CENTRE
FOR HEALTH AND
POPULATION RESEARCH

Annual Report 2002

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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, scientific reports, monographs, working papers, and special publications on subjects relating to infectious diseases, diarrhoeal diseases, health, population, and nutrition. Details of some of these publications may be found in the section ICDDR,B Publications 2002 of this report.

The cover photograph highlights our large-scale project on Maternal and Infant Nutrition in Matlab, dubbed MINIMat. The picture shows a MINIMat baby with its mother and grandma

Preface

This twenty-fourth Annual Report of the Centre documents many aspects of the activities during 2002, including research, support for research, health services, training, dissemination, and administration.

Important findings of studies have been presented under the six research programmes of the Centre. A list of ongoing protocols (completed or incomplete during 2002) with the names of principal investigators and funding agencies has been included separately to identify and recognize the involvement of scientists in their work.

Scientific papers, abstracts, and other documents produced and published by the Centre staff are also listed in the report. Many of the research works included here were initiated in previous years and hence documented in earlier reports. Studies that were completed during 2002 presented the final results. Some of the studies initiated earlier are still ongoing. Preliminary findings from these studies are reported in this document.

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

Table o

Contents

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 of the Gates Award
The tuberculosis initiatives began

2002 ICDDR,B describes mortality benefit from zinc therapy

Board of Trustees 2002

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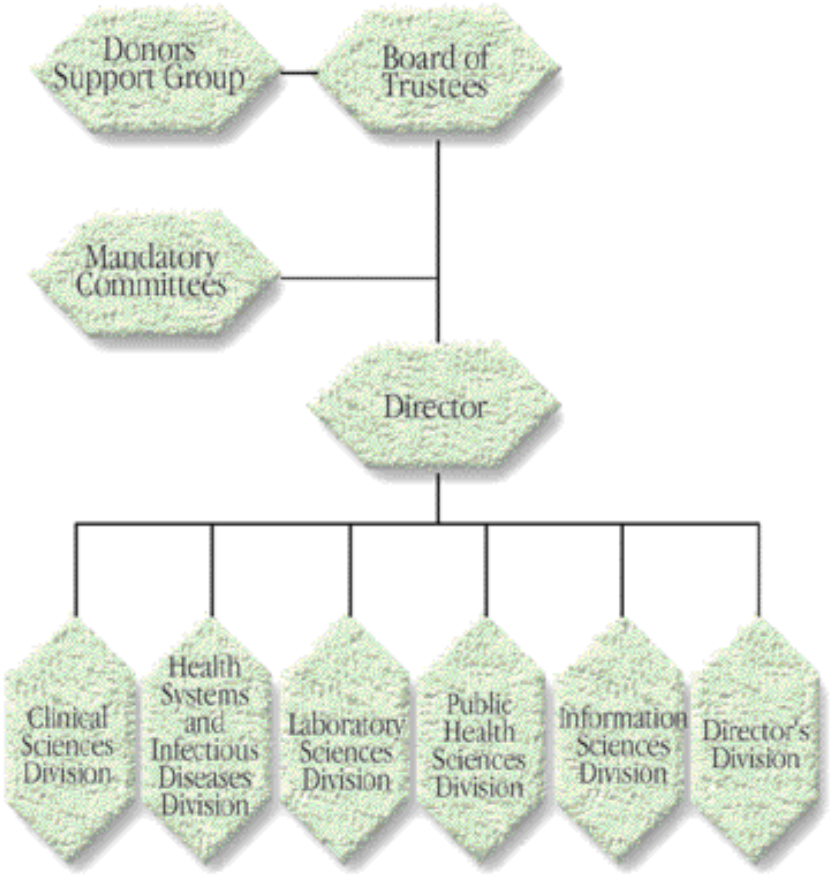
ICDDR,B: Centre for Health and Population Research



David A. Sack, MD

DIRECTOR'S REPORT 2002

The Centre is happy to provide this report of activities for 2002. During the year, the Centre's programmes continued to mature in their scope and productivity. As described here, the understanding of the health problems for poor countries continues to evolve, and the Centre is helping to document these and find practical solutions.

Changes in Leadership

Some changes in key scientific leadership took place in 2002. Prof. Marian Jacobs, a national of South Africa, retired from the Board of Trustees after serving six years, including two years as Chairperson. Beginning in July 2002, Dr. Ricardo Uauy Dagach, a national of Chile, became the Chairperson. Diann Hill, a national of the United States and Head of Human Resources, left in September 2002 and was replaced by Ann Gauvin Walton, a Canadian national. Judith Bennett Henry from Trinidad and Tobago, Executive Assistant to the Director, left the Centre in September 2002 at the end of her contract. Stephen Sage from the United States and Head of Finance left the Centre in November 2002. He was replaced by Aniruddha Neogi from India. Dr. Beena Varghese, an Indian national, joined the Centre in October as Head of the Health Economics Unit of the Public Health Sciences Division (PHSD). Alec Mercer from the UK, joined the Health Systems and Infectious Diseases Division (HSID) as an operations research scientist. Julia Ackley, a US national, joined the Centre as a Senior Associate in the ER&ID Office in August 2002.

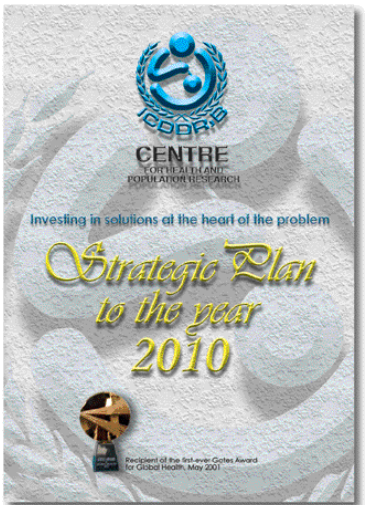
Financial Support

The Centre has faced a difficult situation financially because of the global economic slowdown with resulting decrease in funds. The poor economic situation also made it unwise to use funds from the Centre's modest endowment. Despite the difficult situation, the Centre was able to balance its budget by the end of the year, and this was possible due to strict cost containment, and especially due to the generous support from several donors who contribute to the core and help to sustain the Centre as a vital world resource. The increased activity of the Centre was reflected in the growing budget, now nearly $16 million dollars per annum.

Hopefully, the economic slowdown will be temporary, and donors will again feel more confident in investing in international health. We trust this will allow the Centre to continue to build its endowment which is so critical to the long-term stability and sustainability of the Centre, and especially for the creativity of its programmes. We especially thank the people of Dhaka who have participated with us in the annual fundraising events, the Winter Ball (affectionately known in Dhaka as the 'Diarrhoea Ball') and the art auction. Proceeds from these events added more than $30,000 this year to the Hospital Endowment Fund, and this endowment will, in turn, save countless lives in the future.

Strategic Planning

The Strategic Plan to the Year 2010 was approved after several years in its preparation. It should not be said that the plan is complete because it will never be complete. The plan is a dynamic one that will be monitored and reviewed each year. The plan does describe priorities and goals that are feasible and can be accomplished during the decade. An important aspect of the plan is the revision of the statements of vision, mission, and values which are provided in this Annual Report. The plan uses the 'life-cycle' approach to determine the crucial



UK's Parliamentary Under-Secretary of State Ms Sally Keeble, MP, who is also in-charge of DFID, during her visit to the Centre

life-stages where new knowledge and new approaches will yield the greatest benefits. It also refers to the Development Millennium Goals to coordinate our efforts with other national and international agencies. The plan also prioritizes those activities where the Centre has a relative advantage. It is clear that the next few years will be an exciting and productive period at the Centre. The Strategic Plan is available upon request from the Centre, or it may be viewed on the Centre's website at www.icddrb.org.

Training

Training helps the Centre to communicate its expertise, ideas, and perspectives to a large audience. This year, the Centre hosted over 300 trainees from 33 countries. Some courses were specifically designed for national trainees while others hosted participants from other countries. We anticipate that improvements in the electronic communications could make training increasingly 'virtual'. However, there is no substitute for the real 'hands-on' training provided by ICDDR,B.

Key Initiatives

The six scientific themes continue to define the major research efforts at the Centre. Each of these is highlighted in the Annual Report, and hence, I will not repeat the descriptions of these here. However, I do want to highlight a few studies.

One study evaluated the effectiveness of zinc in the treatment of diarrhoea in the community. Children in selected baris were provided with a daily dose of zinc for two weeks with each diarrhoeal episode along with oral rehydration solution (ORS). Children in other baris received only the ORS. After two years of follow-up, those receiving the zinc had fewer repeat episodes of diarrhoea, fewer episodes of pneumonia and also had a significantly lower mortality rate than those without the zinc therapy. Based on this and other zinc studies at the Centre and elsewhere, a major national intervention is being planned to introduce zinc treatment as part of the standard treatment for every episode of diarrhoea in children below 5 years of age. This will be carried out in partnership with the Ministry of Health and Family Welfare, and national institutions, along with private companies. If zinc can be successfully implemented in this manner, the project has the potential for saving thousands of lives each year in Bangladesh. The project will be a model for other countries as they move towards implementing national programmes to promote the use of zinc.

A second notable project tested the ability of a simple water-filtration method for removing vibrios from surface water. Based on earlier studies showing that *Vibrio cholerae* binds to zooplankton, and on work that the zooplankton can be filtered out using eight folds of a sari, villagers in Matlab were taught how to filter their water before bringing it into the house. Households that were taught how to filter the water had a significant reduction in the incidence of cholera demonstrating the efficacy of the method. Further studies will expand on this finding by determining what else might be done to water to further purify it to make it safe for drinking and other household uses.

The large and complex study on low birth-weight in Matlab, termed the MINIMat study, is now underway and is highlighted on our cover.

SAARC fellows, receiving hands-on training in an ICDDR,B laboratory

A simple water-filtration method for removing vibrios from surface water

Babies who start out small (which make up 45% of the babies born in Bangladesh) have higher rates of illness and death and are likely to have long-term health problems. Although several large-scale nutrition programmes are aimed at improving birth-weight through supplementary feeding during pregnancy, the most effective way to accomplish this is not known, despite the large sums of money being spent on the programmes. We anticipate that the MINIMat study will help define how to make such nutrition programmes effective and which micronutrients and medical treatments during pregnancy are most helpful in improving the health and development of the child.

Another large-scale project is testing a community-based intervention to prevent neonatal deaths. With a decrease in the overall rate of infant deaths, most infant deaths are now occurring in the first few days of life, and many of these are due to early infections. The intervention is exploring ways to identify and treat these neonatal infections, in the hope that this will significantly reduce the numbers of these deaths. Clearly, referral to hospitals for these children, although appropriate, simply takes too long, and treatment needs to be started in the community.

Research on infectious diseases and vaccine development has expanded significantly during the past year. Several vaccines are being studied at the Centre, including vaccines for rotavirus, enterotoxigenic *Escherichia coli*, *Haemophilus influenzae* type b, cholera, and viral influenza. We anticipate that some of these vaccines will be moving into phase-III efficacy studies in the near future. Among the infectious disease studies, tuberculosis is becoming increasingly important as a major disease of poverty and a serious public-health problem. The Centre is conducting surveillance for tuberculosis in Matlab and Dhaka to determine rates of disease susceptibility patterns. The Centre is also working on a new blood test for tuberculosis to help identify those with active infection. Dengue continues to infect people in Dhaka, and surveillance is ongoing to define rates of illness, risk factors, and serotypes. Surveillance for dengue fever has also led to a better understanding of other causes of illness with fever. In Dhaka slums, when blood cultures are obtained from fever patients, *Salmonella typhi* is the most common agent found, and this finding is leading to new research in typhoid.

Population studies have been focusing on the issue of the fertility plateau that has occurred in Bangladesh during the last decade. Following a remarkable increase in the use of contraceptives and a steady decline in fertility, the fertility rates have stabilized at about 3.3 nationally. This is a concern for the country since this rate is higher than that needed for replacement and is also higher than the stated number of children that couples indicate that they desire. Using various databases at the Centre, demographers are attempting to understand why the plateau has occurred and what steps might be taken to improve family-planning programmes.

Bangladesh continues to have a low prevalence of HIV/AIDS compared to other countries, but it seems likely that Bangladesh may have a large epidemic of HIV/AIDS in the near future based on the risk data from the national behavioural surveillance for HIV/AIDS. The Centre is increasing its efforts to prevent HIV/AIDS and has initiated a Voluntary Counselling and Testing Unit. Further, it is collaborating with CARE Bangladesh in initiating a cohort study of HIV infections among

A MINIMat baby with its mother and grandma

Scientists and technicians at work in the newly-established laboratory for study of sexually transmitted infections

intravenous (IV) injecting drug users. Both national serosurveillance and the cohort study show very high rates of hepatitis C infections among IV drug users, and this would appear to be a warning about HIV in the near future.

Clinical Services

In Dhaka, ICDDR,B is often referred to as the 'Cholera Hospital' and the life-saving efforts of the hospital staff are well-known. Of the 100,000 patients who come for treatment of their severe diarrhoeal illnesses, about 10,000 would have died if they had not come for treatment; an average of 27 patients are saved every day of the year. This is a remarkable achievement for a very simple treatment facility where the cost is remarkably low, at an average of $10 per patient treated. The Centre will be examining ways to make the 'Cholera Hospital' even more efficient, but it is already fulfilling a crucial mission in Dhaka.

Physical Facilities

The facilities continue to be improved according to the needs and programmes of the Centre and the availability of funds. While most of the renovations improve the functioning of the existing units, the new laboratories for STI, virology, add significantly to our capabilities to conduct research. Other changes include renovations of the offices of the Clinical Sciences Division and of the study ward to combine the metabolic ward, and a new diagnostic unit on the ground floor of the hospital now provides easy access to patients from Dhaka and elsewhere who come to the Centre to have laboratory tests.

Publications

All internal publications of the Centre are available on the website (www.icddrb.org).

The Journal of Health, Population and Nutrition (JHPN) continues to be published on schedule, and we thank the board members who have been willing to contribute to reviewing manuscripts.

We are very pleased with our new quarterly publication, the Health and Science Bulletin (HSB), modelled after the CDC publication MMWR. The Bulletin provides quick updates of selected topics based on work at the Centre or in collaboration with the Centre.

We hope this annual report gives you a better insight into the Centre's most recent research, activities and accomplishments, and its potential for the future.

Thank you for your interest in the Centre.

David A. Sack, MD
Director

Programme Head
Shams El Arifeen

CHILD HEALTH

Integrated Management of Childhood Illness

The Integrated Management of Childhood Illness (IMCI) strategy addresses the most common causes of child mortality in developing countries through the improvement of skills of health workers, strengthening of health systems, and improvement of community and family practices. With support from WHO and USAID and in partnership with the Ministry of Health and Family Welfare (MoHFW) of the Government of Bangladesh (GoB), ICDDR,B is undertaking an evaluation of IMCI in Matlab upazila. This initiative is part of the global Multi-country Evaluation of IMCI supported by WHO and USAID. The five-year Bangladesh study will measure the impact of IMCI on child mortality.

Details of the study design and key baseline findings were reported in the last year's annual report. We now highlight some experiences and lessons from the first year of IMCI implementation in the study area. The project has ensured a steady supply of drugs and other supplies to the intervention facilities. Intensive monitoring and supervision is made jointly by GoB and ICDDR,B. The ICDDR,B team continued its support for the national IMCI programme during this period, in partnership with UNICEF-Bangladesh and the WHO office in Bangladesh. With support from USAID/Dhaka, the IMCI evaluation in Matlab was expanded to include the development and evaluation of a community-IMCI intervention. Using the existing community-based field staff, such as Health Assistants, Family Welfare Assistants, and Community Nutrition Promoters, an information and communication intervention was started in late 2002 for improved care-seeking and home management in the catchment areas of the intervention facilities.

Initial evidence shows an increase in care-seeking from appropriate healthcare providers for sick children aged less than 5 years in the second half of 2002, following the full implementation of facility-based IMCI in early 2002 (Fig. 1). Data from household monitoring survey provide similar consistent findings (Fig. 2).

Fig. 1. Use of the first-level health facilities for sick children aged less than 5 years in IMCI intervention and comparison areas of Matlab

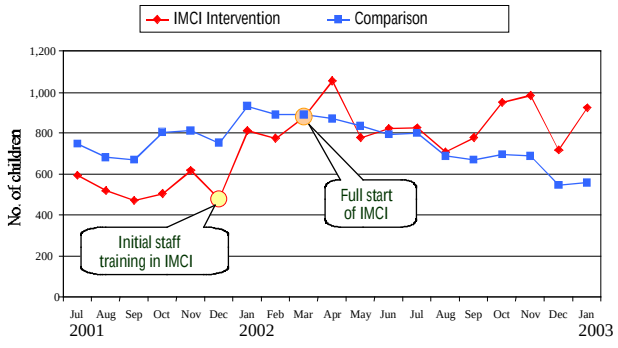
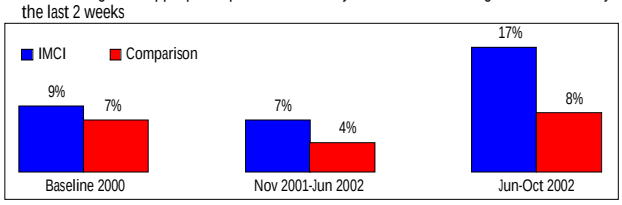


Fig. 2. Care-seeking from appropriate providers* for any illness of children aged less than five years in the last 2 weeks

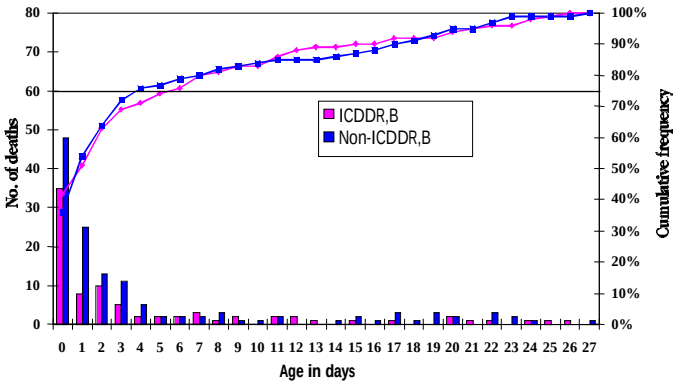


*Appropriate Provider=Health facility, doctors, paramedics, community-based health workers (GoB/NGO)

Neonatal Health Interventions

As in other developing countries, neonatal mortality remains high in Bangladesh and is now the largest component of mortality among children aged less than 5 years. More than three-fourths of neonatal mortality take place in the first week of life, which indicates the need to link safe motherhood and newborn care interventions (Fig. 3). In 2002, the Centre initiated two major intervention research projects on neonatal health aimed at evaluating the impact of a package of

Fig. 3. Neonatal deaths by age at death



Source: *Health and Demographic Surveillance, Matlab 2000*

The Centre initiated two major intervention research projects on neonatal health aimed at evaluating the impact of a package of pregnancy, delivery and newborn care interventions on neonatal mortality

pregnancy, delivery and newborn care interventions on neonatal mortality. The first project was started in 3 upazilas of Sylhet district (Beanibazar, Zakigonj, and Kanaighat), and, by the end of 2002, formative research and baseline household surveys were completed, and staff training started in phases. This study uses a cluster randomized design to evaluate two alternative service-delivery strategies: home-based care and clinic-based care. The study is also designed to improve newborn care, recognition, and management of neonatal infections by mothers and the first-level health workers and to measure antimicrobial resistance. Some findings from the formative research are highlighted in the box.

Who conducts the delivery?
- Senior females in household, often the mother-in-law, direct the process and make decisions
- In upper-class households, a senior female who has assisted with other deliveries in the family will often help deliver the baby
- In lower-class households, a traditional birth attendant (TBA) will often help deliver the baby

Who cuts the cord?
- Baby's mother most commonly cuts the cord herself because cord-cutting is polluting, and as the mother is polluted anyway

When is the cord cut?
- Usually wait for the placenta to be delivered before cutting the cord because it is believed that if the cord-cutting is done before delivery of the placenta, it could retract inward and kill the mother

In which room of the house does the delivery take place?
- Delivery often happens outside the main living area: either in a corner of the house, or even in the kitchen
- The newborn stays with the mother where delivery occurred for at least 7-9 days after birth

The project, supported by USAID, is being implemented in partnership with the Johns Hopkins University, Shimantik (a national NGO), Ministry of Health and Family Welfare, Dhaka Shishu Hospital, BRAC, and Institute of Child and Mother Health, and is funded by USAID (Dhaka and Washington), and the Saving Newborn Lives Initiative of SCF.

The second project was initiated in Mirzapur, Tangail, in partnership with the Johns Hopkins University, Oxford University, Kumudini Hospital, and Dhaka Shishu Hospital, and is funded by the Wellcome Trust. In addition to evaluating a package of obstetric and newborn care interventions, this study has a specific focus on identifying aetiology of neonatal infections in the community. In 2002, formative research was started, and preparatory work was done for baseline assessments. The first phase of the formative research revealed interesting differences from Sylhet. Some key differences have been summarized in the following box :

- Women in Mirzapur are more likely to work outside the home for income
- There is much greater awareness of family planning in Mirzapur
- Unlike in Sylhet where most births are attended by non-trained

Microscopic examination for bacterial vaginosis at Matlab

family members or untrained traditional birth attendants, families in Mirzapur prefer trained birth attendants

Child Development

The Child Development Unit (CDU) continued to provide leadership in the Centre in the area of child development and building cross-divisional collaboration. The Unit strengthened its collaboration with national and international institutions, and the activities accelerated by the joining of Professor Frances Aboud from Psychology Department of McGill University, Canada, as an adjunct scientist. Dr. Jena Hamadani and Dr. Fahmida Tofail were completing their PhD studies. Dr. Baitun Nahar who is trained in paediatrics joined the Unit and is conducting research on mental development of severely-malnourished children. Two psychologists and 5 junior psychologists were trained in conducting the Bayley test and problem-solving tests on infants. During this period, the Unit received funds from the World Bank, Joint Japan/World Bank Graduate Scholarship Program, Department for International Development-UK, and Swedish International Development Agency.

The CDU has two ongoing projects. One examines the effects of nutritional supplementation during pregnancy and breast-feeding practices on motor and cognitive development of infants. This community-based project is part of the MINIMat project.

The second project compares the existing child development activities at the Nutrition Rehabilitation Unit (NRU) of the Dhaka hospital with a low-cost culturally-appropriate systematic programme of psychosocial stimulation and parental counselling. The hypothesis being tested in this study is that such a systematic programme will be a sustainable and cost-effective means of improving the development of severely-malnourished children. Data collection started in October 2002, with expected duration of 18 months.

A study looked at the effects of prenatal zinc supplementation on mental development and behaviour of the offspring. Pregnant women were randomly allocated to zinc (30 mg/day) or placebo from 4 months of gestation to delivery. At 13 months of age, the placebo group had higher scores on the mental development index [B=3.3, SE=1.6, 95% confidence interval (CI): 0.2,6.5 p=0.04] and psychomotor development index (B=5.1, SE=2.4, 95% CI: 0.2,9.9, p=0.04) than the zinc-supplemented group (Hamadani JD. *Lancet* 2002;360:290-94).

In 2002, Maureen Black of the University of Maryland, USA, and colleagues from the Centre and the Johns Hopkins University, USA, completed the data analysis of a study on assessing the effects of

Filling bottles with micronutrient tablets

MINIMat is a major initiative of ICDDR,B aimed at improving our understanding of issues relating to maternal nutrition, and foetal and child growth, and has multiple components

supplementation of infants with zinc and iron on mental and motor development based on the iron/zinc supplementation trial in Matlab. Results of analysis showed that, on an average, infants experienced a reduction in motor development from 6 to12 months of age. Weekly supplementation of iron and zinc was associated with less reduction and better motor scores. There were no significant effects of iron or zinc alone on motor development. Iron alone, zinc alone, or iron and zinc together were associated with better orientation/engagement scores. However, iron and zinc in combination with other micronutrients were not associated with a change in orientation/engagement.

Additional analysis was done in this study to investigate the relationship between maternal depression and mental and motor developments in infants. More than half of the mothers reported depressive symptoms above the clinical cut-off. After controlling for potential confounders, maternal depression was associated with deficits in mental development and behaviour of children, and was significantly related to orientation/engagement (p=0.03) and temperamental behaviour (p=0.005) of children, with a trend towards significance in mental development (p=0.10).

Scientists in the Clinical Sciences Division completed a pilot project to assess the independent effects of energy density and feeding frequency of complementary foods on energy intake from complementary foods and breastmilk. Despite lower intake of high-density complementary foods, energy intake was higher than with low-density complementary foods at the feeding frequency used in the study; and that, despite significantly reduced intake of breastmilk by children receiving high-density complementary foods, their total energy intake was significantly higher than the children receiving the low-density complementary foods. A follow-up study has been designed to help develop practical guidelines for determining appropriate complementary foods for healthy breastfed children in terms of energy density and feeding frequency.

Maternal and Infant Nutrition in Matlab (MINIMat)

MINIMat is a major initiative of ICDDR,B aimed at improving our understanding of issues relating to maternal nutrition, and foetal and child growth, and has multiple components. ICDDR,B is collaborating with BRAC, GoB, Cornell University, London School of Hygiene & Tropical Medicine, Institute of Child Health, London, Umeå University, UC-Davis, London University, National Institute of Public Health, Mexico, Barts Hospital, London, Uppsala University, and Karolinska Institute. This research initiative is being implemented in Matlab in the context of Bangladesh Integrated Nutrition Project/National Nutrition Programme (BINP/NNP) interventions and with support from UNICEF, DFID, and many other sources.

The MINIMat design and interventions were described in the last year's report. By the end of 2002, about 2,464 pregnant women were enrolled in MINIMat and birth-weights of 976 babies were measured.

Sraboni is the first MINIMat baby. She was born on 16 April 2002. She was premature with birth-weight of 1,550 g. She is now 11 months old

REPRODUCTIVE HEALTH

Programme Head
Japhet Killewo

Basic obstetric care services at the union-level facilities in Matlab are now backed up by emergency obstetric care services at the upazila level

The Safe Motherhood Essential Obstetric Care Project in Matlab is a joint study by the Government of Bangladesh (GoB) and ICDDR,B to test and evaluate the impact of implementing functional essential obstetric care (EOC) in a rural area of Bangladesh. The intervention is aimed at increasing the use of facility-based delivery services to reduce high maternal mortality in Bangladesh. Accordingly, skilled attendants are located in facilities to conduct deliveries and to recognize pregnancy and delivery-related complications for subsequent referral to specialized care at higher levels. However, success of the Project was contingent upon provision of quality basic EOC services at the union-level facilities and comprehensive EOC services at the upazila level.

Upgrading facilities to provide requisite services

The year 2002 was a significant landmark for the EOC project as most critical activities were accomplished. A major achievement was the improvement of infrastructure involving a network of facilities for providing both basic and comprehensive EOC services and a referral system allowing access of the Matlab residents to these services. Renovation of all eight Health and Family Welfare Centres (H&FWCs) and training of service providers (FWVs) in the facilities were accomplished in 2001. Hence, by January 2002, all H&FWCs were providing skilled delivery services close to the community. This was the first time in Bangladesh that such services were available at this level of facilities and were used.

As part of the intervention, the Project also upgraded the Matlab Upazila Health Complex (UHC) to provide comprehensive EOC services to complement those provided at the H&FWCs and to receive referrals for more specialized care. Before its upgradation, the UHC was a large complex near a small canal and was providing clinical services with little or no services for pregnant women. The surgical theatre was small and meant for minor operations only. There were no trained staff, no surgical equipment, and no blood-transfusion services. The Project initiated construction of a separate maternity care unit with a fully functional operation theatre adjacent to the UHC so that the same staff and estate services could be shared.

Construction work started in March 2001, and the building was handed over to the Government in April 2002. The Project procured all equipment, furniture, and other supplies and put those in place to initiate surgical and other major obstetric interventions (caesarean sections), which are crucial to the prevention of avoidable maternal deaths.

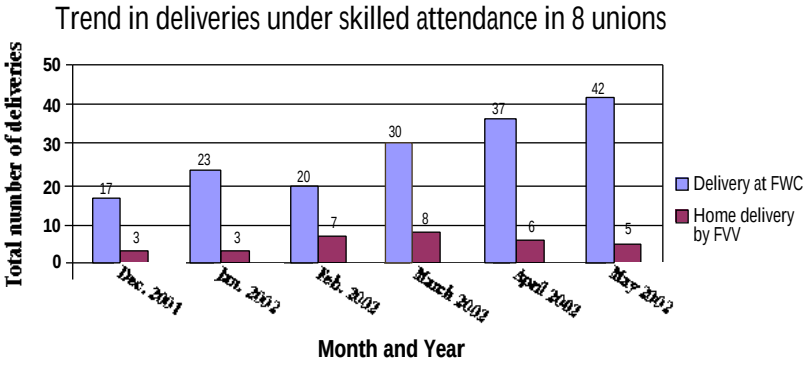
In addition, the water supply and drainage systems for the entire health complex were repaired to facilitate quality comprehensive EOC services. The UHC laboratory was expanded and further equipped to deal with more sophisticated investigations, including blood-transfusion services.

Training and retraining of staff to provide services

By the beginning of 2002, all training was completed, and necessary staff was in place. Training of relevant staff involved all senior staff nurses working at the Matlab UHC and the government family welfare

One of the upgraded H&FWCs at South Upadi in Matlab

Construction work of the new maternity unit was completed in April 2002



visitors (FWVs) to refresh their safe-delivery skills and two laboratory technicians to facilitate safe blood transfusion during caesarean sections, if needed.

Provision of basic and comprehensive EOC services

Along with the initiation of basic EOC at this level, a standard list of supplies, essential to provide quality basic EOC, was formulated, and their regular supply from the Project was ensured. In 2002, 3-4 deliveries were made per month in each H&FWC, and the trend is on the increase. At the upazila level, the provision of basic EOC services was shifted to the newly-constructed MCU, which was being made ready with the installation of an anaesthetic machine so that surgical interventions could begin.

However, during 2002, no comprehensive EOC services could be provided from the Matlab UHC since there was no medical officer trained in obstetrics and gynaecology, although everything was ready to initiate such services. Although caesarean sections could not be started in the newly-constructed MCU, normal deliveries, management of pregnancy and delivery-related complications and referrals to higher-level facilities increased considerably.

Raising community awareness

Bangladesh still has one of the highest maternal mortality rates in the world. More than 90% of births take place at home, mostly done by unskilled attendants. This is practised partly because the community is unaware of the risks attached to childbirth for each pregnancy and partly due to cultural and other barriers to accessing skilled attendance of deliveries. The Project sensitized the community to the risks and existence of functional basic and comprehensive EOC facilities and referral mechanisms so that each delivery can be performed under skilled attendance. The Government of Bangladesh has also emphasized this important aspect as reflected in its reproductive health priorities in the Health and Population Sector Programme (HPSP). As part of the safe motherhood interventions in Matlab, the Project, in 2001, initiated awareness-raising exercise in the community about pregnancy-danger signs during the Safe Motherhood Day on 28 May, and the exercise was repeated in 2002. More intensive house-to-house visits are being made by government fieldworkers, and a detailed behaviour change communication (BCC) package is being developed with the help of the Bangladesh Center for Communication Programs. Together with the BCC package, a pictorial card, which portrays the five main danger signs in pregnancy and delivery, will be given to each pregnant woman. This card is in use in various parts of Bangladesh.

During the house-to-house visits, the field workers will monitor pregnancies in the community and take a census of households while collecting socioeconomic information on assets, farming land, construction material for dwelling houses, type of latrine, etc. and assessing care-seeking behaviour for maternity services. The purpose of this additional data collection is to generate a denominator for different indicators outside the Health and Demographic Surveillance System area of Matlab. The impact of this intense awareness-raising effort will be evaluated at a later date through a community survey.

The first delivery in the UHC maternity care unit took place in May 2002

The maternity care unit is ready for surgical interventions, whenever necessary. The government anaesthetist and the ICDDR,B obstetrician and gynaecologist pose for a group photo with nurses, midwives, and other staff

The GoB pictorial card that was reproduced for use in Matlab. The other side of this card has information on antenatal check-ups, maternal nutrition, and safe delivery

Community midwives: a potential model for increasing skilled attendance at birth in Bangladesh

In Bangladesh, more than 90% of all deliveries take place at home, mostly attended by unskilled service providers. The situation is worse in rural areas compared to urban areas. Only about 6% of deliveries take place in rural health facilities. This level of institutional deliveries is very low considering that about 15% of deliveries are estimated to be at risk of complications and, therefore, should take place in EOC facilities where skilled care is available. Recent data indicate that the proportion of deliveries with skilled attendants is slightly higher (11.6%) than that taking place in facilities (Table 1), implying that a small proportion is taking place at home. Since it is now believed that every pregnancy is at risk of complications, strategies must be put in place to ensure that every delivery has an attendant with sufficient skills to recognize and refer women with complications for specialized care.

Despite attempts to improve the use of health facility in Bangladesh, studies in Bangladesh and elsewhere have shown that women do not want to deliver in health facilities because of the social and cultural barriers that they face in accessing safe motherhood services outside their homes. This means that the improvements being made throughout Bangladesh to upgrade EOC services and the efforts to raise community awareness about pregnancy-danger signs and the existence of upgraded services can only partially address the problem if these social and cultural barriers to accessing care are not addressed at the same time.

What are the options?

While facility-based obstetric care must be encouraged, this option must also be combined with a home-based model for skilled attendants that can gradually replace the traditional form of care given by traditional birth attendants (TBA). Although acceptable by communities, their role in the reduction of maternal mortality has been questioned. As a result, national policies are increasingly discouraging the services of TBAs but not at the same time looking for viable alternatives. There is, therefore, a need to develop alternative strategies to ensure that pregnant women in the community have access to skilled delivery services. One of the promising options is the use of skilled birth attendants with adequate formal education and appropriate midwifery training to serve as private-sector skilled birth attendants in their own communities.

The main differences between trained TBAs and the proposed model of midwives will be: a higher level of formal education and more intensive theoretical and practical training in the later group. Similar models of community midwives have been tried in a limited scale in Bangladesh and other countries with considerable success. However, their deployment or potential has not been adequately explored or studied.

Why is home-based midwifery care needed?

The strategy of the Health and Population Sector Programme of the Government of Bangladesh has taken initiatives to train midwives to

Table 1. Skilled attendance during deliveries in Bangladesh

Area of residence	% of deliveries in EOC facilities	% of deliveries with skilled attendants
Urban	21.4	26.8
Rural	6.1	8.4
Total	**8.8**	**11.6**

Community midwife Rayhan Begum in her residence at Chakaria with a stethoscope and a blood presure machine

This is the home of a community midwife in Chakaria where she provides some midwifery services

conduct deliveries in the EOC facilities to ensure skilled attendance at the majority of deliveries. Although facility-based delivery may reduce pregnancy-related morbidity and mortality in Bangladesh, its effectiveness is not likely to be high due to the following factors:

- Low proportion of institutional delivery in this conservative society where women traditionally prefer and are sometimes obliged to deliver at home
- Inadequate output of midwives from government training colleges, that is unlikely to meet the demand for skilled attendance at deliveries in the near future
- Economic constraints that prevent adequate and quality provision of obstetric care for deliveries in health facilities
- Low coverage of facilities that can provide basic EOC services at the grassroots level

There is, therefore, a need to develop and support a community-based skilled midwifery programme that can effectively reach the majority of women in need of obstetric care. This group of midwives will function as private practitioners in rural areas rather than as government employees or enrolled staff on NGO payrolls.

