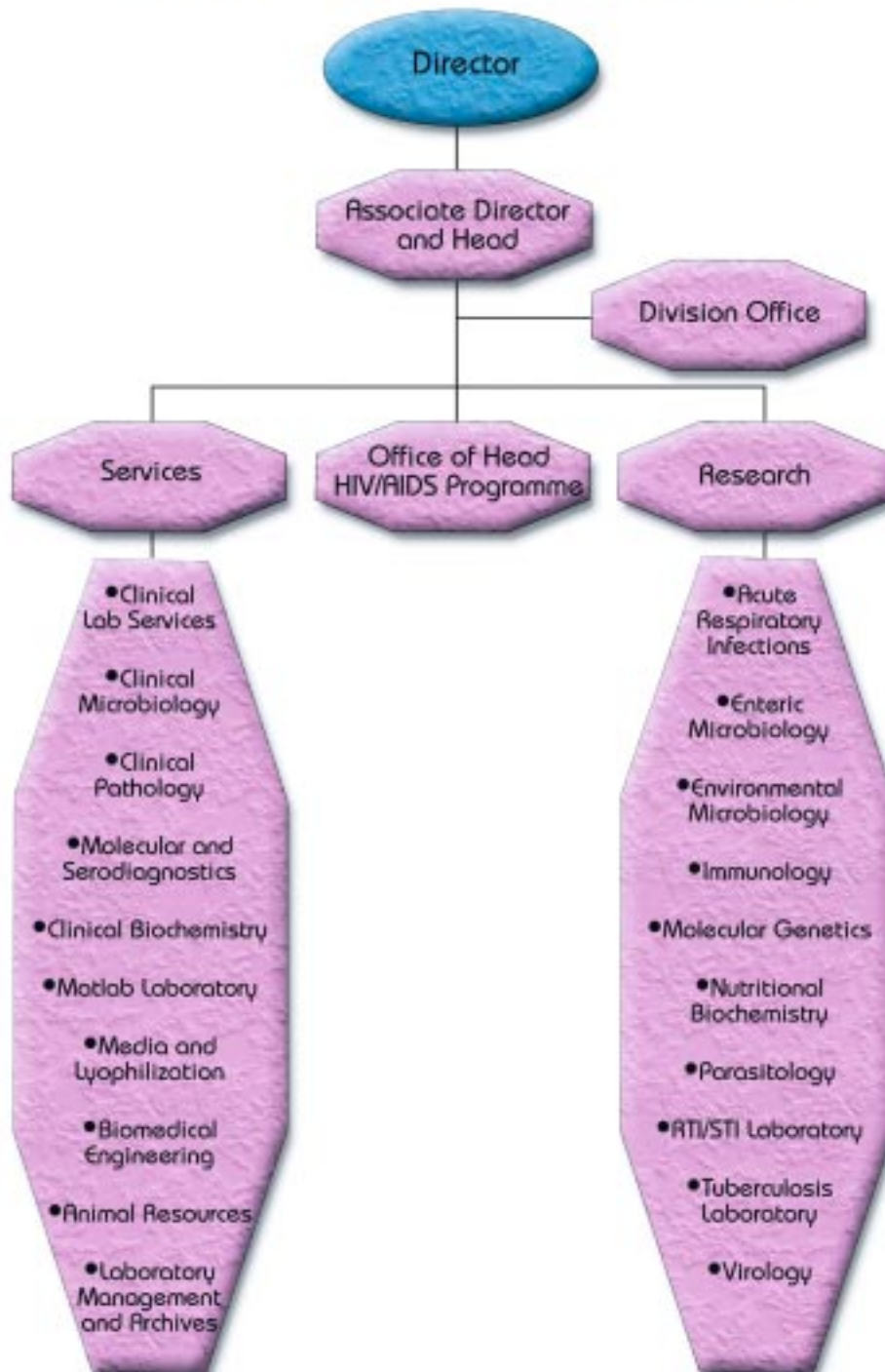
Administrative activities

Mr. Shihab Ahmed replaced Mr. Akhter Ahmed as Coordination Manager of FHRP. Under the leadership of Mr Shihab Ahmed, the FHRP Coordination Unit continued to provide support to FHRP scientists. This included: scientific support on health systems research by the operations scientists both in development of proposals and report writing and dissemination of findings; logistic support to scientists in conducting studies; budgetary advice in preparation and maintenance of budgets under FHRP; and ensuring adherence to the USAID regulations.



We need to identify additional strategies that will lead to effective and widespread dissemination of the study results and in a more timely manner. With this in mind, the Health Systems and Infectious Diseases Division and Information Sciences Division of ICDDR,B introduced the Health and Science Bulletin

Laboratory Sciences Division



**Associate Director and Head
G.B. Nair**



Laboratory Sciences Division

The mandate of the Laboratory Sciences Division (LSD) is to apply science to alleviate disease. The Division has 10 research units. The Division also has 5 diagnostic service laboratories and 4 technical support units which provide essential diagnostic and technical services to the Centre's research projects and to the public at large. The Molecular Serodiagnostic Laboratory is a recent addition to the Dhaka-based Clinical Laboratory Services. Another diagnostic laboratory will start functioning at Chakaria, Chittagong, to provide clinical diagnostic services to the southeastern part of Bangladesh. The scientists of the Division run independent research projects, extend support to other projects within and between divisions and programmes of ICDDR,B, provide in-house, regional, national and international training, act as overseas consultants, and also extend service facilities within and outside the country when required. The range of research activities of LSD includes: use of a simple water filtration process through sari cloth folded 8 times for controlling cholera; monitoring of antimicrobial resistance in Nepal; increase of awareness to control HIV/AIDS in Bangladesh; and improvement of the laboratory capacity for HIV detection in Nepal. The scientists of the Division have actively participated in dissemination of research techniques through a Howard Hughes Medical Institute (HHMI)-supported Advanced Laboratory Training. They presented several papers at the 10th Asian Conference on Diarrhoeal Diseases and Nutrition (ASCODD) and U.S.-Japan Conference on Emerging Infectious Diseases organized in December 2003 in Dhaka.

The Division's unique human resources comprise 4 international scientists, 1 adjunct scientist, 15 national scientists, and 298 technical

and support service personnel, of whom 76 are female and 242 are male. Among them, 174 are fixed-term employees, and 85 are on Contractual Service Agreements (CSA), while 59 are daily wagers. Based on performance, the Scientific Ranking Committee promoted Mr. Ansaruzzaman and Dr. Kaisar Ali Talukder to the rank of Associate Scientist. Mr. Zeaur Rahim, Associate Scientist and Ms Sayera Banu, Assistant Scientist, were awarded PhD degrees by the University of Dhaka in 2003. Dr. Khairun Nessa joined as Assistant Scientist and Head, Molecular Serodiagnostic Laboratory of the Clinical Laboratory Services and Dr. Munirul Alam joined as a Consultant for the ecology part of the NIH-funded project "Epidemiology and ecology of *V. cholerae* in Bangladesh." Eight LSD personnel are pursuing PhD and Masters degree in different countries, and 3 returned in 2003 after obtaining short-term training.

Twenty-five scientists and senior technical staff of LSD travelled overseas during the year to participate in scientific meetings, seminars, and workshops and attend short-term training. Scientists from different research institutions and funding agencies visited LSD either for discussion on various collaborative research activities or for initiating new research collaborations.

In 2003, LSD completed 6 protocols and initiated 8 new protocols. The number of ongoing protocols was 37, of which 4 involved cross-divisional research activities, 2 each with the Clinical Sciences Division and the Public Health Sciences Division. Four were related to scientific/technical services with Nepal and Mozambique. The Division provided technical support for assessing the capacity of 18 labo-

New Programme at LSD

Activities on HIV/AIDS started in ICDDR,B during the early nineties when a group of scientists from the Public Health Sciences Division and Clinical Sciences Division got together to form a working group to understand the issues around HIV/AIDS and to develop skills. In 1996, the Ford Foundation provided a grant to support various activities, including the development of a system for safe blood transfusion at the



HIV/AIDS Voluntary Counselling and Testing Unit on the ICDDR,B Dhaka campus

Dhaka and Matlab hospitals, setting up laboratory facilities for HIV testing within the Virology Laboratory, conducting some unlinked, anonymous testing for HIV, and for training and education of staff on HIV/AIDS.

In 1997, discussions among the Government of Bangladesh (GoB), UNAIDS, and ICDDR,B were initiated on the development of a systematic second-generation surveillance for HIV and risk behaviours in Bangladesh. The surveillance was launched in 1998 with the Social and Behavioural Sciences Programme of the Public Health Sciences Division (PHSD) conducting the behavioural surveillance and the Virology Unit of the Laboratory Sciences Division (LSD) conducting the serological surveillance, both on behalf of GoB. Since then, the surveillance has been carried out annually and has provided key information on the potential of an epidemic in Bangladesh. Around the same time, research activities on STI/HIV/AIDS were being conducted primarily by scientists at PHSD. Other divisions (LSD in particular) were gradually involved actively not only in the surveillance but also in research and provision of voluntary counselling and testing (VCT) services for HIV. Scientists working on HIV/AIDS in the Centre are working alongside the National AIDS and STD Programme of the Directorate General of Health Services under the Ministry of Health and Family Welfare, GoB. Data emanating from ICDDR,B, along with some key services provided, have brought ICDDR,B to the forefront of HIV/AIDS-related activities in the country and in the region. Activities on HIV/AIDS are expanding rapidly at ICDDR,B and, therefore, for better coordination, ICDDR,B has started a programme on HIV/AIDS from 1 April 2003 housed at LSD.

ratories for HIV/AIDS testing and also provided technical expertise for antimicrobial resistance surveillance to 9 participating laboratories in different parts of Nepal and for cholera risk-management activities in

Absorption Spectrophotometer for detection of arsenic in biological specimens. All components of the Division are linked to the local area network for online laboratory management and Navision-Suchona, a

Mozambique. New collaborations were initiated with the Centre for Southeast Asian Studies of Kyoto University in Japan, Institut Pasteur, Paris, France, and the University of Dhaka, Bangladesh, for the ecology and environmental microbiology-related protocols.

The scientists of LSD published 40 papers and 3 review articles in different peer-reviewed journals having excellent impact and also submitted 30 abstracts for presentation at international scientific seminars and workshops.

Extensive renovation work was undertaken to improve the Enteric Bacteriology Laboratory, Immunology Laboratory, T.B. Laboratory, Training Laboratory, and Molecular Serodiagnostic Laboratory. The Division installed an ABI 310 Applied Biosystems automated DNA sequencer, Real Time PCR, and Gel Documentation equipment to conduct molecular research activities. Clinical Diagnostic Services added another Atomic

new MIS software for project monitoring, management, and administrative activities in the Division and the Centre.

Antimicrobial resistance surveillance on some bacterial pathogens in Nepal: a technical cooperation

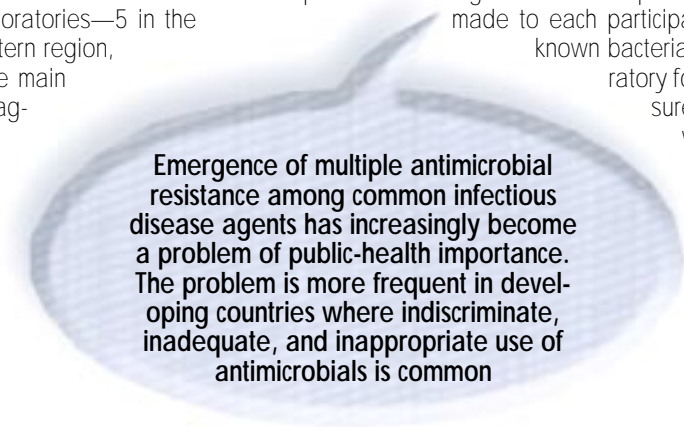
Emergence of multiple antimicrobial resistance among common infectious disease agents has increasingly become a problem of public-health importance. The problem is more frequent in developing countries where indiscriminate, inadequate, and inappropriate use of antimicrobials is common, resulting in more frequent treatment failures in places where capacity of the diagnostic microbiology laboratory is limited due to the lack of technical manpower and inadequate laboratory support services.

To help develop the capacity of the Ministry of Health, His Majesty's Government of Nepal, to control infectious diseases, the USAID–Nepal Mission launched an infectious disease programme. A laboratory-based surveillance on some selected infectious diseases, initiated in 1999, continued up to 31 December 2003. The scientists of LSD provided technical support to 9 laboratories—5 in the Kathmandu valley, 3 in the Western region, and 1 in the Eastern region. The main activity was to strengthen their diagnostic capacity for surveillance of antimicrobial resistance on selected bacterial pathogens of priority infectious diseases.

These were *Vibrio cholerae* and *Shigella* to represent diarrhoeal diseases, *Salmonella pneumoniae* and *Haemophilus influenzae* to represent acute respiratory infection, and *Neisseria gonorrhoeae* to represent sexually transmitted diseases. The activity also included assistance to develop an external quality-control network involving the 9 laboratories and to train the technical manpower as part of technology transfer.

In 2003, essential laboratory supplies were provided, and follow-up technical visits were made to monitor and evaluate the progress of the activities and to suggest remedies for problems faced by them. One yearly workshop was conducted to train and retrain the manpower as part of manpower development and technology transfer. The previously-trained technical staff facilitated such a workshop under the expert guidance of the laboratory scientists of ICDDR,B. Hands-on-training was provided through a number of courses.

In 2003, one hands-on training workshop was conducted in Kathmandu for 22 laboratory technologists and microbiologists working in various hospitals in Nepal. Four technical visits were made to each participating laboratory. Four batches of unknown bacterial strains were provided to each laboratory for assessing the proficiency and to assure external quality. Bacterial isolates were obtained from the participating laboratories for validation (as part of quality control) of their identification and antimicrobial suscepti-



Emergence of multiple antimicrobial resistance among common infectious disease agents has increasingly become a problem of public-health importance. The problem is more frequent in developing countries where indiscriminate, inadequate, and inappropriate use of antimicrobials is common

bility testing. In total, 198 bacterial isolates were obtained, of which 101 were *V. cholerae*, 38 *Shigella*, 40 *S. pneumoniae*, 18 *H. influenzae*, and 14 *N. gonorrhoeae*. The validation scores varied between the laboratories and ranged from 85% to 95%.

Assessment of laboratory capability to test for HIV in Nepal

ICDDR,B conducted a survey of 17 laboratories in different regions of Nepal to assess the capabilities of those laboratories for conducting HIV tests for the purposes of surveillance and voluntary counselling and testing (VCT). The seventeen laboratories were surveyed during 12-15 October 2003 and included those of His Majesty's Government of Nepal Ministry of Health (HMGMOH) and the Nepal Red Cross Society. Sixteen laboratories were surveyed as sentinel laboratories, while one—the National Public Health Laboratory (NPHL)—was surveyed to assess its capacity as a reference laboratory. Assessment was done by 5 teams, each with two members from ICDDR,B, and 3 of which were accompanied by one HMGMOH personnel. Each team covered several laboratories in different regions of Nepal. For each laboratory, a pre-set questionnaire was used—one for the sentinel laboratories and one for the reference laboratory. A report on the assessment has been submitted to USAID Nepal.



ABI Prism 310 automated genetic analyzer dedicated for high throughput genomic and molecular studies, molecular diagnostics, antimicrobial resistance mechanism study, population genetics study, and characterization of new bacterial genotypes.

and quantitative PCR diagnosis of infectious disease agents, development of molecular diagnostics, and mutation detection and for clinical and applied genetics. In addition, the Virology Laboratory has recently procured a Fluorescent Activated Cell Sorter (FACS). FACS is used mostly for enumerating leukocyte subsets through numerous software that are installed. Enumeration of leukocyte subsets is relevant for diagnostics purposes, such as in leukaemia, staging of AIDS, and other important applications. In addition, more sophisticated research using multi-colour analysis is possible with this equipment. Examples include, studies on chromosomes, DNA content of cells, intracellular calcium, and analysis of platelets. Maintenance of these high-tech equipment is volunteered by different laboratories and is accessible to all laboratories and divisions across the Centre. LSD is continuing to strive to purchase other high-tech equipment which will enable scientists to perform all modern tests in ICDDR,B.

Optimizing Laboratory Productivity

In recent years, there has been an increasing demand for infrastructure and equipment essential for high throughput genomic and advanced genetic studies. To cope with this demand, the RTI/STI Laboratory has recently procured an ABI 310 Applied Biosystems automated DNA sequencer. This opens up the horizon for DNA sequencing across different units of the Centre. The sequencer is being used for population genetics studies, novel mutation detection for antimicrobial resistance, characterization of new genotypes, and virulence factors and for molecular diagnosis. The Parasitology Laboratory has recently procured a Real Time PCR for rapid

Population-based evaluation of *Shigella* infections in an urban area of Dhaka, Bangladesh

This community-based surveillance for cases of dysentery due to *Shigella* is being conducted in the Kamalapur urban surveillance area. The study facilitated the estimation of: (a) burden of shigellosis in terms of its incidence, prevalence, and complications, (b) age- and cause-specific mortality among people of all ages and gender, and (c) circulating serotypes and sub-serotypes in the community. The study also monitored antimicrobial resistance.

In total, 2,228 diarrhoeal patients were enrolled during January-December 2003. Of 382 clinical isolates (17%), *Shigella* was found in 312 cases (14%). Of the shigellosis cases, *Shigella flexneri* was the most frequently isolated (49%), followed by *S. boydii* (21%), *S. dysenteriae* other than type 1 (10%), *S. sonnei* (12%), and nontypable *Shigella* spp. (7.0%). In addition, there were 23 cases of cholera caused by *V. cholerae* O1, 4 *V. cholerae* non-O1 and non-O139, one each of *V. parahaemolyticus*, *V. mimicus*, and *V. fluvialis*, 22 *Salmonella* spp., and 18 *Hafnia alvei*. Serotyping and subserotyping were done for 171 strains of *Shigella*. Of the *S. flexneri*, the predominant subserotype was 2a (28.2%), followed by 3a (27.2%); of the *S. boydii*, serotype 14 was the most frequent (23.4%), followed by serotype 12 (17%); of the *S. dysenteriae*, serotype 9 was the most frequent, followed by type 2 and 14 (20% each) and *S. sonnei* phase II (73%). No *S. dysenteriae* type 1 was isolated. Most shigellosis patients, irrespective of age, presented with watery stool (50.4%), followed by mucoid (38.9%) and blood-mixed stool (10.6%). In contrast, *Shigella* strains were isolated from 22 (4.5%) of 503 non-diarrhoeal control cases.

Acute Respiratory Infections Laboratory

Head: Mahabubur Rahman

Acute lower respiratory infection (ALRI), primarily pneumonia, is a leading cause of morbidity and mortality among children, aged less than 5 years, in Bangladesh. About 25% of all deaths of children aged less than 5 years and

about 40% of deaths of infants in Bangladesh are associated with pneumonia. *S. pneumoniae* and *H. influenzae* frequently cause pneumonia. The present hospital-based surveillance in urban Dhaka was carried out to study the epidemiology of pneumonia and antibiotic resistance among bacterial pathogens of pneumonia in children aged less than 5 years for better case management, to disseminate relevant information in a timely manner, and to improve the use of such data for policy decisions, particularly in the ARI control programmes of the Government of Bangladesh.

Enteric Microbiology Laboratory

Head: G. Balakrish Nair

The Enteric Microbiology Laboratory conducts research in the development and application of phenotypic and molecular techniques to identify and characterize diarrhoeagenic organisms from clinical sources and the environment. The techniques used in this Laboratory include gel electrophoresis (conventional agarose gel electrophoresis, pulsed-field gel electrophoresis (PFGE), polyacrylamide gel electrophoresis), nucleic acid preparation, hybridization using non-radioactive probes, ribotyping, oligonucleotide preparation by Oligo 1000 DNA Synthesizer, DNA amplification by polymerase chain reaction (PCR), and fluorescent actin-



Identification of enteric pathogens being demonstrated in the Enteric Microbiology Unit

Considering the importance and interest in *H. pylori* and related pathogens, LSD has developed a dedicated *H. pylori* laboratory for conventional and molecular diagnosis of infection, molecular characterization of strains, monitoring of antimicrobial susceptibility, and population genetics studies of *H. pylori*

staining test (FAST). Diagnostic techniques routinely used include conventional bacteriological culture method, ELISA, tissue culture assay, phage isolation and characterization, colony blot hybridization, DNA probe and PCR assays for rapid identification of diarrhoeal pathogens. Genetic fingerprinting of pathogenic bacteria is done using plasmid analysis, enterobacterial repetitive intergenic consensus-PCR (ERIC-PCR), random amplification of polymorphic DNA (RAPD), PFGE, Ribotyping, PCR-RFLP, RFLP of O-Ag sequence by long PCR as an aid to epidemiological studies. Experiments with animal model for studying mechanisms of pathogenicity are conducted and antisera for bacterial identification are raised in this laboratory. Extensive studies are being carried out by the investigators of this laboratory on the phenotypic and molecular epidemiology of *Vibrio cholerae*, *V. parahaemolyticus*, *Campylobacter*, *E. coli* (especially on Shiga-toxin-producing *E. coli*), *Shigella*, *Salmonella*, *Aeromonas*, and *Helicobacter pylori*. Studies on the mechanisms of antibiotic resistance of *Shigella* and *Salmonella typhi* are also ongoing. National and international fellows are frequently given training on various molecular aspects. MSc, M Phil and PhD students are doing their theses routinely under the supervision of scientists in collaboration with various universities of Bangladesh as well as other parts of the world.

***Helicobacter pylori* Laboratory**

PI: Motiur Rahman

This laboratory is an extension of the Enteric Microbiology Laboratory. *Helicobacter pylori* infection is one of the most common gastric

infections in Bangladesh. Considering the importance and interest in *H. pylori* and related pathogens, LSD has developed a dedicated *H. pylori* laboratory for (i) conventional and molecular diagnosis of infection, (ii) molecular characterization of strains, (iii) monitoring of antimicrobial susceptibility, and (iv) population genetics studies of *H. pylori*.

Current data suggest that approximately 75% of patients referred for upper gastrointestinal endoscopy are infected with *H. pylori*. The Laboratory has been monitoring the antimicrobial resistance patterns of *H. pylori* against commonly-used drugs, such as clarithromycin, amoxicillin, tetracycline, and metronidazole, for treatment of *H. pylori*-associated infection. Currently, 10% of isolates are resistant to clarithromycin, and 75% are resistant to metronidazole. Molecular analysis of clarithromycin-resistant isolates in the laboratory revealed a novel point mutation at 2181 position in the *H. pylori* 23S rRNA gene that contributes to the strains becoming resistant to clarithromycin.

Environmental Microbiology Laboratory

Head: Md. Sirajul Islam

The Environmental Microbiology Laboratory conducts research on the ecology and epidemiology of *V. cholerae*. A study in collaboration with the Northumbria University, UK and the Ministry of Health, Mozambique, is attempting to determine whether similar environmental factors that contribute to epidemics of cholera in Bangladesh also exist in Mozambique. Its overall aim is to transfer technology from

ICDDR,B to the Centre for Environmental Hygiene and Medical Exams (CHAEM), Beira, to combat cholera and other diarrhoeal diseases that occur at regular intervals in Mozambique. In another collaborative study with Stanford University, California, USA, investigations are being carried out in the Matlab Health and Demographic Surveillance area to determine whether *V. cholerae* O1 can form biofilms in the aquatic environment to survive during the inter-epidemic periods. In another collaborative study with Dartmouth Medical College, New Hampshire, USA and University of Maryland Biotechnology Institute, an investigation is being carried out to determine the temporal dynamics of gene expression and regulation under the different environmental conditions. The overall aim of the latter study is to establish an *in situ* incubation experiment in Bangladesh that measures gene expression in bacteria as a function of seasonal variation in the environmental conditions in natural systems. A laboratory-based experiment is being undertaken to investigate the role of physicochemical parameters in the association of cyanobacteria and *V. cholerae* in collaboration with the Johns Hopkins University of USA.

Immunology Laboratory

Head: Firdausi Qadri

Investigators of this laboratory are involved in immunological studies on infectious diseases and nutritional studies relating to micronutrient deficiency to understand its effect on the immune status of infants

and children and their growth and development. Protection from infections is targeted by developing vaccines and inexpensive and novel alternative strategies that can be implemented in Bangladesh.

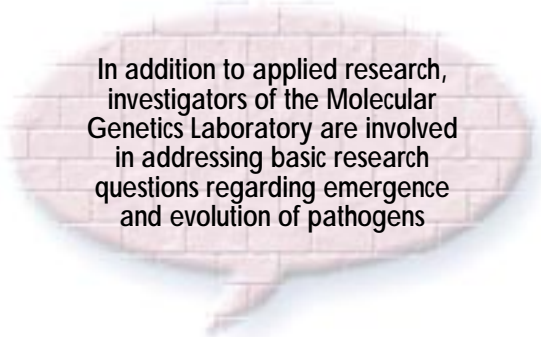
The sphere of interest includes pathogens from non-invasive to intracellular invasive ones for a better understanding of the immunological components leading to pathogenesis or protection. The major interest at present includes research on diseases caused by *Shigella* spp., *V. cholerae*, *V. parahaemolyticus*, enterotoxigenic *E. coli*, *S. enterica* serovar Typhi, *Mycobacterium tuberculosis*, and *H. pylori*. Immunodiagnostic tools are being developed both to detect pathogens and to determine infections in symptomatically- and asymptotically-infected individuals. Efforts are being made to better determine immune correlates of protection that can be tested in vaccinology.