Existing models

In Bangladesh, two well-established models are currently in operation on a limited scale in terms of coverage and linkage with the formal referral system which constitutes one of the critical steps in the reduction of maternal mortality—one in Chakaria and the other in Chandpur. During 2002, a research proposal was developed with financial support from DFID to study the development of the community midwifery model. As a starting point, pilot visits were made to Chakaria and to Chandpur in February 2002 to assess the existing models and how they might be improved and subsequently scaled up to increase their coverage. These models are described below.

Chakaria Community-based Midwifery Project

ICDDR,B initiated the Chakaria Community-based Midwifery Project in 1997 in three unions (Kaiyerbil, Baraitali, and Manik Char) of Chakaria upazila in Cox's Bazar to ensure greater participation of pregnant women in antenatal and safe-delivery care, including referral of complicated cases. Under this project, 11 community health workers, trained in midwifery to serve in the community, provide services both at their residence where they have some basic equipment and supplies, including drugs, and in the homes of women where they may be called upon to attend deliveries. The community midwives receive partial salary support from ICDDR,B, but this support will be withdrawn once they become fully self-sustaining. After the implementation of the Project, the number of women receiving maternity-care services from the midwives increased gradually (Table 2).

Chandpur Community Midwifery Project

A local NGO, Bangladesh Association for Voluntary Sterilization (BAVS), initiated the Chandpur Community Midwifery Project in 1992 covering 12 unions of Chandpur Sadar upazila where 36 women were selected

Table 2. Number of women receiving maternity care from the midwives since 1998 in Chakaria

Year	Antenatal care	Delivery	Referred
1998	253	72	3
1999	496	144	15
2000	2,314	191	54
2001	3,331	213	55
2002	4,570	375	79

and trained as midwives for 6 months to conduct deliveries and provide maternal and child health (MCH) services at home. They were called 'palli' or village nurses. The Project was successfully implemented, and an evaluation of its performance was done after 5 years. The palli nurses were given partial salary support by BAVS for the first 3 years, beyond which they have continued to earn from the women they serve. The success of the programme is reflected by the improved coverage of maternity care provided by the palli nurses (Table 3). When we visited Chandpur in February 2002, we found that 25 of the palli nurses were still in practice and were earning their living from the women they helped deliver in the community. Four palli nurses were elected to political leadership positions at the local level but were still practising midwifery.

Jahan Islam, one of the palli nurses from Chandpur and an active community leader, performs public functions in addition to her routine midwifery services to the community. She is married and educated with 10 years of formal schooling. She has been practising for nearly 10 years, and now has a good reputation. She did not face any social or religious obstacles in taking up her job as a free-market entrepreneur to provide maternity care services. She earns, on an average, Tk 3,000 ($52) per month by conducting 6-8 deliveries, thus making her one of the most empowered women among her peers.

Evaluation of the existing models

Although the two models, Chandpur and Chakaria, differ in their organization and implementation, they have independently shown promising results. However, they have only been tried to a limited extent. Hence, a critical mass of midwives needs to be created in the two communities followed by effectiveness and quality studies to determine the extent to which they have been able to provide skilled care at delivery and the level of quality, including the cost of their services. Subsequently, issues of linkage with formal healthcare systems and sustainability questions should be addressed through dialogue with the relevant stakeholders before scaling up the model.

Measuring the met and unmet needs for specialized obstetric care

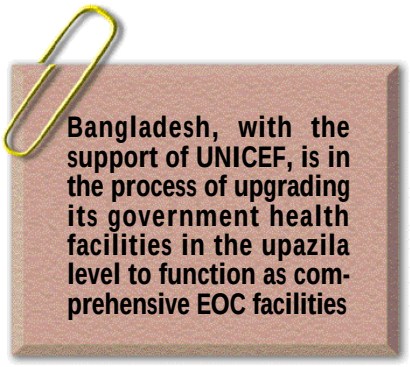
Since the beginning of 2001, the Unmet Obstetric Need (UON) Project has been measuring the incidence of serious delivery-related complications in Bangladesh. More specifically, it focuses on the complications that can only be solved in comprehensive EOC facilities and by obstetricians ('obstetric surgery' in particular). A 'comprehensive' EOC-facility is a facility, fully-equipped and staffed to deal with any delivery-related complications. It is generally agreed that basic EOC facilities or midwives cannot deal with these specific complications. Women facing the serious complications under study in the UON Project are likely to die if they do not receive this specialized healthcare in time.

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 of Antwerp, Belgium. The Project was inspired by the work of Professor Vincent de Brouwere and Professor Wim Van Lerberghe,

Table 3. Maternity cases attended by palli nurses after implementation of midwifery project in 1992 in Chandpur

Year	No. of antenatal care given	% of delivery
1992-1993	5,295	14.3
1996-1997	13,950	52.4

Jahan Islam (front), one of the palli nurses of Chandpur, holding a stethoscope and a blood pressure machine



who developed a new indicator for specialized obstetric care, which is more refined than the currently-used population-based caesarean section rate. The indicator estimates the number of women who died in a certain district and year and of serious delivery-related complications because they could not reach specialized obstetric care in time.

Bangladesh, with the support of UNICEF, is in the process of upgrading its government health facilities in the upazila level to function as comprehensive EOC facilities. Another initiative is the competence-based in-service training of health personnel, including obstetricians. Consequently, the new indicator will be an excellent tool to monitor the local responsiveness and accountability for each facility and district in these processes. It will serve as a starting point for discussion, involving all the stakeholders in the processes for change.

There are a number of problems with the population-based caesarean section rate, which can largely be overcome by this new indicator. For example, the clinical definitions of some complications (indications) requiring a caesarean section are not as standardized as one would like them to be, e.g. prolonged labour, obstructed labour, and foetal distress. The benchmark of 5% of all deliveries needing a caesarean section is set arbitrarily and has never really been validated. Moreover, with every woman undergoing a caesarean section for other-than-strictly medically-defined indications, the unmet need of another woman for it (to survive) will be hidden. In some countries, up to 30% of all deliveries end up in caesarean sections, but does it mean that all women who needed this intervention to survive a serious complication also got it?

Direct measurements of maternal mortality are extremely useful and provide a powerful tool for assessing maternal health, but unfortunately, these are also hard to obtain due to financial, technical, practical and methodological problems, especially in developing countries. The results reflect levels of maternal mortality of an agglomerate period in the past, as large sample sizes are needed for valid measurements. So, despite its usefulness, it cannot be used for routine monitoring of mortality per year, or per district.

For strict methodological reasons, the complications which are being considered for inclusion in the new indicator for specialized obstetric care have been limited to the following:

- delivery-related complications also called 'absolute maternal indications' that need specialized obstetric care (a major obstetric interventions or obstetric surgery) to save the mother's life
- delivery-related complications with high reproducibility of diagnosis (relatively easy to define the complication or diagnosis)
- delivery-related complications for which the incidences are considered more or less stable across populations and over time

The following complications are included as standard absolute maternal indications (AMIs): placenta previa, abruptio placentae, transverse/oblique lie, face/brow presentation, clear mechanical obstructed labour

due to manifest cephalo-pelvic disproportion (e.g. hydrocephalus), ruptured uterus, and uncontrollable haemorrhage.

The concept of the indicator was presented at the National Conference and Annual General Meeting of the Obstetrical and Gynaecological Society of Bangladesh held on 26-27 April 2002.

How is this 'incidence' measured?

An incidence reflects a 'risk', in this case, the risk for any delivery to become complicated by the above-mentioned conditions. To assess this, one needs to study a large delivery-cohort, represented by the total number of deliveries as the denominator and the complications under study occurring among these deliveries as the numerator. Some women with these complications died of it, while others were saved through a major obstetric intervention (obstetric surgery). Hence,

$$\text{The risk or incidence} = \frac{\text{All women with particular delivery-related complications (AMIs)}}{\text{Total number of deliveries}} \Rightarrow \frac{\text{❶ Women who died + ❷ women who were saved with those complications}}{\text{Total number of deliveries}}$$

What can we do with the incidence of AMIs?

Once we know the incidence of AMIs, no more community data are required. As per definition, those incidences are considered more or less stable across populations, and over time; we can calculate the number of expected cases with those specific delivery-related complications in each district and each year, provided we know the number of deliveries. For example, if the incidence is 1% (1 in every 100 deliveries), and there are 54,000 deliveries in a given year in a given district, we expect 540 cases with AMIs in that year and district. As a matter of fact, if the incidence is 1%, we expect for this year around 35,000 cases with AMIs in the whole of Bangladesh, i.e. 35,000 delivering women who will die if they cannot reach the appropriate care of an obstetrician in time.

The number of women with those serious delivery-related complications, *saved* by the obstetricians, can then be compared with the number of *expected* cases. In fact, the met-need can easily be monitored yearly by collecting information from all the existing comprehensive EOC facilities (limited in number). It is thought: if women access the healthcare facilities for AMIs, they will do so for other delivery-related complications as well approximately to the same extent.

The UON team developed a special verbal autopsy questionnaire, which focuses on maternal causes of death

In summary, this new indicator provides information on the extent to which the routine healthcare system of an area, e.g. a district, addresses the need for specialized obstetric care of its population. 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 only needs information from a limited number of specialized hospitals and involves the healthcare providers in the process, which should facilitate change in policy. In percentages, the (un)met need for specialized obstetric care can be compared among districts. Contributions of different sectors of the health system (public, NGO, private), and changes over short time periods, can be visualized. In absolute numbers, it estimates how many women died because they could not have obstetric surgery in time. Concrete numbers of maternal deaths generally draw a striking image. It gives an idea of specific maternal mortality ratios. All these results can be visualized on a geographical map of the country.

This indicator is superior to the only other currently-used indicator for specialized obstetric care (the population-based caesarean section rate), especially when the caesarean section rates increase. Its stable benchmark and more reliable measurements will allow valid comparisons within and outside the country. It is also a good indicator for the functioning of the health system as a whole.

More details on the validation process in Matlab

The study cohort consists of about 60,000 deliveries (1990-1999) by women who were part of the Matlab study area at the time they delivered. Among those ±60,000 deliveries, we need to find those in which the above-mentioned complications occurred. As per definition, any of those conditions is lethal for the woman unless she reaches specialized obstetric care (obstetric surgery) in time; there are, thus, only two possible outcomes for deliveries complicated by AMIs. These are: the woman dies, or she is saved by an obstetrician with surgery.

We need to find information about both.

❶ Women who died of complications

In the study population and during the study period, 1,053 women aged 12-49 years died of various causes. A form completed to record each death included information about the circumstances, as narrated by the relatives, under which the woman died. The UON team developed a special verbal-autopsy questionnaire, which focuses on maternal causes of death. The team interviewed the best possible respondents again (those who were with the woman during her last days and hours) to make sure that all the important details about maternal causes of death are reported. All the interviews were completed, and 2 physicians independently reviewed results of the interviewers. In case of any disagreement between the 2 physicians, a third physician (an obstetrician) made the verdict. Finally, we will know how many women died of the delivery-related complications under study.

❷ Women with complications, who were saved with obstetric surgery

For each birth (also stillbirth and miscarriage), a form was completed

Dr. Holy Dewan and Mrs. Kalpana Biswas, searching through all the sorted files to find the patients coming from Matlab

Mr. Abdus Sabur of the UON team, sorting patients' files by medical speciality, ward, and date in Dhaka Medical College Hospital

under the Health and Demographic Surveillance System (HDSS). On this form, the place of delivery is mentioned. If the delivery was in a hospital, it specifies which hospital. During the study period, there was no hospital in the Matlab upazila providing obstetric surgery, and as a result, people had to visit Chandpur, Dhaka, etc. for surgery. All birth forms for deliveries (1990-1999) in hospitals outside Matlab were photocopied. To make sure we did not miss any, 8 female field workers visited all households in the entire study area with lists of women who had ever belonged to the study population. They enquired and completed a form with details on the delivery and the location of the hospital.

With this information we visited the hospitals mentioned by the women and looked for their clinical information in the hospital registers. Most women delivered in hospitals in Chandpur, and also the facilities in Comilla and Narayanganj. Other women with delivery-related complications from the Matlab HDSS area attended hospitals in Dhaka, such as Dhaka Medical College Hospital.

By the end of 2002, the collection of hospital data was almost completed. What still remains is a number of highly-scattered hospitals, dotted over the whole of Bangladesh, and in large cities, spread among many different hospitals and private clinics.

From nitty-gritty epidemiological research to its utility in public health

In collaboration with the Directorate General of Health Services (DGHS, GoB) and UNICEF, the new indicator has by now been piloted in the first district, Tangail, one of the best-performing model districts. All the existing EOC facilities (public, NGO, and private) were included in the exercise. A benchmark incidence of 1% of AMIs among all deliveries is being used until the data from Matlab are complete. Some conclusions of this first experience are as follows:

- The number of delivering women with severe complications, who can only survive with the help of an obstetrician (midwife cannot save them) was a big surprise to the obstetricians in 2001. Although they are saving lives every day and work hard to help women in need, they had no idea of the need of the population for obstetricians and which women apparently do not reach them.
- The exercise did not take more than a few hours to complete in each facility and it costs little.
- The registers in some facilities can be improved. The DGHS, UNICEF, and Bangladeshi obstetricians developed an excellent set of register tools, which were correctly used in the public facilities at Tangail. However, the private sector has not yet adopted these tools, and their record-keeping systems sometimes lag far behind.
- Persons in charge of record-keeping in private clinics usually have little or no medical background and, thus, however willing and meticulous, depend on obstetricians to complete clinical information. For the same reason, self-evaluation by those private facilities can only be done if the practising obstetricians cooperate fully.

The number of delivering women with severe complications, who can only survive with the help of an obstetrician (midwife cannot save them) was a big surprise to the obstetricians in 2001

- Someone needs to bring the obstetricians together and coordinate the exercise.

The Unified Management Information System of the DGHS plans to include this new indicator in their routine tools to evaluate health services. The DGHS and UNICEF also jointly conducted a nationwide survey of EOC facilities in 1999, including private facilities. For the next survey, the intention is to include this new indicator too. In Bangladesh, there may be rather more migration around childbirth than in most other countries, so it makes perfect sense to evaluate the met and unmet needs for specialized obstetric care countrywide and including all the health sectors.

NUTRITION

Programme Head
(Acting)
S.K. Roy

Of the 18 studies of the Bangladesh Integrated Nutrition Project (BINP)-Operations Research (OR), 14 were completed in December 2001, and 4 were completed in June 2002. The final report on the 18 projects was submitted to the Ministry of Health and Family Welfare (MoHFW), Government of Bangladesh (GoB), National Nutrition Programme (NNP) office, and BINP office. A separate report containing the objectives and findings of the 18 projects was also submitted to the concerned authorities. A presentation was held at the Bangladesh Secretariat in the presence of the Secretary, MoHFW.

The findings of the 4 BINP-OR projects are highlighted below.

Community-based protocolized management of severe child malnutrition

In Bangladesh, 48% of children aged less than 5 years are underweight, and 45% are stunted. Malnutrition rates rise very steeply and peak among weaning-age children (aged 6-23 months) and are clearly related to inappropriate feeding practices and to the high burden of infectious diseases, particularly in this age group. Compared to children who are not underweight (90% of median weight-for-age; RR 1), relative risks of mortality increase steeply for children who are severely underweight (RR 3.8 at 70% of median and 11.6 at 50% of median).

The present efforts of the government programme, under a World Bank-financed National Nutrition Project (NNP), address primarily nutrition problems in rural areas and require the development of a separate 'vertical' infrastructure. ICDDR,B is, therefore, piloting the delivery of child nutrition services as an integral part of the child health services delivered by three existing NGO intervention clinics in the Dhaka metropolitan area. Starting in March 2001, ICDDR,B has enabled the staff of these clinics to apply the hospital-based experience of ICDDR,B with protocolized management and rehabilitation of severe child malnutrition to secondary prevention at the community level. The existing intervention clinic staff, complemented by one protocol-financed dedicated Nutrition Counsellor at each of the three clinics, have been trained and equipped to identify and manage severe child malnutrition among children aged 6-23 months attending the intervention clinics for any reason.

At the first contact, the weight-for-age of attending target-age children is identified from plotted weights on gender-specific z-score-based growth charts developed for the protocol or from reference charts. Mothers of children who are not severely underweight (at or above -3 weight-for-age z-score) are then encouraged to enroll their children for monthly growth monitoring and promotion (GMP), but such children are not followed longitudinally.

Underweight among attending children is extremely severe in many instances, ranging from just below -3 to as low as -6.3 z-scores, equivalent to only 30% of median weight-for-age. Results of household-based interviews for a sub-group of severely-malnourished children enrolled showed that three-fourths of them came from slum dwellings. The median per-capita income in households of the enrolled children was only Tk 18 per day or about 32 US cents—far below the generally-accepted poverty-line of US$1 per person per day. One child in four

had a mother who worked for an income outside the home and one child in six had a father who was not contributing to household expenses. The great majority of young children reached by this pilot intervention originate, therefore, from household environments that are seriously compromised in terms of household food security and/or caring capacity.

Target-age children identified as severely underweight are enrolled for special care and attention, and are followed longitudinally until 'exit' from the protocol. These children are managed according to clearly-defined classification criteria:

Severely-underweight children meeting the above-mentioned criteria are referred to the Nutrition Unit of Dhaka Shishu Hospital. If no hospital-bed is available, the children are sent to a pilot facility for daycare-based management of severe child malnutrition established at the Radda MCH-FP Clinic, which has had excellent outcomes.

Protocol interventions for enrolled severely-underweight children consist of:

- Medical examination by the Medical Officer/Clinic Manager of the intervention clinic

Below -3 weight-for-age z-scores but
- not severely wasted
- no severe illness or complication
- not oedematous

➢ Enroll for home-based protocolized management; 'exit' to GMP on improvement to ≥-3 weight-for-age z-scores

Below -3 weight-for-age z-scores
- with severe illness or complication *or*
- below -3 SD weight-for-length z-scores *or*
- with bi-pedal oedema

➢ Refer for hospital-based management, continued by home-based protocolized management until 'exit' to GMP on improvement to ≥-3 weight-for-age z-scores

Nutrition counselling in a remote village in Dacope, Khulna

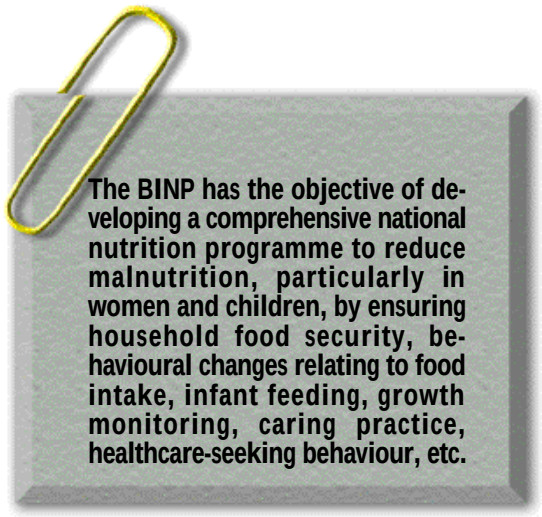
- *If referral criteria met:* Referral for hospital-based management, followed by home-based management after discharge and back-referral to the sending clinic
- *Otherwise:* Home-based management consisting of: outpatient treatment of infectious disease(s); counselling on home-based 'protocolized' feeding of a home-prepared energy-dense diet; an eight-week course of micronutrient supplements based on ICDDR,B practice. A sub-group of enrolled children who came from households, especially with severely-compromised food security or caring capacity received, in addition, a micronutrient-enriched wheat-soy multi-mix donated by the World Food Programme; and scheduled weight gain monitoring until exit from the protocol with ≥-3 SD weight-for-age z-score

At the three intervention clinics, 368 severely-underweight children—186 male and 182 female—were enrolled during 1 March 2000-31 October 2002. The majority (n=206, 56%) of these children had improved to moderate underweight by the end of 2002, while another 87 (24%) had left the catchment areas of the intervention clinics before recovery. Four (1%) children had died while still enrolled in the protocol—three of them in the referral hospital, while one died after discharge from the referral facility. Forty-eight (13%) children were discharged from the protocol unrecovered on grounds of inadequate cooperation and compliance on the part of their parents. Five (1.4%) were lost to follow-up after their initial enrollment. Forty-five (12%) remained under protocolized management as of 31 December 2002.

The mean monthly improvements in nutrition status of all enrolled children for whom two consecutive weights were available for the April 2001-December 2002 period ranged from 0.11 to 0.13 weight-for-age z-scores for the two least well-performing intervention clinics to as high as 0.29 weight-for-age z-scores for the best-performing clinic. The 206 enrolled children who subsequently recovered from severe underweight improved at a mean monthly rate of 0.32 weight-for-age z-scores, with a mean duration of 78 days from enrollment until exit from the protocol with -3 weight-for-age z-scores or above.

Follow-up weights, which would have been due by 31 December 2002 for 143 of the 206 children recovered from severe underweight by 30 June 2002, could be obtained for 73 children (51%). Only 12 (16.4%) of these children had reverted to severe underweight with a mean weigh-for-age z-score of -3.41. Most (84%) recovered children had remained above severe underweight and had, in fact, further improved to a mean weight-for-age z-score of -2.47. However, only 7 children had further improved to a 'normal' nutrition status (weight-for-age z-scores at -2 or above).

A recognized limitation of the current approach is the absence of active outreach. This and the most likely lower prevalence of severe malnutrition among clinic users explain why, despite high levels of severe child malnutrition in urban slums, the number of severely-malnourished children enrolled for protocolized management remained below expectations. Moreover, mothers of the relatively few children who are enrolled at any one time live not close to each other and, therefore, lack peer group support for energetic persistence with the feeding and caring behaviours recommended by the protocol. A proposed next phase of this research would, therefore, complement the current interventions by increased attention to community-level out-



reach. Expected results of such outreach include increased identification of children who are already severely malnourished, peer group support among participating mothers, and earlier recognition and/or prevention of child malnutrition than is achieved with the current approach.

The study was funded by the World Bank grant to ICDDR,B's Nutrition Centre of Excellence; the Operations Research contract with the Bangladesh Integrated Nutrition Project, MoHFW, GoB; GoB-Gates Award Matching funds and ICDDR,B core funds.

Collaborating organizations are: Progoti Samaj Kallyan Protisthan (PSKP), Poribar Porikalpona Sangstha, and NGO Services Delivery Project (NSPD).

Feasible means to address moderately-malnourished children within BINP communities

The BINP has the objective of developing a comprehensive national nutrition programme to reduce malnutrition, particularly in women and children, by ensuring household food security, behavioural changes relating to food intake, infant feeding, growth monitoring, caring practice, healthcare-seeking behaviour, etc. The Project has a programme for operations research through the BINP-OR, from which new insights and understanding are expected to originate for incorporation directly into the programme. One study of the BINP-OR has recently shown that the nutrition status of moderately-malnourished children improves significantly by educational intervention (with or without food supplementation) based on the UNICEF model of the nutritional triangle (food security, disease control, and caring practice) within 3 months, and the change is maintained over the next 3 months.

The study was conducted in 4 upazilas from 4 divisions of the country, where the BINP is operative, to test the feasibility and to examine the differences in information, education and communication (IEC) components for nutrition education in different geographical regions. The 4 upazilas are: Nikli upazila in Kishoreganj district of Dhaka division, Sherpur upazila in Bogra district of Rajshahi division, Chakaria upazila in Cox's Bazar district of Chittagong division, and Dacope upazila in Khulna district of Khulna division. Four unions in each upazila were selected for enrollment of the study and the control subjects. To ensure an adequate number of subjects, 30-40 Community Nutrition Centres (CNCs) in each upazila were selected. One of the 4 unions was identified for the recruitment of control subjects. Finally, 1,231 children, aged 6 months to 2 years, were recruited from the 4 upazilas. Of them, 626 were moderately malnourished, and 605 were either mildly malnourished or well-nourished based on the Gomez classification. Children who were being given supplementary feeding for growth faltering at the time of recruitment were not enrolled in the study, but once recruited, they were not excluded from the study for receiving supplementary feeding from the CNCs. For implementation of a two-pronged nutrition intervention, the subjects were enrolled in two broad groups: management group and preventive group. Moderately-malnourished children were included in the management group as they needed immediate attention to improve their nutritional status,

Counselling at the Nutrition Rehabilitation Unit of ICDDR,B to the mothers of malnourished children

whereas mildly-malnourished or well-nourished children were in the preventive group as they required advice to enable them to maintain their existing nutrition status. Based on the type of education received, the study subjects were categorized into 3 groups. Mothers in the first group received frequent nutrition education (FNE) on food security, disease control, and caring practice twice a week for the first 3 months and once a week for the next 3 months. Mothers in the second group received less-frequent nutrition education (LFNE) on these issues. The third control group received the standard BINP advice on nutrition and health education twice a month. The intervention was continued for 6 months, and the subjects were observed for another 5 months. The village Nutrition Management Committee was involved in monthly meetings for the motivation of the parents, and two of the women's support groups assisted in assembling the mothers of the children for nutrition education. Baseline and follow-up surveys were conducted on demographic and socioeconomic status, childcaring practice, feeding practice, and healthcare practices. Focus-group discussions (FGDs) at baseline were held by the anthropologist on perceptions about child feeding, food taboos, use of growth-enhancing food, function of food for child growth, and caring practices during illness on healthcare-seeking behaviour. A nutrition-education package was developed using the knowledge gained from the FGDs. Points of resistance by mothers were identified, and messages and explanations were built for necessary improvement in behaviour change communication (BCC). Colourful IEC flip-chart was prepared and used by the health assistants while educating the mothers. Two more FGDs were carried out at the end of the intervention and at the end of observation. FGDs revealed that mothers lacked adequate knowledge on the quality and quantity of complementary food for their children or for recognizing a special need for food during rapid growth. Their practice of child-feeding regarding time and frequency was traditional. Some mothers strongly believed that expensive foods or fruits, such as grapes, apples, etc., form blood. They had different perceptions on hot and cold food, and the practice of withholding food during illness was common to all of them. Food items, such as oil and egg, were considered to be too strong, gas-producing, and indigestible for young children. Some mothers believed that disease of a child is God's will, and they would take him to a local *hekim* for purified water or *kabiraji* treatment. There were complaints of not getting attention in the Upazila Health Complex (UHC) when they visited for treatment of their children.

Results of follow-up FGDs conducted at the end of 6 months' intervention showed changes in the negative ideas of adding oil to children's food and addition of eggs to home-made complementary food (*khichuri*). Referral to medical service centres remained a problem of not getting service from the UHC during their need.

Testing of tubewell water for arsenic in Community Nutrition Centres under BINP

The study was conducted in 40 BINP-operated upazilas to assess the concentration of arsenic in tubewell water in all CNCs. The number of community nutrition organizations (CNOs) under these upazilas was 1,328, and the number of CNCs, which were equivalent to the number of total tubewells in the area, was about 7,782. Concentration of arsenic

Results of follow-up FGDs conducted at the end of 6 months' intervention showed changes in the negative ideas of adding oil to children's food and addition of eggs to home-made complementary food (*khichuri*)

A mother is helping her child to recognize objects as part of child stimulation during nutritional management in the community

in water was more than the acceptable level for Bangladesh, i.e. more than 50 µg/L, in 26% of the tubewells tested. It was observed that water from these contaminated tubewells was used for preparing foods in the CNCs. Fewer than 2% of the tubewells were not operative at the time of testing mostly due to presence of arsenic, and the members of CNCs collected water from the nearest arsenic-free safe-water sources, while, on the other hand, a few tubewells were non-functional during the testing period. Members of the CNCs indicated that the best possible alternative source of water for them could be deep handset tubewells which was the most popular option (42%), followed by 3-pitcher filters (25%).

Process and impact study of BINP garden and poultry activities

The primary objective of this study was to provide programme managers and implementers with empirical evidence of both process and impact of BINP garden and poultry activities. Findings of the study showed that 36% of the BINP garden participants and 44% of the BINP poultry participants did not meet the eligibility requirements of BINP at the time of enrollment in the project. The study found that, by and large, the inputs and services required for the successful implementation of these sophisticated systems were rarely and inadequately provided. Although basic training was provided to 97% and 93% of the BINP garden and poultry participants respectively, follow-up services were inadequate. Only 57% and 52% of the BINP garden and poultry participants, respectively, received follow-up visits, and 30.4% and 25% of the BINP garden and poultry participants, respectively, received refresher training.

The level of inputs provided in both garden and poultry projects was generally inadequate for successful implementation. The average size of the BINP home-garden was 3.4 decimals compared to 4.3 decimals of non-BINP gardens. The BINP participants with lower-income households could allocate only 3 decimals to their home-garden instead of 4.1 decimals that non-BINP higher-income families had made available. In the garden project, in which no credit was provided, 43% of the BINP participants had to purchase some amount of additional seeds, 32% had to purchase seedlings, 57% had to purchase fencing, 78% had to purchase chemical fertilizers, 18% had to purchase cowdung, 26% had to purchase chemical pesticides, and 28% had to purchase farm tools. In total, the BINP participants spent Tk 213, and the non-BINP participants spent Tk 235 on inputs for their home-gardens. Among the BINP participants, the lower-income garden participants spent 17% less than those with higher income. In fact, eligible garden participants harvested 25% less than ineligible participants who were able to purchase more inputs. In total, the BINP participants spent Tk 1,392, and the non-BINP participants spent Tk 1,360 on inputs for poultry rearing. Among the BINP participants, the lower-income participants spent 16% less on cash inputs than did those with higher income. As a result of these shortfalls in inputs and services, both garden and poultry participants experienced considerable difficulty. The major problems in the garden project included plant disease (41% of participating households with gardens), animal damage (38%), and low production levels (44%). The major problems in the poultry projects were poultry disease (62%), premature death of birds (44%), non-availability of quality feed (19%), and pest-animal damage (18%). As a result of these problems, the drop-out rates among participating households were high, particularly in the poultry sub-project.

The level of inputs provided in both garden and poultry projects was generally inadequate for successful implementation

Zinc supplementation boosted anti-measles vaccine-specific response, while iron supplementation induced *in vivo* cellular activation. However, co-administration of iron with zinc reduced NK cell proportion in systemic circulation

Among the garden participants, the drop-out before completion of one year was roughly 40%. It may be noted that even among drop-outs, the project usually was not entirely without benefit.

Bibliography of Nutrition Research at ICDDR,B, 1997-2001

With the assistance of the Nutrition Programme, the library staff compiled the Nutrition Bibliography, Volume 2, which was published in 2002 (ICDDR,B Specialized Bibliography Series No. 18). This volume, available in the Centre's library and on the website, includes nutrition research citations from the Centre staff up to December 2001. The 59-pages bibliography lists 83 journal articles, 36 chapters, letters, editorials, and reports, and 187 abstracts.

Malnutrition: meeting the challenges in South Asia–10th Annual Scientific Conference

"Malnutrition: meeting the challenges in South Asia" was the theme of the 10th Annual Scientific Conference (ASCON) of ICDDR,B, held on 11-13 June 2002 in the Centre's Sasakawa Auditorium. The members of the Nutrition Programme presented their research findings at the Conference. All abstracts were published and are available on the website.

Immune responses in Bangladeshi infants randomly allocated to supplementation of iron, zinc, or a micronutrient mix

A sub-sample (n=83) of a community-based, randomized, controlled trial evaluating the efficacy of weekly supplementation of micronutrient formulations for 6 months in infants aged 6 months on various outcomes (growth, morbidity, and anaemia) was enrolled in the study. The aim was to assess the effect of weekly supplementation of 4 different micronutrient formulations for 6 months on innate and specific immune responses in Bangladeshi infants. There were 5 groups of infants given one of the following: iron with riboflavin, zinc with riboflavin, iron and zinc with riboflavin, a micronutrient mix, and riboflavin only. The micronutrient-mix contained two recommended dietary allowance (RDA) of vitamin C, D, E, niacin, B-1, B-6, B-12, folic acid, pantothenic acid, iodine, copper, manganese, and selenium, in addition to iron, zinc, and riboflavin. The infant group receiving riboflavin alone was considered as the control group. Results indicated that zinc supplementation boosted anti-measles vaccine-specific response, while iron supplementation induced *in vivo* cellular activation. However, co-administration of iron with zinc reduced NK cell proportion in systemic circulation.

Child Development and Nutrition

Research on child development was involved in conducting a number of studies in 2002, in collaboration with the Institute of Nutrition and Food Science of the University of Dhaka and the Institute of Child Health of the University College, London. The World Bank, DFID, SIDA, and UNICEF provided funds.

Effects of psychosocial stimulation on mental development of malnourished children in Bangladesh

One of the projects looked at the effects of psychosocial stimulation

After one year of intervention, the children who received psychosocial stimulation had a significantly higher mental development index than a group of similarly-malnourished children who did not receive stimulation

on mental development of malnourished children who attended the CNCs of BINP. In this project, mothers were taught how to improve the development of their malnourished children through simple and practical means. Mothers of malnourished children attended group meetings once a week and were given developmental messages. The children were also visited by our local staff twice a week at their homes. Depending on their development, they were given appropriate toys made of discarded materials, and their improvement was noted. After one year of intervention, the children who received psychosocial stimulation had a significantly higher mental development index than a group of similarly-malnourished children who did not receive stimulation. The intervened children were also happier, more cooperative, more vocal, and less inhibited than the control children. This project was concluded in February 2002.

Effect of fish-oil supplementation during pregnancy on psychomotor development of infants

A study was conducted to determine the effects of supplementation of fish-oil and soy-oil during pregnancy on mental development of the offspring. Pregnant women were randomly allocated to either fish-oil or soy-oil, and their infants were followed up at 10 months of age for mental development. There was no difference between the two groups.

Of 2 ongoing projects, one is looking at the effects of early versus late food supplementation during pregnancy and effects of supplementation of different micronutrients during pregnancy on mental development of the offspring. This is a large project titled MINIMat (for Maternal and Infant Nutrition in Matlab) started in October 2001. Data collection is still going on. However, interim results are presented under the section on Child Health Programme in this annual report.

Efficacy of vitamin A-rich small fish in improving vitamin A status in children in Bangladesh

To improve the vitamin A and iron status in children, aged 3-7 years, using small fish rich in vitamin A, we conducted a feeding trial in urban slums. In the study, 579 children participated from 4 urban slums at Mirpur, Dhaka. Socioeconomic status survey, dietary recall, food frequency, anthropometry, and periodical health examinations were carried out. Stool microscopy was done. A blood sample was drawn from each child to measure the serum retinol, iron status, and acute phase protein.

More than 85% of the children had worms, particularly *Ascaris lumbricoides*. One-third had vitamin A deficiency based on serum retinol. Boys appeared to be at a significantly higher risk. Half of the children were anaemic. Children, aged less than 5 years, were at a significantly higher risk of anaemia. Anaemic children were more prone to vitamin A deficiency.

Based on serum retinol, 196 children were assigned to either mola (small fish rich in vitamin A), or rui with and without vitamin A added to the curry. All children were offered lunch 6 days a week for 9 weeks. A focus-group discussion was conducted to assess the perception of mothers about mola. At the end of the feeding trial, another blood sample was drawn and analyzed for parameters stated earlier. Data are being analyzed.

INFECTIOUS DISEASES AND VACCINE SCIENCES

Programme Head
Robert F. Breiman

2002 witnessed many exciting developments at the Centre in the area of infectious diseases and vaccine sciences. The Programme on Infectious Diseases and Vaccine Sciences (PIDVS) facilitates and focuses on the expanding role of the Centre 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 evaluation of vaccines.

The PIDVS functions to establish priorities, identify resources, and enhance cross-divisional and external collaborations and communication to boost the capacity of the Centre to conduct investigations on prevention of illness, mortality, and economic loss due to infectious diseases. During 2002, studies on cholera and other diarrhoeas, shigellosis, dengue, tuberculosis, influenza, and leishmaniasis highlighted the catalytic role played by the Programme.

ENTERIC DISEASES

Diarrhoea

CTXΦ-independent production of RS1 satellite phage by *Vibrio cholerae*

The devastating watery diarrhoea in cholera patients is caused by cholera toxin produced by *Vibrio cholerae* when it colonizes the intestine. The cholera-toxin genes are, in fact, derived from a bacteriophage (CTXΦ) which infects *V. cholerae* and converts non-toxigenic strains into toxigenic derivatives. The genome of CTXΦ is integrated into the chromosome of toxigenic *V. cholerae* and is termed a prophage. Chromosomal CTXΦ prophage DNA is often found flanked by copies of a related genetic element designated RS1. We have shown previously that RS1 is a satellite phage which uses some of the genes of CTXΦ to produce infectious phage particles (designated RS1Φ). RS1Φ satellite phage further controls the expression and dissemination of CTXΦ. We have discovered a CTXΦ-independent mechanism for the production of RS1Φ which involves a new phage KSF-1Φ isolated from an environmental *V. cholerae* strain. The RS1Φ particles produced in this way infect recipient *V. cholerae* strains by a mechanism that is independent of the CTXΦ receptor, the toxin-coregulated pilus (TCP). Thus, KSF-1Φ is capable of facilitating the transfer of the RS1 element to strains which do not express TCP pili or simply lack the TCP genes. Given that RS1Φ can enhance co-production of CTXΦ particles, KSF-1Φ-mediated dissemination of RS1 can indirectly promote the spread of toxin genes among *V. cholerae* strains. This study also showed that filamentous phages can package diverse DNA elements and may, thus, play an important role in horizontal transfer of genes among bacteria in the natural habitat.

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

Cholera, an epidemic disease, caused by *V. cholerae* O1 and O139, continues to represent a major public-health problem in many

A meeting of the PIDVS scientists with the USAID team

The dipsticks represent the first rapid test, which has been successfully used for detecting *V. cholerae* from rectal swabs, and this would immensely improve surveillance for cholera, especially in remote settings

developing countries. The conventional diagnosis of cholera uses a bacteriological procedure which requires at least 24 hours. Dr. Farida Nato and Dr. Jean Michel Fournier at the Institut Pasteur have recently developed a rapid diagnostic dipstick test based on detection of lipopolysaccharides by immunochromatography on gold particles. The test has a threshold value of 10 ng/mL for O1 and 50 ng/mL for O139 and a shelf-life of 21 days at 60 °C. When evaluated in Madagascar and by us in ICDDR,B using stool samples, the specificity ranged from 84% to 100%. The sensitivity of the dipsticks ranged from 94.2% to 100%. The dipstick used for the detection of *V. cholerae* O1 or O139 is a specific, sensitive and reliable test that can be easily performed for the rapid diagnosis of cholera and can provide a simple tool for epidemiological surveys. We also evaluated the O1 and O139 dipsticks for the rapid detection of *V. cholerae* O1 and O139 from rectal swabs of hospitalized diarrhoeal patients after enrichment for 4 hours in alkaline peptone water. The sensitivity and specificity of the dipsticks were above 92% and 91% respectively. The dipsticks represent the first rapid test, which has been successfully used for detecting *V. cholerae* from rectal swabs, and this would immensely improve surveillance for cholera, especially in remote settings.

Immune response studies on patients with diarrhoea caused by *Vibrio parahaemolyticus*

Our interest in *V. parahaemolyticus*-induced diarrhoea has arisen from the recent prospective study carried out at ICDDR,B which demonstrated that it is also a causative agent of acute gastroenteritis being isolated from diarrhoeal stools of patients attending the Dhaka hospital. Serogroups, such as O3:K6, O4:K68, and O1:KUT, which have pandemic potential, are more prevalent, although the non-pandemic serotypes have also been detected. Symptoms of infection due to *V. parahaemolyticus* usually include acute self-limiting diarrhoea because of consumption of contaminated food. Only the thermostable direct haemolysin (TDH) gene-positive strains of *V. parahaemolyticus* are capable of causing gastroenteritis, and the most important virulence factor identified to date is this virulence antigen. To our knowledge, no information is available on the immunopathogenesis of the disease in humans. We, therefore, carried out a systematic study to better understand the immune responses generated in the host after acute gastroenteritis caused by the pathogen. Adults infected with *V. parahaemolyticus*, belonging to both pandemic and non-pandemic phenotypes, were studied. Stools with a characteristic meat-washed/reddish watery consistency was seen on admission at the hospital, which was positive for occult blood from a moderate to severe grade in the majority of cases. Patients showed a strong antigen-specific immune response by early convalescence, with IgA, IgM and IgG antibody-secreting cell (ASC) responses to TDH. Elevated ASC responses to homologous serogroup-specific lipopolysaccharide (LPS) antigen were also observed. TDH and LPS-specific IgA, IgM and IgG responses were elevated in the circulation. IgA antibody responses were observed in intestinal secretions by early and/or late convalescence.

In addition to these adaptive responses, we also observed increased concentrations of C-reactive protein (CRP) and the nitric oxide me-

tabolites in the systemic circulation at the acute stage. Inflammatory mediators, TNF-α, and lactoferrin increased in mucosal secretions and in plasma, while the chemokine IL-1β was found to be highly elevated only in mucosal secretions.

Duodenal and rectal biopsy sections at the onset of illness showed an acute inflammatory response with the involvement of both the sites during the disease process. The lamina propria showed oedema, congestion of blood vessels, and haemorrhage with an increase of neutrophil polymorphs and macrophages.

The strains belonging to each O:K serotype exhibited varying degrees of resistance to killing by serum, with O8:K21 being most sensitive. An inverse relation was seen between bacterial resistance and onset of the mucosal response; those more susceptible to killing showed a late onset and vice versa. No difference was seen in any study parameter between the immune response induced by pandemic and non-pandemic strains.

In summary, the infection caused by *V. parahaemolyticus* produces an acute inflammatory response, which by convalescence appears to revert back to baseline levels similar to that observed in healthy individuals. The immune response is, thus, different from that seen in *V. cholerae* or that seen in *Shigella*-infected patients. In the former, the inflammatory response at the mucosal site is of a more subtle nature, while in the latter, it is generally more severe, and recovery is not seen as quickly as observed here. This study, thus, indicates that infection with strains of *V. parahaemolyticus* results in a marked antigen-specific B cell response to bacterial antigens, TDH and LPS, and an acute inflammatory response, which is self-limiting.

Thermostable direct haemolysin of *V. parahaemolyticus* stimulates chloride secretion by intermediate conductance chloride channels in human epithelial cell line, Caco-2 (a collaborative study with Japan)

We investigated the chloride secretion and the type of chloride channel of Caco-2 cells induced by thermostable direct haemolysin (TDH) of *V. parahaemolyticus* by the patch clamp technique. Caco-2 cells (confluent) were grown on glass cover-slips and were subjected to ion transport studies, using the cell-attached mode patch clamp technique with and without TDH in cell bath solution. The effect of the chloride-channel inhibitor, 4,4'-diisothiocyanostilbene-2,2'-disulphonic acid (DIDS), was measured by adding DIDS in pipette solution, followed by the addition of TDH to the bath solution, containing Caco-2 cells. Kinetic analysis of cell-attached patches suggested that TDH increased the chloride-channel activity by increasing channel open probability (via an increased channel open time and a decreased channel closed time). Chloride channels of Caco-2 cells were opened by TDH as detected by channel current (2.56 pA) using Biopatch software. The conductance of chloride channels was 42.7 pS, suggesting these as intermediate conductance chloride channels. The opening of chloride channels by TDH was inhibited by DIDS. TDH appears to play an important role in the pathogenesis of

Scientists at the newly set-up 'Advanced Biomedical Research Unit' of ICDDR,B discussing the programme of the study on Peru 15, the live oral cholera vaccine

Jagori, HIV Voluntary Counselling and Testing centre at ICDDR,B that provides confidential testing with counselling for HIV in Bangladesh

diarrhoea caused by *V. parahaemolyticus* by inducing transepithelial chloride secretion. An inhibitor of chloride channels, such as DIDS, may have a potential therapeutic role in the treatment of diarrhoea.

Phenotypic and genotypic analysis of clinical and environmental *Vibrio cholerae* non-O1 non-O139 to identify pathogenic clones and their pathogenic mechanism

In total, 205 *V. cholerae* non-O1 non-O139 clinical (n=145) and environmental (n=60) strains were selected for phenotypic and genotypic characterization. These strains were isolated during 2000-2001. So far, 124 clinical and 31 environmental strains have been serotyped using an international serotyping scheme. Among the clinical strains, serogroup O49 (n=21), O5 (n=14), O176 (n=11), O24 (n=6), and O145 (n=5) were predominant, and the remaining strains belonged to 35 different O-serogroups. Among the environmental strains, serogroup O179 (n=8), O4 (n=7), O121 (n=5), and O70 (n=5) were predominant, and the remaining strains belonged to 4 different serogroups. None of the strains in the environmental serogroup was isolated from the clinical samples.

All these strains were included for adherence assay in HeLa cell. Most clinical strains showed either localized, diffused, or aggregating-type adherence, but only a few strains of the environmental strains produced only aggregative-type adherence in HeLa cell.

All these strains were screened for *ompW* and *ctx* gene by polymerase chain reaction (PCR). The *ctx* gene was detected from only one clinical strain. The result derived from *ompW* gene confirmed the result of conventional biochemical and serological tests.

Research is in progress to detect different virulence genes using various molecular techniques, and to test the pathogenicity of virulence genes, various animal models are used.

Cholera and the Environment

Cholera still strikes in the form of epidemics in Bangladesh and other developing countries where socioeconomic conditions are poor and safe drinking-water is not readily available. However, in Bangladesh, it appears twice a year, maintaining a unique seasonal pattern with a steep rise in pre-monsoon and post-monsoon seasons when water volume decreases with the occurrence of heavy plankton blooms in almost all the surface-water bodies of Bangladesh. Therefore, studies relating to the autochthonous nature of *V. cholerae*, the causative agent of cholera, in the aquatic environment and its epidemic occurrence throughout the world have drawn much attention of the scientific community. The Environmental Microbiology Laboratory, from the very beginning of its journey, has been associated with various research works on the ecology and epidemiology of *V. cholerae*.

In 2002, the Laboratory successfully completed two major studies on cholera in collaboration with the University of Maryland Biotechnology Institute (UMBI) and the Johns Hopkins University of Maryland, USA. One study was focused on the environmental intervention of cholera

by a simple water-filtration technique, and the other was based on the ecology and epidemiology of *V. cholerae* in Bangladesh.

In Bangladesh, a large proportion of villagers still depend on untreated surface water for household purposes and even for occasional drinking and are, therefore, always at high risk to contract cholera and other diarrhoeal diseases. A collaborative study with the UMBI for the environmental intervention of cholera, employing the simplest and cheapest technology of using old 'sari', an inexpensive cloth commonly used by the village women of Bangladesh, as a filtering device was initiated in Matlab villages in 1999. Based on results of ecological studies that *V. cholerae* is commensal to zooplankton and, therefore, can be removed from contaminated water by sari filtration. This filtration can best be achieved using 4 to 8-fold sari material, which allows filtering out both plankton and associated *V. cholerae*. Effective deployment of this filtration technique, from September 1999 to July 2002, in 65 villages comprising approximately 133,000 individuals of the Matlab HDSS area, yielded a 48% reduction in cholera ($p<0.005$) cases compared to control villages not employing filtration.

Investigation on the ecology and epidemiology of *V. cholerae* was carried out to detect the presence of toxigenic *V. cholerae* O1 and O139 in environmental samples, such as water, phytoplankton, zooplankton, aquatic plants, and sediment employing culture, direct fluorescence antibody (DFA), PCR and colony-blot hybridization techniques. *V. cholerae* O1 and O139 were isolated in culturable form and was detected in the viable but non-culturable (VBNC) state in water and plankton samples. Physicochemical parameters of water, recorded during the study, were analyzed to test the proposed hypothetical model for cholera outbreaks in Bangladesh. Results obtained from the statistical analyses fit well with the model and showed correlation with plankton and water temperature at several sampling sites.

A similar type of ecological and epidemiological study has been initiated in collaboration with the Northumbria University, UK, and the Ministry of Health, Mozambique, last year to determine whether similar environmental factors that contribute to cholera epidemics in Bangladesh also exist in Mozambique. The overall aim of the study 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.

V. cholerae is an autochthonous member of the aquatic environment of Bangladesh. However, there are several strategies reported for the survival of this bacterium under adverse environmental conditions. These include high frequency rugose exo-polysaccharide production, entering into a state in which the growth and multiplication of the bacterium ceases but the cells may remain metabolically active, i.e. viable but non-culturable. The bacterium may also reproduce in biofilms, which protect them from adverse effects of various environmental factors. In a collaborative study with Stanford University, California, USA, investigations are being carried out in the Matlab HDSS area to determine whether *V. cholerae* O1 can undergo biofilm formation in the aquatic environment and survive in inter-epidemic

Dr. Doli Goswami is explaining the intervention studies undertaken in Kamalapur field site to Dr. Viveka Persson of SIDA-SAREC

It is concluded that the environment plays a significant role in vibrio-related diseases of humans in Bangladesh

periods of cholera. Standard biofilm sampling devices were installed at specific depths in a canal to support biofilm formation on the solid surface of Plexiglas discs. Samples are collected at 15-day intervals and processed in the laboratory for culture and detection of VBNC *V. cholerae* using the DFA technique. Samples are preserved for further analyses, including detection of mRNA corresponding to the exopolysaccharide (EPS) gene-cluster and also for rRNA species-specific characterization of the members of that particular biofilm consortium. The species frequently isolated from biofilm samples belonged to *V. cholerae* non-O1 non-O139 serotypes, although *V. cholerae* O1 and *V. mimicus* could be isolated from biofilm samples on a few occasions by the conventional culture technique. However, the presence of *V. cholerae* O1 was detected in almost every case by DFA.

In response to adverse environmental conditions, *V. cholerae* adopts several survival strategies, which are regulated by regulatory genes. Expression of such regulatory genes together with other genes that are responsible for metabolic activity, dormancy and pathogenicity under a given set of conditions, can be measured employing DNA microarray technology. In another collaborative study with Dartmouth Medical College, New Hampshire, USA, and the University of Maryland Biotechnology Institute, an investigation has been carried out to determine the temporal dynamics of gene expression and regulation under different environmental conditions. The overall aim of the study is to establish an *in situ* incubation experiment in Bangladesh that measures gene expression in bacteria as a function of seasonal variation in environmental conditions in natural systems. Two ponds of Matlab HDSS area were selected for environmental sampling. One has a profile of high human impact for regular households and other recreational purposes and the other serves as a control, with less human impact. Water and plankton samples are collected at 15-day intervals from both the ponds for culture and DFA to estimate the number of *V. cholerae* O1 and O139 quantitatively and qualitatively. However, samples are also analyzed for plankton dynamics and water chemistry. A representative selection of isolated strains will be further investigated under similar laboratory conditions for gene expression using a microarray technique at Dartmouth Medical College, in collaboration with the University of Maryland.

In a relevant but separate study, we investigated isolation of pathogenic strains of *V. parahaemolyticus* from the aquatic environment in Bangladesh. We were able to isolate pandemic strains of *V. parahaemolyticus* (O3:K6) for the first time in Bangladesh and from the aquatic environment. This serotype has been known to be associated with a high incidence of gastroenteritis in many parts of the world, including Southeast Asia, since 1996. The pandemic strains that were isolated were found to carry the *tdh* (major virulence factor) gene and were positive for GS-PCR and ORF8 PCR. The RFLP of the *tdh* gene analysis revealed the occurrence of two copies of *tdh* gene in the chromosome.

It is concluded that the environment plays a significant role in vibrio-related diseases of humans in Bangladesh.

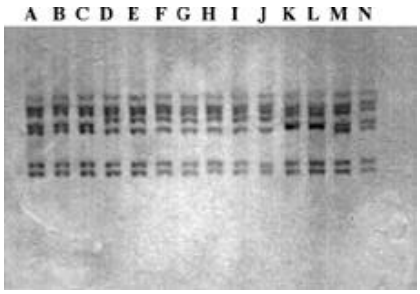


Fig. 2. Ribotyping patterns of *S. flexneri* serotype 1; Lanes: A to C: *S. flexneri;* D to F: *S. flexneri* serotype 1b; G to N: *S. flexneri* serotype 1c

Shigellosis

Phenotypic and genotypic characterization of provisional serotype *Shigella flexneri* 1c and clonal relationships with 1a and 1b strains isolated in Bangladesh

Shigellosis, caused by any one of the four species of *Shigella,* namely *S. dysenteriae*, *S. flexneri*, *S. boydii,* and *S. sonnei,* is one of the major diarrhoeal diseases in Bangladesh and several other countries and is responsible for a significant number of deaths, especially among children. In our study, it has been shown that *S. flexneri* is the most dominant species in Bangladesh, of which serotype 1 was the second most prevalent group. Interestingly, this high rate of prevalence of serotype 1 has been largely augmented by the provisional serogroup 1c. One hundred forty-four strains of *S. flexneri* serotype 1 (1a, 1b, and 1c), isolated from patients attending the Dhaka Hospital of ICDDR,B between 1997 and 2001, were serologically confirmed using commercially-available antisera and a panel of monoclonal antibody specific for *S. flexneri* (MASF). Among the serotype 1 isolates in Bangladesh, the prevalence of provisional *S. flexneri* serotype 1c has increased from 0% in 1985 to 56% in 2001. Detailed biochemical studies revealed that none of the strains in serotype 1 produced indole, while all the strains fermented mannose, mannitol, and trehalose. Twenty percent of 1c and all the serotype 1a strains fermented maltose; arabinose was fermented by 53% of the serotype 1c and 60% of the 1a strains, whereas all the strains of serotype 1b were negative for fermenting these sugars. Only 18% of 1b strains were resistant to nalidixic acid, and most strains of 1c and 1b were resistant to ampicilin, tetracycline, and trimethoprim-sulphamethoxazole. All the strains of 1a and 1b, and about 88% of the 1c strains were found invasive.

Analysis of plasmid profile showed that 26% of the strains of serotype 1 contain identical patterns. Most 1c strains (72%) had 1.6-MDa plasmid, which was not found in either serotype 1a or 1b strains. A self-transmissible middle-range plasmid (35-80 MDa) was found in some strains carrying the multiple antibiotic resistance gene. Pulsed-field gel electrophoresis (PFGE) analysis yielded three types (A, B, and C) with numerous subtypes among the serotype 1c strains, whereas serotypes 1b and 1a yielded only one type for each serotype, and those types were related to the types for serotype 1c strains. Ribotyping analysis yielded three patterns for 1c strains and one pattern each for serotype 1a and 1b strains, which were similar to the patterns for the serotype 1c strains. Overall analysis of the results concluded that the subserotype 1c is closely related to serotypes 1a and 1b. Furthermore, the high rate of prevalence of serotype 1c necessitates the commercial production of antibody against this subserotype to allow the determination of the actual burden of shigellosis caused by provisional serotype 1c.

Molecular characterization of *S. flexneri* type 6

The present classification has placed *S. flexneri* type 6 as a single serotype. In the present study, characterization of type 6 strains has been carried out at the molecular level to indicate the appropriate

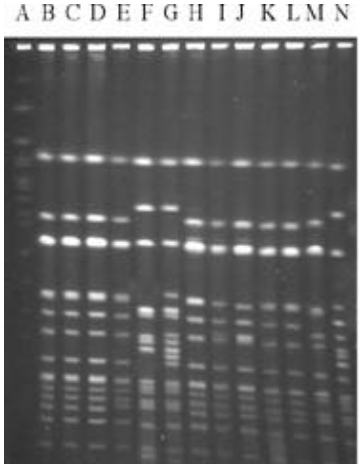


Fig. 1. PFGE patterns of *Not*-I digested chromosomal DNA of *S. flexneri* serotype 1. Lanes: A: *Saccharomyces cerevisiae*; B to L: *S. flexneri* serotype 1c; M: *S. flexneri* serotype 1b; and N: *S. flexneri* serotype 1a

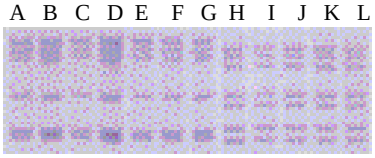


Fig. 4. Ribotyping patterns of *S. flexneri* type 6. Lanes: A to G: type 6 without E1037; H to M: type 6 with E1037

placement of type 6 in the present classification scheme. Thirty-seven strains of *S. flexneri,* obtained from patients attending the ICDDR,B hospital from 1999 to 2001, were preliminarily confirmed as serotype 6 using commercially-available antisera. When these 37 strains were typed using a panel of monoclonal antibodies, 20 strains agglutinated only with type factor 6 (designated as 6a), but the remaining 17 strains agglutinated with type factor 6 and an additional antigenic determinant E1037 (designated as 6b). The sugar fermentation ability shows a clear demarcation with fast and delayed positive reaction for type 6 with (6a) and without E1037 (6b). The 20 strains (6a) fermented mannitol within 2 days, whereas 17 strains (6b) fermented mannitol after 6 days. All the 37 strains harboured the 140-MDa invasive plasmid, had *ipaH* gene, and had the ability to bind Congo red, and representative strains were positive for keratoconjunctivitis in the guinea pig eye attesting their invasive properties. However, they differed only bearing the small plasmids. Twenty of the 37 strains possessed common 2.7- and 1.8-MDa plasmid, whereas the remaining 17 possessed 2.5- and 1.6-MDa plasmid. The PFGE analysis revealed three major types with numerous subtypes among the 37 strains (Fig. 3). Of these, 20 (6a) strains exhibited the type A and B patterns, whereas the 17 strains (6b) exhibited type C. Three different reproducible rRNA gene restriction patterns were also observed among these strains (Fig. 4), of which 20 strains belonged to two ribotypes, i.e., pattern R1 and R2, whereas single ribotype, i.e. R3, was found among type 6 with E1037.

Population-based evaluation of *Shigella* infections in an urban area of Dhaka, Bangladesh

A community-based surveillance for *Shigella* cases completed its pre-surveillance activities in Kamalapur urban surveillance area during July-November 2001, while the clinic-based passive surveillance of diarrhoeal patients kicked off in December 2001. The study will estimate the incidence and prevalence of shigellosis and its complications, age and cause-specific mortality in the community among all ages and gender, estimate distributions of serotypes and subserotypes, and monitor antimicrobial resistance and predictor of epidemic due to *S. dysenteriae* type 1 and *S. flexneri.* During January-December 2002, shigellae were isolated from 164 (14.17%) of 1,157 diarrhoeal patients**.** Among the isolates, the predominant strain was: *S. flexneri* (54%), followed by *S. boydii* (27%), *S. dysenteriae* other than type 1 (9%), *S. sonnei* (6%), and other unidentified *Shigella* species (4%). In addition, there were 19 cases of cholera (4 with *V. cholerae* O1, 6 with *V. cholerae* O139, and 9 with *V. cholerae* non-O1 non-O139), and *Salmonella* spp. were isolated from 9 cases. Most shigellosis patients, irrespective of age, presented with mucoidy stool followed by watery and blood-mixed stool.

Amoebiasis

Field studies of human immunity to amoebiasis in Bangladesh

The protozoan parasite *Entamoeba histolytica* causes amoebic colitis and amoebic liver abscess, which afflict millions of individuals in developing countries. In recent years, molecular genetic techniques and new models of disease have taught us much about the pathogenesis of amoebic infection. Recent recognition of the distinction between invasive *E. histolytica* and non-invasive *E. dispar*

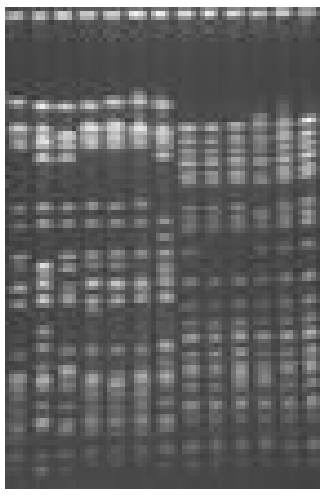


Fig. 3. PFGE patterns of *Xba*I-digested chromosomal DNA of *S. flexneri* type 6. Lanes: A to G: type 6 without E1037; H to M: type 6 with E1037

has made many earlier studies of human immunity uninterpretable, since *E. histolytica*-specific test was not used. A major impediment to developing a vaccine is the lack of knowledge of the existence or nature of acquired immunity. The killing of host cells requires parasite adherence via an *E. histolytica* cell surface lectin specific for galactose (Gal) and N-acetyl-D-galactosamine (GalNAc). Immunization with the Gal/GalNAc–lectin provides protection from amoebiasis in animal models of the disease.

Serum anti-trophozoite IgG antibody response associated with susceptibility to amoebiasis runs in families

We are conducting a prospective study among preschool children, aged 2-5 years, from an urban slum in Mirpur, Dhaka. In year 1 of the study, we observed that children with serum anti-lectin IgG had a higher rate of new *E. histolytica* infection. Now, we have determined that 95% of the children with serum anti-lectin IgG also had serum anti-trophozoite IgG. We have also found that most children who lacked serum anti-trophozoite IgG were unable to develop anti-trophozoite IgG along with a new *E. histolytica* infection, which is consistent with a genetic basis for this trait. We examined family members of the indexed children for serum trophozoite-specific IgG: 217 and 211 family members of 65 anti-trophozoite IgG-positive and 59 anti-trophozoite IgG-negative children respectively were examined. Results of analysis of 214 siblings and 99 sibships with the index child showed that the risk of having serum anti-trophozoite IgG was significantly different for cases and control families. Siblings of an anti-trophozoite IgG-positive index child had 4.8 times higher odds (95% CI, 2.34-9.90) of having an anti-trophozoite IgG response themselves compared to siblings of an anti-trophozoite IgG-negative index child.

A separate analysis of 189 parents and 108 parent-index child relationships did not show any statistically significant association. The lack of an association between anti-trophozoite IgG status of parents and that of their children could be due to a trait that is evident only in childhood or is due to infrequent infection in adults, leading to declining anti-trophozoite IgG responses. We concluded that family aggregation, combined with the failure of most anti-trophozoite IgG-negative individuals to become IgG-positive with a new *E. histolytica* infection, was consistent with genetic contributions to the anti-trophozoite IgG-positive trait.

Consecutive infection of children with different strains of *E. histolytica*

Since many children were infected more than once, we asked if these infections were due to different strains of the parasite. The development of PCR techniques for the identification of genetic polymorphisms in the serine-rich *E. histolytica* protein gene of *E. histolytica* enabled us to identify or 'fingerprint' different strains of *E. histolytica* from infected children in Mirpur, Dhaka. We succeeded in amplifying the SREHP gene in two or more stool samples collected monthly from the same child in a subset of 39 children over a two-year observation period. These gave a total of 119 amplification products

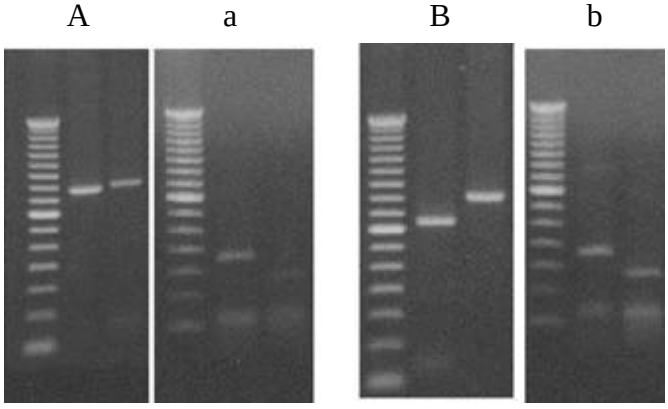


Fig. 5. Re-infection with genetically-distinct strains of *E. histolytica*. The serine-rich *E. histolytica* protein (SREHP) gene was amplified by polymerase chain reaction (PCR) from stool samples from 2 children infected twice with *E. histolytica* during the study period. Child A (A and a) was infected at month 8 and 13 and child B (B and b) was infected at month 10 and 19 of the study. The amplified SREHP gene products are shown undigested (A and B) and *Alu*I digested (a and b). Note that size of the PCR products is different with each infection in the same child. The molecular marker is a 50-bp ladder

Early-morning tirage in Kamalapur field site

and 80 pairs of comparison samples (Fig. 5). There were 62 different SREHP polymorphisms observed in the 119 samples. The differences in the SREHP gene were most likely to be observed between two *E. histolytica* infections separated in time by ≥2 months of no infection. For example, 88% (30/34) of the strains were different when they were separated in time by ≥2 months of no infection vs 22% (6/27) when there was no interval without *E. histolytica* infection. We concluded that many new *E. histolytica* infections in Mirpur were with genetically-distinct strains.

ACUTE RESPIRATORY INFECTIONS

Acute lower respiratory infection (ALRI), primarily pneumonia, is a leading cause of morbidity and mortality in children aged less than 5 years in Bangladesh. About 25% of deaths of children aged less than 5 years and about 40% of deaths of infants in Bangladesh are associated with pneumonia. *Streptococcus pneumoniae* and *Haemophilus influenzae* frequently cause the disease. 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 the relevant information in a timely manner, and finally, to improve the use of such data for policy decisions, particularly in ARI control programmes of the Government of Bangladesh. From 25 March 1999 to 31 May 2001, 1,493 pneumonia cases were enrolled in the study. A bacterial pathogen was detected in 177 of the 1,493 (11.85%) pneumonia cases by blood culture. *S. pneumoniae* was detected in 29 (1.94%) cases, and *Haemophilus* in 25 (1.7%) cases. *Acenetobacter* and *Moraxella* were also detected in 25 (1.7%) and 7 (0.5%) cases respectively. Most (72%) *S. pneumoniae* isolates were resistant to co-trimoxazole by the disc-diffusion method. One isolate was resistant to penicillin and two to chloramphenicol. The prevalence of resistance among *H. influenzae* was: co-trimoxazole 56%, ampicillin 28%, chloramphenicol 36%, and erythromycin 68%. Thirty-six percent of *H. influenzae* strains were resistant to multidrugs (≥3 drugs), 24% to two drugs, and 24% to one drug. All isolates were susceptible to ceftriaxone. The high resistance rate to first-line antimicrobial agent, such as co-trimoxazole, in invasive *S. pneumoniae* isolates and resistance to three conventional antibiotics in *H. influenzae* were worrying. Ceftriaxone can be used as an empirical therapy for the treatment of pneumonia. The findings of the study will be particularly useful in selecting an appropriate antimicrobial therapy for bacterial pneumonia in children. Timely dissemination of the findings and improved use of the appropriate therapy for policy decisions will have a significant impact on reducing mortality of children due to pneumonia.

Haemophilus influenzae type b invasive infections in children (aged <5 years) in Bangladesh: management and prevention

H. influenzae type b (Hib-associated) invasive infections are common in Bangladesh. The emergence of antibiotic-resistant Hib strains significantly increases the treatment cost, duration of hospitalization, risk of mortality, and serious complications in non-immune children suf-

fering from meningitis and pneumonia in Bangladesh since Hib vaccine is not included in the national immunization programme. We studied the epidemiology and antibiotic resistance of Hib infections in clinically-diagnosed hospitalized pneumonia and meningitis children aged less than 5 years. During April 1999-May 2002, a prospective study was undertaken in three hospitals in Dhaka to study Hib infections in children (aged <5 years) with pneumonia and meningitis. All patients had routine laboratory investigations, including cultures of blood and cerebrospinal fluid (CSF) and diagnostic analysis of CSF on admission. Data were collected in a standardized form. The isolation and antibiotic susceptibilities of Hib isolates were performed by the standard disc-diffusion techniques. In total, 58 Hib cases—43 (36 by culture and 7 by latex agglutination) from CSF of 122 (35.3%) children with pyogenic meningitis and 15 from blood cultures of 177 (8.5%) children with bacteraemic pneumonia—were detected. It was the leading cause of bacterial meningitis and the second cause of bacteraemic pneumonia. Most (92%) cases of Hib meningitis and pneumonia clustered in infants aged 4-12 months. Nineteen (37.3%) of 51 Hib isolates were resistant to multidrugs, being simultaneously resistant to any three of four antimicrobial agents: ampicillin, chloramphenicol, co-trimoxazole, and erythromycin. None was resistant to ceftriaxone. Hib is the leading cause of life-threatening infections in children, predominantly in infants of Bangladesh. The emergence of multidrug-resistant Hib infections limits the use of first-line conventional antibiotics compelling physicians to prescribe expensive parental antibiotics, such as ceftriaxone. The high prevalence of invasive Hib infections in Bangladeshi infants may be prevented by a cost-effective Hib-vaccination programme.

INFLUENZA

Influenza is easily spread from person to person and can cause very severe respiratory illness and mortality and can also be responsible for secondary complications, such as bacterial pneumonia, exacerbation of diabetes mellitus, or chronic lung disease. Since the virus can easily re-arrange its genetic make-up, immunity following infection during one season may not protect during the next, explaining why influenza is often considered to be the prototype emerging infectious disease. Despite the recognition of influenza as a global anathema, little is known about its public-health impact in Bangladesh. Results of a pilot study conducted in Kamalapur in 2002 suggest that influenza might account for a substantial proportion of acute febrile respiratory illnesses in children. Most cases occurred during the summer—a surprise since, in most other settings, influenza peaks during winter seasons. Several different influenza viruses circulated in Dhaka during the summer season, which suggest that densely-populated Dhaka may be an ideal location for the spread of multiple influenza viruses.

Recognizing influenza as an emerging priority, the Centre participated in two trials of a new cold-adapted influenza vaccine. The vaccine was highly effective against the disease. Studies conducted here will add to the growing knowledge about the potential benefit of influenza vaccines in settings like Bangladesh where influenza likely contributes to the incidence and severity of acute respiratory infection, the leading cause of childhood mortality.

Researchers in the ARI Laboratory are working for better diagnosis and treatment for respiratory infections

TUBERCULOSIS

Staff members from each of the scientific divisions of the Centre have joined together to study the incidence of tuberculosis in Matlab and drug susceptibility of *Mycobacterium tuberculosis* isolates from Matlab and from the government-operated Shyamoli Chest Clinic in Dhaka. The new Tuberculosis Laboratory of the Centre provides quality control for the laboratory at Shyamoli and performs drug-susceptibility testing of isolates. Related research within the Laboratory Sciences Division (LSD) is evaluating potential new diagnostic tests and molecular diagnostic approaches. During 2002, the tuberculosis team made plans to carry out population-based surveillance for tuberculosis in an urban setting (Kamalapur) and to evaluate the potential that a proportion of patients with chronic cough who are negative for evidence of tuberculosis on initial acid-fast bacilli smear testing might actually have tuberculosis and transmit the disease to others while they go untreated.

Rapid tests for simultaneous detection and molecular typing of *Mycobacterium tuberculosis* complex

Amplification of spacers between the direct repeat regions of the genome of *M. tuberculosis* was performed for its rapid detection. This technique is popularly known as 'Spoligotyping'. Ten Ziehl-Nelson-stained sputum smear-positive slides of different grades (3+ to 1+) and 14 paraffin-embedded tuberculosis (TB)-infected tissue from TB-suspected patients were confirmed by the spoligotyping technique. Genotyping of infecting *M. tuberculosis* was simultaneously performed using this technique. This novel technique will be applied in a community-based TB surveillance study.