The effect of malnutrition, including that of zinc, iron, and vitamin A deficiency, and low birth-weight on the prognosis of infectious diseases and on the immune status of infants and children are also

being investigated. The relationship of different environmental factors on innate and active immunity is being evaluated to provide interesting insights not only into natural infections but also into vaccine efficacy.



*Immunologists
in action and in
contemplation*



In addition to applied research, investigators of the Molecular Genetics Laboratory are involved in addressing basic research questions regarding emergence and evolution of pathogens

The Laboratory is continuously developing and updating research skills and techniques so that the state-of-art quality of work is maintained. Eight funded protocols are ongoing with a few more in the pipeline. Active collaborations with lab scientists, including those in Sweden, USA, Japan, France, and Germany, have helped keep the Laboratory abreast of new developments. In addition, junior researchers are undertaking training in different laboratories worldwide which will further strengthen the existing capabilities.

Molecular Genetics Laboratory

Head: Shah M. Faruque

The Molecular Genetics Laboratory is involved in the development and application of molecular techniques to identify and characterize diarrhoeagenic organisms. The technical facilities available in this laboratory range from gel electrophoresis, DNA hybridizations using both radio-labelled and non-radioactive probes, to the more sophisticated techniques of DNA amplification by PCR. In addition, advanced techniques of DNA sequencing and microarray analysis are conducted through collaboration with various international institutions. Recent diagnostic techniques routinely used include: DNA probe assays of diarrhoeal pathogens, genetic fingerprinting of pathogenic strains as an aid to epidemiological studies, and PCR assays for rapid identification of diarrhoeal pathogens.

In addition to applied research, investigators of the Laboratory are involved in addressing basic research questions regarding emergence

and evolution of pathogens. Research in this laboratory has contributed considerably to the understanding of the emergence and evolution of pathogenic *V. cholerae* strains and factors controlling epidemics of cholera. Development and evaluation of a suitable cholera vaccine is also under progress. Among other research activities, environmental occurrence and biology of diarrhoeal pathogens, including *Shigella* and diarrhoeagenic *E. coli*, are also being investigated.

Nutritional Biochemistry Laboratory

Head: M.A. Wahed

In total, 9,543 tests were performed in 2003 to support 16 research projects in the Laboratory. Serum retinol assay was done for a research project of the Chittagong Medical College. Estimation of short-chain fatty acids was established using high-performance liquid chromatography. As part of good laboratory practice, procedure, techniques, and quality control are now formatted in a manual. Development of software for a laboratory management system is in progress. Preparation of demo report of the inventory control system is completed. Serum stability test for various parameters in the Laboratory has been started. The Laboratory continued its performance with the external quality assurance programme conducted by the National Institute of Standards and Technology, Washington, DC, USA, and the performance for 2003 has again been very good. The Laboratory also participated in the VITAL-EQA (External Quality Assurance) programme conducted by the Centers for Disease Control and Prevention, USA, from 2003.

The Laboratory hosts one PhD student from the Human Nutrition Department, The Royal Veterinary and Agricultural University, Copenhagen, Denmark. Mr. Anjan Kumar Roy completed the MS Access course during April-May 2003 at ICDDR,B. Mr. M.A. Wahed attended two conferences—IVACG in Morocco and ACN in New Delhi—in February 2003. He also participated in the Regional Expert Consultation of the Asia-Pacific Network for Food and Nutrition on Food Composition Activities, Thailand, in November 2003 as a chairperson. He was also the keynote speaker at the Nutrition Advocacy Workshop participated by division-level officers in Sylhet.

Parasitology Laboratory

Head: Rashidul Haque

The Parasitology Laboratory is primarily working on amoebiasis and has recently started to work on malaria and leishmaniasis. The work on epidemiology and immunity of amoebic infection is being conducted in collaboration with the University of Virginia, USA. The work on malaria and leishmaniasis is being conducted in collaboration with other divisions at ICDDR,B, Centers for Disease Control and Prevention, USA, and Armed Forces Research Institute of Medical Sciences (AFRIMS), Thailand. The Laboratory provides diagnostic support to different projects and is involved in training activities of the Centre.

The Laboratory is currently conducting studies to understand human immunity to amoebiasis among children in Bangladesh. The major aims of these studies are to understand innate and acquired immu-

nity to *Entamoeba histolytica*-associated infection. A prospective cohort study is being conducted to achieve the goals of these studies. Epidemiological and clinical characteristics of acute diarrhoea with emphasis on infections due to *E. histolytica* among preschool children in an urban slum of Dhaka, have been studied. Recently, it was also found that, along with mucosal anti-CRD IgA antibodies, human genes underlying susceptibility to intestinal infection with *E. histolytica*.

To understand the malaria drug resistance in Bangladesh, a study was begun in collaboration with the Health Systems and Infectious Diseases Division (HSID) and the Public Health Sciences Division of ICDDR,B and AFRIMS. The Laboratory is providing support for diagnosis of leishmaniasis to the protocol titled "Community-based epidemiologic study of visceral leishmaniasis in Bangladesh." The study is being undertaken by HSID of ICDDR,B in collaboration with CDC to understand the transmission patterns, identify risk factors for leishmaniasis, arrange community-based health education and diagnosis of preclinical infection in Bangladesh.

RTI/STI Laboratory

Head: Motiur Rahman

The RTI/STI Laboratory and its sentinel laboratories in Chittagong, Dhaka, Jessore, and Sylhet are conducting epidemiological studies of RTI/STI among different population groups and are monitoring antimicrobial susceptibility of *N. gonorrhoeae* in Bangladesh. The Laboratory has extended its activity to Nepal and has assisted USAID-



RTI/STI Lab, the hub for STI research in Bangladesh

Nepal in setting up laboratories for diagnosis of STIs and monitoring antimicrobial susceptibility of *N. gonorrhoeae*. The Laboratory provides diagnostic services to national and international STI projects, including HIV and STI surveillance in Nepal.

In parallel to nationwide epidemiological surveillance on RTI/STI, the Laboratory is involved in a number of intervention studies, including "Combined intervention against LBW", training of national and international staff on diagnosis of RTI/STI, and national HIV surveillance. To cope with the advanced diagnostics and high throughput genomic, the Laboratory has recently commissioned the Centre's first DNA sequencing facility. The DNA sequencing unit provides sequencing facilities across the Centre and harbour the Centre's core expertise in bioinformatics. The Laboratory contributes significantly to the Centre's efforts to release data of public-health importance by publishing *N. gonorrhoeae* antimicrobial resistance data routinely in the Health and Science Bulletin of ICDDR,B.

The Laboratory works as a focal point for Bangladesh in the Global Network for Perinatal and Reproductive Health and Gonococcal Antimicrobial Susceptibility Programme of WHO. The Laboratory is also involved in providing consultancy services to national and international projects on RTI/STI.



Scientists working in the Tuberculosis Laboratory

Tuberculosis Laboratory

Head: Zeaur Rahim

The Tuberculosis Laboratory, established in June 2001, has recently been renovated into a complete P3 facility. The Laboratory is equipped with adequate instruments for conducting rapid culture using mycobacteria growth indicator tube and conventional culture and susceptibility testing, PCR-based deletion analysis for identification of *Mycobacterium* spp., spoligotyping, mycobacterial interspersed repetitive units typing, rapid immunological diagnostic test of pulmonary tuberculosis, laboratory diagnosis of paediatric tuberculosis, using gastric aspirate, etc. The Laboratory is collaborating with the Clinical Sciences Division and Public Health Sciences Division of ICDDR,B for research relating to hospital and community-based TB studies. It is jointly working with the National TB Reference Laboratory of the National TB Control Programme (NTP) and National Institute of Diseases of Chest and Hospital, Dhaka, for routinely doing Lowenstein-

Jensen medium-based conventional culture and susceptibility testing of *M. tuberculosis* isolated from sputa samples from TB patients. In 2003, 506 sputa samples were cultured. Senior staff members of the Laboratory are also associated with the national

programme for training laboratory technicians and assessment of laboratories of NGOs working with NTP.

Virology Laboratory

Head: Tasnim Azim

The Virology Laboratory is working on enteric viruses, mainly group A rotavirus, HIV, and dengue. Besides, a study on influenza will start in 2004. In addition to diagnosis of rotavirus, studies are carried out on its epidemiology, immune responses to natural infection, and support for vaccine studies. Laboratory support for various activities of the HIV programme are provided. The activities include: serological surveillance for HIV for Bangladesh which continues to be conducted by this laboratory, research study on injecting drug users, services including voluntary counselling and testing for HIV, and determining absolute CD4 counts in people living with HIV. Dengue typing by PCR and isolation by tissue culture are being done.

Clinical Laboratory Services

Head: Md. Anwar Hossain

Clinical Laboratory Services is a multidisciplinary laboratory comprising: Clinical Pathology, Clinical Biochemistry, Clinical Microbiology, Molecular and Serodiagnostic laboratories, and out-patient service project in Dhaka, and the Matlab Clinical Laboratory. The laboratories cater to the need for diagnostic support to patient-care activities of the Clinical Research and Service Centre (CRSC) in Dhaka and Matlab

*Refurbished reception
area of the Laboratory
Diagnostic services*



and paying patients, including British Embassy medical unit, selected tests for American Embassy medical unit, JICA medical unit, and US Peace Corps. Laboratory diagnostic support is also provided to clinical, community and field studies undertaken by the Centre's scientists. The laboratory scientists carry out research and train national and international fellows, graduate and postgraduate students in laboratory research and laboratory diagnostic techniques. In total, 137,471 specimens and 386,030 tests were processed by the laboratory in 2003. The out-patient service project handled 52,932 patients.

A major contribution of the laboratory services is the availability of safe blood transfusion for in-patients of Dhaka and Matlab hospitals. The cost of blood bags was borne by the laboratories from their earnings.

The major achievement includes the continuation of community-based *Shigella* disease burden study funded by the Bill and Melinda Gates Foundation through DOMI/WHO from the International Vaccine Institute, Seoul

The major achievement includes the continuation of community-based *Shigella* disease burden study funded by the Bill and Melinda Gates Foundation through DOMI/WHO from the International Vaccine Institute, Seoul. The Laboratory supported 18 research protocols in 2003 conducted by other divisions.

A new laboratory facility for molecular and serodiagnostic service has been opened. The office of the Head of Clinical Laboratory Services and its Manager's office were moved to a new location. Physical space for the laboratory at Chakaria has been furnished and is awaiting the installation of equipment. New tests, such as serum ferritin, folate, IgE estimation, lipase, photometric Hb, and micro-albumin from urine were set up and adopted in the Clinical Biochemistry Laboratory; trial for viral load of hepatitis B and C was completed for adopting in the Molecular and Serodiagnostic Laboratory.

One automated blood culture machine was installed in the Clinical Microbiology Laboratory. One Atomic Absorption Spectrophotometer was donated by JICWELS for detection of arsenic from biological specimens; water purification system to reduce water conductivity was improvised and installed in the Clinical Biochemistry Laboratory. ELISA reader, blood sample rotator, shaking water bath, digital pipette, computer, and refrigerator were installed in the Molecular and Serodiagnostic Laboratory. The outpatient waiting area was improved by providing an audiovisual system, an electronic display board, a refrigerator, and an incubator. Necessary hardware (computer, printers, server, and hub) for the local area network for online laboratory

management were installed. The MIS software for the laboratory operation system is under trial for adoption in the Clinical Laboratory Services, and staff members are being trained in operating the software. The system will be interfaced with the Centre-wide MIS software 'Navision.' The Matlab Clinical Laboratory has been renovated, and the sample storage capacity has been increased by providing freezers and a micro-centrifuge machine for processing blood. Equipment for the new laboratory at Chakaria was received.

Under the staff development programme, Dr. Dilruba Ahmed completed her thesis on *Helicobacter pylori* and submitted it to the Department of Microbiology at Otago University, New Zealand, for a doctoral degree. Dr. Md. Anowar Hossain visited Kolkata from 7 to 9 October 2003 in connection with the planning for the sustainability programme of clinical laboratory services. Dr. Anowar and Mr. Md. Khorshed Alam attended the conference organized by the Association of Clinical Pathologists of Nepal held on 21-23 February 2003. Mr. Khorshed Alam also attended a conference on *Campylobacter* and *Helicobacter*-related organisms, CHRO 2003, in Aarhus, Denmark, on 6-10 September 2003. Dr. Hossain, Dr. Dilruba, Mr. Alam, Mr. Atiqullah, and Mr. Sunil Kumar Sen visited Nepal as facilitators at a workshop on antimicrobial resistance surveillance and for the baseline survey for HIV and VCT activities in Nepal funded by the Infectious Disease Programme of USAID-Nepal. Three senior scientific staff members contributed to 4 papers and 16 abstracts as authors and co-authors. The Laboratory services supported training of 46 fellows from national and international institutions and NGOs and mentored one research

student of the University of Ontario, Canada. Orientation was provided to 9 students of the University of Dhaka and 150 students of the American International School.

Dr. Khairunnessa joined the molecular and serodiagnostic unit of the Clinical Laboratory Services on 23 November 2003.

Clinical Pathology Laboratory

Head: Md. Anwar Hossain

The Clinical Pathology Laboratory, comprising haematology, serodiagnostic and microscopic units, performed 134,135 tests/assays on 66,693 specimens of blood, serum, plasma, stool, urine, cerebrospinal fluid, etc. Most (66.83%) of these specimens and tests were paying-cases. Of blood specimens of CRSC patients, 47.5% were collected by finger prick. The laboratory work produced 1341,358 work-load units (WLUs) in 23,077.5 man-hours. The general index of WLUs per person per hour was 58.12 (optimum 42-45), indicating an overload.

The Laboratory collaborated with scientists of other divisions of ICDDR,B on dengue, typhoid and encephalitis studies. Seropositivity of some infectious diseases, such as hepatitis, showed antibody to HAV-27.52% (30 of 109), HbsAg-16.49% (448 of 2,717), HCV-9.2% (41 of 445), and HEV-48.62% (88 of 181). Malarial parasites (*P. vivax* and *P. falciparum*) were detected in 0.69% (8 of 1,154) cases and dengue in 27.5% (44 of 160) cases (staff and paying-

patients only). The External Quality Assurance Scheme (EQAS) in routine haematology, coagulation, and parasitology rated 'excellent' as evident from scores of assessment by EQAS of the College of American Pathologists.

Clinical Biochemistry Laboratory

Head: Ashish Kumar Chowdhury

The Laboratory processed blood, serum, plasma, stool, urine cerebrospinal fluid (CSF), intravenous fluid (IVF), oral rehydration, etc. and performed 132,266 tests/assays on 37,245 specimens. The paying-cases contributed most to the overall workload (66.77%). A number of new tests/assays were introduced with income-generating potential and research. The Laboratory work had 1494,910 workload units (WLUs) in 24,266 man-hours. The general workload index was 61.5 (optimum 42-45) WLUs per person per hour.



Automated Biochemistry analyzer used in the Clinical Biochemistry Laboratory

The Laboratory continued its participation in the External Quality Assurance Scheme (EQAS) sponsored by the World Health Organization through the Wolfson EQA Laboratory, Birmingham, UK. The rated scores indicated its performance to be of 'grade-1' standard.

The Laboratory assisted the Institute of Public Health, Government of Bangladesh, in the estimation of electrolytes, glucose, P^H, lactate, and magnesium as part of the assessment of the quality of intravenous fluid products.

Clinical Microbiology Laboratory

Head: Md. Khorshed Alam

The Laboratory processed 33,534 specimens for culture, isolation, identification, and testing for antimicrobial susceptibility of clinical isolates from various clinical samples, such as blood, stool, rectal swab, urine, throat swab, sputum, CSF, pus, etc. Specimens from hospitalized patients at CRSC contributed most to its overall workload (52.11%). The common diarrhoeal pathogens isolated from 17,588 faecal samples were: *Shigella*-1,560 (8.87%), *V. cholerae* O1-1,654 (9.40%), *V. cholerae* O139-52 (0.30%), *Salmonella* spp.-281 (1.60%), *Aeromonas* spp.-429 (2.44%), and *Plesiomonas*-

184(1.05%); 125 (5.60%) *C. jejuni* were isolated from 2,244 faecal samples. The commonest blood isolates were *S. Typhi* (4.04%, 217 of 5,375) and *N. meningitis* (0.52%), and the most common urine isolate was *E. coli* (12.90%, 946 of 7,348). Among 278 rectal swabs collected by the epidemic control team of the Public Health Sciences Division of ICDDR,B, 58 were positive for *V. cholerae* O1 (20.86%), and no *Vibrio cholerae* O139 was isolated. The Laboratory worked for 28,591 man-hours producing 16,08,244 workload units (WLUs). The general index was 56.25 (optimum 42-45) WLUs per person per hour. The Laboratory continued its participation in the External Quality Assurance Scheme (EQAS) with the College of American Pathologists. The overall rated score was 99%.

A major achievement was the addition of an automated blood culture machine which has facilitated early recovery and reporting of blood pathogens even from patients who had antibiotic prior to sampling. The serotyping scheme of *C. jejuni* and determination of MIC using E-test were performed. The Laboratory supported 20 research protocols. Staff of the Laboratory actively participated in the Nepal antimicrobial resistance surveillance project. The Laboratory has validated the identification and antimicrobial susceptibility testing of bacterial isolates and conducted its external quality-control scheme from January to December 2003. It also maintained the microbial quality control of the Matlab field laboratory. In 2003, the Laboratory trained 9 students from the University of Dhaka and 150 students from the American International School.



Scientists working in the Clinical Microbiology Laboratory

The newly-opened Molecular and Serodiagnostic Laboratory



Molecular and Serodiagnostic Laboratory

Head: Khairun Nessa

This laboratory has recently been opened by incorporating serology which was a part of the Clinical Pathology Laboratory. The serodiagnostic activities have been merged with Clinical Pathology for the year 2003 as molecular part was yet under development. The activities of this unit will include routine serological diagnosis of different infectious and non-infectious diseases, such as typhoid, rheumatic fever, rheumatoid arthritis, dengue, syphilis; and various types of hepatitis and cancer markers. The Laboratory has already started setting up a multiplex PCR assay for the characterization of human diarrhoeagenic *Escherichia coli*. As part of the routine tests, it will start the qualitative and quantitative diagnosis of HBV and HCV and estimation of viral load from the blood specimen, genotyping of HCV and viral load monitoring of HIV. Very soon, the Laboratory will introduce serological diagnosis of more cancer markers, such as CA 19-9, CA 125, CA 15-3. It may add diagnosis of tuberculosis from the sputum specimens in future.

Matlab Clinical Laboratory

Head: Md. Golam Yeahia Khan

The Laboratory processed 13,483 clinical specimens, such as blood, stool, urine, CSF, other biological fluids of patients hospitalized in the Matlab diarrhoea treatment centre and from some field-based research protocols and the Staff Clinic. In total, 19,127 tests were performed on these specimens for laboratory diagnostic support needed for patient-care activities. Microbiological tests for dark-field microscopy were performed on 2,267 specimens (17%), and 4,150 (31%) were cultured for isolation and identification of pathogens and for antimicrobial susceptibility testing. The most common diarrhoeal pathogens isolated were: *V. cholerae* O1 (39.01%), *V. cholerae* O139 (1.52%), *Shigella* (30.94%), and *Salmonella* spp. (7.43%). In total, 14,977 tests were performed on 11,216 specimens for electrolytes, renal function, blood glucose, routine haematology, urinalysis, and stool microscopy for parasites. Microscopy of 4,377 faecal specimens detected *E. histolytica* (1.18%) and *Giardia intestinalis* (5.0%), and *Ankylostoma duodenale* (AD), *Ascaris lumbricoides* (AL), *Trichuris trichiura* (TT), and *Strongiloides stercoralis* (SS) were 1.18%, 39.91%, 26.75%, and 0.86% respectively.



Scientists and technicians at work in the Matlab Clinical Laboratory

The physical facilities were further improved to reduce room temperature during the summer, and the specimen-storage capacity was increased by adding more freezers and one micro-

centrifuge for processing blood for haematocrit. In 2003, the Laboratory supported 6 research protocols and extended short-term support for field studies.

Media and Lyophilization

Head: Qazi Shafi Ahmad

The primary responsibilities of the Media and Lyophilization section are the preparation of bacteriological media, preservation of bacterial stock culture, and decontamination. The section provides technical support to various research projects and clinical laboratories in Dhaka and Matlab by supplying various culture media necessary for the growth and identification of bacterial pathogens.

In 2003, the section supported 53 research projects by supplying 171,000 culture plates and 744 litres of culture broths of different types (Table).

Table. Production of bacteriological media in 2003

Media	Production (Litre)
Culture media solid	3,420
Culture broth	691
Carbohydrate fermentation broth	40
Amino acid broth	13
Total	4,146

The bacterial stock culture collection unit has facilities to lyophilize bacterial stocks and biological specimens ranging from 0.2 mL to 500 mL. In 2003, the unit supported 8 research projects by lyophilizing 4,295 samples of *V. cholerae*, *Shigella*, *Salmonella*, and other biological specimens.

As the main decontamination area of LSD, the section takes care of various infected and biohazardous materials for disposal by autoclaving or burial depending on the material risk factor as classified in biosafety.

Animal Resources Branch

Head: A.S.M. Hamidur Rahman

The Animal Resources Branch provided support to research protocols and to a number of national institutions and was used for training of 60 internee doctors of veterinary colleges of Bangladesh and one postgraduate student from the Bangladesh Agricultural University, Mymensingh.

The number of research animals of different species and volume of blood issued, with amount of waste materials incinerated from the Branch during 2003, are shown in the table.

Table. Number of research animals, volume of blood issued and quantity of waste materials incinerated

Species/Item	No. produced	No. or vol. issued/kg
Rabbit	426	297
Guineapig	121	63
Rat	974	442
Mouse (Swiss albino)	6,872	6,472
Mouse (Balb/C)	559	160
Sheep blood (mL)	-	32,930
Rabbit blood (mL)	-	1,653
Guineapig blood (mL)	-	402
Chicken blood (mL)	-	135
Incineration of waste materials (kg)	-	6,333

In close collaboration with scientists from the Bangladesh Agricultural University, Mymensingh, Chittagong Government Veterinary College, Bangabandhu Sheikh Mujib Medical University, University of Dhaka, and BCSIR Laboratories, the Third Conference of the Bangladesh Association for Laboratory Animal Science was conducted by the Branch on 31 August 2003 aimed at the welfare of laboratory animals. The Branch extended cooperation to a number of hospitals and clinics in metropolitan Dhaka for incinerating their wastes.

Biomedical Engineering Unit

Head: Syed Saiful Huq

The Biomedical Engineering Unit (BMEU) has unique capabilities to deliver a full portfolio of high-quality, multi-platform services across the entire spectrum of biomedical equipment of the Centre. BMEU

offers maintenance, calibration, repair and certification services for equipment of clinics, hospitals, healthcare organizations, etc. BMEU installs new equipment, offers training, and assists in designing and setting up new laboratories in the meticulous and cost-effective manner. The Tuberculosis Laboratory has recently been upgraded to achieve Safety Level III compliance. BMEU also provides indigenous solutions for spare-parts which are either obsolete

or difficult to obtain and fabricates customized functional parts or equipment. For example, BMEU recently fabricated a biohazard cabinet for the Immunology Laboratory.

As biosafety is an important issue for the Laboratory Sciences Division and the Centre, BMEU has been actively participating in implementation of LSD's fire control and protection scheme. It is also working to materialize the integrated biosafety plan for the Centre. It played a commendable role in the management of medical wastes and contributed positively to the national-level policy. The radiation control and management issue has been taken care of efficiently and effectively.

As part of assistance towards national institutions, BMEU offered technical expertise in overcoming the problems with the intravenous

fluid plant of the Institute of Public Health. BMEU is continuing to support the Bangabandhu Sheikh Mujib Medical University to maintain their safety level III laboratory. The expertise of BMEU crossed the domain of national-level support as it successfully provided technical assistance to antimicrobial resistance Programme of the National Public Health Laboratory, Nepal.