Moreover, the spoligotyping technique was applied to genotype sputum isolates of *M. tuberculosis* (n=88) from TB patients of Dhaka and Matlab. The prevalence of *M. tuberculosis* Beijing genotype and clustering of strains were revealed by spoligotying (Fig. 6). This technique was performed at the Laboratory of Dr. ing. A.G.M. van der Zanden, Head of Medical Microbiology and Infectious Disease, Gelre Hospitals, Apeldoorn, Holland.

Rapid diagnosis of pulmonary tuberculosis

To detect active pulmonary TB, the diagnostic performance of an assay based on detection of TB-specific antibodies from peripheral blood mononuclear cells (PBMCs) was investigated. PBMCs from TB patients (sputum smear-positive, bacteriologically-confirmed), non-TB patients, and healthy subjects were cultured at 37 ºC in 5% CO_2 for various time periods in culture media. BCG vaccine-specific IgG antibodies in lymphocyte secretions were measured by enzyme-linked immunosorbent assay (ELISA). Higher BCG-specific IgG antibody responses were obtained when patients were compared with non-TB patients or healthy subjects (p=0.001). The test had a sensitivity of 93% and specificity of 80% with a positive predictive value of 97%. No response was seen in non-TB patients or BCG-vaccinated healthy individuals. The results indicate that this method may be used as a

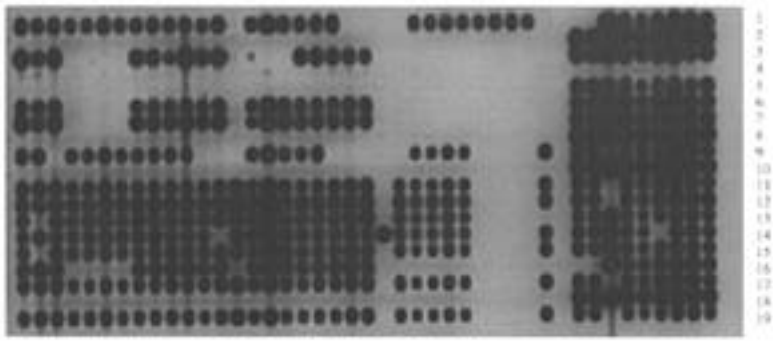


Fig 6. Spoligotypes of *M. tuberculosis* strains isolated from sputum samples from TB patients of Matlab and Dhaka. Lane 4: negative control; Lane 2, 5, 8, 10, and 18: spoligo patterns of *M. tuberculosis* Beijing genotype

Commencing during the recognition of epidemic dengue in Bangladesh in the Summer of 2000, the work on dengue has evolved and, in 2002, was focused on: clinical and epidemiologic studies in two large hospitals in Dhaka

quick diagnostic aid to facilitate the rapid detection of TB cases in TB-endemic countries and in developed countries for screening of suspected patients.

Molecular characterization of *M. tuberculosis* strains in Bangladesh

TB has been a major public-health problem in Bangladesh for many decades. A study was carried out using 48 sputum samples from adult pulmonary TB patients. Deletion analysis, a recently-developed PCR-based technique, was used for identifying the members of *M. tuberculosis* complex. The results showed that the isolates tested were all *M. tuberculosis* strains. Thirteen of 48 strains tested were 'ancestral'-type strains, while 35 were 'modern' strains, indicating that both 'ancestral' and 'modern' strains transmit TB. Thirty-three (69%) strains could be grouped into 8 different clusters. The largest cluster comprised 15 (31%) Beijing strains identified by both deletion analysis and spoligotyping. The results suggest that Beijing *M. tuberculosis* clusters may have a significant role in causing epidemics of TB in Bangladesh. It is a matter of concern since Beijing strains are often associated with drug resistance, display greater virulence, and have been detected in many areas of high prevalence of TB in Asia. Further studies are in progress with a larger sample size to investigate the incidence of Beijing type strains in Bangladesh and to clarify its transmission dynamics in the community.

DENGUE AND DENGUE HAEMORRHAGIC FEVER

Dengue and dengue haemorrhagic fever remain a priority for the PIDVS. Commencing during the recognition of epidemic dengue in Bangladesh in the Summer of 2000, the work on dengue has evolved and, in 2002, was focused on: clinical and epidemiologic studies in two large hospitals in Dhaka; a community-based incidence, seroprevalence, and risk factor study in Kamalapur; studies on the prevalence of disease at out-patient facilities attached to hospitals in Dhaka; and studies of vector dynamics. Data from the hospital surveillance, published in the Centre's new *Health and Science Bulletin,* showed that, while the incidence of dengue detected in the hospital increases with improved socioeconomic status, mortality was the highest among the poor and uneducated, and the data also suggest that there might be a delay in access to timely medical care for the most impoverished. Such data should prompt future studies to examine strategies to address potential inequities in care for severe dengue infection. During 2002, more than 1,000 people in Kamalapur provided sera for seroprevalence studies; antibodies from these healthy people will be compared with antibodies collected during 2003. During the hospital surveillance in 2002, ultrasound scans were done on more than 300 patients with dengue which will enable us to better define the clinical presentation of dengue haemorrhagic fever and identify the factors associated with poor outcome.

Dengue serotyping and genotyping

Den 3 was the commonest serotype in 2000 and 2001, while Den 2 emerged as the predominant serotype in 2002. Sequencing was carried out in 8 dengue strains isolated from dengue-positive serum samples collected during 2000-2001. All 8 virus strains were Den 3 and appear

A health worker is recording history of a child in the post-vaccination waiting area of a clinic

to be of the same lineage. These strains were most closely related to the dengue 3 strains from Thailand. The data suggest that the dengue 3 viruses circulating in Bangladesh may have originated in Thailand but are now endemic in Bangladesh and are evolving locally.

Early diagnosis of dengue virus infection by rapid immunochromatographic test using single serum samples

We compared a rapid immunochromatographic test (PanBio, Australia) with ELISA for the determination of dengue virus-specific immunoglobulin M (IgM) and IgG levels in serum samples obtained from patients suspected of dengue infection. Single serum samples (n=122) were collected from suspected dengue patients after 5 days of fever at a general hospital in Dhaka and were tested for dengue-specific IgM and IgG by rapid immunochromatographic test and ELISA in an ICDDR,B laboratory and at the Holy Family Hospital. A subset (n=30) of serum samples from patients having fever for less than 6 days was also tested for dengue virus by reverse transcription-polymerase chain reaction (RT-PCR) and by tissue culture in the Armed Forces Research Institute of Medical Sciences, Bangkok, Thailand. Of the 122 patients studied, the rapid test, which requires less than 7 minutes to carry out, was positive for dengue infection in 92 (75.4%) cases compared to 95 (78%) by ELISA. The rapid test showed a sensitivity of 91.6% compared to ELISA and a specificity of 81.5% in non-flavivirus infections with an accuracy index, positive and negative predictive values of 89.3%, 90.6%, and 73.3% respectively. By ELISA, 18 patients had primary infection, 77 secondary infection, and 27 no infection. The majority (12 of 18 [66%]) of patients with primary infection by ELISA showed positive IgM but negative IgG (primary infection by rapid test), while 2 showed secondary infection (positive IgG) and 4 showed negative results. Forty-five (58%) of the 77 patients with secondary infection showed positive IgG only (suspected secondary infection by rapid test), while 21 showed positive IgM and IgG (secondary infection), 7 positive IgM only (primary infection), and 4 showed negative results. Dengue serotype 3 virus was detected in 8 (27%) of 30 sera tested by RT-PCR, 2 of them grew virus by mosquito inoculation, followed by tissue culture. Overall, the rapid test was unable to detect the type of infection in 9 (9.5%) and infection in 8 (8.4%) of the 95 dengue cases but could detect 5 (18.5%) new cases among 27 ELISA-negative patients. The single serum rapid test is a useful aid in the early diagnosis of dengue virus infection after 5 days of fever among population having a higher prevalence of secondary dengue infection, although it fails to detect the exact type of infections in some cases. It is less expensive and labour-intensive compared to testing paired serum samples from patients.

Surveillance for the vector of dengue—*Aedes* mosquitoes

Aedes mosquitoes (*Aedes aegypti* and *Aedes albopictus*) are intermediate hosts for the transmission of dengue virus in Bangladesh. A large number of cases of dengue fever were reported from Dhaka metropolitan area since 2000. ICDDR,B conducted a large mosquito larval survey in all wards of Dhaka city during a major outbreak in 2000 and identified areas with high mosquito-density and key breeding containers for *Aedes* mosquitoes. In 2001, ICDDR,B evaluated how community mobilization and household-level motivation worked to

sustain low-density of *Aedes* mosquitoes. ICDDR,B initiated a new entomological study with close linkage to the ongoing Dengue Weekly Active Surveillance Study in Kamalapur. All (approximately 5,000) households under this study were chosen for collecting all fresh water-holding containers (wet containers), and all larvae-positive containers were brought back to ICDDR,B laboratory for identification of species during peak months of August-September 2002 for transmission of dengue. In addition, all clinically-suspected dengue cases identified under the Kamalapur Dengue Weekly Active Surveillance Study were visited at their homes within 24 hours for entomological assessment (approximately 400 cases during the June-October 2002 study period). This entomological information will be used for analysis of risk factor for dengue infection. Results of studies in 2000, 2001, and 2002 indicated that Kamalapur area had a very low *Aedes* mosquito index and that, the number of dengue patients was relatively low. This finding suggests that Kamalapur may be one of the best sites to test future dengue fever vaccines since the majority of population had never been exposed to dengue previously. Continuous surveillance efforts are necessary to prepare for a field site for such vaccine trials.

TYPHOID

The PIDVS has identified prevention of typhoid fever as a major priority. While a major study on the burden of disease is planned for 2003, preliminary studies conducted in Kamalapur in 2002 found the incidence of typhoid in children aged less than 5 years to be 18/1,000 children per year (nearly 1 in 50 children), with high rates of disease in children as young as two years of age. These data suggest that effective typhoid vaccines appropriate for infant immunization are needed for Bangladesh and likely for other developing countries.

Rapid emergence of multidrug-resistant *Salmonella enterica* serovar Typhi with decreased ciprofloxacin susceptibility in Bangladesh

During 1989-2002, we studied the trends in antimicrobial resistance by the disc-diffusion method among 3,132 strains of *S. typhi* isolated from blood cultures of enteric fever cases in Dhaka, Bangladesh. Multidrug-resistant (MDR) *S. typhi*, resistant simultaneously to chloramphenicol, ampicillin, and trimethoprim-sulphamethoxazole, emerged in 1990, peaked in 1994, declined in 1996, and have re-emerged since 2001. Of 128 *S. typhi* strains randomly selected since 1990, increased minimum inhibitory concentrations (MICs) of ciprofloxacin (0.25-0.38 µg/mL) by E-test were detected in 22 (17%) strains. The proportion of strains exhibiting decreased ciprofloxacin susceptibility rose from 8% in 2000 to 46% in 2002. Decreased ciprofloxacin susceptibility was linked to MDR phenotype ($p<0.01$). By the disc-diffusion method, all 22 isolates with increased ciprofloxacin MICs were susceptible to ciprofloxacin (5 µg) and were resistant to nalidixic acid (30 µg), indicating the usefulness of the latter to detect decreased ciprofloxacin susceptibility. The re-emergence of MDR *S. typhi* with decreased ciprofloxacin susceptibility will further complicate the therapy of typhoid fever. Nalidixic acid disc-diffusion may be a useful tool for surveillance and to guide treatment.

Vaccines given to children included both nasal and intramuscular ones

Table. Antimicrobial susceptibility of gonococcal strains isolated during 2002

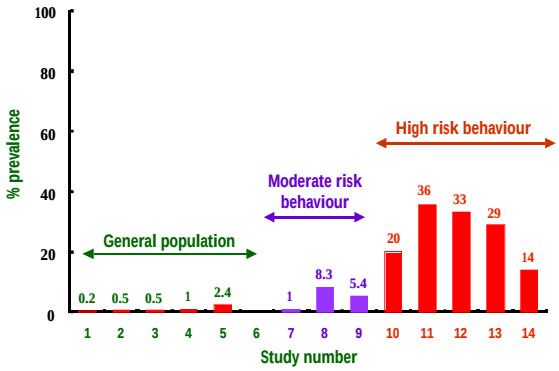
Antimicrobial agent	Susceptible isolates (%)	Reduced susceptible isolates (%)	Resistant isolates (%)
Azithromycin	98	1.5	0.5
Cefixime	100	0	0
Ceftriaxone	98	2	0
Ciprofloxacin	4.4	5.1	90.5
Penicillin	1.7	36.3	62
Spectinomycin	100	0	0
Tetracycline	0.6	4.7	94.7

EPIDEMIOLOGY OF SEXUALLY TRANSMITTED INFECTIONS AMONG WOMEN IN BANGLADESH

The RTI/STI Laboratory, in collaboration with other divisions of the Centre and other institutions in Bangladesh, has already conducted a number of studies with well-defined methodologies in recent years in Bangladesh to collect baseline information on the prevalence of sexually transmitted infections (STIs) in different population groups [males and females from the general population, STI patients, truckers, men who have sex with men (MSM), floating, hotel-based and brothel-based female sex workers, and females living around truck-stands].

Cumulative data from these studies indicate that, despite all efforts to prevent STIs, the prevalence of STIs still remains unexpectedly high among both males and females with high-risk behaviour. The prevalence of gonorrhoea, chlamydia, syphilis, and *Trichomonas vaginalis*-associated infections among hotel-based, brothel-based and street-based sex workers is 16-36%, 16-40%, 17-34%, and 8-25% respectively. On the other hand, the prevalence of gonorrhoea, chlamydia, syphilis, and *T. vaginalis*-associated infections among females from the general population is 0.2-1%, 1.5-2.5%, 1-3%, and 2-4% respectively. However, the prevalence of bacterial vaginosis was high (Fig. 7).

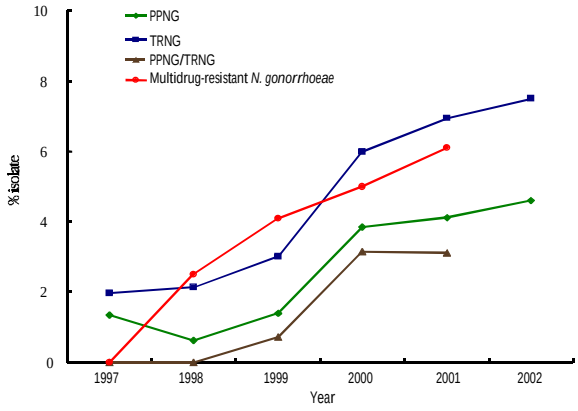
Fig. 7. Prevalence of gonococcal infection among females in Bangladesh



ANTIMICROBIAL SUSCEPTIBILITY MONITORING FOR *NEISSERIA GONORRHOEAE*

The RTI/STI Laboratory has been monitoring antimicrobial resistance of *N. gonorrhoeae* since 1997. Since then, 1,033 gonococcal strains, isolated from males and females from the general population, street-based, hotel-based and brothel-based sex workers, male truckers, and males having sex with males, have been tested for antimicrobial susceptibility, using the National Committee for Clinical Laboratory Standard (NCCLS)-recommended agar dilution method. *N. gonorrhoeae* isolates resistant to ≥3 drugs were defined as multidrug-resistant. Isolates were also tested for the presence of penicillinase-producing *N. gonorrhoeae* (PPNG) and plasmid-mediated tetracycline-resistant *N. gonorrhoeae* (TRNG) (Fig. 8).

Fig. 8. Prevalence of PPNG, TRNG, PPNG/TRNG and multidrug-resistant *N. gonorrhoeae* strains isolated during 1997 to 2002



Less than 5% of the isolates in 2002 were susceptible to penicillin, tetracycline, or ciprofloxacin (Table), and ≥98% of the isolates were susceptible to ceftriaxone, cefixime, and azithromycin. While azithromycin resistance is less than 1%, the MICs of the susceptible isolates have been increasing rapidly (10% of isolates in 2002 having MIC for azithromycin ≥0.25 µg/mL).

The prevalence of PPNG, TRNG, and both PPNG and TRNG has also been steadily on the rise (Fig. 8). Particularly disconcerting has been the emergence of strains possessing both the plasmids. While in 1997, no isolates tested possessed plasmid-mediated resistance to both penicillin and tetracycline, 30% of the isolates did in 2002. A rapid increase in multiple drug-resistance from 0% in 1997 to 61% in 2001 has been observed.

DIAGNOSIS OF RTIS/STIS IN BANGLADESH

The RTI/STI Laboratory has recently initiated an RTI/STI diagnosis service (on a cost-recovery basis) to different national initiatives working in the field of RTIs/STIs. The project is currently providing diagnostic support to a project entitled "Treatment of urethral discharge with azithromycin alone and in combination with cefixime single oral dose regimens" initiated by the Social Marketing Company (SMC) and Dhaka Medical College Hospital.

HIV SURVEILLANCE IN BANGLADESH

During the fourth round conducted in 2002, the surveillance system recorded the highest levels of HIV seen yet in any population in Bangladesh, and this was among injection drug users in central Bangladesh (4%). This rate is close to the 5% mark for a concentrated epidemic. None of the injectors from the two needle exchange sites surveyed in the northwest was infected. Drug injectors also had very high rates of hepatitis C (ranging from 59.8% to 79.5%). As there is evidence that heroin addicts often inject, in this round of surveillance, non-injecting heroin addicts were also tested in central Bangladesh. Fortunately, HIV has not yet penetrated this group. HIV infection remained less than 1% among other vulnerable groups under surveillance in different regions, i.e. female sex workers from 8 brothels, those cruising the streets of three cities, and those working in hotels in one city, and men who have sex with men, including hijras. No HIV was detected among male sex workers, or among male clients (truckers, launch workers, and STI patients) of female sex workers and 'babus' and their boyfriends/regular partners. Overall, 0.3% of 7,877 individuals tested in the fourth round of the surveillance were HIV-positive.

The syphilis rates remained high. The highest rates were once again found among female sex workers. Forty percent of the brothel-based female sex workers at a site in central Bangladesh had had syphilis sometime earlier in their lives, but fortunately, it appeared that intense interventions in many brothel sites (but not all of them) are having an effect, since the data showed a declining trend in the incidence of syphilis cases. Syphilis infections among street sex workers in the central region were also lower in 2002. Among the female sex workers, hotel-based sex workers, many of whom are new to the trade, had the lowest rates of syphilis. Among the male clients of sex workers, babus had the highest rates of syphilis. Among men who have sex with men,

The syphilis rates remained high. The highest rates were once again found among female sex workers. Forty percent of the brothel-based female sex workers at a site in central Bangladesh had had syphilis sometime earlier in their lives

the highest prevalence of syphilis was found in the southeast region. Current syphilis infections were the highest among hijras (10.4%). The data suggest that Bangladesh is at the brink of an HIV epidemic.

CALICIVIRUSES

A study was conducted among 211 children, aged less than 5 years, with watery diarrhoea admitted at the Dhaka Hospital of ICDDR,B during 1999-2001. These children were part of the hospital surveillance system and had none of the enteric pathogens identified in their stool that the surveillance system usually tests for. Thirty-three percent of these children had human caliciviruses detected either by antibodies in serum or presence of antigen in stools. PCR results showed that 10% were positive for Norwalk-like viruses and 3% for Sapporo-like viruses. In 12% of the children, astrovirus was detected in stools. These findings stress that viruses are a major cause of diarrhoea in young children in Bangladesh.

LEISHMANIASIS (KALA-AZAR)

The Centre works in the area of visceral leishmaniasis (kala-azar), in collaboration with the Centers for Disease Control and Prevention (CDC), Atlanta, USA. Studies continued in Fulbaria of Mymensingh district. The work is demonstrating a very high incidence of kala-azar while evaluating new diagnostic approaches and characterizing the clinical presentation. The study is defining the patterns of transmission, will identify risk factors for illness, and is focusing on developing a community-based education and intervention programme for visceral leishmaniasis. Behavioural and vector studies were also ongoing. Once again, staff members from each of the scientific divisions are participating in this study.

Although available data are unlikely to be precise, there is an increasing trend of incidence of visceral leishmaniasis in recent years. Bangladesh reported 3,978 cases in 1993, 7,032 cases in 1998, and 7,640 cases in 2000. Most informed observers assume that the official surveillance figures are substantially underestimated; the incidence is thought to be in the range of 15,000-30,000 per year. In Bangladesh, 20 million people, or 18% of the total population, are considered to be at risk of visceral leishmaniasis, with 29 of 64 districts and 102 of 464 upazilas reporting cases of visceral leishmaniasis.

ICDDR,B and CDC, together with Communicable Disease Control, Directorate General of Health Services, are currently conducting a community-based epidemiologic study of visceral leishmaniasis in three communities (492 households; 2,359 study population) in Fulbaria. A household survey is being conducted to identify current visceral leishmaniasis cases and infections and to document the location, case-management, and outcome of cases treated in the past and current cases. Vector surveillance by monthly sandfly collection is also ongoing. Laboratory data are available by K39 dipstick test, whole promastigote lysate ELISA (the most widely-accepted test for asymptomatic leishmania infection), and leishmanin skin test (a test of cell-mediated immunity to leishmania). This study aims at describing the transmission patterns, identifying the risk factors, and developing a community-

Although available data are unlikely to be precise, there is an increasing trend of incidence of visceral leishmaniasis in recent years

Children playing in the slum environment in Kamalapur are vulnerable to several infectious diseases

based education and intervention programme for visceral leishmaniasis in Bangladesh. In our study area, it was found that approximately 20% of the people were seropositive, 35 cases developed visceral leishmaniasis with typical clinical symptoms, and 4 patients died due to visceral leishmaniasis in 2002.
In Bangladesh, the first-line therapy is sodium stibogluconate 20 mg/kg daily by intramuscular injection for 20 days. The official second-line drug is intramuscular pentamidine 4 mg/kg three times per week for 5 weeks. Sodium stibogluconate is officially available, free of charge, at the upazila-level government hospitals, but intermittent drug shortages have occurred over the past years. A treatment course of sodium stibogluconate for a 40-kg adult purchased from pharmacies around Mymensingh area costs $40-60. Management of visceral leishmaniasis cases already places a large economic burden on the Government, and drug resistance, would add to this. Development of effective prevention and control measures, and facilitating timely diagnosis and treatment of visceral leishmaniasis are, therefore, high priorities.

MALARIA

Malaria was nearly eradicated from most parts of Bangladesh by the 1970s, but it re-emerged as a major public-health problem in the 1990s. Malaria is one of the most important health problems of Chakaria upazila in Cox's Bazar district. There were approximately 1,500 confirmed cases with 70% falciparum malaria rate in 1999 in Chakaria UHC. These figures are thought to be under-estimations and suggest that much more morbidity and mortality occur in endemic communities.

ICDDR,B has a solid infrastructure in the Chakaria research centre and is committed to continuously invest in the centre by diversifying research and service activities. The infrastructure includes: (1) cooperative system support of community self-help organizations, (2) clinical pathology laboratory services, and (3) malaria healthcare service. The malaria healthcare service component includes diagnostic service (rapid dipstick test and microscopic examination), treatment at homes of community health workers, village health posts and social marketing services for insecticide-treated bednets. During the peak malaria-transmission season of May-October 2002, a small-scale pilot study was conducted among 25,000 people in Kakara union of Chakaria.

The four components of the pilot study are: (1) monitoring of fever with diagnostic confirmation to describe epidemiology of malaria in a peak season; (2) entomological study to describe malarial vector behaviour; (3) household malaria-related expenditure study; and (4) qualitative analysis on perceptions among community members about curative and preventive measures.

Malaria is a major cause of morbidity in Chakaria, and the cost of treating malaria from the perspective of the household is unknown. There might be a heavy economic burden on individuals and society due to household costs of malaria. Results of analysis of preliminary data suggest that approximately 30% of households had more than one malaria patient in the past 30 days and that 6% of people living in Kakara union had episodes of malaria during the past 30 days. Information on mosquito-biting behaviour is scarce in the study area.

Following an outbreak of fatal Nipah encephalitis in western Bangladesh in 2001, the PIDVS focused on the aetiology and epidemiology of encephalitis in the country

The proposed research was aimed at identifying the options for appropriate case-management and the economic barriers that malaria patients encounter during episodes of the disease. Findings of research on the household costs of malaria will be useful to examine the ability of individuals and households to afford preventive and curative care of malaria. Information on the household cost of seeking care for malaria will be useful to policy-makers for planning and implementing effective malaria control programmes and also to design interventions to reduce economic barriers during episodes of malaria. The study was intended to contribute directly to designing the most appropriate service options through community self-help organizations that have been established in the study area over the past 10 years.

NIPAH ENCEPHALITIS

Following an outbreak of fatal Nipah encephalitis in western Bangladesh in 2001, the PIDVS focused on the aetiology and epidemiology of encephalitis in the country. While encephalitis is frequently encountered, little is known about its aetiologies here, hampering optimal prevention and treatment. In 2002, a cross-divisional collaboration was forged to develop a protocol to study this problem at three hospitals each in Dhaka, Rajshahi, and Mymensingh. The project, funded by CDC and in collaboration with their scientists, will begin in 2003.

VACCINE STUDIES

Investigations to evaluate a new vaccine to prevent rotavirus infection began in Mirpur during 2002. Safety and immunogenicity studies will likely lead to a full-scale efficacy study of this vaccine produced by Glaxo-SmithKline in Rixensart, Belgium. The vaccine is based on the G1 serotype, but appears to provide cross-protection against serious disease caused by other serotypes. Studies are continuing at the Centre to define serotype distribution of rotavirus infections in Dhaka and Matlab, and work was ongoing to understand background rates of intussusception in Matlab. Since an earlier rotavirus vaccine formulation was rarely associated with intussusception in infants in the United States, such background rates will be important for setting the stage for large-scale vaccine efficacy studies in Bangladesh.

Preparations for in-patient studies of a new cholera vaccine (Peru 15) were in full swing in 2002. This involved creating an in-patient study facility called Advanced Biomedical Research Unit (ABRU) in a separate building on the ICDDR,B campus. There, 30 adults receive vaccine or placebo and are observed for symptoms and adverse events. These studies should lead to efficacy studies to be conducted during 2003.

Studies to evaluate safety, immunogenicity and efficacy of an influenza vaccine given by nasal spray (cold-adapted influenza vaccine) were ongoing in Kamalapur. A study evaluating the effectiveness of *Haemophilus influenzae* type b (Hib) conjugate vaccine in preventing pneumonia and meningitis is ongoing in Mirpur.

Safety and immunogenicity of an enterotoxigenic *E. coli* (ETEC) vaccine was studied in Bangladeshi adults, children, and infants. The trial was funded by SIDA and USAID. ETEC is one of the major causes of

diarrhoea in children in both rural and urban areas of Bangladesh as our surveillance in the recent years has shown. The incidence of ETEC is highest in children aged up to 3 years and a vaccine to prevent ETEC-associated diarrhoea is urgently needed for developing countries. Over the last several years, extensive work is being carried out on an oral-formalin inactivated ETEC vaccine containing 6 colonization factors and the recombinant cholera toxin B sub-unit (the CF-BS-ETEC vaccine). This vaccine has been evaluated in Phase I and II studies in an urban slum at Mirpur in Dhaka city among adults, children, and infants, and interesting results have been obtained. In adults followed by children down to 18 months of age, double-blinded placebo controlled trials have shown that the vaccine is safe and immunogenic. Only in infants aged 6-17 months, the full dose of the vaccine or placebo showed adverse events of somewhat higher frequency of vomiting.

The quantities and doses of vaccines appropriate for children in different settings, however, need to be optimized and have not been done previously for enteric vaccines in any setting in the world. This is an important issue when small-sized infants in developing countries are being immunized and where the vaccine serves as a booster to an already-primed population. For this purpose, dose-finding studies were carried out on the CF-BS-ETEC in children aged 12 years down to 6 months who were given a quarter, half, or full doses of the vaccine. The reduced quarter dose of the vaccine was found to be safest in infants, giving rise to significant mucosal and systemic B cell responses in the IgA isotype.

For all age groups, about 500 Bangladeshi children who have been studied so far, going down from 12 years to 6 months of age, the magnitude of response and the responder frequency seen in the lower doses of the vaccine were comparable with the full dose, suggesting that even a reduced dose of the vaccine was immunogenic, giving rise to significant mucosal and systemic antibody responses. Thus, in an already-primed population, lowered amounts of antigen present in the vaccine in addition to be being safe may also serve to protect from further ETEC infections.

With support from the International Vaccine Institute (IVI), the Centre is exploring various factors that are important for the successful introduction of vaccines to prevent *Shigella*, should effective vaccines become available. The approach used in this *Shigella* project will be a model for collecting information that will be relevant to decision-makers and policy-makers regarding purchase and use of a new effective vaccine. The *Shigella* project uses expertise across the Centre to collect behavioural, economic, epidemiologic and microbiologic data—in combination they provide powerful and compelling information regarding how to prioritize a *Shigella* vaccine among other public-health priorities, how it should be used, and what barriers would need to be addressed to achieve optimal use. Staff members from the Laboratory Sciences Division, Health Systems and Infectious Diseases Division, Public Health Sciences Division, and Clinical Sciences Division have pivotal roles in this study, demonstrating the value of cross-divisional collaboration.

Discussions were held with various sponsors during 2002 regarding the potential evaluation of other crucial vaccines against priority diseases, such as dengue, typhoid, and pneumococcal infection.

IMG-0244 vaccination

COLLABORATIVE WORK

In addition to encouraging collaboration within the Centre where needed to address problems, the PIDVS has identified collaborative arrangements to address priority areas. The Armed Forces Research Institute of Medical Sciences (AFRIMS) is a key collaborator for our work on dengue, and IVI personnel have assisted us in the *Shigella*, cholera, and typhoid projects. The Naval Medical Research Unit in Jakarta, Indonesia, and the University of Queensland in Australia have also provided assistance in our work on dengue. Substantial collaborative networks have been established with the National Center for Infectious Diseases, CDC. Strong collaboration has been forged to address: epidemiology of influenza and respiratory viral infections, aetiology and epidemiology of encephalitis, risk factors for Nipah and other encephalitis outbreaks in western Bangladesh, burden of typhoid fever, evaluation of new rapid, simple diagnostic tests for cholera, typhoid, and *S. dysenteriae* type 1-associated infection, rotavirus vaccine studies, epidemiology of Norwalk virus, epidemiology, diagnosis, treatment and prevention of visceral leishmaniasis, evaluation of the impact of infant immunization on mortality, and use of a new flocculent technology to prevent arsenic exposure and bacterial contamination in drinking-water. This collaboration has involved visits by CDC staff, exchange of ideas and technology, and, in some cases, training of ICDDR,B staff abroad.

New diseases have emerged frequently over the last two decades. Some diseases have presented with frightening speed and devastating consequences, and have garnered international attention and concern. The PIDVS considers that ICDDR,B should play a key role in identifying and addressing the threats of new and emerging disease in the region. We are an active participant in WHO's Global Outbreak and Response Network (GOARN). At the invitation of GOARN, ICDDR,B sent a team of scientists to Zanzibar to investigate an outbreak of cholera during 2002. As one of the most qualified and respected research centres in the developing world, we expect to be called upon more to address new, emerging health threats in the future.

As the Centre expands its horizons into priority infectious diseases, it is clear that human and financial resources must be identified. We will need to use our existing resources in novel ways to enable us to adapt and optimally address new challenges. We will need strong collaboration with other organizations which can supplement our work. Globalization, often discussed in economic terms, is now part of the scientific world. ICDDR,B can be an important partner and provide crucial pieces to puzzles in international efforts to address the threats of emerging pathogens to human health and welfare.

New diseases have emerged frequently over the last two decades. Some diseases have presented with frightening speed and devastating consequences, and have garnered international attention and concern

HEALTH AND FAMILY PLANNING SYSTEMS

Programme Head
Charles P. Larson

Through the integration of expertise found within all the Centre's divisions and programmes, the purpose of the Health and Family Planning Systems Programme (HFPSP) is to conduct research that will generate knowledge applicable to evidence-based health policy and programming. Through the transfer of research findings to decision-makers and the population, the aim is to improve the health of all Bangladeshis, but with a particular emphasis on those living under the most impoverished conditions. This is done by identifying proven, appropriate interventions relevant to priority health issues in Bangladesh and other developing countries. These are then monitored and evaluated as they are applied to the existing systems in the public and private sectors.

The HFPSP has and will continue to identify specific research themes. These are selected on the basis of comparative advantage (areas in which the Centre has recognized expertise), health impact, and information needs as expressed by the Government of Bangladesh (GoB) or partner organizations. The themes currently addressed by operations researchers of the Programme include the following;

- Use and coverage of health services
- Scaling up of zinc as a treatment for childhood diarrhoea
- The functional status and cost-effectiveness of depot-holders working under the NGO Service-delivery Programme of USAID
- Sexuality and reproductive health of youths
- Performance of practice guidelines of the essential services package (ESP)

Early detection and treatment, preferably during the first contact of a client with the healthcare system, is essential for successful prevention and control of reproductive and sexually transmitted infections (RTIs/STIs)

The following is a brief summary of notable achievements of the completed health and family-planning research and ongoing studies in 2002.

Assessment of validity of 'syndromic management flowcharts' in women complaining of vaginal discharge

Early detection and treatment, preferably during the first contact of a client with the healthcare system, is essential for successful prevention and control of reproductive and sexually transmitted infections (RTIs/STIs). In the late 1990s, the USAID-sponsored National Integrated Population and Health Programme (NIPHP), in collaboration with the Ministry of Health and Family Welfare (MoFHW), GoB, developed a technical standard and service-delivery protocol as an aid to RTI/STI-management services in the primary healthcare facilities. This protocol included several RTI/STI syndromic management flowcharts. These flowcharts, addressing the complaint of vaginal discharge, were further modified following a consensus of national and international experts attending the 'National Level Meeting on Syndromic Approach of RTI/STI Case Management' held in May 2000. The flowcharts include a group of symptoms and easily-recognized signs associated with a number of well-defined aetiologies.

In 1998, ICDDR,B sponsored the third of a series of Intervention Design Workshops in which representatives of USAID and all NIPHP part-

ners participated. The need to validate the vaginal discharge-management flowcharts was made a priority.

The study was aimed at assessing the validity of two modified flowcharts for the syndromic management of vaginal discharge—the first without and the second with a speculum examination. The clinic-based and cross-sectional study was conducted in 5 NGO-operated clinics during March 2001-July 2002. In total, 2,752 women complaining of vaginal discharge were included in the study. In addition to the syndromic management using the modified flowcharts, all these women were tested at the ICDDR,B's RTI/STI Laboratory for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* in the endocervix by the PCR technique. Of these women, 1,195 were also tested for *T. vaginalis,* bacterial vaginosis, and fungal infection (candidiasis). Laboratory tests on vaginal fluid specimens included Gram staining for the diagnosis of bacterial vaginosis, culture for demonstration of *T. vaginalis*, and microscopic examination and culture for yeasts. The validity of the modified vaginal discharge-management flowcharts was assessed using the research laboratory test results as the gold standard.