Laboratory Management and Archives

Head: Md. Bodrul Ahsan Prodhan

The Laboratory Management and Archives section coordinates the logistic activities and provides archival support to the Laboratory Sciences Division with the objective of assisting the management of the Division. For carrying out research activities of the Division smoothly, the section coordinates functions, such as installation, repair, renovation, security, cleaning, etc. The section also coordinates the procurement of scientific equipment, reagents, chemicals, consumables, statio-

nery, and other materials through local and overseas purchase. The section oversees the maintenance of the Cold Room and the Specimen Bank. Renovation of the Immunology Laboratory, Tuberculosis Laboratory, and the first floor of the Agrani Bank for the HIV/AIDS

Programme activities were completed in 2003 to facilitate their smooth functioning. Renovation of the Enteric Bacteriology Laboratory started at the end of 2003 and is expected to be completed in early 2004.

The section provides routine support to scientists and researchers by retrieving archived data from the databases maintained for the Centre. It produced monthly recovery reports for the Clinical Laboratory Services (Dhaka and Matlab) and media preparation. In 2003, the section produced 60,641 records and added these to the existing database. The section prepares a weekly surveillance report on major diarrhoeal pathogens isolated

The HHMI-supported Advanced Laboratory Training Course

The Division hosted an Advanced Laboratory Training Course on Infectious Disease Research sponsored by the Howard Hughes Medical Institute (HHMI), USA. The aim of this training course was to promote the capability of researchers in developing countries to apply modern laboratory



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techniques for infectious disease research and develop advanced research skills. The two-week training course was focused on modern molecular and immunological techniques used for infectious disease research and bioinformatics concepts.

In total, 18 participants from 9 countries—7 from Bangladesh and 11 from India, Nepal, Thailand, Vietnam, Malawi, Turkey, Guatemala, and Peru received hands-on-training. Lecture sessions were, however, open to other interested persons from Bangladesh.

from stool/rectal swab samples collected from a systematic 2% sub-sample of all patients attending the Dhaka hospital. In 2003, the section produced 52 weekly surveillance reports on diarrhoeal pathogens to assist the Government of Bangladesh, produced query reports, and performed data analyses for different scientists and researchers for different ongoing protocols.

Role of Honour of the LSD Scientists in 2003

The FAO regional headquarters in Bangkok organized an Expert Consultation of the Asia-Pacific Network for Food and Nutrition Meeting on 18-20 November 2003. The Consultation Meeting was attended by experts from Asia and Asia Pacific. The participants presented the Food Composition Database and follow-up activities relating to ICN/NPAN/WFS. The Deputy Director-General of FAO inaugurated the meeting, while Mr. M.A. Wahed, Head, Nutritional Biochemistry, CSD, was elected Chairman. This consultation revealed that several SAARC countries, including Bangladesh, lag far behind in compiling comprehensive current data on food values compared to Thailand, China, and Vietnam. 'RIGHT TO KNOW WHAT WE EAT' has been voiced as a slogan from the meeting. The proceedings of this consultation will soon be available in the FAO website.

Dr, Firdausi Qadri, Senior Scientist of the Division, was selected as a member of the Steering Committee on Diarrhoeal Disease Vaccines of the WHO Global Programme for Vaccines and Immunization. This committee is within the WHO's Initiatives for Vaccine Research (IVR) and Vaccines and Biologicals Review Board. The IVR Steering Com-

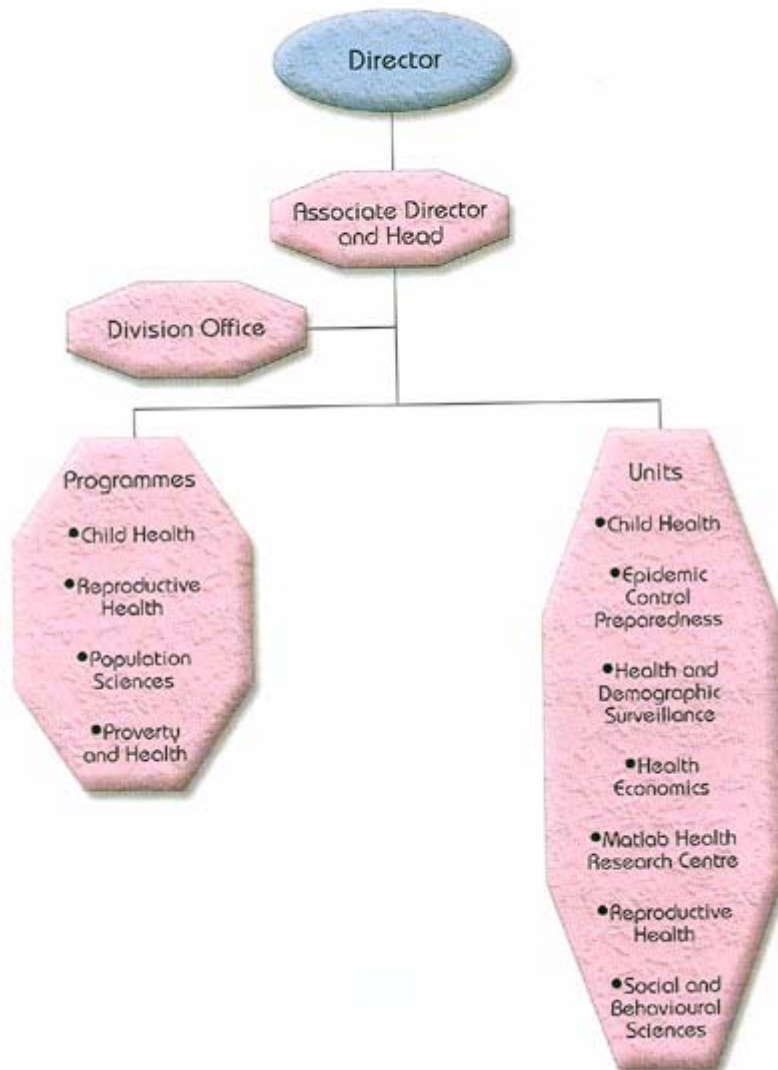
Mr. M.A. Wahed, Head, Nutritional Biochemistry chairing the FAO meeting on Expert Consultation of the Asia-Pacific Network for Food and Nutrition



mittee on Diarrhoeal Diseases Vaccines provides advice to WHO on activities relating to the development of vaccines for cholera and typhoid as well as major enteric diseases caused by rotavirus, *Shigella*, ETEC. The 12-member team is selected by the Director, IVR, based on scientific and technical knowledge of members in microbiology, immunology, biotechnology, vaccine trials, and epidemiology. The first meeting was held in Montreux, Switzerland, on 10 September 2003 to introduce the new members to the overall programme of diarrhoeal disease-related activities, to review progress of ongoing projects, and to plan future activities and collaborations over the next two years.

Dr. Rashidul Haque, Scientist and Head, Parasitology Laboratory, was invited to give the Commemorative Fund Lecture at the 52nd Annual Meeting and Centennial Celebration of the American Society of Tropical Medicine and Hygiene (ASTMH). The 52nd Annual Meeting was held in Philadelphia, USA, on 3-7 December 2003. The topic of his lecture was "Translating recent diagnostic advances to control parasitic diseases in developing countries." ASTMH invites senior researchers resident in the topics for the Commemorative Fund Lecture to make a featured presentation at its annual meeting.

Public Health Sciences Division



Associate Director and Head**Lars Åke Persson**
(Until February)**Abbas Bhuiya**
(From March)

Public Health Sciences Division

The Public Health Sciences Division (PHSD) brings the population perspective to the Centre's mission and focuses on the development and evaluation of population-based interventions to address major health problems. The Division provides various scientific skills and methods. Its research programmes contribute to understanding how health and diseases are generated in the community, with a focus on the vulnerable or disadvantaged groups. It searches for simple and cost-effective approaches that could be widely applied and could increase the absolute level and an equitable distribution of health among groups. The Division has a strong research infrastructure, including provision of primary healthcare services in rural Matlab under Chandpur district and in Chakaria under Cox's Bazar district. Activities were extended to Sylhet, Mirzapur, Chowddagram, and Kapasia in 2002.

In Matlab, the Health and Demographic Surveillance System (HDSS) regularly updates demographic information on 220,000 people. Besides the Matlab Health Research Centre and HDSS, the Division has research units for reproductive health, child health, social and behavioural sciences, health economics, and epidemic control preparedness. PHSD also houses 4 theme-based Centre-wide research programmes on: Child Health, Reproductive Health, Population Sciences, and Poverty and Health.

Research interests include projects addressing the epidemiological patterns of ill health, transmission of infectious agents, especially for diarrhoeal and acute respiratory illnesses, effects of micronutrients, public health nutrition, delivery of healthcare, prevention of illness through education, modification of risk-behaviours, vaccine trials, and community development, interaction of poverty and health, safe water, sexuality and HIV/AIDS, and violence against women.

The International Training Centre in Matlab provides facilities for local, regional and international training courses, and the one in Chakaria mostly caters to local training needs.

The scientific staff comprises public health professionals, epidemiologists, social scientists, population specialists, and health economists. More than 800 staff members worked during the reporting period in long-term and short-term contracts, of whom 10 were at the international level, 76 at the national-officer level, and 714 in other categories.



A section of the renovated office accommodation of the Public Health Sciences Division

The Division continued to expand with a yearly budget of US\$ 6 million in 2003. Thirty-five research protocols were ongoing. Some of these are large-scale umbrella protocols that run over a number of years and involve scientists from different divisions

within the Centre. Combined interventions for low birth-weight and studies on the health consequences of arsenic in tubewell water and poverty and health have been continued with great enthusiasm and success.

After serving the Centre for 4 years as Associate Director and Head of Public Health Sciences Division, Professor Lars Åke Persson left Bangladesh on 27 February 2003. He is now Professor and Chairman of the Department of Mother and Child Health, Uppsala University, Sweden. Dr. Abbas Bhuiya has been Acting Associate Director since March 2003.

Child Health Unit

Head: Shams El Arifeen

The Child Health Unit (CHU) contributes to the development of cost-effective child health and survival programmes by enhancing the understanding of causes of childhood morbidity and mortality and by testing cost-effective public-health interventions. The mandate of the Unit is to conduct programmatic and policy-relevant child health research in collaboration with different programmes and divisions within the Centre, and with national and international institutions to conduct multidisciplinary research, and to assist the Government and other partners in programme development, policy review, and analysis. CHU has identified the following broad areas of priority research: (a) enhancing the understanding of causes of childhood, perinatal and neonatal morbidity and mortality, (b) prevention and management of low birth-weight, (c) child growth and development, including car-

ing, care-seeking practices, and nutritional interventions, (d) testing and evaluation of different vaccines for reducing child morbidity and mortality, and (e) strengthening health systems for delivery of child health practices.

Activities during 2003 are reported in the chapter on the Child Health Programme.

Epidemic Control Preparedness Unit

Head: A.K. Siddique

Surveillance for cholera at sentinel sites

In 2003, due to limitation of funding, the sentinel surveillance for cholera by the Epidemic Control Preparedness Unit (ECPU) was limited to only 3 sentinel sites at Chhatak, Begumganj, and Bakerganj. The frequency of surveillance days was also reduced to 54. In total, 159 diarrhoeal patients were studied during the clinical surveillance, of which all but 3 were acute watery diarrhoea cases, and the remainder were dysentery cases. In contrast to the past 3 years, isolation of *Vibrio cholerae* during the year was significantly lower. Of 124 rectal swabs cultured, *V. cholerae* was isolated from only 5.6% of the specimens. *V. cholerae* O139 was isolated from Begumganj upazila. The presence of O139 strain in the area has been constantly observed during the past 5 years. NIH funding has been secured to continue the surveillance for a further period of 4 years. This will enhance the surveillance activities from 2004.

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Epidemic surveillance

During August–November 2003, a large outbreak of diarrhoea was reported in northeastern and northern areas of Bangladesh. Director General of the Health Services of Bangladesh requested ICDDR,B to conduct an investigation into the outbreak. Physicians of the Epidemic Control Preparedness Unit (EPCU) of ICDDR,B carried out an investigation in 18 upazilas of Nilphamari, Mymensingh, Netrokona, and Jamalpur districts. Over 35,000 cases and 98 deaths were reported from these districts. The EPCU team identified and treated 135 acute watery diarrhoea patients at the field level. A systematic sample of 86 specimens was cultured at the Centre's laboratory in Dhaka. *V. cholerae* was isolated from 58% of specimens. All the isolates were *V. cholerae* O1. Antibiotic sensitivity results revealed that all the isolates were sensitive to tetracycline and erythromycin, but were resistant to co-trimoxazole.

Rangamati district. To determine the serotypes, RT-PCR tests were applied which indicated that the circulating serotypes were DEN 2, DEN 3, and DEN 4 during the surveillance period. It was also noted that dengue transmission occurred throughout the year in Dhaka city.

Health and Demographic Surveillance Unit

Head: Peter Kim Streatfield

The Health and Demographic Surveillance Unit (HDSU) evaluates the impact of different interventions relating to population, health and socioeconomics. The Unit has two functional sub-units: (1) Health and Demographic Surveillance System (HDSS) and (2) Geographic Information System (GIS). Demographic surveillance in Matlab started in 1966, and the surveillance of health conditions was added in 1978 in one half of Matlab (ICDDR,B service area). The GIS component was initiated in 1994. This system for collecting demographic data on more than 200,000 people for over 36 years is the longest-running demographic surveillance system in the world.

Activities during 2003 are reported in the chapter on Population Sciences.

Health Economics Unit

Head: Beena Varghese

The Health Economics Unit (HEU) of ICDDR,B has been working as a resource unit for conducting policy-oriented research. In addition to economic evaluation of different health interventions, the Unit focuses

Surveillance for dengue viral disease in Bangladesh

In September 2003, EPCU completed the two-year clinical surveillance for dengue fever in 2 general hospitals (Shishu Hospital and Dhaka National Medical College & Hospital) in Dhaka city. In total, 4,810 fever cases attended the outpatient departments during the surveillance period, of which 754 were enrolled and screened for the detection of dengue infection by the rapid immunochromatographic test. Results indicated that 182 (24.1%) patients were positive for dengue infection, of which 72 (38.3%) revealed presence of IgM antibody, 52 (28.7%) were IgG-positive, and 58 (31.9%) were positive for both IgM and IgG. The prevalence surveillance was also conducted at Abhoynagar, Chhatak, and Bajitpur Upazila Health Complexes and Rangamati Sadar Hospital. In total, 854 febrile patients attended during the surveillance days at the outpatient department, of which 558 were screened for dengue virus infection. Twenty-five (4.5%) patients were positive by the rapid immunochromatographic screening test. The highest number (16) of patients was detected in

on cost, efficiency, and equity of the interventions with a special focus on poverty and health. It also continued to facilitate its collaboration with different units and divisions across the Centre towards development of research projects. In 2003, the Unit was involved in two economic studies and several collaborative research projects. In 2003, selected staff members participated in national and international conferences and attended the course on 'Epidemiology and Biostatistics' and 'Poverty Measurement: Economic Dimensions'. The Poverty and Health Fellow working in this unit will be completing her fellowship in 2004. At the end of 2003, HEU was shifted to the Health Systems and Infectious Diseases Division and is now called Health Systems and Economics Unit.

Studies conducted or ongoing in 2003 are briefly described below.

Socioeconomic status and child morbidity

Socioeconomic status and childhood morbidity in rural Bangladesh: a study using Matlab health and socioeconomic data

Only a few studies have examined the relationship between socioeconomic status and child morbidity issues, especially the relationship of socioeconomic status with severity of morbidity and cumulative morbidity of a child. The objective of the study was to explore the actual nature of the relationship between socioeconomic status and health condition of children through secondary analysis of data. The study was done in collaboration with the Institute of Health Economics, University of Dhaka. The HDSS data (socioeconomic census

Better reproductive health of poor women ***Current status of women's reproductive health and quality of women's reproductive health services in Bangladesh***

This study, part of a 5-country study funded by the World Bank, is ongoing, and the team includes staff from the Reproductive Health Unit along with the staff from HEU. This study involves quantitative analyses of secondary data and a review of the literature and collection of qualitative data during field visits. The study will enable identification of potential interventions for improving the reproductive health status of poor women in Bangladesh, and hopefully, this will provide policy input into the next Health, Nutrition and Population Sector Programme of Bangladesh.

and child health data) were analyzed to find the child morbidity trend over the 1996-2002 period across different socioeconomic groups in Matlab. Results of the analysis, presented at the National Health Economics Conference in December 2003 in Dhaka, showed that the total morbidity status of children did not differ much among different socioeconomic groups. However, children of the richest group were slightly less likely to have any type of morbidity. Another major finding was that the incidence and recurrence of pneumonia among children showed an increasing trend over the years (10% in 1996 increased to 17% in 2002). This suggests that, to improve the performance of the health sector, targeting by socioeconomic groups may not be essential for reducing childhood morbidity. Output may be improved if overall childcare services (availability and quality) can be improved at the primary-care level. Providers at the primary level

should be trained to manage problems relating to respiratory tract infections in children.

Cost-effectiveness of introducing Hib vaccine in preventing Hib-related illnesses

The objective of the study was to measure the cost-effectiveness (societal perspective) of introducing the *Haemophilus influenzae* type b (Hib) vaccine by estimating the cost or savings of preventing pneumonia and meningitis among vaccinated children compared to non-vaccinated children. HEU will develop a decision model to estimate the cost-effectiveness of Hib vaccines for prevention of Hib-related illnesses. This study by the Child Health Unit measures the effectiveness of Hib vaccine, and HEU has estimated the cost of disease averted using cost-of-illness data for Hib-associated pneumonia and meningitis. Results of the effectiveness study will be incorporated, along with the benefits of prevention of Hib to develop the decision model. Cost of illness (for provider and patient) was obtained from the Dhaka Shishu Hospital. To estimate the patient cost, existing data were used for collecting direct (medical) and indirect costs for patients/guardians. The total treatment cost for meningitis patients was Tk 13,818 (US\$ 238.24) to Tk 22,252 (US\$ 383.65) and for pneumonia patients Tk 3,398 (US\$ 58.58) to Tk 6,332 (US\$ 109.17).

Measuring the impact of tuberculosis illness and treatment on socioeconomic status of households

This project is carried out under the DFID-funded Poverty and Health umbrella project, in collaboration with the Child Health Unit. This research will identify the short-term and long-term impacts of TB illness and then of the treatment on economic status of households. The economic data-collection tools have been developed, and collection of data is in progress in the Kamalapur site in Dhaka city. The project provides data to develop appropriate long-term and short-term policies for prevention and treatment of TB.

Matlab Health Research Centre

Head: Md. Yunus

The Matlab Health Research Centre (MHRC) consists of 3 branches: a clinical research branch that provides clinical services and has facilities for clinical research; a community research branch that offers maternal and child health services in the community and provides support to implementing community-based research and interventions; and a health and demographic surveillance branch covering a population of 220,000 in the ICDDR,B's Matlab study area. The MHRC facilities also include a training centre of international standard, and an administrative and logistic support services branch to facilitate research and training on various areas of current public health importance in Bangladesh and developing countries at large. The study area of MHRC has 4 sub-centre clinics in the field, each covering 28,000 people, run mainly by paramedical staff and a primary care hospital with basic laboratory facilities located in Matlab. Healthcare services provided by MHRC include management of diarrhoea, acute respiratory infections (ARIs), malnutrition, and other problems of child health and reproductive health. Basic maternity care services are offered through the clinics in Matlab and four sub-centres. Emergency obstetric care, including caesarian section, is also offered in collaboration with the government hospital in Matlab. Alongside the clinical services through the diarrhoea hospital and maternal and child healthcare, MHRC serves as the implementation site for various research projects of other units of the Public Health Sciences Division and other divisions of the Centre.

A MINIMat baby, being assessed for psychomotor development



In 2003, 11,292 patients with diarrhoea received treatment at the Matlab health facility, which was 5% higher than in 2002. Thirteen percent of patients came from the Matlab Health and Demographic Surveillance System (HDSS) area. Of 11,292 patients, 1,924 (17%) required admission. The overall case-fatality rate was 0.2%. Stool specimens from all patients (n=1,489) who lived within the HDSS area were cultured. *Vibrio cholerae* O1 and O139 were isolated from 153 (10.3%) and 8 patients (0.5%) respectively. *Shigella* spp. were isolated from 12.1% of specimens in the HDSS area, and 73% of these were *S. flexneri*. In 2003, no *S. dysenteriae* type 1 was found in patients from the HDSS area.

Another 13,645 patients (6,605 women of childbearing age and 7,040 children aged less than 5 years) received medical care from the MCH-FP clinic of Matlab facilities in 2003. Of them, 11,731 (86%) were treated as outpatients and 1,914 (14%) as in-patients. Of 563 in-patient women with labour pain, 505 delivered at Matlab, and the remaining 58 (10.3%) were referred either to the Maternity Care Unit at Matlab Upazila Health Complex or to the Chandpur hospital. In total, 1,042 children aged less than 5 years were admitted as in-patients, and of them, 753 (72%) were treated for acute lower respiratory tract infections (ALRIs); the case-fatality rate was 0.5% (4/753).

Physical facilities in two sub-centres, Block A and B, have been upgraded and expanded to facilitate the implementation of ongoing and new research projects. The second floor of the outpatient department building of Matlab hospital was completed which offers

office space for several new projects and will provide office facilities for the anticipated large research project on rotavirus and other projects.

In 2003, the International Training Centre in Matlab hosted several local and international training courses and seminars. Over 200 national and international visitors saw the Matlab facilities and ongoing research activities.

Major ongoing research activities in Matlab include MINIMat, AsMat, Community IMCI, and recently-initiated epidemiologic research in non-communicable diseases of adults in relation to nutrition in early life.

Arsenic and health

Arsenic is a major environmental catastrophe in Bangladesh. In Bangladesh, about 60-70% of 10-11 million tubewells are contaminated with arsenic, and 20-30 million people are at risk of developing toxic effects of arsenic. The project "Arsenic in tubewell

water and health consequences," which is a joint effort of ICDDR,B, BRAC, and collaborating institutions in Sweden, is benefiting from the ICDDR,B's Health and Demographic Surveillance System in 142 villages in Matlab, Bangladesh.

Trained field staff screened all individuals aged over 5 years (n=166,935) by visiting each household for skin lesions during January 2002–August 2003 and referred suspected arsenic-related cases to physicians who confirmed 578 cases among the suspected 1,677 and performed clinical examination for all cases and randomly-selected controls (n=1,584). Urine and blood samples were collected from all cases and referents. The supervisors checked all forms and reviewed collected data on a random basis. Sub-samples (5%) were re-interviewed and re-examined for validation and data quality. In a latter stage, a Dermatologist of Bangabandhu Sheikh Mujib Medical University and experts from the Institute of Preventive and Social Medicine validated the cases.

An arsenic database has been added to the Matlab Health and Demographic Surveillance System (HDSS), including geographical coordinates, year of installation, depth, and arsenic concentrations of all tubewells. In these databases, information is also included about individuals' skin lesions and their water consumption patterns over the years. Added information on reproductive events and adult mortality during 10 years (1991-2000) is available in the

HDSS database. The competence of field workers, study physicians, laboratory staff, and mitigation team, has been systematically built up during the project period, and a new atomic absorption spectrophotometer has been procured. A strong collaborative team has been formed with experts from ICDDR,B, BRAC, Metals and Health (Karolinska Institute), and the Department of Women's and Children's Health under the Division of International Maternal and Child Health (Uppsala University in Sweden).

Trained field research assistants (FRAs) tested samples of water from all tubewells (n=12,339) for arsenic by the E-Merck test-kit. All water samples were analyzed by atomic absorption spectrophotometer. Experienced staff from BRAC performed a duplicate test using the E-Merck test every fortnight on random samples. The Karolinska Institute, Stockholm, performed duplicate analyses of randomly-selected water samples by hydride-generation atomic absorption spectrophotometer.

An intensive analysis will be conducted during 2004. The project activities will answer the following questions: (i) Who develop arsenic-induced skin lesions and what are the risks at different exposure levels?; (ii) Are there any gender differences in the risk to develop skin lesion at a given level of dose and duration of exposure to arsenic-contaminated water?; (iii) Are individuals with general malnutrition and/or micronutrient deficiencies at a

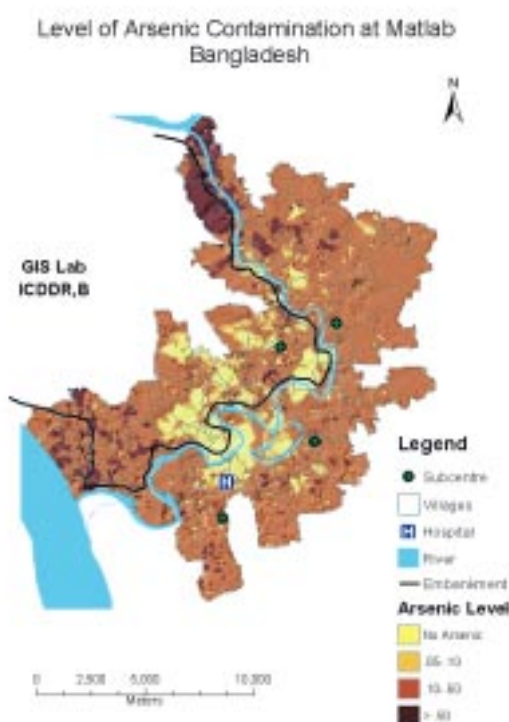


Table 1. Safe water options distributed in Matlab until December 2003

Type of option	Safe water option	Achieved options	Beneficiaries (No. of families)
Household-based	Three-pitcher filter	100	100
	Alcan filter	642	642
	Safi filter	24	24
	<i>Bishudha</i> filter	134	134
	Rainwater harvester	115	115
Community-based	Pond sand filter (PSF)	16	1,600 (100/PSF)
Total		1,030	2,614

greater risk of developing skin lesion than those who are better-nourished?; (iv) Has arsenic exposure resulted in an increased number of miscarriages, stillbirths, and neonatal deaths in the past?; (v) Has the arsenic exposure already resulted in increased deaths from cancer and cardiovascular diseases?; and (vi) What are the experiences of the village-based arsenic mitigation activities carried out so far as an integrated part of the project?

Arsenic and reproduction

Since the inception of this study in November 2001, about 4,000 pregnant women have been identified by community health research workers (CHRWs) and subsequently, 3,100 women have been enrolled in the MINIMat study. About 1,400 urine samples have been analyzed for arsenic, and results are available for 511 (Table 2). The adjusted mean, median, minimum, and maximum concentration of arsenic was 173, 98, 10, and 1116 $\mu\text{g/L}$ respectively. At the gestational age of 30 weeks, the corresponding figures were 86, 210, 6, and 1869 $\mu\text{g/L}$. The concentration of inorganic arsenic and methy-

lated metabolites in urine is determined using direct hydride-generation atomic absorption spectrophotometry (HG-AAS). Some 1,400 urine samples collected during early pregnancy have been analyzed for total arsenic metabolites. Calculated concentrations of 511 urine samples collected during early pregnancy and 172 urine samples collected at the gestational age of 30 weeks are available.

After extensive piloting of the measurements under the supervision and guidance of Professor Sally Grantham McGregor, 1,048 infants were contacted to test milestone development and 822 for problem-solving tests (Table 3). The World Health Organization supports the pilot phase of these measurements, while DFID provides fund for the cost of assessing psychomotor development in 2,500 infants.

Flocculent-disinfectant point-of-use water treatment for arsenic mitigation

The project aims at evaluating the effectiveness of a point-of-use flocculent-disinfectant for arsenic mitigation and improving the quality and microbial safety of pond water. The study enrolled 105 households for 12 weeks. One woman in each household was taught how to treat tubewell water. Drinking-water and spot urine samples

Table 2. Arsenic concentration in urine samples of pregnant women, Matlab, Bangladesh, 2001-2003

Parameter	Urine during early pregnancy ($\mu\text{g/L}$)		Urine at 30 weeks' gestation ($\mu\text{g/L}$)	
	Arsenic	Adjusted arsenic*	Arsenic	Adjusted arsenic*
Median	95	98	69	86
Mean (SD)	176 (± 213)	173 (± 187)	168 (± 279)	210 (± 278)
Range	4-1,281	10-1,116	2-1,880	6-1,869
Percentile				
75	234	236	201	292
90	463	437	343	499

*Adjusted by specific gravity of the urine

were collected at baseline and 2, 5, 9, and 12 weeks after the intervention. Water and urinary arsenic and its metabolites were measured at different weeks of the intervention. The mean baseline arsenic concentration in tubewell water was 162 $\mu\text{g/L}$ (range 15-543). Following initiation of the intervention, arsenic concentration in drinking-water decreased by an overall mean of 138 $\mu\text{g/L}$ (85%, $p < 0.0001$); 88% met the Bangladesh standard of $< 50 \mu\text{g/L}$. Urinary arsenic concentration decreased by a mean of 160 $\mu\text{g/g}$ creatinine (35%, $p < 0.0001$).

93% of the samples meeting the WHO turbidity guideline of < 5 NTU. Free chlorine was detected in 83% of the samples. Further, 35 surface-water samples were collected and treated with the flocculent-disinfectant 3 times at intervals of one month and analyzed for faecal coliforms. Following treatment with the flocculent-disinfectant, 96% of the pond-water samples met the WHO bacterial potability guideline. Samples showed markedly improved clarity. This strategy may be useful in programmes for improving the quality and safety of drinking-water.

The flocculent-disinfectant markedly reduced arsenic levels in tubewell water and, to a lesser extent, urinary arsenic in women who consumed treated water. All pre-treated samples ($n=101$) were non-potable and were contaminated with a mean of 2.9×10^4 CFU/100 mL faecal coliforms. Turbidity ranged from 6 to 92 NTU. Following treatment, 97 (96%) samples met the potability guidelines. Treatment resulted in a mean reduction of 87% in turbidity (mean 4 NTU) with

Table 3. Age distribution of infants tested for problem-solving test

Total no. of infants eligible for test	1,048
No. of tests done	822 (78%)
Mean age in days (SD)	219 (± 6.6)

Skin lesions caused by arsenic from tubewell water



Reproductive Health Unit

Head: Japhet Killewo (Until June)
Acting Head: Peter Kim Streatfield (From July)

The Reproductive Health Unit (RHU) was created in 1996 as a programme with a mandate to address issues relating to reproductive health research in line with the Centre's mission. The Unit conducts research in critical and priority areas of reproductive health in various parts of Bangladesh. Both Reproductive Health Programme and the Reproductive Health Unit are headed by the same scientist.

Activities during 2003 are reported in the chapter on the Reproductive Health Programme.

Social and Behavioural Sciences Unit

Head: Abbas Bhuiya

The goal of the Social and Behavioural Sciences Unit (SBSU) is to institutionalize social and behavioural science research in ICDDR,B. Towards this end, pertinent research is carried out on issues, such as community development, poverty mapping, nutritional status, health and equity, HIV/AIDS, violence against women, sexual behaviour, and safer motherhood.

Fourteen research projects led by the SBSU researchers were ongoing in 2003. Support was also extended to other studies, and participation in national and international activities continued throughout the year. The secretariats of the Bangladesh Health Equity Watch and of the Poverty and Health Programme are housed in the Social and Behavioural Sciences Unit. Building capacity of the staff continued in 2003. At present, 3 staff members are pursuing their higher studies abroad under the Centre's Staff Development Programme.

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

The Chakaria Community Health Project (CCHP) was initiated in 1994 in 3 unions of Chakaria upazila of Cox's Bazar district with the aim of establishing self-help for health through community participation. The activity was replicated in 3 more unions in the last quarter of 1997. The Project mobilized the community through indigenous self-help organizations and made them aware of their health needs, available health resources, and use of these resources in improving their health conditions through participatory methods. Volunteers from 6 unions are engaged in preventive and curative healthcare activities and are trying to achieve self-help for health through the activities of the village health posts and health cooperatives formed by the community. At the 7 village health posts formed so far, the project doctors and paramedics extend preventive healthcare services to the community.

With the efficient services provided by the trained community midwives under the Project, the demand for antenatal care and postnatal care services in the community is increasing. To promote sustainability, the Project has introduced a family-health card, which is sold to the villagers, and also introduced a consultancy fee. The Project has also set up a laboratory with modern diagnostic equipment to render some diagnostic services to the community at a reasonable cost.

One of the major aims of the Project is to reach the poor of the community through its healthcare services. The use-rate of healthcare shows that the Project has succeeded in achieving this. Around 82% of the poor families purchased family-health cards to get healthcare services from the village health posts (Fig.).

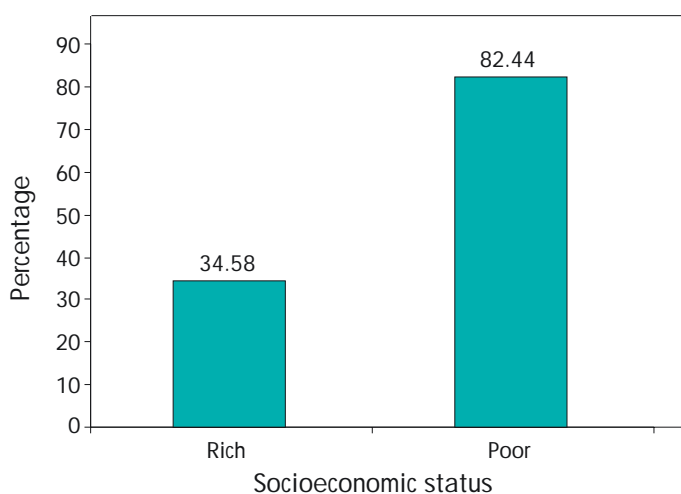
The health cooperative is a comparatively new approach formed with the aim of serving as a social insurance for healthcare for the community. By the end of December 2003, the community formed 77 health cooperatives. The villagers have started to take loans from the cooperatives and use loans to meet their healthcare needs. The Project is encouraging more and more villagers to get involved with the cooperatives through extending additional advantages to cooperative members in receiving healthcare services at the village health posts (e.g. by charging lower consultancy fees, lower fees for health cards, etc.). Although the Project is handling the management and distribution of cooperative funds, it is expected that the community will take full responsibility to run the cooperatives by themselves.

Rapid assessment tool for better health: helping essential service package managers to be more effective

The task of data analysis and interpretation requires expertise beyond the domain of programme management. In this respect, the lot quality assurance sampling (LQAS) method is more rapid, simple, time-efficient, and less costly compared to others because it is based on a much smaller sample size.

The study was aimed at comparing the proportions of inadequately-performing areas in terms of the Essential Service Package programme identified by the LQAS method with those derived from data of the Matlab Health and Demographic Surveillance System (HDSS). The project also examined the experience gained in implementing the tool by the lowest-level supervisors of the health and family-planning programme. In fact, its application in the field situation is very easy. Once the decision models are made, ideally in consultation with policy-makers and programme managers, the task of collecting the required

Fig. Procurement of CCHP card by household socioeconomic status



data and their use in deciding which of the health facility is working adequately or not is very simple. The method can also be used for various other outcome variables. The LQAS method was applied to identify inadequately-performing areas covered by the community health workers on the basis of predefined threshold level of use. While the LQAS method is found to be of acceptable reliability, the challenge is to adopt it in the regular monitoring system at the lowest level of the programme.

The proportion of areas identified as performing inadequately using the LQAS method and HDSS data is statistically similar implying that the conclusion derived about the performance of the area by using the LQAS method and surveillance data is not different. It is possible to train the supervisors to adopt this method for monitoring programme performance. Initially, refresher training is also needed to develop confidence among the supervisors about the practical application of the method. The study has been completed, and a report is being prepared for publication.

Women's health and domestic violence against women

Although sporadic studies and reports by media indicate that domestic violence against women (DVAW) is a serious problem in Bangladesh, reliable estimates of magnitude of DVAW and its precipitating factors and consequences on women's health are absent.

While the LQAS method is found to be of acceptable reliability, the challenge is to adopt it in the regular monitoring system at the lowest level of the programme

Lack of such data has led to off-hand dealing with this issue completely ignoring the fact that however scanty the evidence is, it indicates a serious public-health problem. The paucity of information on the determinants and precipitating factors for domestic violence has similarly impeded the development of sound and effective programmes to address this issue, especially in the area of prevention. Similarly, limited understanding of the linkages between domestic violence and women's physical and mental health problems has resulted in missed opportunities in effectively and directly addressing this issue within the existing health and reproductive health programmes. The present population-based study is sponsored by the urban primary healthcare project with financial support from the Asian Development Bank, and it attempts to address the issues discussed above by seeking to: (1) obtain reliable estimates of the prevalence of DVAW in urban and rural Bangladesh; (2) document the health consequences of DVAW; (3) identify and compare risk and protective factors for DVAW within and between rural and urban settings; and (4) explore and compare the coping strategies used by women experiencing domestic violence.

The study employed both qualitative and quantitative research methods. Qualitative data have been collected using key-informant interviews, in-depth interviews of women with experience of domestic violence, and focus-group discussions. The findings were used for

helping guide development of the study, describing the context within which the quantitative findings are interpreted, and identifying modifications to the research methods.

A cross-sectional survey of 3,130 women aged 15-49 years was carried out during June-October 2001. Women were interviewed in private by trained interviewers about their experience of violence. Counselling services were offered to abused women.

Of the ever-married women interviewed in the survey, 40% in Dhaka and 42% in Matlab reported being physically assaulted by their husbands. The percentage of women reporting ever being sexually assaulted by their husbands was 37% in Dhaka and 50% in Matlab. Sixty-nine percent of ever-married women in Dhaka and 81% in Matlab reported psychological abuse by husband. Lower age at marriage, involvement of dowry in marriage, income-earning by women, frequent verbal disagreements with husbands, and history of physical violence among adults in both the spouses' families were identified as risk factors for physical violence by husbands. Husband's education, perceived natal family support in crisis, and greater within-couple communication were the protective factors against physical abuse by husbands. The results suggest a life-cycle effect with physical violence increasing up to a certain point in age and then decreasing. Women in Dhaka were more likely to be physically abused compared to their rural

peers. An important learning from the study is that the family structure does not contribute to physical violence, and when controlled for other factors, income does not have a significant effect on physical violence.

Positive attributes of the community, high level of communication between spouses, and perceived natal family support proved to be protective factors against sexual violence, whereas history of physical violence in husband's family and dowry, or other demands were identified as risk factors for this form of violence. The women from Dhaka were less likely to report being sexually abused by their husbands compared to women from Matlab.

Similar to the case of sexual violence, positive community attributes are a protective factor against psychological violence against wives. Dowry or other demands, frequent quarrel, low level of spousal communication, and history of physical violence in husband's family are risk factors for psychological violence. Women from Matlab are more likely to experience psychological violence.

The findings of the study also reveal that domestic violence adversely affects women's general health; 14-26% of women who experienced violence from their husbands suffered from poor general health. In contrast, 12.5-16% living in non-violent spousal relationships reported poor or very poor general health. Of ever-married women living with experience of some form of violence in their lives, 62% of urban and 67%



Senior members of the PHSD staff discussed research priorities in a retreat held during February 2003

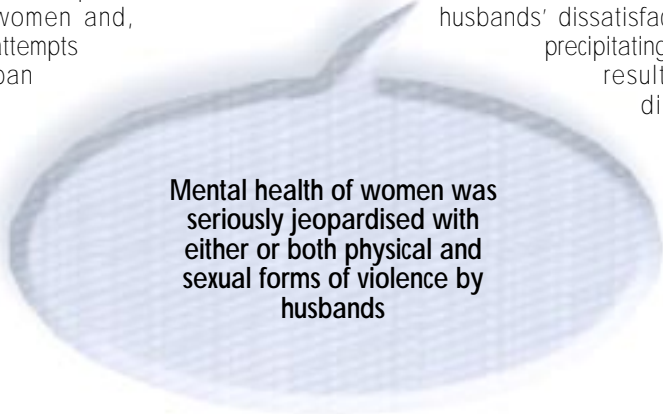
of rural women reported poor health. Specific physical health problems include problems with mobility, memory, increased susceptibility to infections of the reproductive tract, and day-to-day functioning.

This study found that 27% of women with experience of physical violence in Dhaka and 25% of those in Matlab had injuries as a direct result of spousal violence. Abrasions and bruises, followed by cuts, punctures, and bites, were the most common forms of injuries reported. Nearly 35% of ever-married women reporting ever being injured also reported being injured in the last 12 months. 56.7% of those reporting injuries said that such violence leading to injuries occurred once or twice ever in their lives. 29.2% of women said that such violence occurred 3-5 times in their lives, and in 14.1% of cases, such violence has occurred more than 5 times in a lifetime.

Results showed that the mental health of women was seriously jeopardised with either or both physical and sexual forms of violence by husbands. When both physical and sexual violence existed in women's lives, urban women were more prone to mental health problems compared to rural women and, moreover, suicidal attitude and attempts were more common among urban women. Physical violence was more harmful than sexual violence and, when both the forms of violence were present, physical and mental health problems increased.

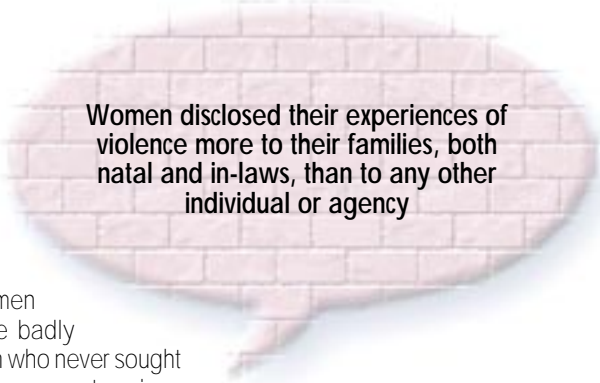
In both urban and rural locales, women appeared to be taking most of the responsibility for birth control. 9.3% of urban and 13.9% of rural husbands, or on an average, 11.6% husbands tried to stop their wives using birth-control methods. 85% of urban and 78% of rural husbands, or on an average, 81% husbands who reportedly opposed their wives' using birth control methods, used verbal communication methods to voice their displeasure. There appeared to be no major difference in women living in and not living in violent relationships regarding the current use of birth control. At the present level of analysis, no significant difference was found for miscarriages among women living in physically-violent and non-violent relationships. However, numbers of abortion increased with physical violence. In non-violent households, there were fewer deaths of children after they were born alive.

Findings on what led to violence revealed that when couples had problems with either side of their respective families, chances of violence increased. Financial crisis in the family, women's refusal of sex, women's disobedience to husbands, and husbands' dissatisfaction with wives were also common precipitating factors. Women reported violence as resulting in health problems and work disruption. Women disclosed their experiences of violence more to their families, both natal and in-laws, than to any other individual or agency. Neighbours were also common confidants of women. Although



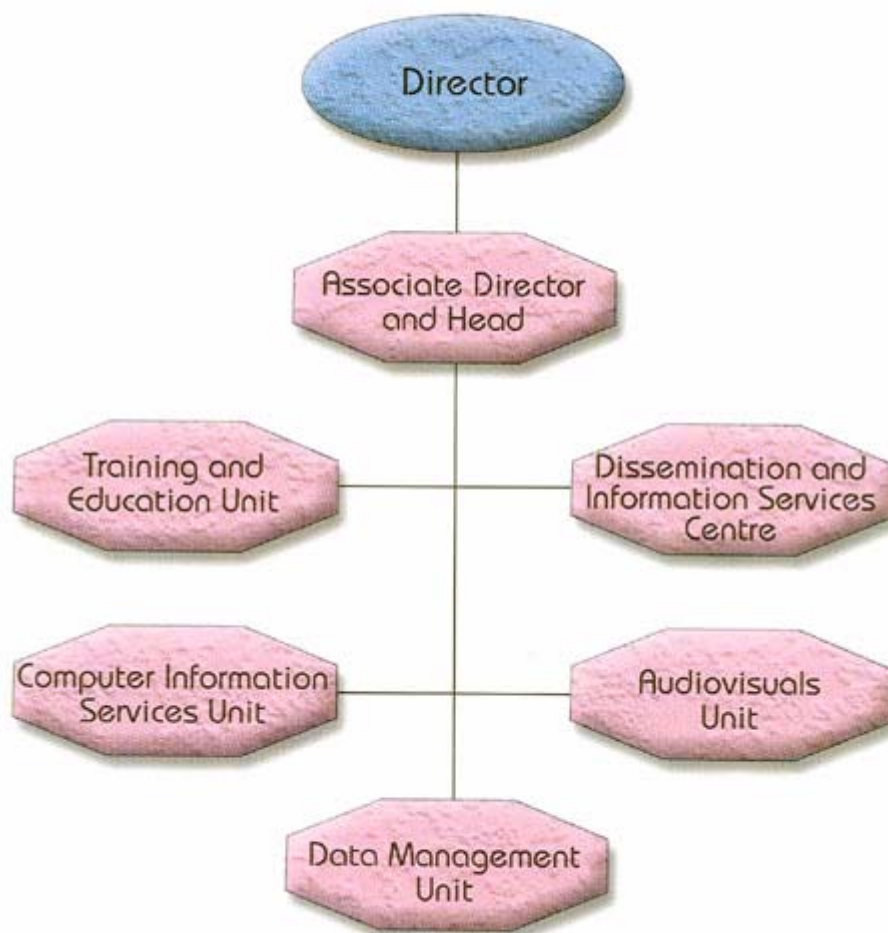
Mental health of women was seriously jeopardised with either or both physical and sexual forms of violence by husbands

children, more often than not, were witness to the violence, women neither talked to, nor sought help from, children. Very few women sought help from formal networks set up for the provision of interventions in the case of violence. In-laws, neighbours, parents, and siblings were most helpful in countering violence against women. Most women sought external intervention when they were badly injured, or feared they would be killed. Women who never sought help from others reported that the violence was not serious enough. Shame, fear of blame, and fear of disbelief were other reasons for silence. More than 80% of women also did not leave their houses as a result of violence. Of those who left, more than 60% returned within a month of being away. Reasons for returning mainly centred on family preservation but were often instigated by husbands/families encouraging the women to return. Further analysis of data is being undertaken.



Women disclosed their experiences of violence more to their families, both natal and in-laws, than to any other individual or agency

Information Sciences Division



**Associate Director and Head
Peter Thorpe**



Information Sciences Division

The Information Sciences Division is responsible for the two-way flow of information and knowledge transfer into and out of the Centre.

The Division is made up of the Training and Education Unit (TEU), the Dissemination and Information Services Centre (DISC), the Computer Information Services Unit (CISU), the Audiovisuals Unit (AVU), and the Data Management Unit (DMU).

The Division has been active during 2003 in the DFID-supported Poverty and Health Project, being responsible for two components: communications and training. In addition to providing logistics assistance for training courses, TEU was also responsible for managing the recruitment and monitoring of 5 Poverty and Health fellows who were appointed on a one-year contract in February 2003. Infrastructural work during 2003 focused on the upgrading of communications facilities in CISU, to ensure an improved and more secure environment, both for our website and for Internet and e-mail use by Centre staff. The Computer Training Laboratory, which opened in July 2002, has continued to be used heavily by Human Resources Department for their staff training courses on the use of MS Office software and by DISC on Internet searching. It is also likely to be used intensively in early 2004 for training on the new Navision system. In addition, a number of the training courses organized by TEU, such as the measurement of poverty, epidemiology and biostatistics, and the health and demographic surveillance system courses, continue to benefit from the use of this facility.

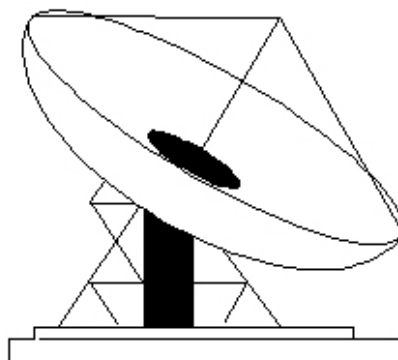
Several members of CISU have been preoccupied during the year, working with the joint Centre-PriceWaterhouseCoopers (PWC) team who have been customizing the MS Navision management informa-

tion system, which will be put into operation at the Centre early in 2004. This has involved travel to Kolkata to work at PWC's offices there as well as intensive work around the Centre. When the package is implemented, routine management of the system will be a responsibility CISU; so thorough familiarity with the software is vital in ensuring smooth operation for users throughout the Centre.

The Advanced Laboratory Course in Infectious Disease Research, sponsored by the Howard Hughes Medical Institute, was organized at the Centre by the Laboratory Sciences Division and TEU, in September 2003.

The Division also played an important part in the planning and management of the 10th Asian Conference on Diarrhoeal Diseases and Nutrition (ASCODD), held at the Bangladesh-China Friendship Conference Centre during 7-9 December 2003. The theme of the conference this year was "Improving Child Health and Nutrition." DISC and AVU personnel were responsible for the management and distribution of the more than 400 abstracts submitted for this meeting, and for the consequent design, publication, and distribution of the Abstracts Book, programme souvenir, and ancillary materials.

Notable among the Centre's publications in 2003 were a special issue of the *Journal of Health, Population and Nutrition* on health equity, the Abstracts Book for the 10th ASCODD, and *Smriti: ICDDR,B in memory*, a collection of reminiscences of their times at the Centre by members of the staff and alumni.



The core of the Centre's work is knowledge generation. In fact, the Centre's vision looks to the application of new knowledge to help people, especially the poor, become healthier and reach their full potential. Knowledge needs to be shared and disseminated if it is to achieve this aim. The Centre does this by training and capacity building and by sharing its knowledge through publications and on its website. Publications, whether in the international health press, in popular newsletters and magazines, or on the web site, assist in spreading the message of the Centre's research work and other activities.

Training courses allow researchers, clinicians and other health workers to come to Dhaka and to see just how the Centre carries out its activities, and on many courses, there is an opportunity to try it out for yourself! Most of the Centre's courses are very practically oriented and make full use of the hospitals, laboratories, and field sites that we have at our disposal.

Training and Education Unit

Head: A.N. Alam

The training courses and workshops, organized by the Training and Education Unit (TEU) in collaboration with the scientific divisions of the Centre and, at times, with national and international organizations, are designed to provide participants with the knowledge and skills applicable to their needs.