The participants were aged 15-49 years, and nearly all were married and housewives. In addition to vaginal discharge, which was the inclusion criteria, various other symptoms, for example, foul-smelling discharge, genital itching, wet garments, dysuria, and dysperunia, were commonly present. The most frequent clinical signs included oozing of foul-smelling discharge in various colours (white, greyish white, greenish yellow, and yellow) and unusual in type (watery, curd-like, frothy) and quantity (scanty or profuse). Endocervical mucopus and friability of the cervix were detected in 17.2% and 33.3% of the studied women respectively.

Among the women tested for vaginal infections, candidiasis (32.1%) was the most common aetiology detected by laboratory tests, followed by bacterial vaginosis (22.7%) and *T. vaginalis* (3.5%). Gonorrhoea and chlamydia were confirmed in 2.4% and 1.7% of the women by PCR.

Evaluated syndromic management flowcharts (with and without speculum) for vaginal discharge had high sensitivity for bacterial vaginosis, candidiasis, or trichomoniasis. Although the specificity of these flowcharts was poor, the positive predictive value of the management flowchart without speculum was much higher than that of the flowchart with speculum examination. Thus, the performance of the vaginal discharge-management flowchart without speculum was better than that of the flowchart with speculum examination in the diagnosis of bacterial vaginosis, candidiasis, or trichomoniasis. Evaluated syndromic management flowchart with speculum examination for cervical infections (gonorrhoea or chlamydia) had poor sensitivity, specificity, and positive predictive value.

The results of the study suggest that the current focus in the syndromic management of women complaining of vaginal discharge needs to put more emphasis on correct diagnosis of the symptomatic women with bacterial vaginosis and candidiasis, as these are common. In ad-

Current focus in the syndromic management of the women complaining of vaginal discharge needs to put more emphasis on correct diagnosis of the symptomatic women with bacterial vaginosis and candidiasis as these are common

In the recent years, a major change in the strategy of providing family planning services has been a gradual shift from door-to-door approach to the static clinic-based approach

dition, for the diagnosis of these conditions, speculum examination would not be indispensable. Speculum examination might contribute to differentiate between various aetiologies of vaginal infections as well as to the specificity of the infections. Nevertheless, this differentiation could also be possible by further modification of the flowcharts without speculum examination, by identifying and selecting the more sensitive and specific symptoms and signs in addition to vaginal discharge, so that the flowchart would be able to differentiate the aetiologies of these vaginal conditions with increased specificity in addition to its high sensitivity. In contrast, cervical infection was a less frequent cause of a consultation for women complaining of vaginal discharge. The evaluated management flowchart with speculum examination for the diagnosis of cervical pathogens has limitations. Despite these limitations, research for simple, rapid, reliable, and inexpensive tests for detection of *N. gonorrhoeae* and *C. trachomatis* remains a high priority for the control of cervical infections. In the mean time, however, the management flowchart with speculum examination that has been evaluated in this study for cervical infection should be made useful in resource-poor settings by further modification.

Screening for syphilis in routine antenatal care

Syphilis is a complex sexually transmitted disease (STD) caused by the bacterium *Treponema pallidum*. This multisystem chronic infectious disease is transmitted through sexual contact and transfusion of infected blood, and from the pregnant woman to her unborn child.

It is estimated that, if an infected pregnant woman remains untreated, there is a 25% risk of giving birth to a baby with congenital syphilis, 22% risk of stillbirth, 20% risk of spontaneous abortion, and 12% risk of neonatal death. There is also the risk of premature delivery.

As the primary lesion is often painless and invisible because of its location in the vagina or cervix and the secondary stage is characterized by non-specific signs and symptoms, the infected women remain unaware of the infection, whether in its primary or secondary stage. Therefore, most women neglect to seek medical help. Only serological tests for screening can confirm whether a woman is infected or not.

Treatment failures with penicillin therapy for the prevention of congenital syphilis increase with increased gestational age, and it is unlikely to be effective after the late second and in the third trimester of pregnancy. For this reason, for screening programmes to be effective, the service providers must reach women preferably in the first trimester.

There is a lack of information on the prevalence of syphilis among pregnant women in Bangladesh. There is also a lack of information on the different operational aspects of syphilis screening, e.g. can antenatal care screening for syphilis be functional or valid at the primary healthcare clinic by the existing providers, such as paramedics? Will it be acceptable by the clients as routine antenatal care? Considering some of these questions, the present study was conducted to: (a) measure the prevalence of positive syphilis serology among pregnant women, (b) assess the validity and reliability of paramedics conducting the rapid plasma reagin (RPR) test to screen for syphilis, and (c)

Health education sessions in the rural areas include group counselling on family planning in the agenda

determine the acceptability of syphilis testing among pregnant women. This clinic-based and cross-sectional study was conducted during November 1999-March 2001 at two urban primary healthcare-level clinics: Sher-e-Bangla Nagar Government Dispensary at Agargaon Pucca Market and the Mirpur PSKP Clinic. The study included all the pregnant women who attended either of the two clinics for antenatal care. In total, 1,206 pregnant women were enrolled in the study.

The RPR test was done twice on each collected specimen, at first by the paramedics in the study clinics and then in the reference laboratory where the *Treponema pallidum* haemagglutination (TPHA) was also done as a confirmatory test for syphilis. Reference laboratory testing of specimens was carried out to provide a gold standard against which to evaluate the RPR test performed by the paramedics. In addition, the results of RPR and confirmatory testing performed at the reference laboratory permitted an estimate of the prevalence of positive syphilis serologies.

Sixty-eight percent of the women were aged less than 25 years; 36% had no education, and 64% had less than 10 years. About half of the pregnant women resided in slum dwellings. All the study women were married, and most of them were housewives. Fifteen percent were garment workers. Monthly household expenditure totalled less than Tk 3,000 for over 50% of the sample. Of the pregnant women, 71% were in the second trimester of their pregnancy. Husbands of 30% of the women worked in various occupations, and 28% were either rickshaw-pullers or drivers.

All the pregnant women were offered screening for syphilis, with 91% agreeing to be screened with a blood sample. Of them, 87% knew their gestational age. Eighty percent were screened at their late second trimester and third trimester. In total, 1,103 (91%) women were screened, and the prevalence of syphilis among them was 1.5%.

The performance of the paramedics was measured in terms of their reliability, by comparing their RPR test results with that of the reference laboratory using Kappa statistic. We also assessed validity, which was measured by comparing the RPR results of the paramedics with that of the reference laboratory. The reliability of the paramedics was poor, with a Kappa of 0.13. The sensitivity and specificity of the paramedics' testing was 0.13 and 0.96 respectively. Based on these results, it is estimated that if the clinics were to rely on the paramedics' RPR testing, 87% of infected women would not be identified and 4% of non-infected women would incorrectly be labelled as positive. Alternatively, we found that if a centralized RPR testing service could be provided, virtually all the infected women would be treated, and only 2% would be treated unnecessarily.

Of 51% of the women who accepted testing, 84% understood what syphilis was and could express the necessity of the test. Of them, 67% reported that they would tell other women about the test. Of this latter group, 98% believed that all pregnant women should have the test and would be willing to pay Tk 20 for the test.

Among the women who refused to be screened (9%), the most commonly-reported reasons for refusal were as follows: 33% felt that

they needed the consent of their husbands, 29% were afraid of giving blood samples, 25% believed that the test was not necessary, and 8% felt that the test would be harmful to their babies.

In conclusion, the occurrence of syphilis among pregnant women, given the severity of its consequences, was high (1.5%). Equally disturbing was that most started antenatal care at a point in their pregnancy too late to prevent congenital syphilis. Screening for syphilis in pregnant women, carried out by paramedics, even under the relatively-controlled supervision of ICDDR,B staff, was unreliable, resulting in unacceptable levels of sensitivity and specificity. The majority of the women accepted testing and understood what syphilis was.

This study points out the current deficiencies in the syphilis-screening programme when carried out by paramedics in the community clinics. Alternative strategies that will result in earlier entry into antenatal care are needed and must be tested.

Scaling up of zinc as a treatment for childhood diarrhoea

Over the next several years, the Centre intends to play a major role in the scaling up of zinc as a treatment for childhood diarrhoea in Bangladesh. Zinc is an essential micronutrient known to be vital to a large range of biologic functions. Importantly, this includes its role in maintaining immune system function, vital to dealing with diarrhoeal illness and other infectious diseases of early childhood. It is recognized that a large proportion of developing-country populations are deficient in zinc, with the most vulnerable groups being young children and pregnant women. This is especially so among the poorest of the poor. It is also known that zinc deficiency places these young children at a greatly-increased risk of infection and death. Given this knowledge, clinical trials were conducted at ICDDR,B, testing the efficacy and effectiveness of zinc as a treatment for diarrhoeal disease in children aged less than 5 years. This research demonstrated that the addition of zinc to the treatment of acute childhood diarrhoea shortens the duration of illness, lessens the likelihood of prolonged diarrhoea, reduces the risk of subsequent diarrhoeal illness, and results in significant reductions in non-injury mortality. For Bangladesh, the consistent use of zinc for treatment of diarrhoea could save the lives of 30,000-75,000 young children per year. A similar use in people with zinc deficiency in other countries could save the lives of hundreds of thousands. Given the current state of knowledge and the enormous implications of the research completed, researchers at ICDDR,B have concluded that it is imperative to scale up the use of zinc and to conduct concurrent research to insure its successful use on a national scale on an accelerated time schedule.

In 2002, several important steps were completed in preparation for a national scaling up of zinc therapy. First, a partnership has been created among the Centre, MoHFW, and the private sector. The latter includes a French non-profit firm Nutriset (the company that has developed the technology to produce a dispersible zinc pre-mix), Square Pharmaceuticals (a Bangladeshi manufacturer), and the Social Marketing Company (a private, non-profit marketing, distribution and sales

The Centre intends to play a major role in the scaling up of zinc as a treatment for childhood diarrhoea in Bangladesh

firm specializing in health products, including the marketing of over 100 million ORS sachets per year in Bangladesh). Nutriset, following a technical assessment of facilities at Square Pharmaceuticals, concluded that a dispersible zinc tablet can be produced and packaged in Bangladesh. This has opened the door for developing a business plan and evaluation protocols for scaling up of zinc over the next 3 years.

Family Health Research Project

The year 2002 marked the completion of the first full year of the Family Health Research Project (FHRP). The mission of FHRP is "to improve the health of the people of Bangladesh by improving effectiveness of the Essential Services Package (ESP) that provides basic medical services to families with emphasis on improving services to vulnerable populations, and on developing new, more cost-effective methods for using resources."

We have been working closely with the Population, Health and Nutrition team of USAID in developing proposals and on their implementation and dissemination.

During the year, 11 research projects were approved by USAID/Dhaka. The studies spanned many disciplines and subject areas to include research into the introduction and evaluation of new tools to promote healthcare delivery and management, effectiveness of community-based strategies, effectiveness and cost-effectiveness of protocols, and vaccines strategies in a community setting. These covered the areas of population sciences, emergency obstetric care, neonatal care, general health, family planning, and EPI. Research especially targets the poor, women, and children. Details of these studies are found under the programme sections of this annual report. Titles of research and the programme responsible are as follows:

Title	Programme/ Division responsible
Community-based component of the evaluation of the health and economic impact of the IMCI strategy in Bangladesh: development and evaluation of a community-based intervention	Child Health
Community-based interventions to reduce neonatal mortality in Bangladesh	Child Health
Meeting additional family health needs of clients by addressing missed opportunities at the ESP clinics	Health and Family Planning Systems
Programmatic and non-programmatic determinants of low immunization coverage	Health and Family Planning Systems
Acceptability, effectiveness and cost of strategies designed to improve access to basic obstetric care in rural Bangladesh	Reproductive Health
Community-based protocolized management of severe child malnutrition: cost and cost-effectiveness analyses of PSKP services	Health and Family Planning Systems
Rapid assessment tool for better health: helping ESP managers be more effective	Public Health Sciences
Plateauing of the Bangladesh fertility decline	Population Sciences
An effectiveness study of *Haemophilus influenzae* type b vaccine	Infectious Diseases and Vaccine Sciences
Levels, trends, and determinants of unwanted births in rural Bangladesh: evidence from the FHRP areas	Population Sciences
Introduction of new hypo-osmolar ORS to routine use	Clinical Sciences

A second component of FHRP is the core support unit. During 2002, the unit was involved in building supporting foundations on which to conduct research across the Centre. These include: continuation of field-site surveillance to provide an area rich in information to conduct interventions and measure their impact; recruitment of two scientists to provide guidance to the scientists across the Centre on operations research; and a logistics unit to provide support to scientists working on USAID-funded projects.

STUDIES FUNDED BY THE FAMILY HEALTH RESEARCH PROJECT

Meeting additional family health needs of clients by addressing missed opportunities at the ESP clinics

Use of ESP services at established NGO and GoB facilities is very low in Bangladesh. One strategy to improve the uptake of services is to identify the needs of clients who visit the health facilities for any one of the services provided and to ensure that the opportunity is taken to offer and provide additional required services. The information obtained from this study will provide ESP service providers with the tools required to take advantage of these otherwise missed opportunities more efficiently.

The objectives of the study are to address: (a) the extent of unmet need for ESP services among clients (or their family members) visiting the NIPHP and GoB clinics and (b) whether unmet need is translated into met-need when the provider detects unmet need through the provision of services, information, counselling, and referrals.

At the end of 2002, the baseline qualitative and quantitative data collection had been completed. From this data it has been verified that in both NSDP and MoHFW clinics there existed a poor understanding of unmet needs. With the exception of a few NSDP sites, health workers were not screening clients for unmet needs. As a result, missed opportunities are uniformly occurring in the provision of reproductive and child health services. Nearly 100% of unmet needs are not being detected and, therefore, remain not served. The research team was also able to complete the preparation of a screening tool, following input from experts in the MoHFW, NGOs, and international organizations. This tool is now being evaluated.

Programmatic and non-programmatic determinants of low immunization coverage

While Bangladesh has improved the vaccination coverage of the five childhood immunizations, there is still room for further 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 to recommend, design, and test interventions to increase the proportion of fully-vaccinated children.

The objectives of the study are to: (a) have an in-depth understanding of the programmatic and behavioural (non-programmatic) factors associated with high drop-out and non-use of immunization and (b) identify the underlying programmatic and non-programmatic determinants of low-coverage factors, thereby increasing the full coverage of EPI by reducing left-outs and drop-outs.

Data collection for both quantitative and qualitative components has been completed in six selected upazilas. A survey of immunization coverage was done in all the upazilas among 2,702 randomly-selected children aged 12-23 months, ranging from 259 to 614 children in different upazilas. In-depth interviews of mothers of 79 fully-immunized children, 97 drop-out, 84 left-out, and 37 receiving invalid dosage were conducted. At least one session of each of the health assistants of these selected upazilas was conducted. In-depth interviews of service providers and managers were also conducted. Reporting and record-keeping systems were examined. The data are being analyzed for report writing and dissemination.

Reproductive health services for adolescents

Adolescents in Bangladesh are exposed to the same reproductive health risks as adolescents in other developing countries. These adolescents do not have accurate knowledge about reproductive health issues and have limited access to accurate health information and services while still being at a stage in life associated with an increased likelihood of sexual activity. This intervention provided a holistic approach, in collaboration with the Government of Bangladesh and the Concerned Women for Family Development, in three different settings (school, community, and worksite) to improve knowledge on reproductive health among adolescents.

The hypotheses of the study are as follows:

- Development and distribution of 'easy-to-read information materials' on reproductive health can lead to significant improvement in knowledge on reproductive health and use of related services among adolescents attending schools.
- Introduction of 'adolescent-friendly clinics' increases the use of reproductive services by school-going adolescents.

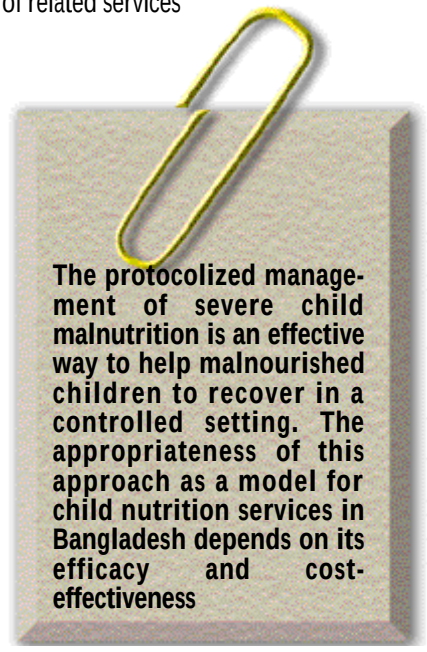
Community-based protocolized management of severe child malnutrition: cost and cost-effectiveness analyses of PSKP services

The protocolized management of severe child malnutrition is an effective way to help malnourished children to recover in a controlled setting. The appropriateness of this approach as a model for child nutrition services in Bangladesh depends on its efficacy and cost-effectiveness.

The objectives of the study are to: (a) assess the costs of the intervention with consideration of the service providers and client costs, (b) assess the effects/impact generated by the intervention, and (c) execute a costing and cost-effectiveness analysis of the intervention.

Translation of research findings into policy and practice

The FHRP and the USAID Population, Health and Nutrition team have a strong focus on facilitating and encouraging the results of its research projects being translated into policy and practice. The mechanisms in place are: (1) setting the agenda, including partnerships in the proposal development, (2) interest groups, and (3) as the studies are completed, the inclusion of programmes in the dissemination of findings to demonstrate the implications to practice.



POPULATION SCIENCES

Programme Head
Peter Kim Streatfield

Health and Population Sector Programme, 1998-2003

Scientists of the Population Sciences Programme of the Centre contributed to the annual evaluation of the Bangladesh Health and Population Sector Programme (HPSP), 1998-2003 for the Government of Bangladesh (Status of performance indicators 2002: Health and Population Sector Programme 1998-2003 by P.K. Streatfield, A. Mercer, A.B. Siddique, Z.U.A. Khan, and A. Ashraf). This was the final evaluation of the set of performance indicators that are used as the basis for monitoring progress across the health and population sector. This approach of selecting a set of milestones and indicators, agreed upon at the outset by the Government and development partners, to be reviewed jointly each year, is becoming the norm for sector-wide programmes (SWAp). The team leader has been involved in this process since the initial selection and justification of the set of indicators in early 1998 and in each subsequent annual review.

While the indicators are designed to cover a great many aspects of the national health and population activities, a number of the key milestones reflect progress in demographic and health outcomes for which data are not readily available from the national management information system (MIS) or other routine sources.

While this is not the place to review the entire health and population sector, a brief summary could be illuminating. A major change in the sector involved a planned integration of the directorates of health services and family planning. This was intended to facilitate linkages and referrals up and down and across all levels. Household visits by fieldworkers were stopped as part of this process, and there was widespread uncertainty about shifting from a domiciliary approach to a static-clinic approach. Despite considerable disruption in the service-delivery system, most indicators did not deteriorate, and several actually improved. Use of safe motherhood services has improved after years of stagnation, and the use of family-planning services continued to rise, although fertility remained on a plateau. Immunization remained static, as did distribution of vitamin A. Some specific disease-oriented interventions, such as case detection and treatment of TB, remained unchanged, albeit still well below optimal levels. Malnutrition levels remain high and stable, and it will be important to monitor the next three-year plan when a major nutrition intervention (National Nutrition Programme) is integrated with other health and population activities.

The follow-on three-year programme (HNPSP 2003-2006) will become more ambitious, incorporating nutrition, as mentioned above, as well as attempting to cover urban health issues, an important field in which ICDDR,B could feasibly make further useful contributions through its research. An area of focus which will see greater emphasis on the next programme is equity of health, nutrition, and service-delivery. This is certainly an area in which ICDDR,B is well-situated to contribute to identifying appropriate indicators, both direct and proxy, of

A Community Health Research Worker in her routine household visit

Explaining forms used for registering vital events

economic status, and in the potential for the surveillance systems to closely monitor the dynamic aspects of poverty and how episodes of illness, with direct costs through medical expenses, and indirect costs in lost economic productivity, can be measured.

Ageing of the Bangladesh population: health implications

Why are the demographic consequences of declining fertility and mortality important in Bangladesh? Why is the Population Programme now focusing on the older population rather than the continuing problems of the young? Although the elderly, aged 60 years plus, account for only 5% of the population, they account for one-third of the total deaths. Together with the age group of 45-59 years, so 45+ years, they account for half of all deaths annually.

During the present century, the Bangladesh population will grow predominantly in the elderly age group. The absolute numbers of people under 15 years of age will remain fairly constant at around 46-47 million. The population of working ages—15-59 years—will almost double to 136 million. The elderly age group will increase almost 10-fold to 65 million, accounting for more than one in four of the total compared to one in twenty today. This massive increase is the result of declining fertility and modest gains in life expectancy.

The consequences of this change in relative proportions of the elderly compared to the younger ages are reflected in the 'dependency ratio', which shows the number of people of working age (15-59 years) per elderly person. Of course, not all people of working age are in paid employment, but this is a demographic ratio, with obvious economic implications.

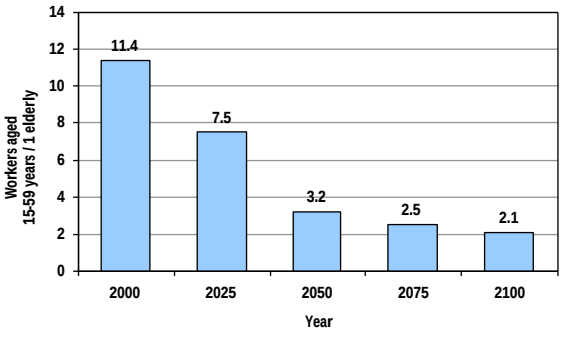
Figure 1 illustrates that there are now about 11 'workers' per elderly person, but by mid-century that will fall dramatically to three 'workers', and by the end of the century, it will be only two. With the changes in the nature of family structure, increasingly contracting from extended to nuclear families, there are clear implications that the high morbidity burden of non-communicable diseases among the growing elderly population, coinciding with a shrinking support network, due to demographic and social changes, will impose an ever larger burden on the public or state health system. What is striking about these findings is that the heavy focus on infectious and poverty-related diseases may result in the assumption that so-called 'life-style' diseases (as they are called in the West) are not an issue in Bangladesh. That is clearly not the case.

Burden of disease in Bangladesh

The Ministry of Health and Family Welfare (MoHFW) of the Government of Bangladesh is currently planning for the follow-on programme to the HPSP, 1998-2003. The new Health, Nutrition and Population Sector Programme (HNPSP) will run for three years from July 2003. The HNPSP will include some significant changes from the HPSP, such as nutrition and urban health being explicitly covered, and increased emphasis on a variety of new or re-emerging diseases and conditions.

As part of the background documentation for the HNPSP 2003-2006, the Population Programme personnel and others carried out a review of available evidence on burden of disease for Bangladesh, expressed in terms of disability-adjusted life years (DALYs), including years of life

Fig. 1. Ratio of working-age population to elderly population in the 21st century



This is the time to start planning campaigns or programmes of education in preventive behaviours, including better nutrition, limiting cigarette smoking, and strengthening the government regulatory powers to reduce accidental injuries through better control of road and water traffic, reduce air and water pollution, etc.

lost (YLLs) and years lost to disability (YLDs) (P.K. Streatfield, L.A. Persson, H.R. Chowdhury and K.K. Saha. Disease patterns in Bangladesh: present and future health needs, 2001). The study threw light on a number of conditions, particularly among adults, which contribute substantially to the burden of disease in Bangladesh, but which are not given full consideration in the allocation of resources to what is basically a primary healthcare focus through the essential services package (ESP).

This exercise required considerable 'detective work' assembling data from a wide variety of sources, including the Health and Demographic Surveillance System from Matlab, data from the Bangladesh Bureau of Statistics, the Health Information Unit, and Unified Management Information System from the MoHFW, and with extrapolations from the South Asian patterns found in the WHO volumes of global burden of diseases. Information from various sources was cross-checked with each other, but there remain gaps that require strengthening of the verbal autopsy system, as discussed below.

The following graph of DALYs lost in Bangladesh indicates that infections, although greatly reduced in overall proportions of deaths, still rank high in terms of DALYs because these occur particularly in childhood, and an entire lifetime is lost when a child dies, compared to relatively fewer years with diseases, such as cardiovascular disease (CVD) or cancers, which strike later in life.

In the overall calculation, some 47.5 million DALYs are lost annually in Bangladesh—about one-third to disability (14.3 million), and the remainder to death (33.2 million). Many diseases have two main outcomes, either death or relatively quick recovery and little disability—diarrhoeal and respiratory diseases, except TB, tend to be examples that can be seen to have only a small proportion of disability. In contrast, unintended injuries, malnutrition, maternal complications, and neuropsychiatric disorders have disability as major contributors to their DALYs lost.

This is the time to start planning campaigns or programmes of education in preventive behaviours, including better nutrition, limiting cigarette smoking, and strengthening the government regulatory powers to reduce accidental injuries through better control of road and water traffic, reduce air and water pollution, etc.

Causes of death in Bangladesh

The findings of the study are that, of the approximately one million deaths annually, non-communicable conditions account for about 40% of the total, half of these being cardiovascular disease. With the primary focus of HPSP being infectious diseases, several major contributors to overall mortality are not fully covered.

The second category after cardiovascular diseases is malignant neoplasms (some 6% of total). Among females, these tend to be reproductive in nature (cervical, uterine cancers), while among males, these tend to be associated with the consequences of smoking (lung, mouth, and oropharyngeal cancers). Until recently, little attention has been given to smoking as a risk factor, either directly through the above-listed cancers, and as a factor exacerbating other respiratory conditions, such as TB.

Fig. 2. Disability-adjusted life years (DALYs) lost, Bangladesh, 1990

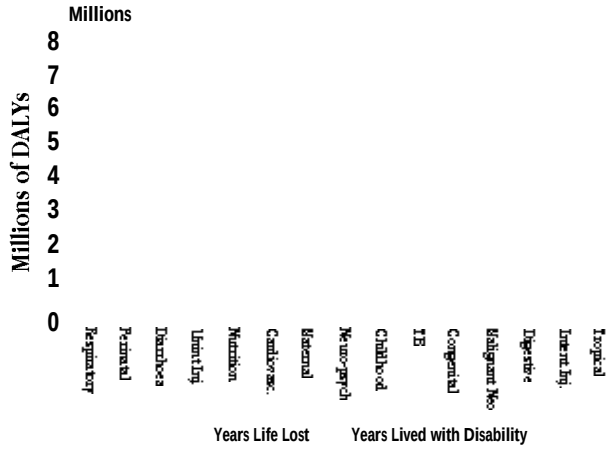
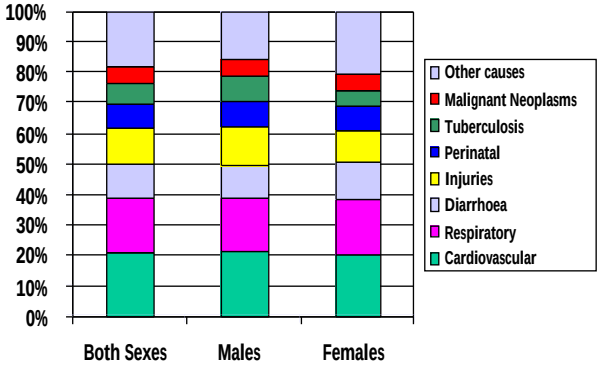


Fig. 3. Distribution of causes of death, all ages, both sexes, Bangladesh



It is surprising that injuries, mainly unintentional, account for almost one in 8 deaths. These are primarily road accidents, but include drowning, now the leading single cause of death for children in ICDDR,B's field site in Matlab. Nationally, there are no interventions to address prevention or resuscitation of such cases.

'Other causes' comprise a mixture of non-communicable diseases, such as diabetes (1.0%), intentional injuries—homicide and suicide (2.3%), and infectious diseases, such as malaria (0.2%), HIV/AIDS (0.3%), and categories like maternal causes (1.6%), which can include many specific causes. The estimate of deaths due to HIV/AIDS, at 3,200 annually, is considerably higher than the official figure (total 300 or so, since the epidemic began). It is much lower, however, than the estimate of 15,000-20,000 cases based on WHO models would imply. Nevertheless, HIV does seem to be at a remarkably low level in Bangladesh considering the widespread high-risk behaviours, and the high levels of STDs among risk-groups reported in the annual sentinel surveillance. Malaria also appears to be underestimated by the national reports, which tend to average 500-1,000 deaths annually compared to 2,000 using this approach. Malaria is considered endemic in 14 of 64 districts, mainly in the eastern border area near Myanmar and western border near India.

One of the shortcomings of using a single cause of death approach, as with Global Burden of Disease (GBD), is the tendency to underestimate the contribution of associated causes, such as malnutrition. Here nutritional problems account for only 2.7% of the total, or 30,000 deaths annually. In a country where 45% of all babies are said to be of low birth-weight, over half of children aged less than 5 years are moderately or severely malnourished, and half of all women are malnourished, this factor can reasonably be expected to play a major role in susceptibility to disease.

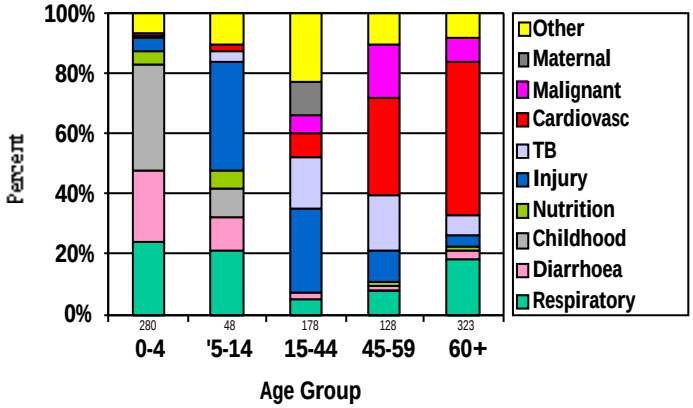
Age patterns

The patterns of the above conditions vary greatly by age, many of the non-communicable conditions being concentrated in the older ages.

Among the children aged less than 5 years, infections, such as respiratory and diarrhoeal diseases, still dominate, although perinatal causes are becoming increasingly important proportionately, as other causes decline. Among older children aged 5-14 years, accident becomes the most important cause. In the reproductive ages, accidents are still important, particularly for males, but maternal causes are a major cause for females. TB becomes a significant cause in this age group (and for older ages), and intentional injuries become equally important for males and females, although suicide is more common for females. Although cardiovascular disease plays some role in this age range, it becomes the major cause for those in the older working ages—45-59 years (Fig. 4).

Among the elderly (60+ years), cardiovascular disease accounts for more than half of the deaths. Diabetes appears to be quite minor as a direct cause, but presumably contributes through other outcomes. Malignant neoplasms account for a substantial number of deaths among older people, but not to the same extent as cardiovascular disease.

Fig. 4. Distribution of deaths, by cause and age group, M+F, Bangladesh, 2000



Efforts have been instituted to use local-level information on burden of diseases for planning at the district and lower levels

Information on disease burden for district-level planning in Matlab

Efforts have been instituted to use local-level information on burden of diseases for planning at the district and lower levels. Together with staff from other surveillance systems belonging to the INDEPTH Network, analysis was undertaken at a workshop in Tanzania to determine which conditions and diseases contributed to the overall burden of diseases in the Matlab upazila. Communicable diseases, combined with maternal, perinatal and nutritional causes, contribute the major share with 44% of all years of life lost. Perinatal causes account for 15%—a serious problem. Non-communicable causes account for about one-third (37%) and injuries for one in 8 (12%).

Three quarters (74%) of the causes of the disease burden can be addressed by available cost-effective interventions. The major non-communicable causes, such as cardiovascular disease and chronic obstructive pulmonary disease, do not have reasonably accessible interventions available in rural Bangladesh at this time. Strategies, such as IMCI and Safe Motherhood, should reduce some of the disease burden of maternal and perinatal mortality, if implemented.

Adult health, morbidity, and mortality

The impressive gains in life expectancy in Bangladesh over the past few decades have been primarily the result of increased survival among the young, that is, reductions in deaths due to infectious diseases, particularly in diarrhoeal and respiratory diseases. As we saw earlier, adults tend to suffer more from accidents and non-communicable diseases, although certain chronic infectious conditions, such as TB, rank high.

Because the focus in global, national and local health programmes, such as the ICDDR,B's Matlab intervention activities, have been on child health, our data-collection systems have been developed with this in mind. Diagnosing the more complicated causes of adult deaths has been given less attention. With the growing recognition of the importance of ill health of adults as a precipitating factor to the impoverished state of many families, greater attention is now being given to understanding the dynamics of adult morbidity and mortality and the links with economic status of the family.

Historically, a high proportion of adult deaths have been ascribed to 'senility' or 'unspecified causes'. This might be expected where no clinical autopsies are possible, and fieldworkers and a medical assistant relying on verbal information from family members make the diagnosis of cause of death. In cases of stroke, cardiovascular accidents, or cancers, it may well be so that even family members have inadequate information of the medical history of the deceased to make an accurate assessment.

Explaining HDSS in field to visitors from Tanzania, Vietnam, and Nicaragua

International workshop on accessing Matlab HDSS database using Excel

To strengthen diagnosis of the causes of adult death (all deaths in fact), the HDSS has designed new verbal autopsy instruments and created and trained a team of 5 field staff (male and female) to work with the experienced medical assistant and a review committee of physicians to ensure the collection of sufficient information to make a valid diagnosis. 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. The question sequences vary with the type of causes usually expected for these different age groups (see above discussion on age patterns of causes of death). These sets of questionnaire have been based on algorithms initially designed by WHO and modified by a Working Group representing many surveillance systems belonging to INDEPTH Network.

After considerable pre-testing and refining of the questions and algorithms during 2002, the new verbal autopsy system will be introduced in Matlab from January 2003. The Community Health Research Workers (CHRWs) will continue to detect events and ask several basic questions to complete the HDSS death form. This will trigger off a visit by the field research supervisors of the verbal autopsy team within 2-6 weeks following the event, and the full verbal autopsy instrument will be asked of family members who were present at the time of passing away of the individual concerned. Both old and new systems will be 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.

An additional change is upgrading from version 9 to version 10 of the International Classification of Diseases. This new version is similar to the previous one, but with greater emphasis on newer conditions, such as HIV/AIDS, which have emerged in the past two decades. A list of the 3-digit 'core' categories of ICD-10 codes has been prepared and the medical assistant will have to select a 3-digit code from the list. During 2003, each VA questionnaire will be reviewed and diagnosed by two physicians and the medical assistant independently at least six months later, and compared with the diagnosis of HDSS death forms from the old system.

Incidentally, the field research assistants whose task is to supervise the Community Health Research Workers, have been reclassified to GS-4 level from GS-3. A selected team has been identified to carry out the cause-of-death diagnosis as part of the VA team.

Do health interventions improve health equity?

Analysis was carried out on Matlab HDSS data, where cohorts of children were followed retrospectively for several years, one group

The 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

from 1983, and a second group from 1993. In terms of economic equity, the gap in survival of children from poor households compared to better-off families, was widened over the decade of observation—obviously an undesirable outcome. This was the case in the area where the MCH intervention of ICDDR,B was offered, as well as in the non-intervention area.

In terms of gender equity, the result was different. The advantage that boys had in child survival in the earlier times was reduced to almost zero in the later period, except for infants in the area not receiving the ICDDR,B interventions.

The surveillance data in Matlab are being strengthened in 2003 by the next round of a socioeconomic survey of the total population. This will introduce many new measures of economic status and will permit testing of various simple proxy measures to identify the poor, and so-called 'poorest of the poor', or ultra poor. The HDSS will also be institutionalizing a number of community-level measures, monitoring food production and prices, wage rates and employment trends, land prices, etc. It is planned to have a more comprehensive system of monitoring economic factors in the Matlab area by the end of 2002.