In 2003, TEU conducted 13 courses and workshops (Table) to fulfill its objectives of: (a) increasing capacity to conduct research in developing countries; (b) increasing capabilities to manage programmes for the control of diarrhoeal diseases; (c) improving skills of health personnel through hands-on training on specific aspects of diarrhoeal diseases and nutritional

problems; and (d) improving response to new and emerging issues in health and population.

The participants of the training courses and workshops included 468 scientists, physicians, health administrators and health personnel, and trainers from 26 countries (Asia-15, Africa-5, North America-2, and Europe-4). Another 683 persons received orientation training on different aspects of diarrhoeal diseases, nutrition, and reproductive health.

Japan International Corporation of Welfare Services (JICWELS), Office of Foreign Disaster Assistance (OFDA)/USAID, World Health Organization, DFID, and Howard Hughes Medical Institute, USA, provided support to most training programmes.

Table. Training courses and workshops conducted during 2003

Date/Course/workshop title	No. of courses/workshops (n=13)	No. of participants (n=274)	Countries represented (n=28)
Health Research Training			
4-29 May; 3-28 August Introductory Course on Epidemiology and Biostatistics	3	54	Bangladesh
19-30 January Workshop on Health and Demographic Surveillance System: Longitudinal Data Analysis (DFID)	1	15	Indonesia, Nicaragua, Pakistan, Tanzania, India, South Africa, Vietnam, and Bangladesh
International Workshops/Courses			
16 February-13 March Emerging and Re-emerging Pathogens (JICWELS)	1	5	Japan
3-24 April; 12-23 October Emergency Response to Cholera and Shigella Epidemics (OFDA/USAID)	2	31	Afghanistan, Bangladesh, Indonesia, Iraq, Japan, Kenya, Malawi, Mozambique, Pakistan, Rwanda, Somalia, Sudan, Uganda, USA, and Zimbabwe
29 June-3 July Regional Training Course on Measuring Poverty: Economic Dimensions (DFID)	1	17	Bangladesh, Nepal, and Pakistan
8-23 September Advanced Laboratory Training Course in Infectious Disease Research (HHMI)	1	18	Bangladesh, Guatemala, India, Malawi, Nepal, Peru, Thailand, Turkey, and Vietnam
National Training Courses/Workshops			
5-10 April Comprehensive Training Course on Prevention and Management of Malnutrition: Children, Adolescent Girls, and Women	1	30	Bangladesh
26-30 January Clinical Management of Diarrhoeal Diseases for MD, DCH, FCPS, and FCGP students	3	44	Bangladesh
Fellowship Programme			
International Fellowship (elective training and training for postgraduate degree and diploma)	--	40	Bangladesh, Canada, the Netherlands, Japan, UK, and USA
Clinical Fellowship	--	8	Bangladesh
Nursing Fellowship	--	12	Bangladesh

Fellowship in Poverty and Health Research

To promote and increase poverty-focused health research capacity in Bangladesh, the Centre introduced a fellowship programme in February 2003. The objective of the programme is to strengthen the knowledge base to understand health problems of the poor, interaction of poverty and ill health and to identify policy and programmatic options to improve health, especially of the poor, and to reduce poverty in the developing world, including Bangladesh. The programme was sponsored by DFID.

In the first phase of the programme during 2003, 5 fellowships were offered to young Bangladeshi researchers with commitment to and potential for making a career in research targeted towards lessening poverty in the country. Graduates in medicine and in areas of social sciences with outstanding academic achievements and excellent language proficiency in English and Bangla were considered for these fellowships.

Comprehensive Training Course on Prevention and Management of Malnutrition: Children, Adolescent Girls, and Women

At the request of the Marie Stopes Clinic Society, Bangladesh, a 6-day Comprehensive Training Course on Prevention and Management of Malnutrition: Children, Adolescent Girls, and Women was conducted during 5-10 April 2003 for 30 medical officers, clinic managers, paramedic, field coordinators, health

Educators, and programme officers of the Urban Primary Health Care Project (UPHCP) of Marie Stopes Clinic Society. The objective of the training workshop was to impart knowledge and to develop skills on 'best practices' in the management of severely-malnourished children. The course provided the participants with guidelines for nutritional rehabilitation, nutrition education, growth monitoring, assessment of malnutrition, implementation and follow-up of nutritional rehabilitation plan.

UPHCP, consisting of 6 Primary Health Care Centres and a Comprehensive Reproductive Health Care Centre, aims at improving the health status of the urban poor population, especially of women and children, by improving access to health services and changing the way in which health services are provided in urban areas.



Dr. A.N. Alam, Head of the Training and Education Unit, presenting his lecture to the participants of the Advanced Laboratory Training Course, sponsored jointly by Howard Hughes Medical Institute (HHMI) and ICDDR,B

Future strategy

The future strategy of the Unit is to: (a) increase capacity of the Centre's trainers by providing training in training pedagogy; (b) develop new courses in poverty and health methodology; (c) develop training courses in CD-ROM; (d) strengthen collaboration with universities within and outside Bangladesh to offer postgraduate diplomas/degrees; and (e) identify new donors for additional funds to implement future plans and to make the training programmes self-supportive.

Dissemination and Information Services Centre

Head: M. Shamsul Islam Khan

With 11 staff members, the Dissemination and Information Services Centre (DISC), comprising Information Services Branch and Publications Services Branch, provides information services and disseminates relevant information through publications and website. The mission of DISC is to diffuse global results of health, nutrition and population research for solving the common health, nutrition and population problems, especially in the context of the developing world.

Md. Nazimuddin, Librarian, left DISC to join BRAC University as Deputy Librarian and Talut Solaiman, Publications Officer left to join DFID/Dhaka as Resource Centre Manager. The position of Librarian was renamed Senior Information Officer, and was

filled by Information Officer Md. Anisur Rahman. Dilruba Mahbuba joined DISC as Information Officer.

Information Services Branch

Librarian: Md. Nazimuddin (Until January)
Senior Information Officer: M. Anisur Rahman (From February)

At the end of 2003, the Library had over 53,000 books, project protocols, bound journals, and documents/reprints. In 2003, 1,522 new books (92 purchased), research protocols, and bound journals were added to the library collection, and 71 books (30 downloaded from Internet) were collected for the Poverty and Health Resource Centre housed at DISC. The Library received 334 current periodicals, 80 newsletters, and one CD-ROM database, and spent US\$117,918 to procure 225 current journals and one database. Ten new titles were added, and 3 titles were dropped.



A library official Mr. Md. Ekramul Hassan showing three library users how to search a desired item using the Internet

During the reporting year, there were nearly 1,8000 reader-visits took place, and 573 persons from both within and outside the Centre used the library facilities for searching and browsing of papers, publications, and in-house and international databases, including Medline/PubMed, Popline, HINARI, and AGORA. The staff dealt with 1,750 queries. Five hundred computerized literature searches were conducted for the Centre's staff and 200 for external users. Nearly 60,000 pages of photocopies were made—half of which were for external users. The Library lent 921 books and bound journals to other organizations under the inter-library loan arrangements. The British Council in Dhaka donated 25 books to the Centre's library. The Nuffield Library of the British Medical Association continued to provide free photocopying service. At the end of the year, the 5 library databases contained 13,478 items.

In 2003, the Library donated over 790 publications and journal issues to the Bangladesh National Scientific & Technical Documentation Centre and to the libraries of Kumudini Medical College, Bangladesh Institute of Development Studies, Bangladesh Rural Development Training Institute, BANSDOC, Bangladesh Health Professionals Institute (Academic Institute of CRP), Directorate of Environment, Institute of Child Health and Shishu Hospital, Institute of Nutrition and Food Science, North-East Medical College, and North Bengal Medical College.

The library staff conducted two-hour training sessions on Internet searching for outside library patrons. Thirty-one library members participated in these sessions. They learned how to access and search the Internet databases, how to access online periodical articles, monographs, reports, documents, and library catalogues, and how to download the searched materials for subsequent access and use by them.

Two hundred forty-one persons were enrolled as library members in 2003, and the Library earned Tk 253,666 from membership fees, daily-use fees, sales of membership forms, overdue fines, photocopying service, and literature searches.

Publications Services Branch

Dissemination Manager: M.A. Rahim

The Publications Services Branch produces the Annual Report, the quarterly peer-reviewed Journal of Health, Population and Nutrition (JHPN), the quarterly English newsletter Glimpse, a Bangla health magazine, Shasthya Sanglap (3 issues/year), working papers, scientific reports, and special publications. The Branch also provides editorial advisory service and disseminates findings of research carried out by the scientific staff of the Centre and other output information through its internal publication series and the Centre's website.

Journal of Health, Population and Nutrition

During the reporting year, 135 manuscripts were received from 31 different countries for publication in JHPN. During the reporting year, 94.81% of the articles were submitted from developing countries. Fifty articles—41 original papers, 2 short reports, 3 editorials, and 4 letters—were published in its four issues. The September Issue published papers exclusively on 'Health Equity'. All manuscripts went through the strict review process to ensure the quality of the papers, which resulted in the rejection of 57 (42.22%) manuscripts in 2003.

In 2003, the Branch edited and published the Annual Report 2002, Smriti Book, Abstracts Book of the 10th Asian Conference on Diarrhoeal Diseases and Nutrition (10th ASCODD), 4 issues of the Journal of Health, Population and Nutrition, 3 issues (one issue combined) of the English newsletter Glimpse, and one issue of the Shasthya Sanglap. DISC rendered editing services to the scientists for 6 papers and publications (368 pages). In total, 111,728 copies of different publications (Annual report, Glimpse, Shasthya Sanglap, JHPN, and Health and Science Bulletin) were distributed/mailed to over 121 countries. The Branch displayed and distributed publications at various important meetings, workshops, and conferences.

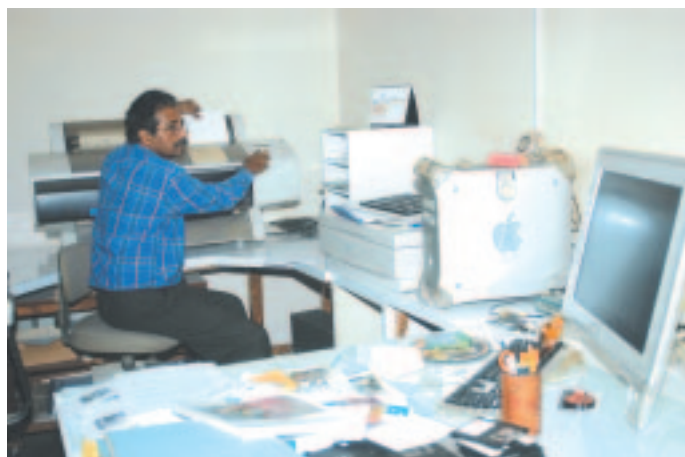
In 2003, DISC earned US\$12,658 from subscriptions, membership fees, and sales of services and publications. In addition, the cost of 72 journals (US\$ 32,752) was also recovered from several projects within the Centre.

Audiovisuals Unit

Head: Asem Ansari

The Audiovisuals Unit (AVU) provides support to the Centre's scientists by preparing graphics material for their documents and audiovisual presentations. The Unit is also responsible for the cover design of all publications and formatting of the Centre's quarterly newsletter Glimpse and the Annual Report.

In 2003, production of slides, pictures, microphotography, gels, animal dissection photography, graphs, and charts continued. The Unit arranged audio- and video-recording of important meetings, seminars, symposia, and conferences organized at the Centre, in addition to taking photographs of important visitors to the Centre.



Mr. Asem Ansari at work in his Audiovisuals Unit, now equipped with the latest AppleMac system, including a high-resolution printer and scanner

During the reporting year, the Unit designed covers, laid out pages, and processed DTP output for the Annual Report 2002, all issues of the newsletter Glimpse published during 2003 and produced the Centre's calendar and year planner for 2004, along with a number of brochures, posters, post cards, and other display materials.

The Unit had a busy year with the preparation of audiovisual materials for the 10th Asian Conference on Diarrhoeal Diseases and Nutrition (ASCODD), the International Conference on Infectious Diseases in the Pacific Rim sponsored by the US-Japan Cooperative Medical Science Program held in December. Work relating to Annual Ball 2004 was also completed in late 2003.

The Unit earned an amount of over US\$ 9840.00 from the sale of above services during 2003.

Computer Information Services Unit

Head: M. Farhad Hussain

The Computer Information Services Unit (CISU) provides, coordinates, and manages information and communication technology (ICT)-related services at the Centre. It supports the Centre's research and management programmes with efficient, cost-effective information systems, networking and communication services. The objectives of CISU are to: (a) provide state-

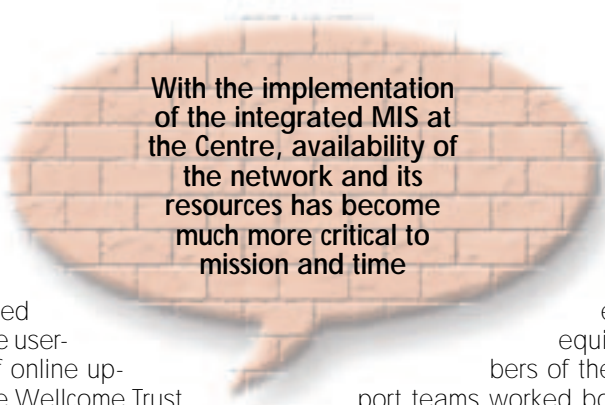
Mr. Farhad Hussain, Manager of CISU, configuring an e-mail server with his professional staff



of-the-art computing and communication facilities; (b) provide high-quality, centralized and integrated support services; (c) develop appropriate ICT policies, standards, and guidelines. The Unit carried out its various activities in 2003 with 11 personnel.

Major activities and services offered

The Centre's computer network is connected to the international Internet backbone through a satellite-based communication system, and its Dhaka and Matlab stations are connected through a microwave link with voice and data-transmission facilities. CISU maintains the Centre's communication infrastructure and local area network with more than 700 computers.



With the implementation of the integrated MIS at the Centre, availability of the network and its resources has become much more critical to mission and time

The Centre's website (<http://www.icddrb.org>) has been developed into a database-driven, knowledge-based dynamic website, which has become more user-friendly and interactive with provision of online update of web pages. CISU worked with the Wellcome Trust, UK, to develop a website for the ICDDR,B-HHMI Advanced Laboratory Training Course in Infectious Disease Research, and an online discussion forum is being developed for the participants of the course. The intra-website (<http://Centre>) has also been improved. The site announces weekly activities, such as seminars, visitors' schedules, internal vacancies, notices, events, etc.

CISU maintains several servers for databases, applications, e-mail, website hosting, and domain authentication. It also holds a file and print server to provide centralized data back-up and printing services. The Unit has developed disaster-recovery plans for the servers. Several database-oriented customized software applications were developed. CISU has been playing a major role implementing an integrated MIS at the Centre. The Centre's network infrastructure has been improved and, as a result, the network is up and running with minimum congestion and negligible downtime. The Internet bandwidth has been upgraded from 256 kbps to 512 Kbps. A firewall, a gateway virus protection, and an Intrusion detection system now secure the Centre's network.

Services relating to repair of, and support for, computers, printers, and networking equipment were provided. Members of the software and hardware support teams worked both at the user end and in the computer hardware laboratory to make certain prompt and quality services for the computer users of the Centre. Operating Systems, MS Office, anti-virus, e-mail and other applications have been installed and configured in computers according to the need of the users.

Future planning

CISU is working to ensure the smooth integration of available computing resources in the network without any disruption in services. With the implementation of the integrated MIS at the Centre, availability of the network and its resources has become much more critical to mission and time, which means that the availability of network and its resources has become more important with the introduction of the integrated MIS and that it is pertinent to the objectives of the Centre; the downtime of the network should now be kept at the absolute minimum level. At the same time, it is necessary to ensure the security of the resources in the network. To address these key issues, CISU plans to restructure the network at the Centre. Considering the size and nature of the network, CISU plans to establish a struc-

tured and flexible cabling system at the Centre which can be adapted for any application from telephone to LAN or an emerging technology like ATM.

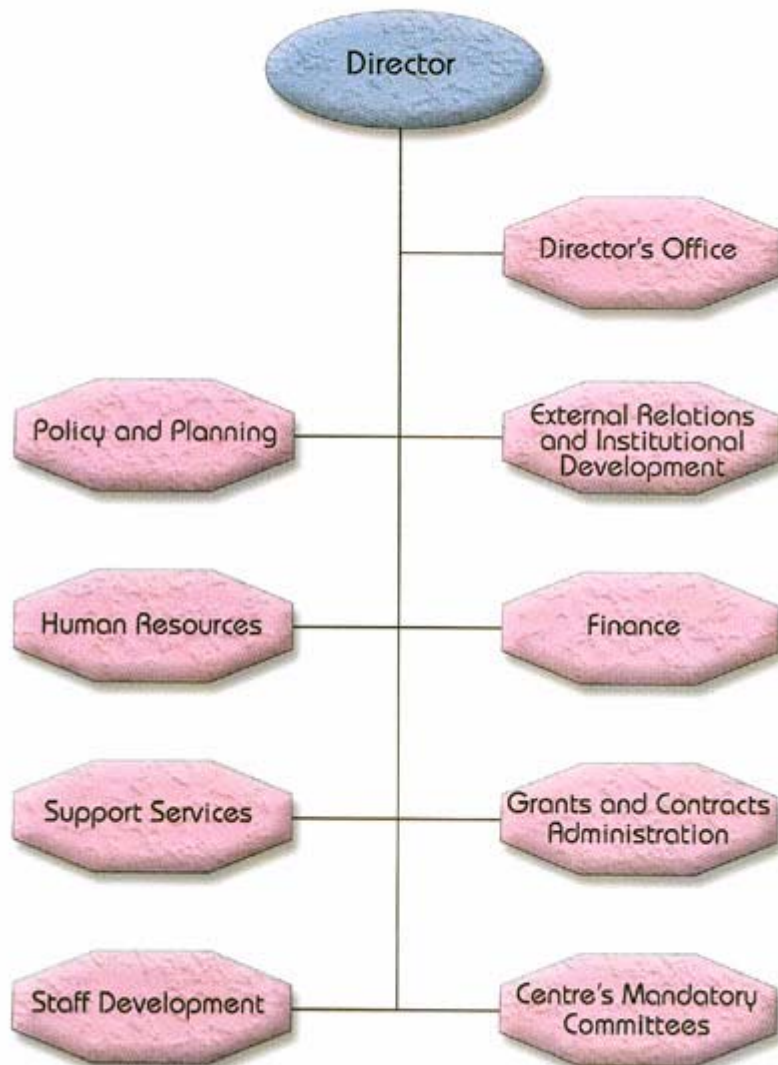
Data Management Unit

Head: M. Farhad Hussain

The Data Management Unit (DMU) provides support and solutions to those parts of the Centre, which have no data management staff of their own. The Unit works under the administrative and technical supervision of the Computer Information Services Unit (CISU). The Unit carries out its activities with two programmers. The DMU has developed several customized software applications for different research laboratories and other entities of the Centre. A Laboratory Management System has been developed for the Nutritional Biochemistry Laboratory, and an Inventory Management System has been developed for the RTI/STI Laboratory. The Unit is providing maintenance and enhancement support for the developed applications. A Patient Management System is being developed, customized, and maintained for the Staff Clinic of the Centre. Presently, the Unit is developing a customized database-driven application for the Training and Education Unit. DMU played and continues to play an active role in the process of implementation of the Navision MIS at the Centre,



Director's Division



**Director
David A. Sack**



Director's Division

Human Resources Department

Head: Ann Gauvin Walton

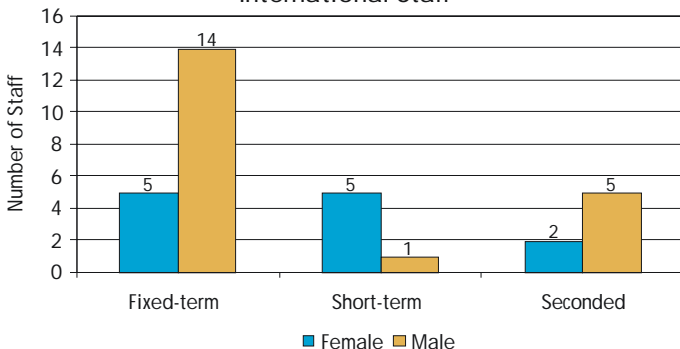
The Human Resources Department with 19 staff members is responsible for recruitment, contracts, compensation and benefits, gender equality, staff development, and data management. The Department also looks after the well-being of employees and their dependants by providing free medical treatment through its Staff Clinic. Throughout the year, HR provided support to recruit 100 fixed-term employees and 299 employees under Contract Services Agreement (CSA). As of 31 December 2003, the Centre had a staff complement of 1,873. The following graphs depict the staff gender distribution in various employment categories.

The Human Resources Department has been working towards the development and implementation of an integrated management information system for the Centre. Following the functional requirements definitions, the systems analysis and design phases were completed. This project required the Human Resources Department to redefine all its processes and implement a new departmental structure. The system will radically change the manner in which the Department pro-

vides services to the organization. The perceived benefits of the new system for HR include increased ability to be more responsive to the organizational needs, reduced paperwork and improved workflow through fewer authorization levels, central repository for HR and payroll information and reporting, standardized information, reduced lead times for recruitments, and user-friendly online HR processes, such as leave management and performance appraisal. Implementation is scheduled for early 2004.

Historically, the Centre has addressed issues relating to women's equality both through research and services and within the organization. However, in recent years, there has been a growing recognition of the need to address gender issues in a systematic way. In response, the Centre formed a Gender Equality Committee in 2002 that took a number of steps to address gender issues at the organizational level. In February 2003, the Committee initiated the process of drafting a Gender Policy with participation and contributions from all divisions of the Centre. Subsequently, Centre-wide consultations took place to give staff at all levels an opportunity to review and provide input to the draft policy. In June 2003, the Board of Trustees approved the Gender Policy. The Gender Policy seeks to

International Staff



National Staff



Workshop of the Gender
Equality Committee,
February 2003



complement and strengthen the focus on gender equality in the Centre's Strategic Plan. A 15-member committee has been created to support implementation of the Policy. The Centre plans to recruit a Gender Specialist in early 2004 and complete a gender audit to review key organizational structures and procedures to identify whether and how they discriminate against women or men and identify possible measures to overcome these biases.

New International Professional Staff

Ms Loretta Saldanha, an Indian national, joined the Centre as Executive Assistant to the Director on 10 April 2003.

Staff Development Office

Manager: Bejoy R. Saha

Under the Staff Development Programme, the Centre regularly orga-

nizes internal workshops and training courses and sends members of staff to local and overseas institutions for higher studies and focused training aimed at improving its manpower to sustain ongoing research, training, and clinical services and to develop well-trained staff to meet the future needs. Under this programme, 118 staff members were benefited in 2003 with financial support from the Bill and Melinda Gates Foundation-Bangladesh grant to the Centre, Circle-Around-the-Centre Fund, and fellowships from several agencies and various projects of the Centre.

Foreign training: Fifty-one personnel attended training courses/study programmes in Australia, France, India, Japan, New Zealand, the Netherlands, Sweden, Thailand, UK, and USA. Of 19 personnel who completed their studies and training, one received the PhD degree, 8 returned after completing the partial requirement for their doctoral studies, 3 obtained their Masters degree, and 7 completed non-degree training in various disciplines. During the year, 25 staff members left to begin their higher studies or training abroad. At the end of the year, 31 personnel were studying abroad—21 for PhD degree, 7 for Masters degree, and 3 for non-degree focused training.

In-country training: Nineteen staff members received in-country training in various disciplines. Of them, 14 were sent for long-term training/study programme—Masters degree (7), Certificate in Computer Programming (4), Chartered Accountancy (1), Postgraduate Diploma in Development Planning (1), and Postgraduate Diploma in Library and Information Science (1). During the year, one staff member acquired a PhD degree in Microbiology from the University of Dhaka and 2 acquired MBA degree.

In-house training: Under the in-house training programme, 48 personnel attended several workshops and training courses organized by the Training and Education Unit of ICDDR,B.

Twenty-four personnel attended the Introductory Course on Epidemiology and Biostatistics; 5 staff members attended the Workshop on Benchmarks of Fairness for Health Care Reforms, 12 attended the Training Course on Measuring Poverty: Economic Dimensions, 5 attended the Workshop on Health and Demographic Surveillance Systems and Longitudinal Data Analysis, and 2 from Chakaria Community Health Project, Public Health Sciences Division, received hands-on training on laboratory techniques at the Centre's Clinical Laboratory Services in Dhaka.

Finance Department

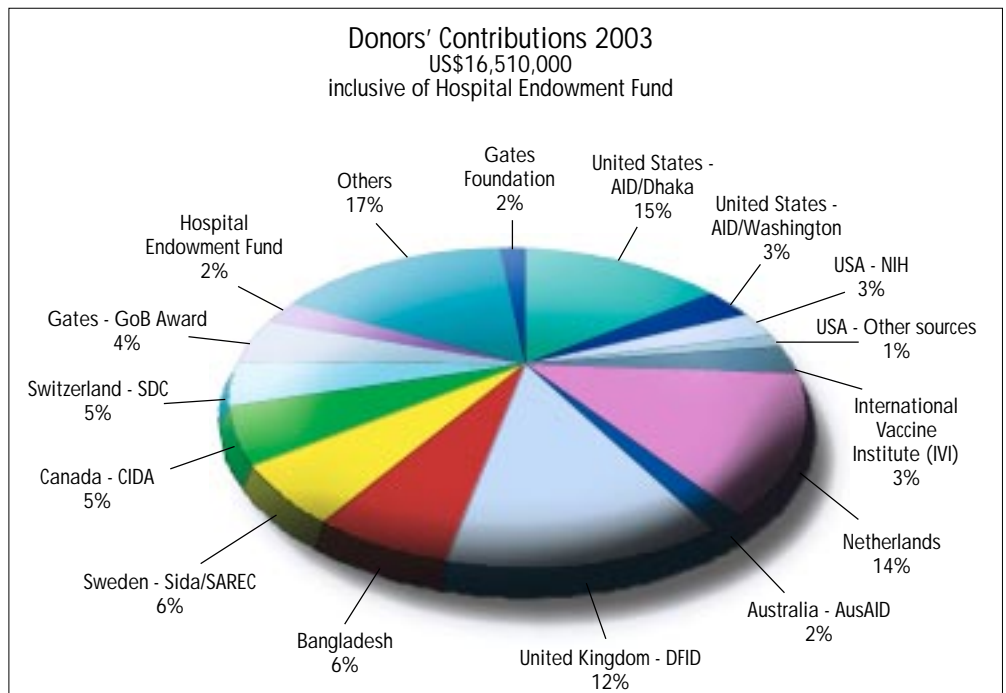
Head: Aniruddha Neogi

The Finance Department has the overall responsibility for financial operations, Centre's procurement along with inventory control and management of fixed asset. The financial operations include: cash management and custodianship of all funds, management of staff compensation, preparation of annual budget, recording of all financial transactions and commitments, preparation of financial reports for the Board of Trustees, man-

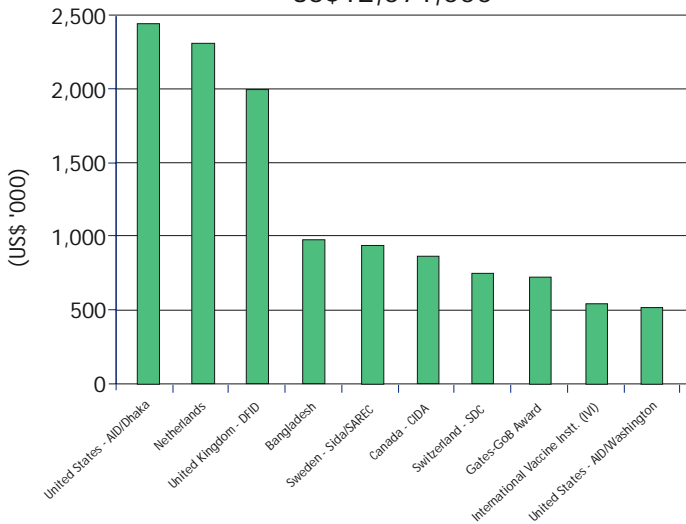
agement, and donors. The Finance Department is also responsible for facilitating the annual audit and assuring timely audits for all donors' contributions. The Procurement and Materials Section purchases sophisticated scientific equipment, perishable and non-perishable chemicals and reagents, drugs and medicines, consumables and the like from overseas and local markets. The Section also facilitates the contract for logistics and support services.

Following are the highlights for 2003:

- Total contribution from donors was US\$16,510,000 (inclusive of US\$400,000 from HEF), which was greater by 8% over the previous year.
- Core contribution increased by US\$1,446,000 (36%) while the project contribution decreased by 5% compared to that of the last year. The increase in core contribution was mainly due to contribution from Canada-CIDA.



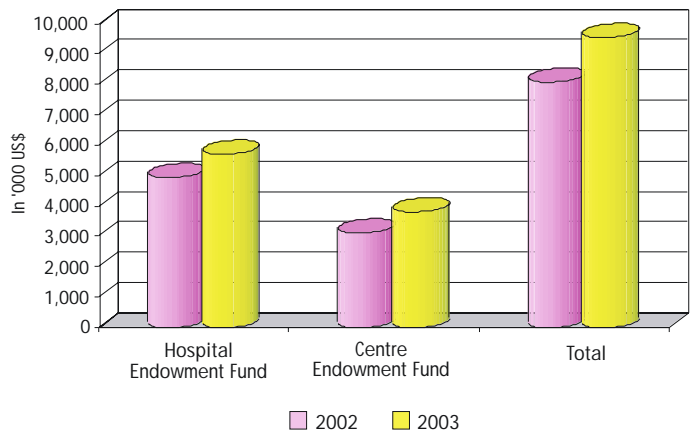
Top 10 Donors 2003
US\$12,071,000



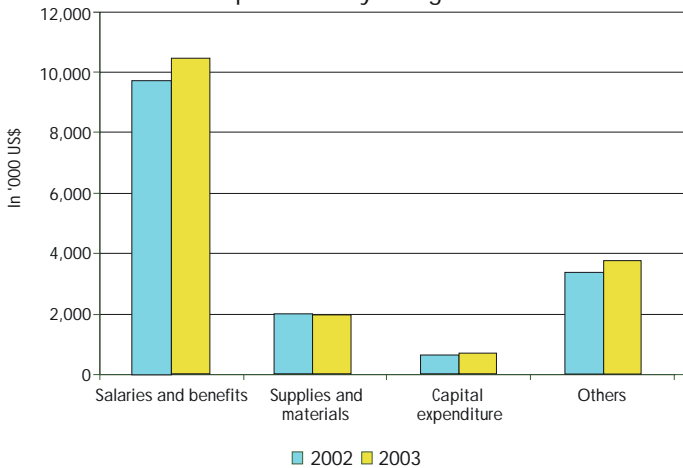
- Operating surplus for the year was US\$163,000 compared to a surplus of US\$73,000 of the last year.
- Cumulative deficit of operating account was decreased by US\$179,000 to US\$2,636,000 (US\$ 2,815,000 last year).
- Market value of endowment funds increased by 21% over the previous year from US\$8,093,000 to US\$9,759,000.

- Total expenditure increased by US\$1,099,000 (7%) to US\$17,017,000 compared to that of the previous year.
- Personnel cost for national and international staff was 61.6% of total expenditure, which was similar to that of the last year.
- Procurement costs of consumables and capital items increased by 3% to US\$2,833,000, compared to that of the last year. These were purchased from overseas and local markets.

Endowment Funds
Market Value as at 31 December



Expenditure by Categories



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



Prof. A.K. Azad Khan, Chair of the Finance Committee of the Board of Trustees, signing the 2003 Annual Financial Statements at Dhaka, together with Director Prof. David A. Sack, Head, Finance Mr. Aniruddha Neogi, senior personnel of the Finance Department, and the auditors

1) We have audited the financial statements of INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH (ICDDR,B) for the year ended December 31, 2003, from which these abridged financial statements were derived.

2) We report that:

2.1) Certain capital expenditure pertaining to Enterprise Resource Planning system have been classified as deferred expenditure. This is not in compliance with the stated accounting policies. Had the above costs been fully expensed in accordance with the stated policies, net surplus before depreciation for the year and the net assets would have been lowered by US\$320,000.

2.2) Non-recognition of "ICDDR,B Employees Separation Payment Fund" balance as at December 31, 2003 of US\$12,044,767 and corresponding investments with Generali Worldwide Insurance Company Limited of Guernsey, Channel Islands.

3) In our report of same date we expressed an opinion that the financial statements, from which these abridged financial statements were derived, present fairly the financial position of the Centre in all material respects in accordance with the accounting policies disclosed therein, subject to our observation in Paragraph 2.1 and 2.2 above.

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

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

Hoda Vasi Chowdhury & Co

Chartered Accountants

Dhaka, March 18, 2004

KPMG

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH
STATEMENT OF FINANCIAL POSITION AS AT DECEMBER 31, 2003 (US \$ 000) - ABRIDGED

	<u>2003</u>	<u>2002</u>
Total Assets	23,192	19,430
Assets	23,192	19,430
Cash and bank	5,094	3,281
Accounts receivable	3,409	2,862
Hospital Endowment Fund Investments	5,758	4,962
Centre Endowment Fund Investments	3,672	3,131
Inventories	420	532
Fixed assets	4,519	4,662
Deferred Expenditure	320	-
Total Liabilities and Fund Balances	23,192	19,430
Current Liabilities	9,875	7,486
Fund Balances	13,317	11,944
Fixed Assets Fund	4,519	4,662
Hospital Endowment Fund	5,758	4,962
Centre Endowment Fund	3,672	3,131
Reserve Fund	2,004	2,004
Operating Fund	(2,636)	(2,815)

STATEMENT OF ACTIVITY (OPERATING FUND) (US\$ 000) - ABRIDGED

Income	17,180	15,991
Contributions	16,110	15,276
Contributions from Hospital Endowment Fund	400	-
Other items	670	715
Expenditure	17,017	15,918
Salaries and benefits	10,476	9,749
Supplies and materials	1,975	2,055
Capital expenditure	858	702
Other items	3,708	3,412
Surplus for the year before depreciation	163	73
Depreciation (without effect on Operating Fund)	1,001	956
Deficit for the year after depreciation	838	883

STATEMENT OF CASH FLOWS (US\$ 000) - ABRIDGED

Cash flows from operating activities	2,758	(100)
Cash used in investing activities	(1,178)	(679)
Cash flow from financing activities	233	33
Net Increase/(decrease) in cash and cash equivalents	1,813	(746)
Cash and cash equivalents at beginning of the year	3,281	4,027
Cash and cash equivalents at end of the year	5,094	3,281

Executive Director, ICDDR,B

Member, Board of Trustees

This is the abridged form of the Financial Statements referred to in our report of same date.

Hoda Vasi Chowdhury & Co
Chartered Accountants

KPMG

Dhaka, March 18, 2004

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

Contributions:	<u>2003</u>	<u>2002</u>
	16,110	15,276
Australia - AusAID	292	214
Bangladesh	969	766
Belgium - BADC/BTC	111	128
Canada - CIDA	859	48
European Union	(10)	293
Ford Foundation	-	243
Gates-GoB Award	730	413
Gates Foundation	311	
Howard Hughes Medical Institute	195	38
International Vaccine Instt. (IVI)	545	352
Japan	-	564
Japan-JICWELS & Others	66	67
MGH-Harvard University (a)	150	151
Netherlands	2,312	1,856
New England Medical Center (NEMC)	137	147
Saudi Arabia	50	53
Sri Lanka	4	-
Sweden - Sida/SAREC	937	741
Swiss Red Cross	161	162
Switzerland - SDC	750	500
The Johns Hopkins University (a)	97	29
The Rockefeller Foundation	131	63
Thrasher Research Fund	93	226
UNICEF	117	230
United Kingdom - DFID	1,998	1,656
United States - AID	3,277	4,295
United States - NIH (a)	167	203
University of Basel-SDC	51	77
University of Newcastle-DFID	-	35
University of Virginia (NIH) (a)	56	63
UNOCAL Foundation	19	56
WHO	163	439
World Bank	48	(1)
Disaster Fund (UNOCAL, Shell, Cairn, Others)	-	5
Centre Endowment Fund	49	71
Others (b)	1,275	1,093

a) Includes subcontracts from the National Institutes of Health (NIH), USA

b) Contributions in 2003 from "Others" for project funds include:

Canadian HC-Local Fund Management Office (LFMO), CDC-Atlanta, Circle-around-the-Centre, Concern, Dartmouth College, Ellison Foundation, Foundation for the Advancement of Clinical Epidemiology (FACE) Inc., George Mason Foundation, Intercell-Cistem Biotech, International Atomic Energy Agency, International Science & Technology Institute Inc., International Nutrition Foundation, New York University School, National Institute of Ageing, Nestle Foundation, Novartis Nutrition, Nutrition Third World, Plan Bangladesh, Pathfinder International, Procter & Gamble, SBL Vaccines, Self Sustaining Units, Umea University, UFHP, UNAIDS, UNOPS, Uppsala University, Urban Primary Health Care, US-Japan, The Netherlands Foundation for the Advancement of Tropical Research (WOTRO) and Wyeth.



2003 Centre Endowment, Hospital Endowment and Circle-around-the-Centre Fund Donors

Individuals

\$1,000+

R. Terence and Nancy Ann Budden
Tikki and Amy Pang
Edward T. and Krista B. Ryan
David A. and Jean C. Sack
R. Bradley and Josephine A. Sack

\$500 to \$999

Monir Ahmed
Ali Shafqat Akanda (*gift matched by Autodesk, Inc.*)
Colette Chabbott and Theodore H. Thomas
John A. Smetanka

Up to \$499

Anonymous
Julia M. Ackley and Cameron L. Burks
Shams El Arifeen
John C. and Louise N. Ballard
Peter N. Ballard
Barkat-e-Khuda
David M. and Annie Bishai
Dilip I. and Mino D. Chandarana
Andrew L. and Katherine Singley Dannenberg
Anthony E. and Melodia Drexler
Gangarosa International Health Foundation
Karen and Joseph Hall
Jason B. Harris and Regina C. LaRocque
Sarah Hawkes
Faisal Hossain
Elthem B. Kabir
Rosie Khandker
Beth D. Kirkpatrick and John R. Doty, III
John La Montagne
Daniel Langsam
James Levinson
Cheryl Mitchell and Ken Ellis
Mohamed Obanni
Henry B. Perry, III
Dorothy J. and James R. Pollino
David B. and Joanna S. Sacher
Rafizuddin Sarker
Marian S. Schwartz
Shahryar Shareef
N. Suwannapong
B. OR. Mangal P. Swaminathan
Robert C. and Judith Whitney Terry
Carel Van Mels
Carol Vlassoff

Corporations and Associations

\$1,000+

American Express, Ltd.
ICDDR,B Employees Multipurpose Cooperative Society, Ltd.
The Scobie and Claire MacKinnon Trust

\$500 to \$999

Reliance Insurance, Ltd.
United Insurance Company, Ltd.

Up to \$499

Autodesk, Ltd.
Delonix International, Ltd.
Gulf Environment Technology, Ltd.
Tech Valley Computers, Ltd.
Tradesworth Ltd.
Zonta International Club

Historically, the Centre has addressed issues relating to women's equality both through research and services and within the organization. However, in recent years, there has been a growing recognition of the need to address gender issues in a systematic way

Support Services Department

Senior Manager: Colonel Tajul Islam Ghani (Retd)

The Support Services Department plays an important role in developing and sustaining the Centre's infrastructure and facilities, while providing logistic support to the various activities of the Centre. Its activities are managed by 233 personnel in the 6 units, namely Travel and Estate, Civil Engineering, Electrical and Telecomm Engineering, Transport, General Services, and Cafeteria Services.

In 2003, the Travel Unit coordinated in-country and foreign travel of 396 staff and visitors; the Civil Engineering Unit planned and initiated numerous renovation and construction work to accommodate different offices in new settings, e.g. Finance and Procurement Office, the Metabolic Ward of the hospital, the immunology laboratory, and the Bioengineering unit of the Laboratory Sciences Division. The Transport Unit coordinated transport services for approximately 350 personnel every day. On an average, 400 members of the staff use the canteen facilities on every work day, and in addition, the Cafeteria Services Unit also arranged meals for various events organized by the divisions/departments during the year.

Apart from carrying out its normal activities, the Department provided major logistic support to the 10th Asian Conference on Diarrhoeal Diseases and Nutrition (10th ASCODD) and the International Conference on Emerging Infectious Diseases in the Pacific Rim, sponsored by the U.S.-Japan Cooperative Medical Science Program held in December.

Committees

Board of Trustees

Chairperson: Prof. Ricardo Uauy Dagach

The Board consists of 17 members who serve in their individual capacity with a Chairperson and the Director of the Centre as its Member-Secretary. The trustees include three members nominated by the Government of Bangladesh, one member nominated by the Director-General of the World Health Organization (WHO), one representative from another UN agency, and 11 members from different countries and organizations, more than 50% of whom must come from the developing countries, including the members nominated by Bangladesh. Except for the Director, all members are appointed to fill a three-year term with a provision to extend for a second three-year term. The Board meets twice a year in June and November.

Four new trustees joined the Board in 2003. They are: Mr. Mirza Tasadduq Hussain Beg (Bangladesh), Dr. Kul Gautam (UNICEF), Mr. A.F.M. Sarwar Kamal (Bangladesh), and Dr. Halima Abdullah Mwenesi (South Africa).

In 2003, the Board had its first meeting on 1-3 June and the second meeting on 31 October-2 November.

The key issues that were discussed and resolved included: strategic plan, human resources, financial health, salary increase, and infrastructure development.

At both meetings, the Board expressed its satisfaction at the progress made at the Centre and congratulated the Centre on its excellent performance, including progress in the implementation of the Strategic Plan.

Programme Coordination Committee

Chairperson: Prof. M.A. Matin

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

Research Review Committee

Chairperson: Prof. David A. Sack

ICDDR,B attaches great importance to the development of high-standard research proposals by its scientists and collaborating institutions. To achieve this, research proposals so developed are subjected to rigorous review to ensure their quality. The Research Review Committee (RRC) reviews the research protocols of the Centre and evaluates their scientific merit, competence of principal investi-


gators, and relevance of protocols to the objectives, priorities, and Strategic Plan of the Centre.

The Committee is composed of clinicians, epidemiologists, nutritionists, laboratory scientists, gynaecologists, social scientists, and demographers/population scientists from both within and outside the Centre. In 2003, the Committee, in its 12 meetings, considered 43 new protocols, approved addendum proposals and time extensions for a number of approved protocols, and reviewed the reports of completed protocols.

Ethical Review Committee

Chairperson: Prof. Mahmudur Rahman (Until 30 May)
Prof. A.K.M. Nurul Anwar (From 1 June)

The Ethical Review Committee (ERC), responsible to the Board of Trustees, is the sole body empowered to give ethical clearance for research protocols involving human subjects before any activity of the protocol starts. The Committee comprises 15 members: 4 from the Centre, one each from the Programme Coordination Committee, the Bangladesh Medical Research Council, and the WHO-Bangladesh, RRC Chair or his representative, and the remaining 7 selected by the Committee on an individual basis. The members of the Committee have a broad range of experience and expertise to undertake competent review and evaluation of all ethical aspects of research protocols. During the year, 3 members retired, and 3 new members replaced them.



Four new trustees joined the Board in 2003. They are: Mr. Mirza Tasadduq Hussain Beg (Bangladesh), Dr. Kul Gautam (UNICEF), Mr. A.F.M. Sarwar Kamal (Bangladesh), and Dr. Halima Abdullah Mwenesi (South Africa)

Data Safety Monitoring Boards formed last year were active and met a number of times during the year for overseeing the implementation of concerned research protocols

The Committee followed the ethical principles laid down in the ERC Guidelines and made risk/benefit analysis and scientific merit of protocols while reviewing them. Protocols were approved ensuring the welfare and rights of the subjects participating in research projects. The Committee kept in view that "in research on humans, the interests of science should never take precedence over considerations related to the well-being and human rights of the subjects." At times, the Committee looked into the scientific soundness of the proposals as well since it believed that "any unsound research is unethical."

In 2003, one Data Safety Monitoring Board (DSMB) was constituted for overseeing the implementation of a research protocol titled "Randomized comparison of maternal and infant immunization strategies to prevent pneumococcal disease". DSMBs formed last year were active and met a number of times during the year for overseeing the implementation of concerned research protocols. During the meetings, DSMB, in addition to monitoring the implementation of protocols, advised and guided the concerned investigators in implementing their research protocols following the 'Principles of Good Research Practice' and as per the ERC-approved research protocols.

The businesses of all the meetings of the Committee were transacted with quorum as required under the ERC Guidelines. The Committee followed good operating procedures, completed the review process speedily, and maintained an accurate record-keeping system.

During the year, 42 research protocols involving human subjects were considered. All the protocols were approved, but many of them had

to be modified to incorporate the observations of the Committee. In addition, a number of proposals for addendum to, and modifications of, ongoing research protocols were approved.

In 2001, the Centre had a Federalwide Assurance (no. FWA 00001468) from the Office for Human Research, U.S. Department of Health and Human Services.

Animal Experimentation Ethics Committee

Chairperson: Dr. Mirza A. Jalil

The Animal Experimentation Ethics Committee (AEEC), established by the Board of Trustees, ensures compliance of the standard procedure for protection of animals used in the Centre's research, reviews protocols involving research with animals, and gives clearance of protocols. AEEC comprises 10 members—5 representing national institutions involved in research and rearing of laboratory animals, 3 members on their individual capacity, and 2 from the Centre.

AEEC met once in 2003 and considered research protocols involving animals. All of these were approved after modifications to address the issues raised by the Committee.

The Committee reviewed and modified AEEC Guidelines and Application Form for submission of research protocols for consideration of AEEC to the Board of Trustees for approval. The Committee also reviewed and suggested modifications to the 'Manual for Care and Use of Laboratory Animals'.

Staff Welfare Association

President: Md. Sirajul Islam

The ICDDR,B Staff Welfare Association (SWA) is a body of elected staff representatives. The Association is recognized by the Centre management and the Board of Trustees to ensure good relationship between the staff and the management.

Several accomplishments were made in 2003. To name some—two salary adjustments twice in the year; educational stipends provided to the children of low-paid employees; continuous support provided to the breastfeeding facilities for lactating mothers working in the Centre; annual picnic, and various indoor games. The SWA arranged a ceremony for the first time to honour its staff members for their extra-ordinary performance in the SWA activities.

SWA played an important role in maintaining a harmonious relationship between the staff and the Centre management in 2003.

External Relations and Institutional Development Office

Head: Ishtiaque Zaman

Since ICDDR,B is a non-profit institution, the Centre relies on financial support from its many development partners. With a staff of 5, the task of identifying funding for initiatives, and maintaining relations with the Government of Bangladesh (GoB), development partners, the media, and general public, falls largely on the External Relations

and Institutional Development (ER&ID) Office. The ER&ID Office works closely with Director of the Centre, the Centre Directorate, and scientists to prepare proposals and communications on the activities of the Centre. Identifying donors for endowment funds is an important priority for the ER&ID Office since it is the endowment that provides stability for the Centre's future.

A significant change during 2002 was the decision by GoB to request bilateral development partners to fund the programme of the Centre. The Secretary of Economic Relations Division within GoB (and also a member of our Board of Trustees) wrote to and met with the Centre's development partners and encouraged their financial support to the Centre. Based on this request from GoB, several agencies are considering initiating or increasing their contribution.

Highlights included the return of the Canadian International Development Agency (CIDA) as a core donor to the Centre. Canada had been



Development Partners' meeting at ICDDR,B

Mr. Victor Carvell, Director, Bangladesh Desk of Asia Branch at the CIDA headquarters visited for exploring the possibility of CIDA's funding for core activities of the Centre



a consistent donor to the Centre's programme from the beginning, so their return after a short hiatus was especially welcome. In making their contribution, representatives from CIDA expressed the importance of funding the Centre's overall strategic plan, rather than specific projects or protocols, since, in their opinion, this was the most effective means to help the Centre achieve its mission and, through this, to improve the health of the people of Bangladesh.

Another development was the decision by GoB to substantially increase its own annual contribution, and in addition, to partially covering the costs of the 10th Asian Conference on Diarrhoeal Diseases and Nutrition (ASCODD) and many of the costs of the 25th Anniversary celebrations. The Centre is also participating with GoB on specific projects, including the national surveillance of HIV-AIDS, the baseline survey of the National Nutrition Programme, and anticipated projects with the National Tuberculosis Programme.

A third highlight of 2003 was the grant from the Bill & Melinda Gates Foundation which makes possible a major new nationwide project to encourage the use of zinc for the treatment of diarrhoea. This project is being carried out in collaboration with GoB, NGOs, and the Social Marketing Company, and builds on much of the clinical research at the Centre, funded by USAID, that has shown the remarkable clinical benefits for providing a 10-day course of zinc to children whenever they have a diarrhoeal illness. We anticipate that this project will serve as a model for other countries which plan to implement zinc programmes for treatment of children.

Other development partners who significantly increased their funding to the Centre in 2003 include DFID-UK, the Netherlands, and the Swiss Agency for Development and Cooperation (SDC). The US Government supports the Centre through two agreements: one based in Dhaka and one in Washington. The cooperative agreement with USAID/Washington expired in 2003, but a follow-on 5-year project called HARP, run in collaboration with Johns Hopkins University, Boston University, and other partners, will replace it. This new project will focus on research leading to the introduction of new child health interventions. Additionally, the Centre has joined with Deloitte Touche Tohmatsu Emerging Markets Limited to provide technical services to USAID under its TASC II programme.