Plateau in fertility decline

The historical data from the Matlab HDSS have been used extensively in the past year to contribute to an ongoing study of the decade-long stagnation of fertility in Bangladesh (and in Matlab itself). The detailed birth histories with accurate birth dates have proven invaluable in calculating precisely how rising use of family planning has resulted in longer inter-birth intervals, which contributed to a 'tempo' in the cross-sectional measures of fertility. This created a dramatic fall in fertility level in the 1980s, which has levelled out into a plateau throughout the 1990s. The next phase of the research is focusing on the next decade, and the vital question of when the fertility decline will resume.

Health and Demographic Surveillance System

In Matlab, considerable effort has gone into 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 the 14,000 plus wells is being tested for arsenic content, followed by screening of residents where water sources are contaminated. The 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 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. Pregnancy and birth are also being monitored by the HDSS as input to the IMCI study.

Explaining field activities of HDSS to visitors

An unusual use of the historical data has been to explore the possibility that children born in a food-deprived phase of the year experience dramatically-increased mortality after puberty compared to children born during a food-sufficient (e.g. harvest) period of the year, irrespective of the overall levels of food availability

An unusual use of the historical data has been to explore the possibility that children born in a food-deprived phase of the year experience dramatically-increased mortality after puberty compared to children born during a food-sufficient (e.g. harvest) period of the year, irrespective of the overall levels of food availability. This pattern was observed in the Gambia by the British Medical Research Council, and the Health and Demographic Surveillance Unit of ICDDR,B has worked with this group at Cambridge and London School of Hygiene & Tropical Medicine to explore the much larger database of Matlab. Thus far, it seems that the patterns are not reproduced in this part of Asia.

A somewhat similar study is beginning on young people either being born, or passing through puberty, around the time of the disastrous famine of 1974. Cohorts of children and young people will be followed to monitor their survival compared to children born in non-harvest periods to determine if under-nutrition at certain critical phases of life results in elevated risk of morbidity or mortality due to certain non-communicable diseases. This issue relates to the 'Barker hypothesis' which suggests that the immune system is programmed and formed in these vulnerable phases, and any disruption at these times may result in long-delayed negative health consequences. Such studies are not feasible prospectively, but are well-suited to a longitudinal surveillance system as in Matlab.

Many of the above studies have required the collection of some additional information and strengthening of the routine HDSS data-collection systems, which are sufficiently flexible to respond to the growing demands of researchers in the field.

Training on analysis of longitudinal data

In collaboration with other INDEPTH surveillance sites, the Health and Demographic Surveillance Unit (HDSU) conducted a two-week workshop on the analysis of longitudinal data—one week in Dhaka taught by Professor Ed Frongillo of Cornell University, the second week by HDSU staff and others. This has proved to be a popular course with so many sites now collecting longitudinal health and demographic data, but not always being well-trained in the analysis of such unique data. Participants came from Indonesia, Vietnam, Nicaragua, South Africa, Tanzania, India, Pakistan, and Bangladesh. The course was supported with funds from the Poverty and Health Programme of the Centre.

Many studies have required the collection of some additional information and strengthening of the routine HDSS data-collection systems

ONGOING RESEARCH PROTOCOLS 2002

Clinical Sciences Division

Alam NH. A double-blind, randomized, placebo-controlled, parallel group study to assess the efficacy, safety and tolerability of racecadotril in the treatment of acute diarrhoea resulting from Vibrio cholerae in adults
Starting date: 1 June 2000
Funded by: GlaxoSmithKline (GSK), UK

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: Nestle Research Foundation, USA

Alam NH. Introduction of new hypo-osmolar ORS to routine use in the management of diarrhoeal disease
Starting date: 1 October 2002
Funded by: USAID/Dhaka

Ahmed T. Use of metronidazole in improving nutritional rehabilitation of severely-malnourished children recovering from diarrhoea: a randomized-controlled trial
Starting date: 1 January 2001
Funded by: World Bank

Ahmed T. Study on iron supplementation and growth
Starting date: 1 May 1997
Funded by: USAID/Washington

Ashraf H. Evaluation of lactoferrin (Latex agglutination-Leuko® and a new dipstick-Leuko-Stock®–test) and modified guaiac–test (Colo-Rectal®–test) as screening tests in the diagnosis and differentiation of inflammatory and non-inflammatory diarrhoea in patients with acute infectious diarrhoea
Starting date: 1 January 2002
Funded by: University of Basel, Switzerland

Bardhan PK. Absorption of water and electrolytes from a lipsomal oral rehydration solution: an in vivo perfusion study of rat small intestine
Starting date: 1 October 2002
Funded by: Creative Research Management, USA

Hamadani JD, Huda SN. Effect of psychosocial stimulation on the development of malnourished children in BINP centres in Bangladesh
Starting date: 1 November 1999
Funded by: Nutrition Centre of Excellence (World Bank)

Hossain MI, Rabbani GH. Clinical evaluation of green banana (amylase-resistant starch) in the management of childhood shigellosis
Starting date: 15 August 2000
Funded by: USAID/Washington

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 2002
Funded by: LHSTM, UK

Islam M. Effects of frequency of feeding and energy density of complementary foods on total energy intakes by healthy, breast-fed children in Bangladesh: preliminary study to determine the number of days required to detect the changes in breastmilk intake following introduction of complementary foods with varied energy density
Starting date: 1 July 2002
Funded by: Allen Foundation, USA

Jamil KMA. A pilot study to assess antioxidant status in healthy and malnourished Bangladeshi children.
Starting date: 15 March 2002
Funded by: University of California–Davis, USA

Khan WA. Molecular epidemiology of cryptosporidiosis
Starting date: 16 May 2001
Funded by: Massachusetts General Hospital, USA

Khan WA, Chowdhury HR. An open, randomized clinical trial comparing the efficacy and safety of a single dose of ciprofloxacin with erythromycin administered 6-hourly for 3 days in children with cholera
Starting date: 15 May 2001
Funded by: New England Medical Center, USA

Khan WA. Calcium homestatis, cramping and tetany in-patients infection with V. cholerae O1 or O139
Starting Date: 15 April 2002
Funded by: GlaxoSmithKline (GSK), UK

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 and SAREC, Sweden

Osinski P. Community-based protocolized management of severe malnutrition
Starting date: 1 December 1999
Funded by: World Bank and Bill & Melinda Gates–GoB Fund

Rabbani GH. Evaluation of apple polyphenal (applephenon‰) in reducing cholera toxin-induced intestinal secretion in rabbit
Starting date: 1 September 2000
Funded by: Tomen Corporation, Japan

Rabbani GH. Role of nitric oxide and reactive oxygen species in the pathogenesis of experimental shigellosis
Starting date: 1 March 2000
Funded by: USAID/Washington

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

Roy SK. Clinical trial of zinc supplementation in cholera patients
Starting date: 1 October 2000
Funded by: Thrasher Research Fund, USA

Roy SK. Feasible means to address moderately-malnourished children within BINP communities
Starting date: 19 December 2000
Funded by: Ministry of Health and Family Welfare, Government of Bangladesh

Sarker SA. Evaluation of probiotic bacteria (Lactobacillus paracaasei) in non-cholera diarrhoea in children
Starting date: 1 March 2000
Funded by: Karolinska Institute, Sweden

Sarker SA, Fuchs GJ. Helicobacter pylori infection-associated hypochlorhydria and iron-deficiency anaemia in childbearing women in Bangladesh
Starting date: 1 December 1999
Funded by: SDC, Switzerland

Health Systems and Infectious Diseases Division

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, USA

Breiman RF. A prospective, randomized, partially-blinded, placebo-controlled, Phase-III, multi-centre trial to assess safety, tolerability and immunogenicity of liquid influenza virus vaccine, trivalent, types A and B, live cold-adapted (liquid CAIV-T), administered concomitantly with live-attenuated, poliovirus vaccine in healthy children
Starting date: 1 November 2001
Funded by: Wyeth–Lederle, USA through Quintiles

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 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
Starting date: 1 September 2002
Funded by: Wyeth–Lederle. USA through Quintiles

Hadley M. Identification of factors influencing and determining nurses' behaviour in the delivery of hands-on patient care
Starting date: 14 October 2002
Funded by: DFID, UK

Hasan Y. Meeting additional family health needs of clients by addressing missed opportunities at the ESP clinics
Starting date: 20 March 2002
Funded by: USAID/Dhaka

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

Mazumder 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

Nahar Q. Operations research on strategies to improve reproductive health services for adolescents
Starting date: 5 January 2000
Funded by: USAID/Dhaka

Nahar Q. Operations research on strategies to improve reproductive health services for adolescents by NGOs
Starting date: 1 September 2000
Funded by: USAID/Dhaka

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 November 2002
Funded by: CDC, Atlanta, USA and IVI, South Korea

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

Rahman AS. Randomized, double-blind controlled trial of wheat flour (chapatti) fortified with vitamin A and iron in improving vitamin A and iron status in healthy, school-aged children in rural Bangladesh
Starting date: 1 November 2001
Funded by: MOST Project, USA

Rahman S. Strategies to improve prevention and management of reproductive tract infections and sexually transmitted diseases
Starting date: 1 October 1998
Funded by: USAID/Dhaka

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

Azim T, Salam MA. Identification of risk factors and study of the outcome of Shigella-associated haemolytic-uraemic syndrome
Starting date: 30 July 1999
Funded by: Government of Japan, UNOPS, and USAID/Washington

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

Azim T. Investigation of importance of Norwalk-like viruses in childhood diarrhoea in Bangladesh
Starting date: 1 October 1998
Funded by: USAID/Washington

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: WHO

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/Washington

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

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

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 August 2002
Funded by: Bill & Melinda Gates–GoB Fund

Haque R. Field studies of human immunity to amoebiasis in Bangladesh
Starting date: 10 August 1998
Funded by: University of Virginia, USA through NIH

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

Hossain A. Population-based evaluation of Shigella infections in urban area of Dhaka, Bangladesh
Starting date: 7 January 2001
Funded by: IVI, South Korea

Islam MS, Colwell RR, Huq A. A simple water filtration for cholera intervention
Starting date: 15 September 1998
Funded by: NIH, USA through University of Virginia

Islam MS, Curts T, Barer M. Are water-sterilization ponds barrier to or reservoirs of cholera? How much V. cholerae is there in waste water?
Starting date: 31 August 1998
Funded by: University of Newcastle Upon Tyne, UK

Islam MS, Taylor RK. Environmental persistence of Vibrio cholerae
Starting date: 1 October 2001
Funded by: NISSAN Scientific Foundation, Japan

Nair GB. Molecular epidemiology of the pandemic clones of Vibrio parahaemolyticus in Bangladesh
Starting date: 1 August 2000
Funded by: Government of Japan

Qadri F, Akramuzzaman SM. Immune response to V. cholerae in Bangladesh
Starting date: 15 September 2000
Funded by: NIH, USA through Massachusetts General Hospital

Qadri F. Study of specific and innate mechanisms of the immune response in acute watery diarrhoea due to V. cholerae and entertoxigenic E. coli: studies in patients and vaccines
Starting date: 1 January 1999
Funded by: SIDA

Qadri F. Phase II. Safety and immunogenicity studies of a killed oral enterotoxigenic Escherichia coli vaccine in Bangladeshi children
Starting date: 1 January 2000
Funded by: USAID/Washington

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 and SAREC

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/Washington

Rahman M, Hossain S, Zaman K. Surveillance of invasive influenzae (Hi) and Streptococcus pneumoneae (Spn) diseases and the antimicrobial resistance and serotype patterns of Hi and Spn isolates in Bangladesh
Starting date: 1 October 1998
Funded by: USAID/Washington

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: comparative study between patients and household contacts
Starting date: 1 July 2002
Funded by: Bill & Melinda Gates–GoB Fund

Raqib R. Further studies of immunoprotective and immunopathogenic mechanisms in shigellosis
Starting date: 1 January 1999
Funded by: SIDA

Raqib R. Innate and adaptive immune response in Shigella infection
Starting date: 1 January 2002
Funded by: SIDA

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/Washington

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 Foundation, USA

Public Health Sciences Division

Alam DS. Association between size at birth and childhood blood pressure, fasting glucose and insulin concentrations, lipid profile and insulin-like growth factor-1 (IGF-1) during preschool age in rural Bangladesh
Starting date: 21 April 2001
Funded by: World Bank

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, 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. Community-based interventions to reduce neonatal mortality in Bangladesh
Starting date: 1 March 2002
Funded by: USAID/Dhaka and ICDDR,B

Arifeen SE. A community-based, randomized controlled trial to assess the effect of zinc supplementation in <5-year old Bangladeshi children during diarrhoea on clinical course of diarrhoea, subsequent diarrhoea and ARI morbidity, and growth
Starting date: 1 August 1998
Funded by: Johns Hopkins University, USA and USAID/Washington

Arifeen SE. An effectiveness study of Haemophilus influenzae type b vaccine
Starting date: 1 April 2000
Funded by: Government of Bangladesh and ADB

Arifeen SE. Aetiology, prevalence and treatment of neonatal infections in the community
Starting date: 1 November 2002
Funded by: Welcome Trust, UK

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

Arifeen SE. Safety, dose immunogenicity, and community transmission risk of a candidate Shigella flexneri 2a vaccine (SC602) among young children in rural Bangladesh
Starting date: 1 January 2001
Funded by: Walter Reed Army Institute of Research and National Vaccine Program Office, USA through USAID/Washington

Bairagi R. Contraceptive use dynamics in Bangladesh
Starting date: 29 May 1998
Funded by: European Union

Bhuiya A. Improvement of health through community development-oriented programme in rural Bangladesh
Starting date: 1 January 1994
Funded by: Consortium of Swiss, German and Dutch Red Cross

Bhuiya A. Monitoring the disparity in health status and access to, and utilization of, healthcare services: Bangladesh Health Equity Guage-Phase I
Starting date: 1 July 2001
Funded by: Rockefeller Foundation, USA

Bhuiya A. Rapid assessment tool (RAT) for better health: helping essential service package (ESP) managers to be more effective
Starting date: 1 March 2002
Funded by: USAID/Dhaka

Bhuiya A. A study on the effects of poverty alleviation programmes on health: third phase of the BRAC-ICDDR,B joint project in Matlab, Bangladesh
Starting date: 1 September 2000
Funded by: Rockefeller Foundation, USA

Blum LS. Socio-cultural and behavioural component for dysentery study
Starting date: 1 June 2001
Funded by: IVI, South Korea (with funds from Bill & Melinda Gates Foundation, USA)

Bosch A. Adolescents' reproductive health in rural Bangladesh: impact of experiences in childhood
Starting date: 1 January 2001
Funded by: Netherlands Foundation for the Advancement of Tropical Research, The Netherlands

Dieltiens G. Unmet need for major obstetric interventions in Bangladesh
Starting date: 8 January 2001
Funded by: Directorate General of International Cooperation, Belgium

Khan SI. Male sexuality and masculinity: implications for STD/HIV and sexual health interventions in Bangladesh
Starting date: 1 October 2001
Funded by: AusAID, Australia

Killewo J. Essential obstetric care
Starting date: 1 October 1999
Funded by: European Union

Killewo J. Male involvement in reproductive health
Starting date: 21 November 1999
Funded by: European Union

Killewo J. Acceptability, effectiveness and cost of strategies designed to improve access to basic obstetric care in rural Bangladesh (revised)
Starting date: 7 March 2002
Funded by: USAID/Dhaka

Persson LÅ. Arsenic in tubewell water and health consequences
Starting date: 1 November 2001
Funded by: SIDA, WHO, and USAID/Dhaka

Persson LÅ. Combined interventions to promote maternal and infant health
Starting date: 1 November 2000
Funded by: UNICEF

Persson LÅ. Impact of energy and protein food supplementation of rural Bangladeshi pregnant women on the birth-weight of their newborns
Starting date: 1 November 2000
Funded by: UNICEF

Rahman M. Efficacy of flocculent technology as an arsenic mitigation strategy
Starting date: 15 December 2002
Funded by: Procter and Gamble, USA

Ruchira TN. An action research into positive and negative deviance in child nutrition in rural Bangladesh
Starting date: 1 October 1999
Funded by: World Bank

Ruchira TN, Azim S. Women's health and domestic violence
Starting date: 1 March 2000
Funded by: Government of Bangladesh and Asian Development Bank (ADB)

Siddique AKM. Epidemiology and ecology of V. cholerae in Bangladesh
Starting date: 1 January 1997
Funded by: NIH, USA through Johns Hopkins University, USA

Siddique AKM, Rahman M. Surveillance of dengue viral disease in Bangladesh
Starting date: 1 May 2001
Funded by: USAID/Washington

Streatfield PK. Plateauing of the Bangladesh fertility decline
Starting date: 1 March 2002
Funded by: USAID/Dhaka

Wagatsuma Y. Community-based study of bronchial asthma among children in an urban slum in Dhaka, Bangladesh
Starting date: 1 May 2002
Funded by: University of Tokyo, Japan

Wagatsuma Y. Pilot study on epidemiological and socioeconomic factors related to malaria in endemic communities of Bangladesh
Starting date: 25 April 2002
Funded by: DFID

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: 16 June 2000
Funded by: USAID/Washington

Zaman K, Haruko T. Epidemiology of bronchial asthma among children in rural Bangladesh at Matlab
Starting date: 1 March 2001
Funded by: NISSAN Scientific Funds and University of Tokyo

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 July 2001
Funded by: USAID/Washington, National Vaccine Program Office, and WHO

Zaman K. A community-based, randomized controlled trial to assess the efficacy of iron and/or zinc or a micronutrient-mix supplementation to reduce anaemia and morbidity and to improve growth and development in Bangladeshi infants
Starting date: 1 August 1999
Funded by: USAID/Washington and the Netherlands Nutricia Research Foundation

Associate Director
and Head
Barkat-e-Khuda

POLICY AND PLANNING

Strategic Plan

The Strategic Plan of the Centre was approved at the November 2002 meeting of the Board of Trustees. The document is being printed. The Centre adopted new vision, mission, and guiding values as follows.

Vision

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

Mission

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 Vulnerables
- Promote Equity and Diversity
- Transparency and Accountability
- Effective Use and Development of Resources
- Fiscal Prudence

The major issues, research priorities, and new programmes are briefly described below.

Expected Accomplishments during the Coming Decade

The Centre is proud of its achievements in the past. As we look forward and take into consideration the expected scientific developments and the Centre's mandate, expertise, and capacity, we expect that the following major contributions could realistically result in success stories with a dramatic impact on health and welfare. We will build on our strengths and opportunities to gradually expand the Centre's role in the field of international health. These are not goals, hopes, or dreams; these are advances that can be made through the efforts of the Centre staff, in partnership with others, including the Government of Bangladesh and national research institutions, within the Plan period.

During the coming decade, the Centre expects to:

- ❒ contribute to the introduction of cost-effective strategies for zinc therapy in diarrhoea
- ❒ help reduce maternal morbidity and mortality and improve perinatal and neonatal health

We will build on our strengths and opportunities to gradually expand the Centre's role in the field of international health

- ❒ develop an effective package for the prevention of foetal growth restriction
- ❒ help identify a package of suitable vaccines for diarrhoea and acute respiratory infections
- ❒ define the burden of tuberculosis and identify effective strategies for prevention and control
- ❒ address the stagnation of fertility decline
- ❒ help prevent the epidemic of HIV/AIDS and RTI/STI
- ❒ contribute to knowledge that can impact on reducing the burden of vector-borne diseases

New Programmes

In the near future, the Centre expects to form at least three new programmes: poverty and health, HIV/AIDS, and safe water. Inequity of health services continues to be a problem throughout the world, including Bangladesh. This aspect of health interventions will be a major focus of the Centre's research. The Centre will conduct studies to understand better the relationship between poverty and health to document the economic benefits of good health and the economic consequences of ill health. The Centre will also assist in better understanding of the beneficial or adverse health consequences in social and economic development. The HIV/AIDS Programme will expand the ongoing activities that already started to control the impending epidemic of HIV in Bangladesh. This will include expansion of the ongoing surveillance activities, provision of a model centre for voluntary counselling and testing, and interventions to prevent the spread of HIV/AIDS. The programme on safe water will coordinate activities that are involved with provision of bacteriologically and chemically (e.g. arsenic) safe water and operations research relating to provision of safe water.

Monitoring of Project Activities

Currently, different projects have their own monitoring systems. However, there is no central monitoring system to track the performance of the projects. There is also a need to develop a central database for preparing reports for donors in particular. The objectives of the proposed monitoring system are to help facilitate timely reporting to donors, monitor the implementation of the Strategic Plan, and keep programmes on track. This will be a management tool to enable managers at different levels to determine the progress of work, problems/difficulties encountered in carrying out the work, and ways of resolving problems and provide the needed guidance to facilitate smooth implementation of the work. Monitoring of project activities will form part of the overall Management Information System (MIS) for the Centre, linking human resources and finance. Development of the monitoring system is underway.

Monitoring of project activities will form part of the overall Management Information System for the Centre, linking human resources and finance. Development of the monitoring system is underway

Centre Scientific Forum List 2002

Ahmed S. Cost of under-five healthcare services in a rural area of Bangladesh: findings from the IMCI evaluation study in Matlab

Ahmed T. Child health and nutrition in Afghanistan

Alauddin M, Rabbani GH. Health effects of environmental pollution in Bangladesh: roles of arsenic and organic pollutants

Amin S. Effectiveness trial of Haemophilus influenzae type b (Hib) vaccine in Bangladesh and burden of Hib disease in Bangladesh

Arifeen SE, Larson CP. Re-visiting priorities for child health interventions

Bern C, Wagatsuma Y. Visceral leishmaniasis in South Asia–a re-emerging problem

Bhuiya AU. What villagers can do for their health: recent experiences from Chakaria

Bhuiya AU, Khan SI. The role of social and behavioural science research in preventing HIV/AIDS in Bangladesh

Blum L, Naved R, Kabir I, Roy SK. The role of caring practices in child nutrition in Bangladesh

Brooks WA. Efficacy of zinc as an adjuvant in the management of severe pneumonia in children less than two years old

Golden M. Type I and type II nutrients: a new concept

Hamadani JD, Yesmin S, Mehrin F. Effect of phychosocial stimulation on mental development of malnourished children in BINP community nutrition centre

Hossain A, Routh S, Blum L. Paving the way for introduction of vaccines to prevent Shigella infections via epidemiologic, microbiologic, economic and behavioural studies—what decision-makers will need to know

Jamil KMA. Assessment of carotenoid bioavailability from plant sources

Kabir I. Complementary feeding: current knowledge, confusions, and global recommendation: a community-based study to improve complementary feeding practices

Kalluri P. Feasibility of implementing the safe water system for diarrhoea prevention in Afghanistan

Khanum R, Khatun J. Addressing missed opportunities can help achieve integration goals of essential health and family-planning services: urban experience

Killewo J, Dieltiens G, Anwar I. Quality of care of reproductive health

Larson CP, Sack DA. Zinc supplementation: where are we? Where do we go from here?

Mekalanos JJ. Genetic studies on Vibrio cholerae

Mitra D, Alam S. Family Health Research Project surveillance sites: past, present, and future

Mostafa G, Streatfield PK. Health implications of an ageing Bangladeshi population

Nair GB, Hossain A, Rahman M. Laboratory networking: a tool for quality antimicrobial resistance: data generation ICDDR,B's experience in Nepal

Persson LÅ, Bhuiya AU. Poverty and health

Rabbani GH. Double-blind controlled trial of L-histidine-supplemented Ceralyte-90 in the treatment of severe cholera in adults

Rabbani GH, Saha SK. Role of anti-oxidants in arsenic-induced toxicity

Rahman S. Screening for syphilis as a routine antenatal care: what are the operational aspects?

Rahman M. Multidrug-resistant typhoid fever epidemic—what have we learnt?

Roy SK, Wahed MA. Micronutrients in health

Sack DA. Review of the recent Board of Trustees meeting and orientation of the Centre Manual

Salam MA. Diagnosis of pneumonia in children with dehydrating diarrhoea

Saifi R. Contraceptive method-choice in Thailand and policy implications for the Bangladesh family planning programme

Sarker SA, Bardhan PK. Helicobacter pylori infection in Bangladesh: its implication in gastric function and anaemia

Talukder KA, Nair GB, Sack DA. Changing epidemiology of Shigella infection

Uddin J, Ashraf A. Incorporating community's voice to facilitate transparency and accountability in the Health and Population Sector Programme

van Mels C, Alam N, Streatfield PK. Surveillance systems and changes in mortality patterns

Zaman K, Rahim Z, Banu S, Raqib R. ICDDR,B research to address the challenge of tuberculosis in Bangladesh

TRAINING AND INFORMATION DISSEMINATION

Training and Education Unit

Head
A.N. Alam

In 2002, the Training and Education Unit (TEU) conducted 28 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 and for family-planning services; (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 training courses and workshops, organized 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.

The participants of the 28 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 633 persons received orientation training on different aspects of diarrhoeal diseases and reproductive health.

Participants in the international course on Emerging and Re-emerging Pathogens receiving hands-on training in the Dhaka Hospital of ICDDR,B

The Government of Japan, Japan International Corporation of Welfare Services (JICWELS), Office of the Foreign Disaster Assistance (OFDA), USAID/Washington, World Health Organization, UNDP, and Bill & Melinda Gates-GoB Funds provided support to most training programmes.

Some of the major training programmes are briefly described below.

International Training Courses and Workshops

Emerging and Re-emerging Pathogens

Seven physicians from different hospitals and medical schools of Japan attended a training course on Emerging and Re-emerging Pathogens held on 3-28 February 2002. The course was sponsored by the JICWELS.

The participants received hands-on training at the Centre's Dhaka hospital in the management of patients with cholera and shigellosis and in the laboratory for identification of diarrhoeal pathogens and their sensitivity patterns. Management of severely-malnourished children and a visit to the Matlab Health Research Programme site for practical experience in community management of diarrhoeal diseases were additional components of the course. Diseases, re-emerging as major health problems, such as tuberculosis, kala-azar, dengue, and malaria, were also included as topics for classroom discussions and clinical demonstration.

Table. Training courses and workshops conducted during 2002

Course/workshop title	No. of courses/ workshops (n= 28)	No. of participants (n=468)	Countries represented (n=26)
Health Research Training			
Introductory Course on Epidemiology and Biostatistics	2	37	Bangladesh
Basic Course on Epidemiology and Biostatistics	1	17	Bangladesh (UNICEF Programme Coordinators and staff from its development partners)
International Workshops/Courses			
Emerging and Re-emerging Pathogens	1	7	Japan
Clinical Management of Diarrhoeal Diseases	1	9	Bangladesh, Indonesia, Philippines, Kenya, and Thailand
Laboratory Diagnosis of Common Infectious Disease Agents	1	5 (+7 SAARC fellows)	Kenya, Philippines, and Thailand
Reproductive Health: Rhetorics into Reality through Innovative Approaches	2	23	Bangladesh, Cambodia, India, Indonesia, Kenya, Myanmar, Pakistan, Philippines, Tanzania, Thailand, Vietnam, Zambia, and Zimbabwe
Management of Severe Malnutrition	1	21	Bangladesh, Bhutan, India, Indonesia, Myanmar, and Nepal
Emergency Response to Cholera and *Shigella* Epidemics	1	12	Azerbaijan, Belgium, India, Indonesia, Kenya, Sweden, and Tanzania
National Training Courses/Workshops			
Clinical Management of Diarrhoeal Diseases for MD, DCH, FCPS and FCGP students	3	45	Bangladesh
Reproductive Health: Rhetorics into Reality through Innovative Approaches	3	30	Bangladesh
Reproductive Health: Rhetorics into Reality through Innovative Approaches for Community Leaders	8	150	Bangladesh
Measuring Poverty: Economic Dimensions	1	18	Bangladesh
Arsenic Measurements of Drinking-water in Bangladesh for Chemists, Analysts, and Engineers of DPHE	2	13	Bangladesh
Research Development Workshop (Treatment of Malnourished Children)	1	11	Bangladesh, ICDDR,B staff
Fellowship Programme			
International Fellowship (elective training and training for postgraduate degree and diploma)	-	37	Austria, Bangladesh, Bhutan, Canada, Egypt, France, India, Sweden, and USA
Fellows from SAARC countries	-	13	Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka
Clinical Fellowship	-	8	Bangladesh
Nursing Fellowship	-	12	Bangladesh

A section of the participants in the course on Reproductive Health: Rhetorics into Reality through Innovative Approaches

Reproductive Health: Rhetorics into Reality through Innovative Approaches

Two international workshops on Reproductive Health: Rhetorics into Reality through Innovative Approaches were organized on 12-23 March and on 8-19 September 2002 with UNDP and Gates-GoB grants. Twenty-three participants from Bangladesh, Cambodia, India, Indonesia, Myanmar, the Philippines, Thailand, Vietnam, Kenya, Tanzania, Zambia, and Zimbabwe attended the workshops.

The workshop was designed for the family-planning programme managers and policy planners with the specific objectives of: (a) identifying mutually-reinforcing and interactive relationship among population, development, and reproductive health with challenges and opportunities; (b) familiarizing participants with evolving interventions gained from the experiences of Maternal, Child Health and Family Planning projects of ICDDR,B; (c) acquainting them with operations research activities in the process of policy formulation in the field of population and reproductive health; (d) developing an understanding of the importance of, and strategy for, community participation and bottom-up planning for achieving long-term sustainability in family-planning and reproductive health performance, including safe-motherhood; and (e) developing skills for initiating innovative rural development activities for successful implementation and long-term sustainability of family-planning and reproductive health programmes under government and NGO initiatives. The workshop included theoretical lectures and visits to the field sites of ICDDR,B at Matlab, Mirsarai, and Chakaria and also to the government and NGO clinics. In addition, the participants made a short presentation on the profile of family-planning and reproductive health activities in their home countries.

Emergency Response to Cholera and *Shigella* Epidemics

The Centre organized one workshop from 21 April to 2 May 2002 with support from the OFDA, USAID/ Washington, to train the healthcare professionals of international NGOs and other agencies that respond to disaster situations. The workshop was attended by 12 participants from 7 countries, representing Médeicins sans Frontiéres (Belgium), International Medicine Corps, International Rescue Committee, World Vision Indonesia, Care India, Huddinge University in Sweden, and OFDA, African Regional Office (ARO). The objective of the workshop was to strengthen the capacity of the international NGOs in managing epidemics of cholera and shigellosis effectively to reduce morbidity and mortality. The workshop participants were required to identify and apply preparedness and response measures to manage diarrhoeal epidemics in emergency and disaster situations effectively, and to prepare an action plan for their organizations, using the knowledge gained from this course.

A new initiative will be undertaken to arrange training workshops and offer fellowships in the fields of poverty, health, and equity.

The evaluation showed that the objectives were generally met. Most participants felt that the level of the course was appropriate, and the duration was about right. The overall evaluation was excellent. Evaluation on individual sessions and instructors was good to excellent.

Laboratory Diagnosis of Some Common Infectious Disease Agents

A two-week course on Laboratory Diagnosis of Some Common Infectious Disease Agents was organized on 16-27 June 2002. The course, organized with financial assistance of the Government of Japan, was attended by 12 participants—7 SAARC fellows from Bangladesh, India, Maldives, Nepal, and Sri Lanka and 5 other participants from Kenya, the Philippines, and Thailand. The SAARC fellows included two each from Bangladesh and Sri Lanka, and one each from India, Maldives, and Nepal. The participants learned the principles of laboratory procedures for isolating and identifying some common infectious disease agents. The course included lectures and practical sessions in microbiology, molecular biology, serological techniques, and animal experimentations.

Clinical Management of Diarrhoeal Diseases

A 2-week international training course on Clinical Management of Diarrhoeal Diseases, organized from 31 March to 11 April 2002, was attended by 9 participants from Bangladesh, Indonesia, Kenya, the Philippines, and Thailand. The course was designed to provide the participants with skills required to diagnose and treat diarrhoea of various aetiologies and associated complications in both hospital and the community. In addition, the participants were taught to organize courses for health personnel in their own countries. Their tuition fees, travel, and living expenses were provided by a grant from the Government of Japan.

WHO-sponsored Inter-country Training Workshop on Management of Severe Malnutrition

The inter-country training workshop on management of severe childhood malnutrition, jointly organized and sponsored by ICDDR,B and the World Health Organization (SEARO, New Delhi), was held in ICDDR,B from 11 to 22 December 2002. Twenty-one participants from Bhutan, Nepal, India, Indonesia, Myanmar, and Bangladesh attended the workshop.

The workshop, specifically designed for the WHO Guidelines, is of the 'training of tutors' type. Six facilitators were trained initially, who subsequently trained other doctors and nurses. The workshop trains health professionals and, at the same time, develops facilitators who will train others in future.

The main objective of the training workshop on severe malnutrition was to impart knowledge and develop skills on 'best practices' in the management of severely-malnourished children. Without the implementation of 'best practices', it is impossible to reduce the high case-fatality rates among severely-malnourished children in Southeast Asian countries. Follow-up monitoring and evaluation is included to know if a particular healthcare facility from where participants received training has implemented the WHO Guidelines or not.

Participants in the WHO-sponsored Inter-country Training Workshop on Management of Severe Malnutrition

In presence of faculty members, a group of trainees from the Department of Public Health Engineering, Bangladesh learning how to measure arsenic contents in groundwater

The training of facilitators continued for 3.5 work-days with additional home tasks, while the training of participants was for 6 work-days. All participants completed the modules.

Prof. Ann Ashworth of London School of Hygiene & Tropical Medicine participated as a facilitator and was instrumental in making the workshop successful.

In an evaluation of the course, 24% of the participants found it very useful, and 71% found the course useful, while 5% felt that the course was somewhat useful.

SAARC Fellowship Programme

Thirteen fellows from the SAARC countries, viz. Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka, received training on clinical management of diarrhoeal diseases and laboratory diagnosis of common infectious disease agents for a 6-week period. For the first two weeks, the participants attended the international training course either on Clinical Management of Diarrhoeal Diseases or on Laboratory Diagnosis of Common Infectious Disease Agents. In the following 4 weeks, the fellows received practical training either in the hospital or in different laboratories of the Centre.

The aim of this programme was to help strengthen infectious disease control programmes in the SAARC countries.

Course on Arsenic Measurements in Groundwater

Two training courses on arsenic measurements in groundwater were organized at the Centre with grants from JICWELS, Japan, on 27-29 August and 1-3 September 2002. The courses were attended by 13 chemists, analysts, and engineers from the Department of Public Health Engineering, Government of Bangladesh.

National Courses

Reproductive Health: Rhetorics into Reality through Innovative Approaches

This national course, an abridged version of the international course, was offered three times on 15-18 April, 29 July-1 August, and 23-26 September 2002 at the Matlab Health Research Centre with UNDP grant. The course was attended by 22 Civil Surgeons, Deputy Directors of Family Planning, Upazila Health and Family Planning Officers, and Family Planning Officers from selected districts and upazilas of Chittagong and Sylhet divisions. Eight selected NGO personnel working on reproductive health and/or family planning in these two divisions also attended the course.

In addition, a specially-designed short course was conducted eight times at the Matlab Health Research Centre. The course was attended

Learning how to use PC-based software for data analysis is an integral part of the course on Epidemiology and Biostatistics

by 150 community leaders from the Maltab Health and Demographic Surveillance System area. The course was aimed at strengthening the cooperation of the community leaders in the implementation of the reproductive health and family-planning programmes.

Introductory Course on Epidemiology and Biostatistics

In collaboration with several national institutions, two 4-week Introductory Course on Epidemiology and Biostatistics were organized for 37 professionals from government and non-government organizations of Bangladesh. These courses were arranged as part of the Centre's effort to assist the national institutions in developing human resources for conducting research. The participants were trained about how to plan, design, and undertake epidemiological studies, and analyze and interpret data using principles of biostatistics and EPI Info software. They also developed research protocols in groups for implementation in their institutions.

Basic Course on Epidemiology and Biostatistics

A 2-week Basic Course on Epidemiology and Biostatistics was conducted on 14-25 July 2002 for 17 Programme Coordinators of UNICEF and officials from its development partner organizations: City Corporations of Dhaka, Chittagong, Khulna, and Rajshahi, Rangamati Civil Surgeon's Office, and Institute of Public Health Nutrition, Dhaka.

The course was sponsored by UNICEF-Dhaka and aimed at orienting the participants in basic concepts of epidemiology and biostatistics to enable them to undertake and evaluate epidemiological studies. The specific objectives were to help the participants to understand and critically analyze reports; analyze and interpret data using epidemiological and biostatistical principles; develop conceptual framework for monitoring and evaluation; and plan, design, and undertake epidemiological studies.

Future strategy

The future strategy of the Unit is to: (a) strengthen collaboration with universities within and outside Bangladesh, that could offer postgraduate diplomas/degrees; (b) collaborate with regional institutions to develop and offer new courses; and (c) identify new donors for additional funds to implement future plans, and to make the training programmes self-supportive. A new initiative will be undertaken to arrange training workshops and offer fellowships in the fields of poverty, health, and equity.

Dissemination and Information Services Centre

Head
M. Shamsul Islam Khan

The Dissemination and Information Services Centre (DISC) is entrusted with the responsibility of meeting the information needs of ICDDR,B scientists and eligible information-seekers by maintaining a world-class modern library with IT facilities and also disseminates research findings and other technical information of the Centre through various publications. DISC, as the Centre's paraphernalia for this two-way communication, is composed of: (1) Information Services Branch and (2) Publication Services Branch.

DISC organizes information resources on health, population, nutrition, environment research, and related disciplines and encourages their use and application.

In 2002, DISC managed its activities with a total of 11 personnel. One library advisory committee and 3 editorial boards provided continued guidance in the improvement of information services, dissemination of information, and production of publications. All publications produced by DISC were uploaded in the Centre's website in both PDF and text formats for wider dissemination and use.

The DISC staff provided extensive support in organizing the 10th Annual Scientific Conference (ASCON) of the Centre held on 11-13 June 2002. The activities included coordination with authors and participants and members of the central Organizing Committee and Scientific Committee, arranging review of abstracts submitted for the Conference, and editing/printing of the 168-page programme and abstracts book. In total, 151 abstracts (100 as oral presentations in 21 sessions and 51 as poster presentations in 10 sessions) were published in the book; this was the ever-highest number of abstracts presented at any annual scientific conference of ICDDR,B. The abstracts book is available online on the Centre's website. The theme of the Conference was "Malnutrition: Meeting the Challenges in South Asia". About 400 delegates and participants from home and abroad attended the Conference.

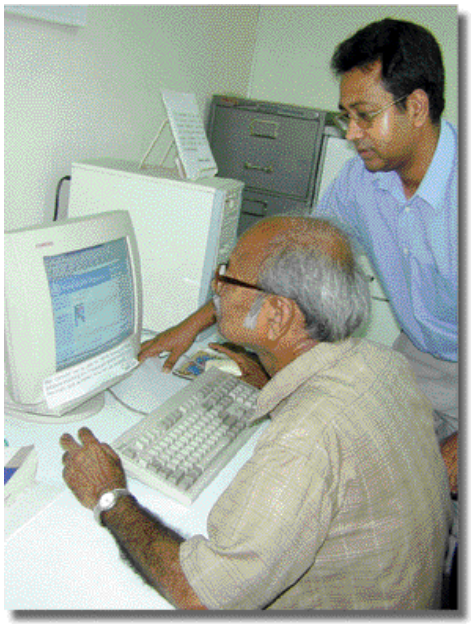
Four staff members attended training courses, four attended conferences/workshops, and under a study-tour/orientation programme, four visited several libraries in the USA, UK, Switzerland, and Thailand. The DISC staff published three papers in a local journal. In 2002, DISC earned an amount of US$13,611 from the sale of services and publications and from membership fees. In addition, the cost of 89 journals (US$33,907) was recovered from various projects.

Information Services
Librarian: Md. Nazimuddin

The Information Services Branch, or the library, is fully equipped with modern tools of information technology, including facilities for online

DISC organizes information resources on health, population, nutrition, environment research, and related disciplines and encourages their use and application

Mr. Al Mamun, a senior official of DISC, helping a library user in online search of medical literature



literature search. At the end of December 2002, the library had a total collection of over 37,587 books, reports, project protocols, and bound journals, and 13,260 reprints and other documents. The process of collecting books, journals and other periodicals, and CD-ROMs through purchase, gift and exchange programmes was strengthened during the year. Besides, 109 publications were downloaded from the Internet and were processed. The library collection was enriched by adding 2,333 new books (225 purchased), reports, documents, and research protocols, including 613 bound journals. Of these, 102 and 24 books were collected for the Poverty and Health Resource Unit and the Family Health Resource Unit respectively. Thirty-four books were received from the British Medical Association on a complimentary basis. The library staff processed 2,114 books, reports, documents, project protocols, and reprints.

The library received 326 current periodicals, 80 newsletters, and one CD-ROM database, and spent an amount of US$103,915 to procure 216 titles of current journals on subscription and the database. Four new journals were added, and 8 titles were dropped in 2002. The journal section is responsible for acquisition, organization, management, and preservation of all kinds of serial publications and for handling electronic subscriptions. The section ensured timely acquisition of journals to keep scientists, researchers, and other library users informed of the latest research results and related news. Several of the subscribed journals were available online.

During 2002, the total number of reader-visits was 11,949. Scientists and research-support staff of the Centre, health professionals and researchers of other organizations, university teachers and students, trainees, and visitors used the library facilities.

The library added three new personal computers for exclusive use of library patrons in the reading rooms. Due to the availability of these computers, library users could simultaneously undertake literature searches and read publications on the web extensively. In total, 511 persons from both within and outside the Centre used the facilities for searching and browsing of articles, documents, reports, and other publications, and searching of databases, particularly the Medline and Popline, and in-house databases. The library records revealed that they mainly browsed for finding information on research outputs, organizational web pages, institutional publications, training opportunities, and higher studies.

Referral services, bibliographic and photocopying services, online dissemination of information, and Internet services were also strengthened during the year. The library staff met 1,750 formal and informal queries of library patrons. During the reporting period, the library enrolled 290 persons as members, resulting in an earning of Tk 142,135. In total, 56,340 pages of photocopies were done and supplied to the users; of these, 28,345 were supplied to library users from outside the Centre. As usual, the Nuffield Library of the British Medical Association provided photocopies of journal articles free of charge. Photocopies of articles were also procured from the London School of Hygiene & Tropical Medicine and through commercial sources for several scientific staff members of the Centre. Adding information on new materials further enriched the in-house databases of the library. At the end of December 2002, the monograph database had 6,114 items, document database 2,092 items, Centre's publications database 2,182 items, ongoing project database 546 items, and the periodicals database 565 items. In total, 299 computerized literature searches from Internet databases were provided to the Centre staff and external users.

The library maintained inter-library loan relationship with several libraries in Dhaka city. In total, 1,016 books and bound journals were lent to the National Health Library and Documentation Centre, and libraries of the Bangladesh Institute of Development Studies, Institute of Nutrition and Food Science (University of Dhaka), and Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine & Metabolic Disorders (BIRDEM). Under the corporate membership, the library borrowed books and videos from the British Council Library in Dhaka.

In 2002, the library permanently withdrew 700 issues of old journals and 895 issues of old newsletters and 13 less-used books from the library collection. Besides, 732 issues of duplicate journals were donated to 12 libraries. The libraries which benefited from these donations included libraries of the Bangladesh Institute of Development Studies, BIRDEM, Bangladesh Rural Development Board, Chittagong Medical College, East West University, Institute of Child Health and Shishu Hospital, International Angel Association, Institute of Public Health Nutrition, North East Medical College, Maulana Bhashani Medical College, National Health Library and Documentation Centre, and the National Library of Bangladesh.

Under Current Awareness Service, the Centre's scientists were kept informed of the incoming learning resources through the monthly New Acquisition List (13 lists, 745 citations). The list disseminated information on new books. The Matlab library was enriched by adding 329 issues of various new journals and 60 books, and by subscribing to 8 journals. The library services were strengthened for the Matlab staff.

Mrs. Jean Sack, Informatics Consultant, with assistance of the library staff, conducted several two-hour training sessions on web-based literature search in the Centre's computer laboratory. About 75 staff members of the Centre and library members from outside the Centre

The library added three new personal computers for exclusive use of library patrons in the reading rooms. Due to the availability of these computers, library users could simultaneously undertake literature searches and read publications on the web extensively

The Publication Services Branch produces Annual Report, quarterly peer-reviewed Journal of Health, Population and Nutrition (JHPN), quarterly English newsletter Glimpse, four-monthly Bangla health magazine Shasthya Sanglap, working papers, scientific reports, monographs, bibliographies, and special publications

participated in these sessions. They learned how to access and search the Internet databases, how to access articles of periodicals, monographs, reports, documents, and library catalogues online, and how to download the searched materials and transfer these to other locations for subsequent access and use.

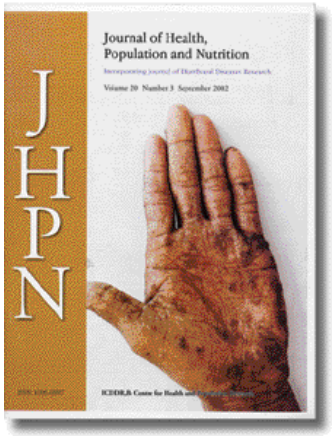
The library staff compiled and published the 59-page 'Bibliography of Nutrition Research at ICDDR,B, 1997-2001'; it contained information on 306 papers and abstracts published by scientific staff of the Centre involved in nutrition research. The bibliography is available online at the Centre's website.

Publication Services
Editor: M.A. Rahim

The Publication Services Branch produces Annual Report, quarterly peer-reviewed Journal of Health, Population and Nutrition (JHPN), quarterly English newsletter Glimpse, four-monthly Bangla health magazine Shasthya Sanglap, working papers, scientific reports, monographs, bibliographies, and special publications. The Branch also provides editorial advisory service for the production of several divisional and project documents. It 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.

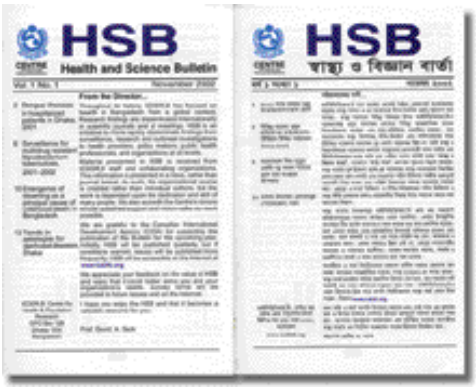
In 2002, the Branch edited and published the Annual Report 2001, 4 issues of the Journal of Health, Population and Nutrition, 4 issues of the English newsletter Glimpse, 3 issues of the Shasthya Sanglap, Programme and Abstracts book of the 10th Annual Scientific Conference (ASCON), and other materials for the 10th ASCON. The Branch also published the Bibliography of Nutrition Research at ICDDR,B, 1997-2001. Under the Editorial Advisory Service, different departments and individual scientists of the Centre are given assistance in editing their articles and documents. In 2002, DISC rendered editing services to the scientists for 11 papers and publications (560 pages). Formatting and printing supervision of a new quarterly publication Health and Science Bulletin (HSB) were also done at the Publication Services Branch. During the year, 125,500 copies of different publications (Annual Report, Glimpse, Shasthya Sanglap, JHPN, HSB) were distributed/mailed. Copies of Glimpse and HSB were distributed/mailed to 120 countries. The Branch arranged display and distribution of publications in various important meetings, workshops, and conferences as part of promotional activities of the Centre. Some of the periodical publications are highlighted below.

***Journal of Health, Population and Nutrition (JHPN)*:** The Journal succeeded in rapid publication of articles on original research of relevance to developing countries, and has attracted the attention of scientists around the world at all levels. In 2002, one hundred and fifty manuscripts were received from 38 countries (including 12 from ICDDR,B) for publication; 86.84% of the articles were received from developing countries. All manuscripts went through the strict review process to ensure quality. This resulted in rejection of 58 (38.67%) manuscripts in 2002. The four issues published in 2002 included 55 papers (43 original papers, 1 short report, 5 editorials, 5 letters-to-the



Journal of Health, Population and Nutrition had a new cover design in 2002, with the flexibility of using different pictures in different issues

Bi-lingual Health and Science Bulletin is a new addition to the Centre's quarterly periodicals



editor, and 1 review article). The Editorial Board was reorganized to make it more responsive. The responsibilities of Section Editors were defined and reorganized to share more responsibility with respect to reviewing and selection of expert reviewers for submitted manuscripts. On the basis of input on the performance of manuscript review, Dr. Tasnim Azim, Dr. Abbas Bhuiya, Dr. Peter Kim Streatfield, Dr. Yukiko Wagatsuma, and Dr. K. Zaman of ICDDR,B were included in the Editorial Advisory Board as members. The Journal was made freely available through the Internet.

***Glimpse*:** Contents and quality of the newsletter were improved which attracted the attention of more readers during the year, especially for its coverage of the new initiatives and scientific programmes of the Centre. In 2002, the newsletter highlighted the issues covering water and health, new research initiatives on kala-azar, vaccine developments, training courses and workshops organized at the Centre, profile-raising events, 10th Annual Scientific Conference, annual activities of 2001, achievements of the staff-development programme, Hospital Endowment Fund, new project for arsenic research in Matlab (AsMat), quality assurance for arsenic measurements, reception to alumni, art exhibition and auction (Art for Health), and other activities of the Centre. Mr. Peter Thorpe, Associate Director and Head, Information Sciences Division, took over as the new Editor-in-Chief from the December Issue of the newsletter.

***Shasthya Sanglap*:** This health magazine is published to highlight primary healthcare issues and other health problems to educate the health workers who work at the grassroots level and the readers at large. In 2002, the magazine covered issues relating to HIV/AIDS, reproductive health, breast-feeding, abortion, peptic ulcer, role of fats in infant food, trafficking of children and women, child psychology, safe blood transfusion, childhood migraine, use of condom in family planning and prevention of sexually transmitted diseases, prevention of blood-transmitted diseases in workplace, hepatitis B, chicken pox, etc. In total, 30,000 copies of each issue of the magazine were published for distribution mainly in Bangladesh. Some copies of the magazine are also used in India and the UK.

***Health and Science Bulletin*:** With support from the Canadian International Development Agency, the Centre launched a new quarterly bi-lingual (English and Bangla) bulletin titled 'Health and Science Bulletin' (HSB) in December 2002. According to ICDDR,B Director Prof. David A. Sack, the "HSB is an initiative to more rapidly disseminate findings from surveillance, research, and from outbreak investigators to health providers, policy-makers, public health professionals, and organizations at all levels. Material presented in HSB is received from ICDDR,B staff and collaborating organizations." About 10,000 copies of the first issue were published for distribution among health professionals, physicians, researchers, libraries, and scientists all over the world. The first issue of the Bulletin highlighted, with editorial comments, dengue illnesses in hospitalized patients in Dhaka during 2001; surveillance for multidrug-resistant *Mycobacterium tuberculosis*, 2001-2002; emergence of drowning as a principal cause of childhood death in Bangladesh; and trends in aetiologies for diarrhoeal diseases, Dhaka.

The Centre launched a new quarterly bi-lingual (English and Bangla) bulletin titled 'Health and Science Bulletin' (HSB) in December 2002

Mr. Asem Ansari , Head of the Audiovisuals Unit, briefing his two assistants on the production of graphics in his newly-installed G4 AppleMac

Audiovisuals Unit

Head
Asem Ansari

The Audiovisuals Unit (AVU) provides support to the Centre's scientists and members of the management team by preparing graphics material for their documents and audiovisual presentations. These include: slides, pictures, microphotography, gels, animal dissection photography, graphs, and charts. The Unit arranges 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. The Unit designs covers, lays out pages, and processes DTP output for the Annual Report, all issues of the English newsletter Glimpse and produces the Centre's calendar, brochures, posters, and other display materials. AVU is also active in providing support for fundraising activities.

During the reporting period, 7,598 copies of photo prints (coloured and black and white) were produced, 182 copies of film were developed, 192 pictures were taken, 124 copies of posters/design materials, 2,086 copies of call card/invitation card, and 2 albums were produced. The number of video/audio cassettes recorded was 12. Cover design for the Centre's Journal was done for all four issues that came out in 2002. Annual Report 2001 and 4 issues of Glimpse were formatted by the Unit and printing supervision done.

The Unit earned a total amount of US$7,700 during 2002.

Last year's success in raising about US$19,000 for the Hospital Endowment Fund through a silent art auction has inspired ICDDR,B to launch a similar event called 'Art for Health' in 2002. The auction was held on 1-5 November at the Rooftop Pavilion of the Centre. The auction was organized mainly at the initiative of Asem Ansari, the Centre's In-house Artist and Head of the Audiovisuals Unit. The event coincided with the November Meeting of the Centre's Board of Trustees, so international visitors to the Centre could also participate.

An illustrated brochure was published on the occasion. The brochure highlighted short biographies of the artists with their portraits and photos of their paintings and artworks. Detailed information, along with photographs of the paintings and artworks, was also made available online at www.icddrb.org.

The auction raised more than Tk 731,000.00 (equivalent to US$12,565.00) from the sale of the paintings and artworks. In addition, Duncan Brothers (Bangladesh) Ltd. contributed Tk 250,000.00 (US$4,298.50) as sponsor of the event. Thus, the event raised a total amount of US$16,862.00 for the ICDDR,B Hospital Endowment Fund.

Over the next years, the Unit plans to:

- digitize all photographs previously produced and improve the set up for production of all photographs digitally in future
- digitize all previous graphics materials and improve the set up for creative graphic designing and production
- acquire modern equipment and tools for better and cost-effective production of illustrative publications
- set up a digital video-production system.

Computer Information Services Unit

Manager
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-of-the-art computing and communication facilities; (b) provide high-quality, centralized and integrated support services; and (c) develop appropriate ICT policies, standards, and guidelines. The Unit carried out its various activities in 2002 with 10 personnel.

The Centre's computer network is connected to the international Internet backbone by a satellite-based communication system, and its Dhaka and Matlab stations are connected through a microwave link with voice and data-transmission facilities. The CISU maintains the Centre's communication infrastructure and the local area network with more than 700 computers.

The Centre's website (http://www.icddrb.org) has been developed as a database-driven, knowledge-based dynamic website, which has become more user-friendly and interactive with provision for the online update of web pages. The website includes a Web Mail facility that enables users to access their e-mails from any Internet location. The intra-website (http://Centre) has also been improved. The site announces weekly activities of the Centre, upcoming seminars, visitors' schedules, internal vacancies, notices, events, etc.

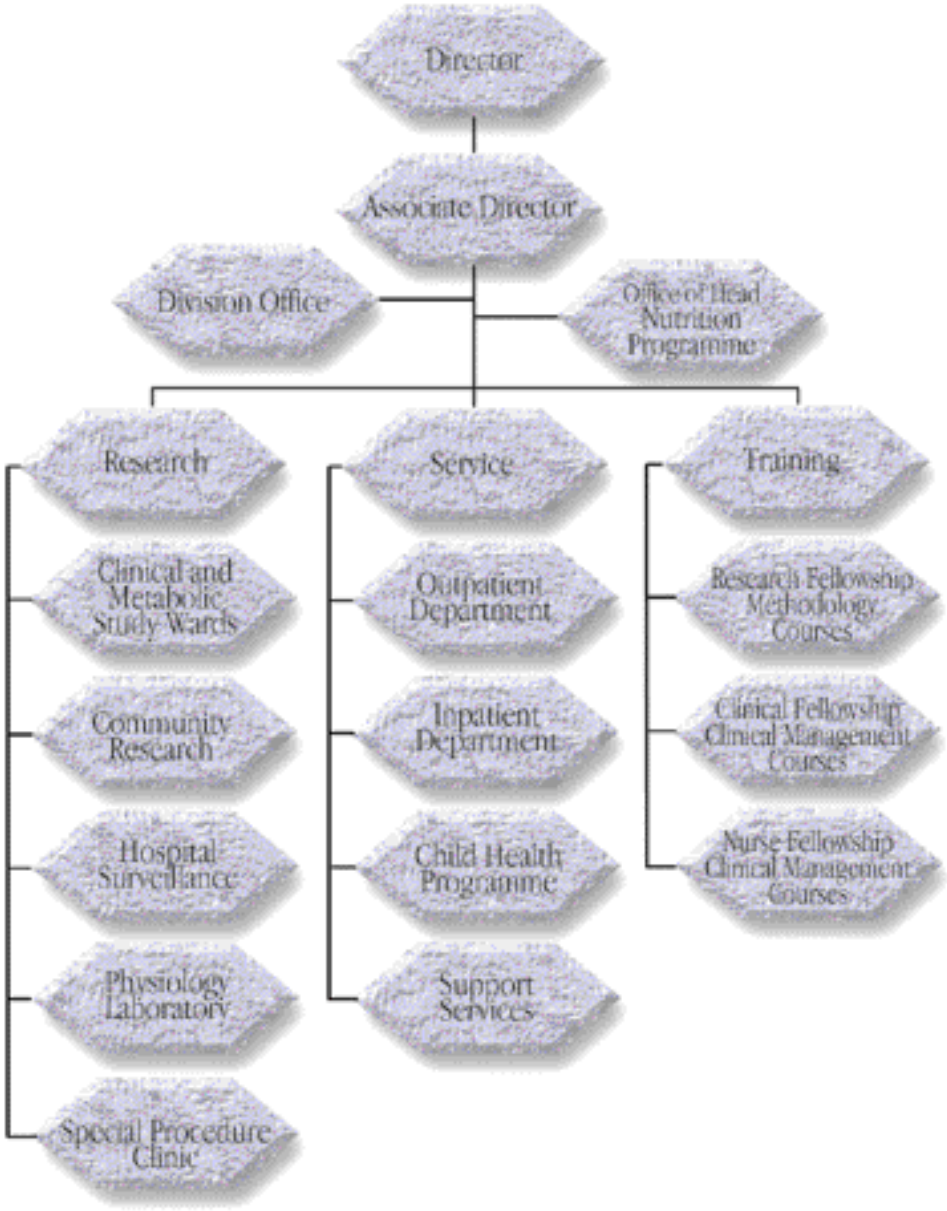
The CISU maintains several servers for databases, applications, e-mail, website hosting, and domain authentication. It also holds a file and print server to provide centralized data backup and printing services. Standardization of software and hardware is being established for the Centre to follow. The Unit has developed disaster recovery plans for the servers. Several database-oriented customized software applications, such as the Laboratory Management System for the Clinical Laboratory Services Programme, Inventory Management System for the RTI/STI Laboratory, a Grants and Contracts Information System, and a Project Monitoring System, have been developed.

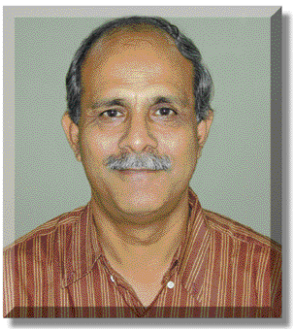
Services relating to the repair of, and support for, computers, printers, and networking equipment are provided. Members of the software and hardware support teams work both at the user-end and in the computer hardware laboratory to provide prompt and quality services for computer users in the Centre. Operating systems, MS Office, anti-virus, e-mail and other applications are installed and configured in the computers according to the need of the users.

The CISU is working on improving the present computer network and communications infrastructure at the Centre. Considering the aggressive rate of Internet adoption and fast growth in the number of end-users, the Unit plans to ensure adaptability, flexibility, longevity, and security of the network and to guarantee the smooth performance of web browsing and downloading through elimination of bottlenecks and limitations of the existing network and communications infrastructure of the Centre.

Mr. M. Farhad Hussain, Manager of CISU, and his professional staff, configuring a web server

Clinical Sciences Division





Acting
Associate Director
and Head
M.A. Salam

CLINICAL SCIENCES DIVISION

In 2002, the Clinical Sciences Division (CSD) carried out its research, patient-care, and training activities with the support of 132 regular and 60 project staff. Another 89 health workers, 56 personnel on contractual service agreement (CSA), 15 trainee doctors, and 15 trainee nurses significantly contributed to fulfill the mandate of the Division. Two national scientists of the Division were rewarded with international scientific ranking. Two paediatricians and a consultant radiologist facilitated training of the clinical fellows and staff.

The CSD continued to provide administrative, logistics, and other support to the Nutrition Programme which is housed in the Division.

Clinical Research and Service Centre
PI: M.A. Salam
Funded by: Core (ICDDR,B)

In total, 100,380 patients (7,080 higher than in 2001) attended the Clinical Research and Service Centre (CRSC) (Dhaka Hospital) for treatment of their diarrhoeal diseases with or without associated health problems, of whom 302 (0.3%) died—exactly the same proportion as in 2001. In total, 35,643 (35.5%) patients with mild diarrhoea were referred to the PSKP clinic, and 3,234 (9.1%) of them were referred back to the CRSC for hospitalized management. Of the total patients, 67,242 (67%) were admitted to the Short Stay Ward (SSW); of them, 27,495 (41.6%) were discharged within 12 hours, 45,984 (68.4%) were discharged within 24 hours, and 7 (0.01%) died. Another 7,100 (7.1%) patients were admitted to the longer-stay General Ward (GW), Special Care Unit (SCU), Research Wards, and Nutrition Rehabilitation Unit (NRU); of them, 548 (7.7%) were admitted to the Research Wards under 11 different research protocols conducted by the CSD alone or in collaboration with the Laboratory Sciences Division. Of the remainder 6,552 patients, 2,391 were admitted to the SCU with very severe diseases; of them, 290 (12.1%) died. Of the 4,834 patients treated solely in the GW, 4 (0.08%) died compared to 8 or 0.2% in 2001. Of 7,100 patients admitted to the longer-stay wards, 256 (3.6%) absconded; 251 (3.5%) took discharge against medical advice, and 88 (1.2%) were referred to other hospitals for management of complications. In total, 98,135 litre of intravenous (IV) fluids (1.4 litre/admitted patient), and 386,049 litre of oral rehydration solutions (3.8 litre/patient) were used at the CRSC in 2002.

Duty doctor examining a patient admitted to the Special Care Unit of the Dhaka Hospital

Franchising Patient-care Services of ICDDR,B
Coordinators: Shahadat Hossain, Hasan Ashraf, and M.A. Salam

Established in March 2000, this collaborative project with a local NGO called Progoti Samaj Kallyan Protisthan (PSKP) is franchising the patient-care services of the Dhaka Hospital of ICDDR,B under the NGO Support Delivery Programme (NSDP). Located within ICDDR,B campus, the Clinic provides ICDDR,B's standard clinical

A patient with severe dehydration is drinking oral rehydration solution while receiving intravenous fluid

services to mild and uncomplicated diarrhoeal patients along with other ESP (essential services package) delivery based on the 'one-stop-shopping' concept. In 2002, PSKP staff treated 35,643 patients at the Clinic; of them, 3,234 (9.1%) were referred back to ICDDR,B for further, hospitalized management.

Promotion of Breast-feeding
PI: I. Kabir
Funded by: USAID

This activity exemplifies incorporation of important research findings into service activities of the Centre. The aim of this initiative is to promote and support exclusive breast-feeding (EBF) to infants aged less than 6 months through appropriate counselling and advocacy by trained breast-feeding counsellors, nurses, and physicians. Three thousand six hundred fifty-two mother-infant pairs were included in the breast-feeding counselling sessions during 2002. Of them, 1,980 (54%) mothers of infants aged less than 6 months were counselled to re-establish EBF, and another 1,638 mothers of infants aged 6-24 months were counselled to continue breast-feeding and start complementary feeding. The breast-feeding counsellors provided practical assistance to the mothers in positioning and attachment for successful lactation. At discharge, 60% of the mothers were reverted to EBF for their babies, and the rest 40% were practising partial breast-feeding. Of 158 babies who were non-breastfed on admission, 36% reverted to partial breast-feeding at discharge. Follow-up of 10% of the mother/infant pairs was carried out to evaluate the breast-feeding practices at their home after discharge from the hospital.

Nursing Unit
Nurse Manager: Mohammad Ullah

In 2002, a team of 67 nurses (52 staff and 15 trainees) supported the patient-care, research, and training activities of the Division and the Centre. One Nursing Officer is studying a 2-year BSc Nursing course at the College of Nursing in Dhaka. The Nurse Manager worked as a co-investigator of a research protocol titled "The identification of factors influencing and determining nurses' behaviour in the delivery of hands-on patient-care", funded by the DFID, UK.

X-Ray Unit

The two radiographers of the X-ray Unit, CRSC, performed 11,292 X-ray examinations that included 9,387 chest X-rays, 1,584 abdominal X-rays, and 321 X-rays of other body-parts. In total, 348 EKG examinations were performed.

Preventive Health Services/Care under Child Health Programme
Coordinator: Tahmeed Ahmed
Funded by: ICDDR,B

Established in 1988, the Child Health Programme (CHP), staffed by health workers, paramedics, and two doctors, serve the preventive

The success of the Child Health Programme as a model for dissemination of knowledge and practice of healthcare in the community has made its activities and role a regular component of the training courses for national and international participants

health functions of the CRSC. In addition to the Nutrition Rehabilitation Unit (NRU), it operates a Nutrition Follow-up Unit (NFU), an immunization centre, a health-education scheme, and a family-planning counselling and supporting unit. Most children and their mothers visiting the CRSC for treatment of diarrhoeal diseases and associated health problems do not receive any prior preventive health services, and the CHP offers these services based on the 'missed opportunities' concept. The programme imparts training to healthcare providers and undertakes operations research in these areas.

Three hundred forty very severely-malnourished children were treated during 2002 in the NRU where a standardized feeding protocol using inexpensive, locally-available and culturally-acceptable diets has been successfully developed and tested. The NFU treated 1,468 severely-malnourished children. Thirty-one children were diagnosed to have tuberculosis (TB) and received anti-TB treatment. In total, 17,690 health-education sessions on the prevention and home management of diarrhoea, prevention of malnutrition using appropriate complementary diets, and importance of immunization were conducted with mothers and female caretakers of children, covering an estimated 106,140 individuals. Immunization against 6 vaccine-preventable diseases was provided to 4,401 (100% of the eligible) children, and tetanus toxoid was administered to 4,858 women of childbearing age. Vitamin A capsules were also administered to 1,884 children who did not receive the vitamin during the previous 6 months. The programme provided family-planning services to 865 parents of children attending the hospital.

The CHP is the hub of the Centre's research on severe malnutrition. Ongoing studies focus on home-based management of severe malnutrition, assessment of the efficacy of metronidazole in improving nutritional rehabilitation, and diagnosis and treatment of TB in severely-malnourished children. Based on the findings of research conducted by the scientists of CSD indicating the usefulness of child stimulation in improving psychomotor development of malnourished children, a research project has been undertaken to examine if such a programme could be established at the NRU as a routine activity.

The success of the CHP as a model for dissemination of knowledge and practice of healthcare in the community has made its activities and role a regular component of the training courses for national and international participants. Largely because of the efforts of the programme in treating and preventing severe malnutrition, the WHO has decided to hold the regional training courses at the Centre, on severe malnutrition, for participants from South Asian countries.

Patients admitted to the Research Ward

Childhood TB project

Within the CHP, this component aims at identifying and managing TB among children attending the CRSC. The modified Kenneth-Jones score

Results of preliminary analysis show a good correlation between consumption of green banana and production of SCFAs in the colon

(KJS), a clinical scoring system, is used for diagnosis. The KJS is based on points given to age of the child, history of contact, nutrition status, chest X-ray abnormalities, BCG vaccination in the past, results of the Mantoux test (MT), and cervical lymphadenopathy. A KJS of 5 or more justifies anti-TB treatment. The cost-free treatment constitutes an initial 2-month therapy with isonicotinic acid hydrazide (INH), rifampicin, and pyrazinamide, followed by a 4-month therapy with INH and rifampicin. Over 400 children with a median age of 15 months were diagnosed and treated for TB over a 5-year period. The male-to-female ratio was 1.6:1, and 95% of the children were severely malnourished with a weight-for-age of 46±8% of standard reference. A history of contact with a TB patient was obtained in 40% of the children. MT was positive in 33% of the children. Radiological evidence of parahilar or paratracheal lymphadenopathy was observed in 58% of the children. The median KJS in this group of children was 5 with an interquartile range of 4-6.

Fellowship Programmes

For over a decade, the CSD has established case-management training programmes for medical doctors and nurses. The objective of the Clinical Fellowship Programme is to impart further training to young medical graduates with demonstrated initiatives for postgraduate studies in Paediatrics and Internal Medicine. Fifteen 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 recognize the training programme for higher studies in Paediatrics and Internal Medicine. Similarly, there is a programme for provision of hands-on training to 15 nurses at the CRSC each year.

Travellers' Clinic

This clinic processes clinical specimens submitted by various individuals and clinics within the Dhaka city for clinical pathology, microbiological and biochemical tests, and performs upper gastrointestinal endoscopic and sigmoidoscopic examinations. In addition, the Clinic carries out vaccination against many common infectious agents, including mumps, measles, rubella, *H. influenzae*, *S. typhi*, hepatitis A and B viruses, and varicella. In the last 6 months, the Clinic provided services to 1,024 patients. Discussion and planning are underway for modification and expansion of the services of the Clinic.

Experiments in progress at the Physiology Laboratory

Physiology Laboratory

PI: Golam H. Rabbani

The Physiology Laboratory was established in 1995 with the objective to provide opportunity to scientists of CSD and LSD to conduct studies on animals

During high patient visits, the shed outside the Dhaka Hospital remains busy

and humans to understand the pathophysiological mechanisms of enteric infections and electrolyte transport, and to evaluate the efficacy of antisecretory agents. Current activities include the following:

Short-chain fatty acids

SCFA analysis in stool samples: Short-chain fatty acids (SCFAs) are produced in the colon from the bacterial fermentation of un-absorbed carbohydrates. In collaboration with the Nutritional Biochemistry Laboratory of the Centre, methods of extraction of total SCFAs from stool specimen and performing of the assay using high-pressure liquid chromatography (HPLC) have been developed. Experiments were conducted to understand the relationship between production of SCFAs in the colon and intestinal inflammation, and analysis was performed for stool samples of patients enrolled in a clinical study to evaluate the role of green banana (containing amylase-resistant starch) in the management of childhood shigellosis. Results of preliminary analysis show a good correlation between consumption of green banana and production of SCFAs in the colon. These data will be useful in understanding the mechanisms of amylase resistance starch-mediated improvement in gastrointestinal diseases.

Myloperoxidase

Myloperoxidase in stool is a biomarker of gut inflammation, and a spectro-photometric assay method has been established for the determination of its concentration in stool for use in clinical and animal studies.