The ER&ID Office attempts to highlight the work of the Centre and the policy implications of the work in various ways through the media. In this role, it organized press conferences, including one prior to the 10th ASCODD and one prior to the 8th International Conference on Emerging Infectious Diseases in the Pacific Rim, both held in December 2003.

To ensure open lines of communication with development partners, meetings of the Development Partners Group (DPG) are held after



Press briefing on the celebration of the 25th Anniversary of ICDDR,B

The British Commonwealth parliamentarians, visiting the Outpatient Unit of the Centre's Dhaka hospital



each Board meeting. These meetings provide an opportunity for the Centre to present its programme, some important findings, and its funding needs. It also provides an opportunity for the partners to interact with the senior members of the Centre's management team, scientists, and trustees. Ms Renate Pors of the Netherlands Embassy, who had chaired the DPG, left Bangladesh in mid-2003, and Neil Squires of DFID/Bangladesh became the new chair.

A noteworthy event to help celebrate the Centre's 25th Anniversary was a formal Fundraising Dinner at the House of Lords in London. Hosted by Baroness Pola Uddin of Bethnal Green, a peer of the House of Lords and a renowned and well-respected figure among the Anglo-Asian communities in the UK, the event attracted many British people, including those originally from Bangladesh, companies, media groups, and foundation donors. It generated much needed financial support for the Centre. The event also provided a valuable profile-raising opportunity, leading to a prominent news article entitled "In Search of Humanitarian Science" in the *British Medical Journal*¹.

Another special event was the Fundraising Ball at the Winter Garden of the Dhaka Sheraton in February. This has become an annual event in Dhaka and provides an opportunity for the community to help support the work of the Centre's hospital and to enjoy a social evening together. More than 300 people come to the Ball annually.

The ER&ID Office also arranges visits to the Centre by distinguished visitors, and these visits do make a real impact. For example, a visit

in April 1995 by the U.S. First Lady Hillary Rodham Clinton left a lasting impression which she describes in her recent autobiography 'A Living History'². She described how impressed she was that a health research institution [ICDDR,B] located in a developing country was leading the world by example. Likewise, a visit to Matlab by American journalist Amy Waldman led to an article describing ICDDR,B's achievements in the Sunday edition of the *New York Times*. Similarly, the visit by an American movie team led to the production of a video called 'The Hot Zones'³ which was aired on the US channel PBS and led to donations towards projects to improve water supply in Bangladesh.

Grants and Contracts Administration

Grants and Contracts Administrator: Vanessa Brooks

Grants and Contracts Administration is part of the Director's Office and reports to the Centre's Director. The Grants and Contracts Administrator (GCA) reviews proposed agreements with other agencies, develops legal documents for the Centre, and advises the Director and the Centre Management on contractual and legal matters. These include technical revisions to bilateral and multilateral agreements, sponsored research awards with universities and research institutions,

¹Watts G. In pursuit of "humanitarian science." *BMJ* 2003;327(7427):1308; ²Clinton HR. *A living history*. New York: Simon & Schuster, 2003. 576 p.

³Waldman A. In rural part of Bangladesh, an ideal lab. *The New York Times*. Wednesday, 26 March 2003

His Excellency Mr. Harry K Thomas, new US Ambassador to Bangladesh, being briefed on the Centre's activities during his visit to ICDDR,B



and other sponsored research contracts. GCA interfaces with representatives from pharmaceutical companies, private sector, multilateral institutions, governments, and foundations, and research institutions when entering into new research arrangements by negotiating such agreements, drafting the terms of research awards, and related confidentiality agreements. GCA also ensures that the Centre implement projects with local collaborators by drafting sub-contracts with the Government of Bangladesh, NGOs, or local companies that provide service components to the Centre's research initiatives. The Grants and Contracts Administration works closely with the External Relations and Institutional Development Office to ensure that the donor guidelines are met and with the Finance Department to ensure that budget requirements are accurately reflected in research agreements.

Given the expanded agenda of the Centre and the broader spectrum of collaborative relationships, the Centre now regularly incorporates into its contracts with collaborating institutions the guidelines for intellectual property rights, ownership of data and specimens, and

the right to publish results in accordance with the international guidelines and standards of review. Thus, in 2003, the Grants and Contracts Administration worked with the Centre scientists to ensure that agreements on new collaborative research included these provisions that not only protect the Centre's rights, but also reinforce the Centre's efforts to achieve a partnering relationship with universities and international research institutions globally. The expansion of collaborations among the existing scientific partners and the creation of new partnering relationships indicate that the Centre's policies are consistent with those of its partnering institutions and reflect an overall recognition of the standard of the work conducted by its scientists. New collaborating agreements with Plan International and Pasteur Institut, the undertaking GAVI-supported research on pneumococcal disease burden, and a major collaborative effort with Nutriset Company and local partners in the scaling up of zinc intervention for diarrhoeal diseases are among the examples of new partnerships. Through NIH sub-contracts, research protocols have continued with Johns Hopkins Bloomberg School of Public Health, Stanford University School of Medicine, University of Virginia, Dartmouth College, University of Maryland Biotechnology Institute, Harvard Medical School, Harvard School of Public Health, and Ellison Medical Foundation. New NIH-



His Excellency Mr. Borje Mattsson, Swedish Ambassador to Bangladesh and Centre Director Prof David Sack, signing funding agreement on an arsenic project

Ms Judith Robinson, Director for South Asia, AusAID and Ms Janet Donnelly, First Secretary of the Australian Embassy in Dhaka, being briefed on the treatment facilities at the Centre's Dhaka hospital by Dr. M.A. Salam



Asia section from AusAID, Canberra; HE Mr. Harry K Thomas, American Ambassador to Bangladesh; HE Mr Gerry Campbell, Canadian High Commissioner to Bangladesh; HE Mr. Borje Mattsson, Swedish Ambassador to Bangladesh; Mr. Jurg Casserini, Charge d'Affaires of the Swiss Embassy in Bangladesh; Mr. Fazlur Rahman, Secretary to the Government of Bangladesh; Mr. A.F.M. Sarwar Kamal, Secretary, MoHFW; British Commonwealth Parliamentary delegation; Professor Jeffrey Turnbull, Dean of the Faculty of Medicine, University of Ottawa; Baroness Pola Uddin of Bethnel Green, UK; Dr. Bob Black, JHU; Prof. Jehan-Francois Desjeux, CNAM, Paris, and many others.

funded collaborations with University of California-Davis, University of Virginia, and Johns Hopkins Bloomberg School of Public Health are underway. In the area of vaccine and infectious diseases research, the Centre has expanded research initiatives with Centers for Disease Control and Prevention, International Vaccine Institute, Family Health International, and private biotechnology firms globally.

Visitors in 2003

A number of dignitaries visited the Centre during 2003. They, among others, are: Mr. Victor Carvell, Director of the Bangladesh Programme from the CIDA Headquarters; Ms Judith Robinson, Director of South



Nutrition specialist Dr Tahmeed Ahmed, demonstrating the ingredients of the standardized low-cost diet for severely-malnourished children to Ms Nan Dale, President of Helen Keller International, who visited the Centre with some of her colleagues

Collaborations

International

Albany Medical Center, USA
 Australian National University
 Canadian International Development Agency (CIDA)
 Centers for Disease Control and Prevention (CDC), Atlanta, USA
 Cornell University, USA
 Department of Nutrition, University of California Davis, USA
 DFID
 Edith Cowan University, West Perth, Australia
 Global Health Equity Gauge Alliance (GEGA)
 Harvard University, USA
 Helen Keller International
 Indian Institute of Population Sciences, India
 Institute of Child Health, London, UK
 International Emerging Infections Program, Ministry of Public Health, Thailand
 Johns Hopkins University School of Public Health, Baltimore, USA
 Karolinska Institute, Sweden
 London School of Hygiene & Tropical Medicine, London, UK
 Massachusetts General Hospital, USA
 National Center for Infectious Diseases, USA
 Oxford University, UK
 Population Studies Centre, University of Pennsylvania
 RAND Corporation
 Save the Children, USA

Southampton University, UK
 The Netherlands Interdisciplinary Demographic Institute
 UNICEF
 University of Basel, Switzerland
 University of Bath, UK
 University of California-Davis, USA
 University of Makerere, Kampala
 University of Maryland, USA
 University of Texas at Galveston, USA
 University of Umea, Sweden
 Uppsala University, Sweden
 Wageningen Agricultural University, The Netherlands
 WeD (Well-being in Developing Countries) Group, University of Bath, UK
 WHO Western Pacific Regional Office
 World Bank
 World Health Organization

National

APOSH
 ARI Programme of Government of Bangladesh
 Bandhan Hijra Sangha
 Bandhu Social Welfare Society
 Bangabandhu Sheikh Mujib Medical University
 Bangladesh Association of Voluntary Sterilization
 Bangladesh Breastfeeding Foundation
 Bangladesh Bureau of Statistics

Bangladesh Institute of Development Studies
 Bangladesh National Nutrition Council
 Bangladesh Paribesh Andolon
 Bangladesh Rural Advancement Committee
 BIRDEM
 CARE Bangladesh
 College of Home Economics
 Concern Bangladesh
 Dhaka Medical College Hospital
 Concerned Women for Family Planning
 Dhaka City Corporation
 Dhaka Medical College Hospital
 Dhaka Shishu Hospital
 Directorate General of Health Services
 Directorate of Family Planning
 Directorate of Health Services
 Durjoy Nari Sangha
 Family Planning Association of Bangladesh
 GoB-EPI Programme
 GoB-TB/Leprosy Control Programme
 Gonoshasthya Kendra
 Health Economics Unit of the Ministry of Health and Family Welfare
 Holy Family Hospital
 Holy Family Red Crescent Hospital
 Institute of Child Health and Shishu Hospital, Mirpur, Dhaka
 Institute of Nutrition and Food Science (INFS)
 Institution of Public Health Nutrition
 Jagrato Jubo Shagha
 Jahangirnagar University
 Karmajibi Kallyan Sangha
 Kumudini Welfare Trust (Kumudini Hospital)
 M.A.G. Osmani Medical College and Hospital, Sylhet
 Marie Stopes Clinic Society
 Ministry of Health and Family Welfare
 Mukti Mahila Samity
 Mymensingh Medical College Hospital
 Nari Maitree
 Nari Mukti Sangha
 National Institute of Population Research and Training
 National Institute of Preventive & Social Medicine
 National Nutrition Project
 Paricharja
 PIACT Bangladesh
 Plan Bangladesh
 Prochesta
 Progoti Samaj Kallyan Protisthan
 Radda MCH-FP Centre, Mirpur, Dhaka
 Rajshahi Medical College Hospital
 Rural People's Development Sangstha
 Save the Children Fund-Australia
 Srishti
 Sustha Jibon
 The Salvation Army
 University of Dhaka,
 Voluntary Paribar Kallyan Association
 World Vision, Bangladesh

ICDDR,B Publications 2003

A. Internal Publication Series

1. ICDDR,B Annual report 2002. 180 p.

Working Paper

1. Rahman S, Bogaerts J, Rahman M, Razzak R, Nessa K, Reza M. Validity assessment of flowcharts for syndromic management of vaginal discharge / edited by M. Shamsul Islam Khan. 2003. iv, 38 p. (ICDDR,B working paper no. 158)

Special Publications

1. Hossain S, Sarker S, Khanam R, Islam Z, Saha NC, Routh S. Operations research on ESP delivery in urban areas. Operationalizing an urban essential services packages clinic: findings and implications / edited by M. Shamsul Islam Khan. 2002. iv, 98 p. (ICDDR,B special publication no. 115)*
2. Improving child health and nutrition: abstracts book [of the] 10th Asian Conference on Diarrhoeal Diseases and Nutrition, 7-9 December 2003, Bangladesh-China Friendship Conference Centre, Dhaka / edited by M. Shamsul Islam Khan, M.A. Rahim, and M.A. Salam. 2003. ix, 226 p. (ICDDR,B special publication no. 117)
3. Sarker S, Islam Z, Hossain S, Saifi RA, Saha NC, Jahan M, Begum HA, Routh S. Operations research on ESP delivery and community clinics in Bangladesh: preliminary assessment of performance of two selected community clinics / edited by M. Shamsul Islam Khan. 2002. vi, 127 p. (ICDDR,B special publication no. 114)*
4. Smriti: ICDDR,B'er hareya-jaoya dingulo [Smriti: ICDDR,B in memory] / edited by Jean Sack and M.A. Rahim. 2003. 139 p. (ICDDR,B special publication no. 118)
5. Streatfield PK, Mercer A, Siddique AB, Khan ZUA, Ashraf A. Health and Population Sector Programme 1998-2003, Bangladesh: status of performance indicators 2002; a report for the Health Programme Support Office for the annual programme review 2002. 2003. xiv, 145 p. (ICDDR,B special publication no. 116)

Scientific Report

1. Health and demographic surveillance system—Matlab. V. 34. Registration of health and demographic events 2001. 2003. ix, 90 p. (ICDDR,B scientific report no. 90)

Journal and Newsletters

1. Journal of Health, Population and Nutrition. V. 21, no. 1-4, 2003
2. Glimpse. V. 25, no. 1-4, 2003
3. Shasthya Sanglap. V. 11, no. 3
4. Health and Science Bulletin. V. 1, no. 2-5, 2003
5. Equity Dialogue. V. 1, no. 1-2, 2003

B. Original Scientific Papers (including short reports)

1. Aaby P, Bhuiya A, Nahar L, Knudsen K, de Francisco A, Strong M. The survival benefit of measles immunization may not be explained entirely by the prevention of measles disease: a community study from rural Bangladesh. *Int J Epidemiol* 2003 Feb;32(1):106-16
2. Ahluwalia IB, Bern C, Costa C, Akter T, Chowdhury R, Ali M, Alam D, Kenah E, Amann J, Islam M, Wagatsuma Y, Haque R, Breiman RF, Maguire JH. Visceral leishmaniasis: consequences of a neglected disease in a Bangladeshi community. *Am J Trop Med Hyg* 2003 Dec;69(6):624-8
3. Ahmed SM, Adams AM, Chowdhury M, Bhuiya A. Changing health-seeking behaviour in Matlab, Bangladesh: do development interventions matter? *Health Policy Plan* 2003 Sep;18(3):306-15
4. Alam DS, Van Raaij JM, Hautvast JG, Yunus M, Fuchs GJ. Energy stress during pregnancy and lactation: consequences for maternal nutrition in rural Bangladesh. *Eur J Clin Nutr* 2003 Jan;57(1):151-6
5. Alam MA, Miah MRA, Rahman M, Sattar H, Saleh AA. Antimicrobial susceptibility pattern of *Neisseria gonorrhoeae* isolated from floating female commercial sex workers in Dhaka, Bangladesh. *J Infect Dis Antimicrob Agent* 2002 Sep-Dec;19(3):93-9*
6. Alam NH, Hamadani JD, Dewan N, Fuchs GJ. Efficacy and safety of a modified oral rehydration solution (ReSoMaL) in the treatment of severely malnourished children with watery diarrhea. *J Pediatr* 2003 Nov;143(5):614-9
7. Alam NH, Ashraf H, Khan WA, Karim MM, Fuchs GJ. Efficacy and tolerability of racecadotril in the treatment of cholera in adults: a double blind, randomised, controlled clinical trial. *Gut* 2003 Oct;52(10):1419-23
8. Alauddin M, Alauddin ST, Bhattacharjee M, Sultana S, Chowdhury D, Bibi H, Rabbani GH. Speciation of arsenic metabolite intermediates in human urine by ion-exchange chromatography and flow injection hydride generation atomic absorption spectrometry. *J Environ Sci Health Part A Tox Hazard Subst Environ Eng* 2003 Jan;38(1):115-28

*Not listed in earlier annual reports

9. Albert MJ, Qadri F, Wahed MA, Ahmed T, Rahman ASM, Ahmed F, Bhuiyan NA, Zaman K, Baqui AH, Clemens JD, Black RE. Supplementation with zinc, but not vitamin A, improves seroconversion to vibriocidal antibody in children given an oral cholera vaccine. *J Infect Dis* 2003 Mar 15;187(6):909-13
10. Ali IKM, Hossain MB, Roy S, Ayeh-Kumi PF, Petri WA, Jr., Haque R, Clark CG. *Entamoeba moshkovskii* infections in children, Bangladesh. *Emerg Infect Dis* 2003 May;9(5):580-4
11. Ali M, Wagatsuma Y, Emch M, Breiman RF. Use of a geographic information system for defining spatial risk for dengue transmission in Bangladesh: role for *Aedes albopictus* in an urban outbreak. *Am J Trop Med Hyg* 2003;69(6):634-40
12. Amita, Chowdhury SR, Thungapathra M, Ramamurthy T, Nair GB, Ghosh A. Class I integrons and SXT elements in El Tor strains isolated before and after 1992 *Vibrio cholerae* O139 outbreak, Calcutta, India. *Emerg Infect Dis* 2003 Apr;9(4):500-2
13. Åsling-Monemi K, Peña R, Ellsberg MC, Persson LÅ. Violence against women increases the risk of infant and child mortality: a case-referent study in Nicaragua. *Bull World Health Organ* 2003;81(1):10-6
14. Azim T, Zaki MH, Podder G, Sultana N, Salam MA, Rahman SM, Sefat-e-Khuda, Sack DA. Rotavirus-specific subclass antibody and cytokine responses in Bangladeshi children with rotavirus diarrhoea. *J Med Virol* 2003 Feb;69(2):286-95
15. Baqui AH, Zaman K, Persson LA, Arifeen SE, Yunus M, Begum N, Black RE. Simultaneous weekly supplementation of iron and zinc is associated with lower morbidity due to diarrhea and acute lower respiratory infection in Bangladeshi infants. *J Nutr* 2003 Dec;133(12):4150-7
16. Begum A, Nilufar S, Akther K, Rahman A, Khatun F, Rahman M. Prevalence of selected reproductive tract infections among pregnant women attending an urban maternal and childcare unit in Dhaka, Bangladesh. *J Health Popul Nutr* 2003 Jun;21(2):112-6
17. Bhuiya A, Sharmin T, Hanifi SMA. Nature of domestic violence against women in a rural area of Bangladesh: implication for preventive interventions. *J Health Popul Nutr* 2003 Mar;21(1):48-54
18. Bhuiyan NA, Qadri F, Faruque ASG, Malek MA, Salam MA, Nato F, Fournier JM, Chanteau S, Sack DA, Nair GB. Use of dipsticks for rapid diagnosis of cholera caused by *Vibrio cholerae* O1 and O139 from rectal swabs (note). *J Clin Microbiol* 2003 Aug;41(8):3939-41
19. Bina J, Zhu J, Dziejman M, Faruque S, Calderwood S, Mekalanos J. ToxR regulon of *Vibrio cholerae* and its expression in vibrios shed by cholera patients. *Proc Natl Acad Sci USA* 2003 Mar 4;100(5):2801-6
20. Bishai D, Koenig M, Khan MA. Measles vaccination improves the equity of health outcomes: evidence from Bangladesh. *Health Econ* 2003 May;12(5):415-9
21. Breiman RF, Evans MR, Preiser W, Maguire J, Schnur A, Li A, Bekedam H, Mackenzie JS. Role of China in the quest to define and control severe acute respiratory syndrome. *Emerg Infect Dis* 2003 Sep;9(9):1037-41
22. Chakraborty S, Khan A, Kahali S, Faruque SM, Yamasaki S, Ramamurthy T. Infantile diarrhoea associated with sorbitol-fermenting, non-Shiga toxin-producing *Escherichia coli* O157: H⁻ (brief report). *Eur J Clin Microbiol Infect Dis* 2003 May;22(5):324-6
23. Chowdhury AMR, Bhuiya A, Mahmud S, Salam AKMA, Karim F. Immunization divided: who do get vaccinated in Bangladesh? *J Health Popul Nutr* 2003 Sep;21(3):193-204
24. Colwell RR, Huq A, Islam MS, Aziz KMA, Yunus M, Khan NH, Mahmud A, Sack RB, Nair GB, Chakraborty J, Sack DA, Russek-Cohen E. Reduction of cholera in Bangladeshi villages by simple filtration. *Proc Natl Acad Sci USA* 2003 Feb 4;100(3):1051-5
25. Datta S, Khan A, Nandy RK, Rehman M, Sinha S, Chattopadhyay S, Das SC, Nair GB. Environmental isolates of *Aeromonas* spp. harboring the *cagA*-like gene of *Helicobacter pylori*. *Appl Environ Microbiol* 2003 Jul;69(7):4291-5
26. Faruque SM, Kamruzzaman M, Asadulghani, Sack DA, Mekalanos JJ, Nair GB. CTX₂-independent production of the RS1 satellite phage by *Vibrio cholerae*. *Proc Natl Acad Sci USA* 2003 Feb 4;100(3):1280-5
27. Faruque SM, Zhu J, Asadulghani, Kamruzzaman M, Mekalanos JJ. Examination of diverse toxin-coregulated pilus-positive *Vibrio cholerae* strains fails to demonstrate evidence for *Vibrio* pathogenicity island phage. *Infect Immun* 2003 Jun;71(6):2993-9
28. Faruque SM, Kamruzzaman M, Meraj IM, Chowdhury N, Nair GB, Sack RB, Colwell RR, Sack DA. Pathogenic potential of environmental *Vibrio cholerae* strains carrying genetic variants of the toxin-coregulated pilus pathogenicity island (note). *Infect Immun* 2003 Feb;71(2):1020-5
29. Faruque SM, Chowdhury N, Kamruzzaman M, Ahmad QS, Faruque ASG, Salam MA, Ramamurthy T, Nair GB, Weintraub A, Sack DA. Reemergence of epidemic *Vibrio cholerae* O139, Bangladesh. *Emerg Infect Dis* 2003 Sep;9(9):1116-22
30. Faruque SM, Chowdhury N, Khan R, Hasan MR, Nahar J, Islam MJ, Yamasaki S, Ghosh AN, Nair GB, Sack DA. *Shigella dysenteriae* type 1-specific bacteriophage from environmental waters in Bangladesh. *Appl Environ Microbiol* 2003 Dec;69(12):7028-31
31. Frongillo EA, Chowdhury N, Ekstrom EC, Naved RT. Understanding the experience of household food insecurity in rural Bangladesh leads to a measure different from that used in other countries. *J Nutr* 2003 Dec;133(12):4158-62
32. Garg P, Aydarian A, Smith D, Morris JG, Jr., Nair GB, Stine OC. Molecular epidemiology of O139 *Vibrio cholerae*: mutation, lateral gene transfer, and founder flush. *Emerg Infect Dis* 2003 Jul;9(7):810-4
33. Gazi R, Chowdhury AMR. Perceptions of rural Bangladeshi women on sexually transmitted infections. *South Asian Anthropol* 2003 Sep;3(2):177-90
34. Hang L, John M, Asaduzzaman M, Bridges EA, Vanderspurt C, Kirn TJ, Taylor RK, Hillman JD, Progulsk-Fox A, Handfield M, Ryan ET, Calderwood SB. Use of *in vivo*-induced antigen technology (IVIAT) to identify genes uniquely expressed during human infection with *Vibrio cholerae*. *Proc Natl Acad Sci USA* 2003 Jul 8;100(14):8508-13
35. Haque R, Mondal D, Kirkpatrick BD, Akther S, Farr BM, Sack RB, Petri WA, Jr. Epidemiologic and clinical characteristics of acute diarrhea with emphasis on *Entamoeba histolytica* infections in preschool children in an urban slum of Dhaka, Bangladesh. *Am J Trop Med Hyg* 2003 Oct;69(4):398-405
36. Hosegood V, Campbell OMR. Body mass index, height, weight, arm circumference, and mortality in rural Bangladeshi women: a 19-y longitudinal study. *Am J Clin Nutr* 2003 Feb;77(2):341-7 (ICDDR,B data used)

37. Hossain MA, Khatun M, Arjumand F, Nisaluk A, Breiman RF. Serologic evidence of dengue infection before onset of epidemic, Bangladesh. *Emerg Infect Dis* 2003 Nov;9(11):1411-4
38. Hossain MS, Salam MA, Rabbani GH, Kabir I, Biswas R, Mahalanabis D. Rice-ORS versus glucose-ORS in management of severe cholera due to *Vibrio cholerae* O139 Bengal: a randomized, controlled clinical trial. *J Health Popul Nutr* 2003 Dec;21(4):325-31
39. Hyder AA, Arifeen S, Begum N, Fishman S, Wali S, Baqui AH. Death from drowning: defining a new challenge for child survival in Bangladesh. *Inj Control Saf Promot* 2003 Dec;10(4):205-10
40. Hyder SMZ, Persson L-Å, Chowdhury AMR, Lönnerdal B, Ekström E-C. Impact of daily and weekly iron supplementation to women in pregnancy and puerperium on haemoglobin and iron status six weeks postpartum: results from a community-based study in Bangladesh. *Scand J Nutr* 2003;47:19-25
41. Islam MM, Barua MK, Bairagi R. Quality characteristics of field workers and contraceptive use dynamics: lessons from Matlab, Bangladesh. *Asia-Pacific Popul J* 2003 Mar;18(1):43-62
42. Ivarsson A, Hernell O, Nyström L, Persson LÅ. Children born in the summer have increased risk for coeliac disease. *J Epidemiol Community Health* 2003 Jan;57(1):36-9
43. Ivarsson A, Persson LÅ, Nyström L, Hernell O. The Swedish coeliac disease epidemic with a prevailing twofold higher risk in girls compared to boys may reflect gender specific risk factors. *Eur J Epidemiol* 2003 Jul;18(7):677-84
44. Jakariya M, Chowdhury AMR, Hossain Z, Rahman M, Sarker Q, Khan RI, Rahman M. Sustainable community-based safe water options to mitigate the Bangladesh arsenic catastrophe—an experience from two upzilas. *Curr Sci* 2003 Jul;85(2):141-6
45. Khan MM, Ahmed S. Relative efficiency of government and non-government organisations in implementing a nutrition intervention programme—a case study from Bangladesh. *Public Health Nutr* 2003 Feb;6(1):19-24
46. Khan S, Hasan MAK, Bhuiya A, Hudson-Rodd N, Siggers S. How safe is sex with condoms?: an in-depth investigation of the condom use pattern during the last sex act in an urban area of Bangladesh. *Int J Men's Health* 2003;2(3):167-82
47. Koenig MA, Ahmed S, Hossain MB, Mozumder ABMKA. Women's status and domestic violence in rural Bangladesh: individual- and community-level effects. *Demography* 2003 May;40(2):269-88
48. Kurazono H, Nakano M, Yamamoto S, Ogawa O, Yuri K, Nakata K, Kimura M, Makino S-i, Nair GB. Distribution of the *usp* gene in uropathogenic *Escherichia coli* isolated from companion animals and correlation with serotypes and size-variations of the pathogenicity island. *Microbiol Immunol* 2003;47(10):797-802
49. Lind T, Lönnerdal B, Stenlund H, Ismail D, Seswandhana R, Ekström EC, Persson LÅ. A community-based randomized controlled trial of iron and zinc supplementation in Indonesian infants: interactions between iron and zinc. *Am J Clin Nutr* 2003 Apr;77(4):883-90
50. Lind T, Lönnerdal B, Persson LÅ, Stenlund H, Tennefors C, Hernell O. Effects of weaning cereals with different phytate contents on hemoglobin, iron stores, and serum zinc: a randomized intervention in infants from 6 to 12 mo of age. *Am J Clin Nutr* 2003 Jul;78(1):168-75
51. McCoy D, Bambas L, Acurio D, Baya B, Bhuiya A, Chowdhury AMR, Grisurapong S, Liu Y, Ngom P, Ngulube TJ, Ntuli A, Sanders D, Vega J, Shukla A, Braveman PA. Global Equity Gauge Alliance: reflections on early experiences. *J Health Popul Nutr* 2003 Sep;21(3):273-87
52. Menken J, Duffy L, Kuhn R. Childbearing and women's survival: new evidence from rural Bangladesh. *Popul Dev Rev* 2003 Sep;29(3):405-26 (Matlab data used)
53. Milton AH, Hasan Z, Rahman A, Rahman M. Non-cancer effects of chronic arsenicosis in Bangladesh: preliminary results. *J Environ Sci Health Part A Tox Hazard Subst Environ Eng* 2003 Jan;38(1):301-5
54. Nato F, Boutonnier A, Rajerison M, Grosjean P, Darteville S, Guenole A, Bhuiyan NA, Sack DA, Nair GB, Fournier JM, Chanteau S. One-step immunochromatographic dipstick tests for rapid detection of *Vibrio cholerae* O1 and O139 in stool samples (note). *Clin Diagn Lab Immunol* 2003 May;10(3):476-8
55. Pandey M, Khan A, Das SC, Sarkar B, Kahali S, Chakraborty S, Chattopadhyay S, Yamasaki S, Takeda Y, Nair GB, Ramamurthy T. Association of cytolethal distending toxin locus *cdtB* with enteropathogenic *Escherichia coli* isolated from patients with acute diarrhea in Calcutta, India (note). *J Clin Microbiol* 2003 Nov;41(11):5277-81
56. Qadri F, Alam MS, Nishibuchi M, Rahman T, Alam NH, Chisti J, Kondo S, Sugiyama J, Bhuiyan NA, Mathan MM, Sack DA, Nair GB. Adaptive and inflammatory immune responses in patients infected with strains of *Vibrio parahaemolyticus*. *J Infect Dis* 2003 Apr 1;187(7):1085-96
57. Qadri F, Ryan ET, Faruque ASG, Ahmed F, Khan AI, Islam MM, Akramuzzaman SM, Sack DA, Calderwood SB. Antigen-specific immunoglobulin A antibodies secreted from circulating B cells are an effective marker for recent local immune responses in patients with cholera: comparison to antibody-secreting cell responses and other immunological markers (note). *Infect Immun* 2003 Aug;71(8):4808-14
58. Qadri F, Ahmed T, Ahmed F, Sack RB, Sack DA, Svennerholm A-M (PTE Study Group). Safety and immunogenicity of an oral, inactivated enterotoxigenic *Escherichia coli* plus cholera toxin B subunit vaccine in Bangladeshi children 18-36 months of age. *Vaccine* 2003 Jun 2;21(19-20):2394-403
59. Rabbani GH, Saha SK, Akhtar M, Marni F, Mitra AK, Ahmed S, Alauddin M, Bhattacharjee M, Sultana S, Chowdhury AKA. Antioxidants in detoxification of arsenic-induced oxidative injury in rabbits: preliminary results. *J Environ Sci Health Part A Tox Hazard Subst Environ Eng* 2003 Jan;38(1):273-87
60. Rahman M. The Bangladesh arsenic catastrophe: clinical manifestations (short report). *Trop Doct* 2003 Jan;33(1):42-4
61. Rahman M, Mukhopadhyay AK, Nahar S, Datta S, Ahmad MM, Sarker S, Masud IM, Engstrand L, Albert MJ, Nair GB, Berg DE. DNA-level characterization of *Helicobacter pylori* strains from patients with overt disease and with benign infections in Bangladesh. *J Clin Microbiol* 2003 May;41(5):2008-14

62. Raqib R, Moly PK, Sarker P, Qadri F, Alam NH, Mathan M, Andersson J. Persistence of mucosal mast cells and eosinophils in *Shigella*-infected children. *Infect Immun* 2003 May;71(5):2684-92
63. Raqib R, Rahman J, Kamaluddin AK, Kamal SM, Banu FA, Ahmed S, Rahim, Z, Bardhan PK, Andersson J, Sack DA. Rapid diagnosis of active tuberculosis by detecting antibodies from lymphocyte secretions. *J Infect Dis* 2003 Aug 1;188(3):364-70
64. Sabin KM, Rahman M, Hawkes S, Ahsan K, Begum L, Black RE, Baqui AH. Sexually transmitted infections prevalence rates in slum communities of Dhaka, Bangladesh. *Int J STD AIDS* 2003 Sep;14(9):614-21
65. Sack RB, Siddique AK, Longini IM, Jr., Nizam A, Yunus M, Islam MS, Morris JG, Jr., Ali A, Huq A, Nair GB, Qadri F, Faruque SM, Sack DA, Colwell RR. A 4-year study of the epidemiology of *Vibrio cholerae* in four rural areas of Bangladesh. *J Infect Dis* 2003 Jan 1;187(1):96-101
66. Saha SK, Baqui AH, Darmstadt GL, Ruhulamin M, Hanif M, Arifeen SE, Santosham M, Oishi K, Nagatake T, Black RE. Comparison of antibiotic resistance and serotype composition of carriage and invasive pneumococci among Bangladeshi children: implications for treatment policy and vaccine formulation. *J Clin Microbiol* 2003 Dec;41(12):5582-7
67. Steffen R, Sack DA, Riopel L, Jiang Z-D, Stürchler M, Ericsson CD, Lowe B, Waiyaki P, White M, DuPont HL. Therapy of travelers' diarrhea with rifaximin on various continents. *Am J Gastroenterol* 2003 May;98(5):1073-8
68. Talukder KA, Islam Z, Islam MA, Dutta DK, Safa A, Ansaruzzaman M, Faruque ASG, Shahed SN, Nair GB, Sack DA. Phenotypic and genotypic characterization of provisional serotype *Shigella flexneri* 1c and clonal relationships with 1a and 1b strains isolated in Bangladesh. *J Clin Microbiol* 2003 Jan;41(1):110-7
69. Talukder KA, Islam MA, Khajanchi BK, Dutta DK, Islam Z, Safa A, Alam K, Hossain A, Nair GB, Sack DA. Temporal shifts in the dominance of serotypes of *Shigella dysenteriae* from 1999 to 2002 in Dhaka, Bangladesh. *J Clin Microbiol* 2003 Nov;41(11):5053-8
70. van Ginneken J, Razzaque A. Supply and demand factors in the fertility decline in Matlab, Bangladesh in 1977-1999. *Eur J Popul* 2003;19(1):29-45

C. Review Articles, Book Chapters, Papers in Conference Proceedings, and Monographs

1. Ahmed M, Rabbani GH, Anwar KS, Alam K, Chowdhury AKA, Rahman MT, Alimuzzaman. Therapeutic evaluation of antioxidants and metal chelator in a rabbit model of chronic arsenic poisoning. *In: Rabbani GH, editor. Annual report 2002 (incorporating annual reports of 1999 and 2001). Dhaka: Bangladesh Arsenic Control Society, 2002:42-8**
2. Ahmed M, Rabbani GH. Therapeutic evaluation of antioxidants in a MICE model of chronic arsenic poisoning. *In: Rabbani GH, Ali SMK, Das HH, Hossain A, Gupta PKS, Haq I, Islam MM. Double-blind, randomized, placebo-controlled trial of antioxidant vitamins and minerals in the treatment of chronic arsenic poisoning in Bangladesh: final report 2003. Dhaka: Bangladesh Arsenic Control Society, 2003:119-26*
3. Alam AN, Ahmed T. Cholera. *In: Rakel RE, Bope ET, editors. Conn's Current therapy 2003. Philadelphia: Saunders, 2003:80-3*
4. Alam NH, Ashraf H. Treatment of infectious diarrhea in children. *Pediatr Drugs* 2003;5(3):151-65
5. Ali M, Ashley C, Haq MZ, Streatfield PK. Spatial modeling of risk factors for gender-specific child mortality in a rural area of Bangladesh. *In: Khan OA, Skinner R, editors. Geographic information systems and health applications. Pennsylvania: Idea Group Publishing, 2003:224-42*
6. Ali SMK, Edib K, Pramanik MA, Alam AMS, Rabbani GH, Anwar KS, Hossain A, Nasir M, Sengupta PK, Saha SK. Nutritional consequences of chronic arsenic poisoning in children and mothers of Bangladesh: a case-control study. *In: Rabbani GH, editor. Annual report 2002 (incorporating annual reports of 1999 and 2001). Dhaka: Bangladesh Arsenic Control Society, 2002:28-32**
7. Bryce JB, Arifeen SE, Pariyo G, Lanata CF, Gwatkin D, Habicht J-P; Multi-Country Evaluation of IMCI Study Group (Amaral J, Mshinda H, Schellenberg JA, Huicho L, de Savigny D, Vaughan JP, Black RE, Burnham G, Victora CG, Adam T, Gouws E). Reducing child mortality: can public health deliver? *Lancet* 2003 Jul 12;362(9378):159-64
8. Claeson M, Gillespie D, Mshinda H, Troedsson H, Victora CG; Bellagio Study Group on Child Survival (Arifeen S, Black RE, Bhutta Z, Bryce J, Evans T, Gwatkin D, Habicht J-P, Jones G, Lanata CF, Schellenberg JA, Morris SS, Pariyo G, Perkin G, Steketee R, Wagstaff A). Knowledge into action for child survival. *Lancet* 2003 Jul 26;362(9380):323-7
9. Development through self-help: be a part of it; self-help promotion moving ahead; report of the Conference on Development Through Self-help, held in Dhaka, on 10-11 November 2001. Dhaka: Self-Help Promotion Event Secretariat, Social and Behavioural Science Programme, ICDDR,B: Centre for Health and Population Research, 2003. 44 p.
10. Faruque SM, Sack DA, Sack RB, Colwell RR, Takeda Y, Nair GB. Emergence and evolution of *Vibrio cholerae* O139. *Proc Natl Acad Sci USA* 2003 Feb 4;100(3):1304-9
11. Faruque SM, Mekalanos JJ. Pathogenicity islands and phages in *Vibrio cholerae* evolution. *Trends Microbiol* 2003 Nov;11(11):505-10
12. Haque R, Huston CD, Hughes M, Houpt E, Petri WA, Jr. Amebiasis. *N Engl J Med* 2003 Apr 17;348(16):1565-73
13. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS; Bellagio Child Survival Study Group (Schellenberg JA, Bruce J, Claeson M, Arifeen SE, Evans T, Gillespie D, Gwatkin D, Habicht J-P, Lanata CF, Mshinda H, pariyo G, Troedsson H, Victora CG, Wagstaff A). How many child deaths can we prevent this year? *Lancet* 2003 Jul 5;362(9377):65-71
14. Khan A, Datta S, Das SC, Ramamurthy T, Khanam J, Takeda Y, Bhattacharya SK, Nair GB. Shiga toxin producing *Escherichia coli* infection: current progress & future challenges. *Indian J Med Res* 2003 Jul;118:1-24
15. Mahmood B, Ahmed MU, Mahmood S, Ahmed MS, Moosa S, Qaium MA. Dengue virus: a review. *Osmani Med Teach Assoc J* 2002 Jul;1(2):57-62

16. Mahmood SAI. Social death part of AIDS tragedy. *Nirmul* 2003 Mar;5:1-17
17. Mostafa G, Streatfield PK. Health implications of an ageing Bangladeshi population. *In: Sattar MA, Kabir M, Kabir H, Elahi KM, Abedin S, editors. The elderly: contemporary issues. Dhaka: Bangladesh Association of Gerontology, 2003:33-53*
18. Naved RT. A situational analysis of violence against women in South Asia. *In: Violence against women in South Asia: a regional analysis. Bangkok: Asian Forum of Parliamentarians on Population and Development, 2003:1-27*
19. Osendarp SJM, West CE, Black RE; Maternal Zinc Supplementation Study Group (including G.J. Fuchs). The need for maternal zinc supplementation in developing countries: an unresolved issue. *J Nutr* 2003 Mar;133(3):817S-27S
20. Rabbani GH, Saha SK, Marni F, Akhter M, Alauddin M, Mitra AK, Nasir M, Chowdhury AKA. Antioxidants in detoxification of arsenic-induced oxidative injury in rabbits. *In: Rabbani GH, editor. Annual report 2002 (incorporating annual reports of 1999 and 2001). Dhaka: Bangladesh Arsenic Control Society, 2002:69-80**
21. Rabbani GH, Saha SK, Akhtar M, Marni F, Mitra AK, Ahmed S, Alauddin M, Bhattacharjee M, Sultana S, Chowdhury AKA. Antioxidants in detoxification of arsenic-induced oxidative injury in rabbits. *In: Rabbani GH, Ali SMK, Das HH, Hossain A, Gupta PKS, Haq I, Islam MM. Double-blind, randomized, placebo-controlled trial of antioxidant vitamins and minerals in the treatment of chronic arsenic poisoning in Bangladesh: final report 2003. Dhaka: Bangladesh Arsenic Control Society, 2003:105-17*
22. Rabbani GH, Nasir M, Saha SK, Islam MM, Alauddin M. Clinical and biochemical profiles of patients with chronic arsenicosis in Bangladesh. *In: Rabbani GH, editor. Annual report 2002 (incorporating annual reports of 1999 and 2001). Dhaka: Bangladesh Arsenic Control Society, 2002:18-27**
23. Rabbani GH, Sack DA, Choudhury MR. *Vibrio cholerae*. *In: Milliotis MD, Bier JW, editors. International handbook of foodborne pathogens. New York: Dekker, 2003:217-35*
24. Ramamurthy T, Yamasaki S, Takeda Y, Nair GB. *Vibrio cholerae* O139 Bengal: odyssey of a fortuitous variant. *Microbes Infect* 2003 Apr;5(4):329-44
25. Saidel T, Mallick PS, Azim T, Alam MS, Reddy A, Khanam R, Fee N, Baatsen P. HIV in Bangladesh: is time running out? Dhaka: National AIDS/STD Programme, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of Bangladesh, 2003. 35 p.
26. Salam AKMA, Alam MS, Choudhury KK. Inequalities in the utilisation of safe delivery services in Bangladesh: barriers to reducing maternal mortality. Dhaka: Bangladesh Health Equity Watch, 2003. i, 19 p. (Equity watch paper no. 2)

D. Letters, Editorials, and Abstracts in Journals

1. Alam K, Hossain MA, Islam N, Sen SK, Sur GC, Talukder KA, Nair GB, Sack DA. Enhanced isolation of *Shigella* species by extended incubation of primary isolation plates (letter). *J Health Popul Nutr* 2003 Dec;21(4):396-7
2. Alam NH, Hamadani JD, Karim M, Faruque ASG. Effectiveness of a dietary treatment algorithm for home-management of children with persistent diarrhoea: a clinic to community-based study (abstract). *Gut* 2003 Nov;52 (Suppl VI):A195
3. Amann J, Bern C, Chowdhury R, Ali M, Akter T, Wagatsuma Y, Fox L, Vaz LE, Haque R, Secor WE, Breiman R, Maguire JH. High rate of leishmanin skin test reactivity loss in a visceral leishmaniasis endemic village in Bangladesh (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):410
4. Asaduzzaman M, John M, Hang L, Khan AI, Taylor RK, Ryan ET, Calderwood SB, Qadri F. Immunogenic potential of the toxin co-regulated pilus antigen, TcpA: induction of mucosal and systemic antibodies after natural *Vibrio cholerae* infection in Bangladesh (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):245
5. Ashraf H, Beltinger J, Alam NH, Bardhan PK, Faruque ASG, Akter J, Gyr K. Screening of patients with acute infectious diarrhoea evaluation of faecal occult blood test and lactoferrin latex agglutination test (abstract). *Gut* 2003 Nov;52 (Suppl VI):A196
6. Bardhan PK, Kogon M, Khan A, Beglinger C, Gyr N. Accuracy of 14C-D-xylose breath test in diagnosing small intestinal bacterial overgrowth in a tropical environment (abstract). *Gut* 2003 Nov;52 (Suppl VI):A196
7. Bardhan PK, Alam NH, Beglinger C, Gyr N. Evaluation of acid steatorrhea to assess steatorrhea in young children with diarrhea in Bangladesh (abstract). *Gastroenterology* 2003 Apr;124(4 Suppl 1): A-144
8. Bhattacharya SK, Sarkar K, Nair GB, Faruque ASG, Sack DA. Multidrug-resistant *Shigella dysenteriae* type 1 in South Asia. *Lancet Infect Dis* 2003 Dec;3(12):755
9. Bhuiya A. Inequity in health: let's not live with it (editorial). *J Health Popul Nutr* 2003 Sep;21(3):165-7
10. Black MM, Baqui A, Zaman K, Persson LA, Arifeen SE, Le K, McNary S, Black RE. Iron and zinc supplementation promote motor development and explanatory behavior among Bangladeshi infants (abstract). *FASEB J* 2003 Mar;(3 Pt II):A1200
11. de Francisco A, Hyder AA, Arifeen SE, Baqui AH. The dangers of childhood (letter) *Lancet* 2003 Jan 4;361(9351):86
12. Duggal P, Haque R, Roy S, Mondal D, Sack RB, Farr BM, Beaty TH, Petri WA, Jr. HLA class II alleles influencing susceptibility to *Entamoeba histolytica* infection (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):190
13. Dutta S, Ghosh A, Ghosh K, Dutta D, Bhattacharya SK, Nair GB, Yoshida SI. Newly emerged multiple-antibiotic-resistant *Shigella dysenteriae* type 1 strains in and around Kolkata, India, are clonal (letter). *J Clin Microbiol* 2003 Dec;41(12):5833-4
14. Hang L, John M, Asaduzzaman M, Bridges EA, Vanderspur C, Qadri F, Kirn T, Taylor RK, Hillman JD, Handfield M, Ryan ET, Calderwood SB. Use of *in vivo*-induced antigen technology to identify genes uniquely expressed during human infection with *Vibrio cholerae* (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):123-4
15. Hira K, Khan WA, Mackay MR, Cohen S, Leav BA, Calderwood SB, Ryan ET, Ward HD. Genetic variation in *Cryptosporidium parvum* isolates from children with diarrhea in Bangladesh (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):534

16. Hughes MA, Haque R, Petri WA, Jr. Amebiasis (letter). *N Eng J Med* 2003 Jul 17;349(3):307-8
17. Islam MM, Peerson JM, Ahmed T, Dewey KG, Brown KH. Effects of energy density of complementary foods on total energy intakes by healthy, breastfed children in Bangladesh: a preliminary study (abstract). *FASEB J* 2003 Mar; (3 Pt II):A1199
18. Jakariya M, Chowdhury AM, Hossain MZ, Rahman M. Management of chronic arsenicosis (letter). *Trop Doct* 2003 Oct;33(4):251-2
19. Kalluri P, Rahman S, Ansaruzzaman M, Bird M, Faruque ASG, Naheed A, Bhuiyan NA, Nato F, Fournier JM, Bopp C, Mintz ED, Breiman RF, Nair GB. Evaluation of rapid diagnostic assays for *Vibrio cholerae* O1: does sensitivity vary by skill level? (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):245-6
20. Khan AM, von Gierke U, Hossain MS, Fuchs GJ. Tetracycline in the treatment of cholera caused by *Vibrio cholerae* O1 resistant to the drug *in vitro* (letter). *J Health Popul Nutr* 2003 Mar;21(1):76-8
21. Kidd M, Bourgeois DL, Lastovica AJ, Louw JA, Sack DA. No relationship between *Helicobacter pylori* adherence factors, babA2, sabA and Gm1 and gastroduodenal disease (abstract). *Gastroenterology* 2003 Apr;124(4 Suppl 1): A-269-70
22. LaRocque RC, Saha D, Khan A, Akramuzzaman S, Qadri F, Faruque ASG, Ryan ET, Calderwood SB. The serum vibriocidal antibody is an incomplete predictor of protection from *Vibrio cholerae* infection in urban Bangladesh (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):244
23. Qadri F, Svennerholm AM, Bhuiyan TR, Ryan ET, Saha D, Faruque ASG, Faruque SM, Weinbraub A, Nair GB, Sack DA, Calderwood SB. Re-emergence of *Vibrio cholerae* O139 after a decade of low prevalence: comparison of immunological responses and virulence potential—implications for vaccine development (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):419
24. Rabbani GH, Ahmed S, Majid N, Saha SK, Akhtar M, Marni F, Hossain I, Wahed MA. Green banana reduces clinical severity and colonic inflammation in acute childhood shigellosis: a double-blind, randomized, controlled trial (abstract). *Gastroenterology* 2003 Apr;124(4 Suppl 1):A-63
25. Rogers KA, Khan WA, MacKay MR, Cohen S, Kane A, Karim MM, Ahmed S, Calderwood SB, Ryan ET, Ward HD. Systemic antibody response to genotype-specific recombinant *Cryptosporidium parvum* antigens in Bangladeshi children with diarrhea (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):256
26. Sack DA. When should cholera vaccine be used in cholera-endemic areas? (editorial). *J Health Popul Nutr* 2003 Dec;21(4):299-303
27. Sarker SA, Bardhan PK, Rahman M, Beglinger C, Gyr N. Usefulness of the *Helicobacter pylori* antigen test for detection of *Helicobacter pylori* infection in young Bangladeshi children (abstract). *Gastroenterology* 2003 Apr;124(4 Suppl 1): A-178
28. Sur D, Niyogi SK, Sur S, Datta KK, Takeda Y, Nair GB, Bhattacharya SK. Multidrug-resistant *Shigella dysenteriae* type 1: forerunners of a new epidemic strain in eastern India? (letter). *Emerg Infect Dis* 2003 Mar;9(3):404-5
29. Vaz LE, Bern C, Haque R, Akhter S, Roy S, Amann J, Fox L, Ali A, Wagatsuma Y, Breiman R, Maguire J, Secor WE. Predicting disease development and treatment success for visceral leishmaniasis (abstract). *Am J Trop Med Hyg* 2003 Sep;69 (Suppl 3):412
30. Zaman K, Haruko T, Yunus M, Arifeen SE, Chowdhury HR, Chakraborty J, Baqui AH, Iwata T. Bronchial asthma among rural Bangladeshi children: an epidemiological study (abstract). *J Jpn Pediatr Soc* 2003 Feb;107(2):221-(37)