Oxidant-antioxidant biomarkers

Collectively, the whole blood GSH assay, thiobarbituric acid-reactive substances (TBARS) assay, total antioxidant status (TAS), and nitrite/nitrate (NO) assays indicate the oxidative and antioxidative status of the body, and these are useful in clinical and animal studies. For example, they are being 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 NO and reactive oxygen species in the pathogenesis of experimental shigellosis

In the first study, arsenic trioxide was administered to rabbits for one week and was found to cause a decrease in the whole blood GSH and an increase in the serum level of TBARS, and nitrite and nitrate

Patients attending the clinic at the Nandipara Field Site of the Clinical Sciences Division

compared to the normal levels. Treatment with antioxidants reverses these effects of arsenic. These results are being published in the *J Environ Sci Health* in 2003. Data of other studies are being analyzed.

Surveillance

Hospital Surveillance Programme

Diarrhoeal disease and enteric infection surveillance in Dhaka and Matlab hospitals

PI. A.S.G. Faruque
Funded by: USAID

Over 100,000 patients visit the Dhaka and Matlab hospitals of the Centre each year for the treatment of their diarrhoeal illnesses and associated health problems. A Diarrhoeal Disease Surveillance System, established at the Dhaka Hospital in 1979, was extended to the Matlab Hospital 5 years ago to collect information on clinical, epidemiological and demographic characteristics of patients. A systematic 2% sub-sample of patients attending the CRSC, Dhaka 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 available valuable information to the hospital clinicians in the provision of care to patients and enables the Centre to detect the emergence of new pathogens and in early identification of outbreaks and their locations enabling 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. Information collected is representative of the population. Hence, it provides an important database for conducting epidemiological studies, validation of results of clinical studies, help develop new research ideas and study design, improved patient-care strategies, and introduce preventive programmes. The table shows diarrhoeal pathogens isolated in 2002.

Nandipara Clinic

Coordinator: S.A. Sarker

The Nandipara Clinic, established in peri-urban Dhaka in 1985, provides opportunities to scientists of CSD in carrying out community research.

Fig. Estimated number of patients according to aetiologic agents enrolled into the ICDDR,B Surveillance Programme, Dhaka, 2002

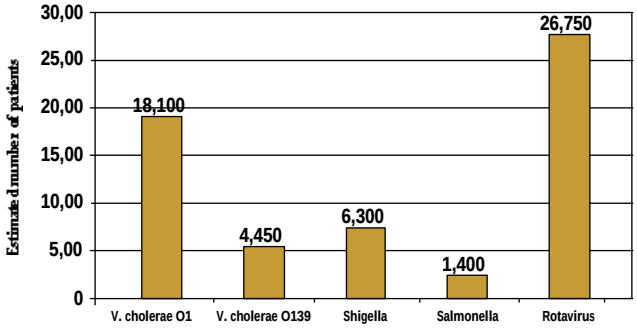


Table. Surveillance for aetiology of diarrhoea, Dhaka and Matlab, 2002

Pathogen identified	Dhaka (n=1,969)		Matlab (n=1,615)	
	No.	%	No.	%
V. cholerae O1	362	18.4	173	10.7
V. cholerae O139	89	4.5	15	0.9
Shigella	126	6.4	153	9.5
Rotavirus	535	27.1	363	22.5
Enterotoxigenic *Escherichia coli*	-	-	239	2.1
Salmonella	28	1.4	34	2.1
E. histolytica	25	1.3	19	1.2
Giardia lamblia	40	2.0	36	2.2

Note: Efforts to detect enterotoxigenic *E. coli* have been stopped at the Dhaka Hospital since October 2001

The expertise of Training and Education Unit of the Centre, along with resources of the CSD, in conducting international courses has earned for the Centre the prestige of being the seat for regional training courses on management of severe malnutrition

Covering a population of 3,500, living in an area of about 2.5 sq km, it provides treatment for minor illnesses of family members of individuals enrolled into research studies. During 1997-2001, the activities of the Clinic were expanded to the adjacent area for a study supported by the National Institutes of Health, USA, which examined the role of infection due to *Helicobacter pylori* as a cause of iron-deficiency anaemia. Ongoing research in this community-based clinic is assessing the prevalence of low gastric acid secretion (hypochlorhydria) relating to infection due to *H. pylori* in childbearing women and its potential role in the causation of iron-deficiency anaemia.

Other Accomplishments

***Regional Training Workshop 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 Southeast Asia, a region that has a very high burden of childhood malnutrition. The severe form of malnutrition—children with 'skin and bones' or swelling of feet—is associated with a high death rate that remained unchanged over the last five decades.

ICDDR,B has formulated standardized protocols, and the WHO has already published the guidelines for management of severe malnutrition in children (Management of severe malnutrition: a manual for physicians and other senior health workers). 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 are implemented across healthcare facilities in Asia and Africa to reduce the excessively high case-fatality rates among children with severe malnutrition in these regions.

Mothers/caregivers feeding their children admitted to the Nutrition Rehabilitation Unit of the Dhaka Hospital

Based on six instructional modules, the WHO has developed a training course. The modules were field-tested in ICDDR,B in December 2000. Subsequent courses, based on these modules, have been successfully organized in Afghanistan and East Africa, and very recently, in the Centre for participants from 6 South Asian countries. The expertise of Training and Education Unit of the Centre, along with resources of the CSD, in conducting international courses has earned for the Centre the prestige of being the seat for regional training courses on management of severe malnutrition.

***Improvement of physical facilities of the CRSC*:** According to the Strategic Plan of CSD, the physical facilities of the CRSC were improved during the year, which include the following:

a. Bed-space for hospitalized patients: Initially designed for 180 patient-beds, including 30 beds dedicated for two research wards, the CRSC remains overcrowded due to the significantly increased number of patient-visits since its establishment in 1983, resulting in great inconveniences to patients and their attendants and to

Eligible women in the reproductive age attending their patients are immunized against tetanus

hospital staff. Currently, the CSD is in the process of increasing patient-care area that would modestly improve space/patient-bed.

b. Improvement of Special Care Unit (SCU): The current SCU with 9 beds, being not adequate to meet the current need, often requires additional beds. The CSD, thus, decided to relocate the SCU to a more spacious area currently used as the Metabolic Research Ward.

c. Establishment of an ARI Ward: Acute respiratory infection (ARI) is the leading cause of childhood death and morbidity in Bangladesh. It is the most common associated illness among children attending the CRSC with diarrhoeal diseases and is the most important cause of deaths among children attending this hospital. Therefore, the CSD decided to establish a separate ward for the management of longer-stay patients with respiratory illnesses to improve care of such patients and to facilitate research on ARI.

d. Special Procedure Clinic (Travellers' Clinic): This Clinic performs endoscopic examinations mostly for research projects of CSD and LSD but it is also used for diagnostic purposes. As part of the Centre's effort to strengthen the 'Diagnostic Unit', renovations have been made, and establishment of ultrasonographic facilities has been planned.

***Awards*:** Dr. M. Ali Azam, Medical Officer, CHP, CSD, received a Young Investigator's Award for his research presentation titled "Reduction in case fatality among severely-malnourished children with diarrhoea using a standardized management protocol" at the 26th International Congress of Internal Medicine, held in Kyoto, Japan, on 26-30 May 2002. Dr. Jena D. Hamadani, Associate Scientist, CSD, received a Young Investigator's Award for her research presentation titled "The effects of zinc supplementation during pregnancy or infancy on mental development of infants" at the Mini-Symposium on Nutrition and Brain Function and Development, held in London, UK, on 16-19 September 2002. Dr. Hasan Ashraf, Associate Scientist, CSD, received the United European Gastroenterology Week (UEWG) 2002 Young Investigator's Award for his presentation at the 10th UEGW, held in Geneva, Switzerland, on 19-23 October 2002.

***Advanced Training on Cardio-pulmonary Resuscitation*:** In two batches, 2 members of the CSD staff, 4 clinical fellows, 2 nurses, and 4 nurse fellows were trained on advanced cardio-pulmonary resuscitation organized by, and conducted at, the BIRDEM. This programme, expected to improve the life-support activities of the CRSC, would continue in 2003 and beyond.

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 the 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 fieldwork conducted within the Centre and elsewhere, and provides a testing ground to determine what adaptations are needed to make positive findings from artificial controlled research studies applicable to real-world settings.

The Division uses its own 'real-world' field sites. In contrast with Matlab where health services are delivered by ICDDR,B staff in a manner unlike the way services are delivered in Bangladesh, the 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 the government and non-government organizations (NGOs)-provided health services.

The 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 testing of interventions in the research sites of the Division.

The 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.

The HSID has 5 international-level staff members. In addition to Division Head Dr. Breiman, who is on secondment from the Centers for Disease Control and Prevention (CDC), Atlanta, USA, Dr. Charles Larson, on secondment from 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 is an operations research scientist, and Ms Mary Hadley from the United Kingdom is coordinator for the Family Health Research Project. Thirty-eight national

Mr. Neil Brandes, Ms Gina Coco, and Dr. Ruth Fischer of USAID visiting the Kamalapur field site

Dr. Viveka Persson of SIDA-SAREC at the Kamalapur field site

officers and 179 general services and field-level staff members work in the HSID. Ten HSID personnel were studying abroad during 2002 for their masters and PhD programmes (3 PhD and 7 masters).

Field Sites Unit
Head: Ali Ashraf

Kamalapur

The Kamalapur urban site is located in the southeast quadrant of Dhaka, approximately 30 minutes' drive from ICDDR,B. Eighty personnel work in the project. Kamalapur, with a population of 140,000 (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, and 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. The first part of the summary of infectious disease activities discusses the disease burden studies, and the second specific interventions. It concludes with a look ahead to future studies under active development.

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 at 5 of 8 unions. Twelve personnel are involved in 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 at 7 of 16 unions. Twelve personnel are involved in surveillance and management of data collection, and 10 research and field support staff facilitate and support targeted research.

The attack rate of *Shigella* has remained much higher in young children than in persons aged 5 years and over

During the year, several research projects were conducted in Mirsarai and/or Abhoynagar. These are: (1) Strategies to improve reproductive health services for adolescents; (2) Flour fortification with vitamin A and iron in healthy school-age children; (3) Meeting additional health needs of clients by addressing missed opportunities at the ESP clinics; and (4) Programmatic and non-programmatic determinants of low immunization coverage in Bangladesh.

Infectious Diseases Unit
Head: W. Abdullah Brooks

The Unit focuses its work at the Centre's field sites. During 2002, most of the infectious diseases work was carried out in Kamalapur. There are plans for expansion to other HSID field sites in the future.

Studies on disease burden

Dengue: The NIH-funded study on the burden of dengue disease began in October 2002 and has continued apace. Major accomplishments include a pre- and post-season serosurvey of nearly 1,000 randomly-selected individuals, whose blood will be studied by MAC ELISA for a 4-fold titre change indicating recent infection, and single dilution-neutralizing antibody assay to determine the infecting serotype. It is anticipated that this will give a clear picture of infection patterns and disease burden, irrespective of clinical disease presentation. In addition, longitudinal fever surveillance has continued. One member (Dr. Podder) of the team from the LSD was sent to Indonesia for training in conducting the neutralizing antibody assays.

Typhoid: The 2001 dengue longitudinal surveillance, funded by USAID, was accompanied with blood culture collection during December 2000-October 2001 to determine other causes of fever besides dengue. Those cultures yielded high rates of *Salmonella typhi*, indicating that the overall incidence across all age groups was about 4 cases/1,000 people/year. However, the rates were over 8 times higher in children aged less than 5 years (nearly 2% per year) than people aged 5 years or older. In about 53% of cases, typhoid fever occurred among children aged less than 5 years. Additionally, only 4% of the infections in young children occurred in the first year of life, whereas 85% of the infections occurred among children aged less than 5 years during the next 3 years of life. This provides further evidence that strategies of disease prevention with vaccines should be focused on children aged less than 5 years.

Shigella: Study on the burden of shigellosis disease, funded by the International Vaccine Institute (IVI), Seoul, Korea, has continued into its second year of observation. During the first year, stool samples were collected from over 1,200 persons. The attack rate of *Shigella* has remained much higher in young children than in persons aged 5 years and over. About half of all shigellae was *S. flexneri*, and about one-third

Influenza vaccine arrives in cold-chain at the Kamalapur field site

ICDDR,B researchers working for randomization of their study subjects

was *S. boydii*. It is planned that the surveillance during 2003 will move from a passive system to one that includes weekly home visits.

Respiratory viral infections: As part of an increasing trend of inter-institutional collaboration, a pilot study of sera from the 2001 dengue surveillance was analyzed at the Influenza Branch at the CDC, for antibodies to respiratory viruses. It was found that nearly half of all febrile respiratory diseases could be explained by the common respiratory viruses and that influenza (A and B) and human metapneumovirus are important causes of febrile respiratory illness among children aged less than 13 years.

Vaccine studies

A prospective, randomized, partially-blinded, placebo-controlled, Phase–III, multi-centre trial to assess safety, tolerability, and immunogenicity of liquid influenza virus vaccine, trivalent, types A and B, live, cold-adapted (liquid CAIV-T), administered concomitantly with live-attenuated, polivirus vaccine in healthy children

The first Good Clinical Practice (GCP)–level trial of an experimental influenza vaccine in the Kamalapur urban site was completed and closed in May 2002. Of all the international sites, Kamalapur had the highest number of vaccinees.

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, administered concomitantly with a combination live-attenuated, mumps, measles, and rubella vaccine in healthy children aged 11-24 months

The second GCP influenza vaccine study began in October 2002. Although vaccine arrived only 3 days before the end of the recruitment period, the team successfully enrolled and vaccinated its allotted 150 study subjects in the 3-day period. The second round of vaccination was completed in November. In the interval, there was a National Immunization Day for polio. Working closely with the Dhaka City Corporation, the study succeeded in ensuring complete polio coverage for all study subjects, while losing none to the study for unscheduled live vaccine exposure. This illustrates the ability of the Centre to conduct ground-breaking research without detracting from full support to the existing public-health activities. The vaccine is ongoing in its morbidity surveillance phase.

Future activities

Studies on incidence and transmission of tuberculosis: To complement studies on rural incidence, the incidence of tuberculosis will be defined and issues relating to transmission (rates in households and

The purpose of the Journal Club is to provide an opportunity to discuss and explore research methodology. Once monthly, a member of the Division chooses a peer-reviewed article for discussion among the Club participants

neighbourhoods) and successful therapy will be addressed. Healthcare-seeking practices of TB patients in urban areas of Bangladesh will be studied, and the role of non-government health providers in achieving the goals of DOTS will be evaluated.

Burden of typhoid disease: This is a joint study on disease burden involving ICDDR,B, CDC, and the IVI. It is integrated with the dengue disease burden study and takes patients from the same febrile episodes. It seeks to continue to confirm the understanding of the typhoid disease burden and identify modifiable risk factors for illness. The objective is to lay the groundwork for vaccine intervention in the appropriate high-risk population.

Typhoid rapid diagnostic study: This is an add-on to the typhoid study, funded by CDC, to compare two rapid diagnostic kits for the identification of typhoid cases, either as an adjunct to, or in lieu of, blood cultures in field settings.

Evaluation of typhoid vaccine: Discussions are ongoing with several sponsors on plans for evaluating promising vaccines to prevent typhoid fever.

Study on rapid diagnostic assay for Shigella: The objective of this study is to determine the sensitivity, specificity, and positive and negative predictive values of rapid diagnostic assays for the diagnosis of *S. dysenteriae* type 1-associated infection.

A post-vaccination waiting area

Epidemiology of respiratory infections: In collaboration with the CDC, studies on viral aetiology will be carried out among patients with pneumonia to define the role played by viruses, such as influenza, respiratory syncytial virus, parainfluenza, adenovirus, and metapneumovirus in childhood pneumonia. In the same population, a pneumococcal disease burden study will be conducted: an epidemiological and laboratory-based study to define the disease burden of pneumococcal pneumonia and invasive pneumococcal disease, associated with sepsis and meningitis.

Journal Club

Although initiated by the Infectious Diseases Unit, this is a division-wide activity. The purpose of the Journal Club is to provide an opportunity to discuss and explore research methodology. Once monthly, a member of the Division chooses a peer-reviewed article for discussion among the Club participants.

Surveillance and Data Resources Unit

Head: Carel van Mels

The Unit was created in August 2002 out of the previous Data Resource Unit with added responsibilities in the area of surveillance design and demographic research. Carel van Mels moved over from the Matlab Health and Demographic Surveil-

Asthma study challenge test in the Kamalapur Clinic

lance Unit in the Public Health Sciences Division to head the newly-created unit. A demographic research sub-unit has been added to the Unit.

The sub-unit is responsible for the "Levels, trends and determinants of unwanted pregnancies in rural Bangladesh" protocol. This USAID-funded protocol, approved during the reporting period, started in December 2002. The staff members of the Unit also participate in the USAID-funded "Plateauing of the Bangladesh fertility decline" study of the Centre's Population Sciences Programme, while the Unit gives technical support to this protocol.

The Unit provided assistance with the questionnaire design and preparation of the data entry and editing programmes for several surveys, including the end-line survey of the adolescents. It also supported the preparation of the extended health and demographic surveillance in Kamalapur. Kamalapur has the only urban surveillance system of ICDDR,B and, from next year, will cover annually a population of around 200,000. Sub-samples will be visited at a higher frequency. To be better able to provide support to surveys, the Unit created a space with 10 workstations for data entry. In addition, the Unit provides expertise on statistical analysis to different protocols.

Apart from this assistance to other researchers and protocols in the Centre, the Unit is responsible for the continuous cleaning and entry of the regular HSID surveillance data and preparation of the three-monthly surveillance reports. Ways have been reviewed to improve the accessibility and user-friendliness of the HSID surveillance databases.

The draft of a chapter for the INDEPTH monograph on causes of death has been prepared with input from the Field Sites Unit. This monograph will be published in 2003. Staff of the Unit participated in several other INDEPTH activities, such as the Burden of Disease Workshop in Dar-es-Salaam and the Model Life Table Workshop in Elmina (Ghana). INDEPTH is the International Network of field sites with continuous Demographic Evaluation of Populations and Their Health in developing countries. It unites 31 surveillance organizations in Africa and Asia. The HSID Surveillance System is one of its members. To raise the profile of the HSID surveillance sites, a poster presentation was developed in collaboration with the INDEPTH secretariat and was shown at the November 2002 Global Forum for Health Research in Arusha.

As coordinator of the Centre's Project Management Information System, the Unit head arranged a second mission by Mr. Frans Schiereck, who provides technical expertise (in this area) to the Centre and assists in the decision-making process on which software to use. The mission was, for a large part, funded by the Netherlands Management Cooperation Programme. The Unit head participated in

Despite the availability of large health service-delivery network in the public sector, the private sector still dominates the healthcare provision in the HSID field sites

One-fourth of diarrhoeal episodes were treated with ORS and drugs mostly obtained from the pharmacy-based healthcare provider. The use of ORS is widely recommended by the pharmacy-based healthcare provider along with other drugs

the negotiations with a possible supplier of a Centre-wide Management Information System on specifications and necessary modules.

Selected childhood illness and use of health services in HSID field sites

In addition to quarterly demographic surveillance, data on the prevalence of diarrhoea and acute respiratory tract infection (ARI) among children aged less than 5 years were collected at the rural field sites at Mirsarai, Abhoynagar, and Keshobpur of Health Systems and Infectious Diseases Division since April 2000. Data were collected from the caretakers (primarily mothers) using one-week recall period and the following operational definition of diarrhoea and ARI, including resort to healthcare.

Diarrhoea: Loose or watery motion three or more times and stool with blood, irrespective of number of defaecations in a day during the last 7 days.

ARI (for children aged less than 2 months): Noisy breathing, fast breathing, and severe chest in-drawing. The danger signs include blue/dark colour of skin/body, reluctance to feeding, abnormally sleepy, strider in calm child or wheezing, convulsion (convulsion is not always necessary symptom for ARI), fever or low body temperature.

ARI (for children aged 2 months up to 5 years of age): Difficult breathing (noisy breathing, fast breathing, and chest in-drawing). The danger signs include blue/dark colour of skin/body, abnormally sleepy, and/or difficulty in walking, unable to drink, strider in calm child or wheezing, convulsion, and severe malnutrition.

No consultation was made with any healthcare provider for 17% of diarrhoeal episodes. Only ORS was used in 26% of diarrhoeal episodes. Initially, the caretakers bought ORS from the grocery or other types of shops for treatment. One-fourth of diarrhoeal episodes were treated with ORS and drugs mostly obtained from the pharmacy-based healthcare provider. The use of ORS is widely recommended by the pharmacy-based healthcare provider along with other drugs. The most frequently-prescribed drugs are metronidazole and nalidixic acid. Only in a few cases of diarrhoeal episodes, zinc was also prescribed.

No consultation was made with any healthcare provider for 8% of ARI episodes. Data on the name of drugs prescribed by the healthcare providers are available for 81% of all ARI episodes. The most commonly prescribed drugs are co-trimoxazole, amoxicyllin, and erythromycin.

Despite the availability of large health service-delivery network in the public sector, the private sector still dominates the healthcare provision in the HSID field sites. The pharmacy-based healthcare providers, followed by private clinic/hospitals and homeopathic practitioners, were mostly consulted for treatment of diarrhoeal and ARI episodes. Although most pharmacy-based healthcare providers are not formally trained, they have a prominent role in influencing healthcare-

Table. Childhood illness and use of health services in HSID field sites

	2000*	2001	2002
Children under surveillance	7,124	7,132	7,299
Total episodes of diarrhoea	1,308	1,208	717
Use of health services for diarrhoea			
None	16%	17%	17%
Public sector	5%	5%	5%
Private sector	79%	78%	78%
Total episodes of ARI	276	179	153
Use of health services for ARI			
None	8%	9%	7%
Public sector	13%	16%	16%
Private sector	79%	75%	77%

*Data for three quarters

Several new research ideas were generated and discussed at the division level. Some of these new concepts have been developed into full-scale research protocols

seeking behaviour of the caretakers. Any public-health intervention attempting to test new protocol for treatment of children with diarrhoea and ARI should consider the role of pharmacy-based healthcare providers.

Health and Economic Policy Unit
Head: Ziaul Islam

The Unit is mandated to pursue key research agenda pertinent to service-delivery systems and economic issues in the field of health, nutrition, and population. It functions to promote relevant scientific concepts, protocol development, project implementation and dissemination by enhancing team spirit, partnership building and mentoring individual potentials. As a catalytic body, the Unit is internally linked with the Programme on Health and Family Planning Systems, Programme on Infectious Diseases and Vaccine Sciences, Family Health Research Project, and other units housed in the Division. It also facilitates Centre-wide collaboration and networking with external partners in national and international arenas. In 2002, four health systems research projects and two economic studies were conducted by the staff members of the Unit. Besides, several new research ideas were generated and discussed at the division level. Some of these new concepts have been developed into full-scale research protocols. With regard to cross-divisional scientific involvement, the unit members got actively involved in programmes and project activities of common interests led by other divisions, namely LSD and PHSD during the same period. The Unit facilitated Centre's representation abroad in 3 international workshops organized by INDEPTH and International Vaccines Institute and several conferences/workshops organized by the Ministry of Health and Family Welfare, Government of Bangladesh.

The asthma study team at the Kamalapur field site

Studies conducted during the reporting period are briefly described below.

Addressing missed opportunities at ESP clinics
Meeting additional needs of clients by addressing the missed opportunities at the ESP clinics

In primary healthcare clinics, clients usually appear for a specific service or need at a time and the providers, in turn, concentrate on that particular service or need. Other unstated potential need(s) of the clients are likely to remain unmet. These unmet/additional health needs could be addressed by developing appropriate screening tools, guidelines, and providing necessary training to the providers

Different strategies were tested to disseminate information on reproductive health. User-friendly booklets on Puberty, Marriage and Family Life, and STI and HIV/AIDS, were developed and distributed

and thus enabling them to tap the opportunity of client-contact for addressing unmet/additional health need(s). With this assumption, a study was aimed at: (a) assessing the current practices and barriers to identifying unmet health needs and tapping missed opportunities at the GoB- and NGO-run ESP clinics and (b) testing a strategy to address missed opportunities. The study was conducted in collaboration with the Ministry of Health and Family Welfare and NGO Service Delivery programme. The initial findings showed that a screening tool could be useful; the proportion of additional needs identified by using screening tools among the attending client in GoB and NGO clinics were 13% and 30% respectively. Of all identified additional needs, almost 91% were provided with services in GoB clinics and 58% in NGO clinics. The rest were either referred to or provided with appropriate information (preparation of final report is underway).

Reproductive health services for adolescents

Strategies to improve reproductive health services for adolescents in the public sector and by the NGO

Evidence from a number of studies has confirmed that adolescents in Bangladesh do not have accurate knowledge about reproductive health issues and have limited access to accurate information and services. Evidence also suggests that despite rapid development of family-planning services over the last 25 years, the reproductive health needs of adolescents were not addressed by the government programme. On the other hand, a growing number of programmes aimed at improving the reproductive health of adolescents have emerged in the NGO sector, but most of these programmes are still small-scale and reach only a few adolescents.

Considering the above situation, a study was undertaken to improve the knowledge of reproductive health of schoolgoing and non-schoolgoing adolescents and increase the use of clinics by adolescents in urban and rural areas.

The intervention addressed the adolescents in three selected settings—community, school, and garment factory. Different strategies were tested to disseminate information on reproductive health. User-friendly booklets on Puberty, Marriage and Family Life, and STI and HIV/AIDS, were developed and distributed. Besides, health-education sessions in the community and peer-education supported by above-mentioned booklets were implemented. The effects were measured through comparing baseline and end-line surveys (continued data analyses are planned, and preparation of final report is in progress). Early results include the following:

- Community-based, peer groups meeting around reproductive health issues were extremely difficult to maintain and are labour-intensive. Even with extensive effort, two-thirds of the subjects dropped out of the peer groups.
- The school-based intervention was able to achieve parents' and teachers' support for the distribution of three booklets dealing with: (1) normal sexual development, (2) family planning, and (3) STDs/AIDS.

Despite continuing concerns and interests of all stakeholders, half of the children are not fully immunized in Bangladesh

- The school-based distribution of booklets significantly improved knowledge in several areas, but did not have an important impact on behaviours.

- Garment workers, the third target group, are a very mobile group. Most subjects who entered into this study had terminated their employment within a few months. To reach this population, it will be necessary to devise alternative strategies which link work-sites with the communities from which these youths have in-migrated to Dhaka.

Towards achieving optimal immunization coverage in children
Programmatic and non-programmatic determinants of low immunization coverage in Bangladesh

Despite continuing concerns and interests of all stakeholders, half of the children are not fully immunized in Bangladesh. Earlier, there had been remarkable success in increasing immunization coverage among children from 2% in the mid-1980s to 95% with at least one dose. However, in recent years, coverage has been dropping. There are barriers that must be overcome to achieve optimal protection, which would result from full immunization. Children are still not fully immunized due to high drop-out rates. The most common reasons parents give for not completing vaccination of their children have been somewhat consistent and relate to what is classified in these surveys as "lack of information and knowledge."

In this background, a study is being conducted to ascertain the reasons of existing gaps in effective communication relating to immunizations. Data collection for both quantitative and qualitative components has been completed from 6 selected upazilas and are being analyzed. The findings of the study are expected to provide useful information to design appropriate strategies to reduce drop-outs and re-invigorate the national immunization programme.

Food fortification for school-aged children
Randomized, double-blinded controlled trial of wheat flour (chapatti) fortified with vitamin A and iron in improving vitamin A and iron status in healthy, school-aged children in rural Bangladesh

The objective of the study was to evaluate impact of consuming chapatti fortified with iron and vitamin A by the study children, primarily, on their vitamin A status reflected in serum retinol level and in addition, on iron status reflected on serum ferritin, transferrin receptor and haemoglobin levels at 6 months. This was conducted as a cluster-randomized, double-blinded controlled trial in a rural area of Mirsarai under Chittagong district. Chapatti prepared from wheat flour fortified with vitamin A (retinyl palmitate, 10,000 IU/kg flour), iron (electrolytic elemental iron, 66 mg/kg flour), and a few other vitamins and minerals were consumed by apparently healthy school-aged children (6-15 years) daily for 6 months. Three hundred fifty-two healthy school-aged children were enrolled from 48 randomly-selected households for the study. Baseline, a mid-point and end-line blood samples were examined to see the effect of the intervention.

Preliminary results suggest a significant positive impact of fortification on the serum retinol levels of the study children.

Economic evaluation of shigellosis in an urban area of Bangladesh

In collaboration with the International Vaccine Institute, an economic evaluation of shigellosis cases was initiated in the Kamalapur ICDDR,B surveillance area. The purpose of this study is to determine the total cost of treatment by estimating the cost from two perspectives—providers' cost and patients/household costs. Data are being collected through household interviews and facility-level surveys as planned in the protocol.

Cost analysis of protocolized management of severely-malnourished children in PSKP clinics

A costing study was done during the reporting period at 3 selected PSKP clinics in Dhaka to assess the additional cost implications of operating "protocolized management of severe malnutrition in children in urban primary care clinics." This is an intervention jointly undertaken by ICDDR,B and PSKP. Cost information on the part of the provider and the households was collected through a series of household interviews, provider interviews, and review of records (data analysis and report writing are in progress).

Projects

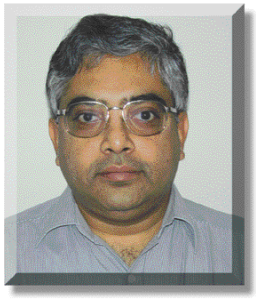
- Meeting additional health needs of clients by addressing missed opportunities at the ESP clinics.
- Strategies to improve reproductive health services for adolescents.
- Flour fortification with vitamin A and iron in improving vitamin A and iron status in healthy school-aged children.
- Programmatic and non-programmatic determinants of low immunization coverage in Bangladesh.
- Economic evaluation of shigellosis in an urban area of Dhaka, Bangladesh.
- Cost analysis of community-based protocolized management of severely-malnourished children in the PSKP clinics.

Ongoing research

Fourteen research protocols are ongoing during 2002.

Preliminary results suggest a significant positive impact of fortification on the serum retinol levels of the study children

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 diseases. As shown in the organogram, the Division is broadly divided into two functional components: research and services. The research component is further subdivided into 10 units, which perform a wide array of activities. Many techniques developed in the research units are transferred to the Clinical Laboratory Services, which, in turn, makes such services available to the public at large. Currently, we are at a stage of introducing molecular diagnostics into the Clinical Laboratory Services. Scientists in the Division perform independent projects, extend support to other projects within and between divisions and programmes, participate in the in-house, regional, national and international training, act as overseas consultants and also extend service facilities, when required. Activities of the LSD range from low-tech interventions (filtration of water through sari cloth to prevent transmission of cholera) to very basic research, such as the fundamental discovery of filamentous phage-packaging diverse elements, thereby playing an important role in horizontal transfer of more genes than previously appreciated.

The Division has 4 International Scientists, 1 Adjunct Scientist, 15 National Scientists, and 261 members of technical and support service staff, of whom 109 are females and 171 are males. Of them, 170 are on fixed-term, and 74 are on contractual service agreements (CSA), while 36 are daily wagers. In recognition of their outstanding contributions during the past few years, 2 National Scientists were ranked as International Scientists, 4 Associate Scientists were promoted to Scientists, and 4 technical and administrative managers were reclassified to their next higher level. Dr. Ramesh C. Halder left the Division to accept a fellowship at the University of Southern California, USA.

Scientists of the Division were actively involved in consultancy services with the World Bank, International Vaccine Institute, Japanese International Cooperative Agency (JICA), and Situation Assessment of Sexual Health (SASH) Clinical Epidemiology Project in China. Thirty scientists and senior technical staff participated in overseas scientific meetings, seminars, and workshops, and attended short-term training, while 7 members of the staff are currently abroad for higher studies in different areas. Thirty distinguished scientists from different research institutions and funding agencies visited the LSD for discussion on various collaborative research activities with scientists of the Division.

During the year, the Division completed 10 research protocols and initiated 7 new protocols. Of the 33 ongoing protocols, 5 are cross-divisional research activities—2 with Clinical Sciences Division, 2 with Health Systems and Infectious Diseases Division, and one with Public Health Sciences Division. The Division continued extending technical support for antimicrobial resistance surveillance to 9 participating laboratories in Nepal and for cholera management activities in Mozambique. The Division is in the process of beginning new collaborative research activities with Intercell Biomedical Research and Development AG, Austria, Centre for Southeast Asian Studies of Kyoto University in Japan and with scientists of Institut Pasteur, Paris, France.

The Division acquired an atomic absorption spectrophotometer with hydride generator, automated blood analyzer, automated blood gas analyzer, a two-chambered walk-in cold room, a fluorescence-activated cell sorter (FACS), and a nucleotide sequencer to facilitate high-tech research and clinical diagnostic activities

In 2002, the LSD scientists published 42 papers in different peer-reviewed journals carrying excellent impact factors and presented 10 abstracts at international scientific seminars and workshops. The Division set up a functional data-nest equipped with 8 computers, and shifted the Specimen Collection Unit of the Clinical Laboratory Services Programme to the southwest corner of the ground floor of the Hospital Building, providing more facilities for its users. A new RTI/STI Laboratory was opened on 7 July 2002. The relocation of the Virology Unit to the eastern wing of the second floor of the Hospital Building was completed, and the construction work for installation of a new walk-in cold room was also completed. During the year, the Division acquired an atomic absorption spectrophotometer with hydride generator, automated blood analyzer, automated blood gas analyzer, a two-chambered walk-in cold room, a fluorescence-activated cell sorter (FACS), and a nucleotide sequencer to facilitate high-tech research and clinical diagnostic activities.

The external review of the scientific activities of LSD was conducted during 4-5 June 2002. Dr. I.K. Wachmuth, Dr. Tikki Pang, Dr. Wanpen Chaicumpa, and Major General A.S.M. Matiur Rahman reviewed the research activities and achievements of the Division over the past five years. The reviewers praised the commendable scientific achievements of the Division and encouraged the scientists to keep up quality research activities in the future.

Consultancy service in Sri Lanka for World Bank activities

Dr. Tasnim Azim, Scientist and Head, Virology Laboratory, worked as a member of the International Development Association (IDA) team which undertook HIV surveillance mission to Sri Lanka from 28 September to 9 October. The team consisted of Ms Nancy Fee, HIV/AIDS Development and Management Officer, World Bank, South Asia, and Madhuwanthi Opatha and Corrine Perrera of World Bank, Colombo. The purpose of the mission was to collaborate with the Government of Sri Lanka in the development of an appropriate second-generation HIV surveillance system, in line with the internationally-accepted standards established by WHO and UNAIDS. The team developed and detailed the scope, approach, requirements, and costs of the proposed surveillance system.

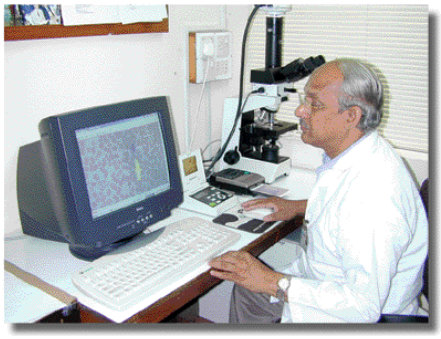
Consultancy service between ICDDR,B and IVI

As per the agreement between ICDDR,B and International Vaccine Institute (IVI), Mr. Ansaruzzaman visited 5 laboratories in 4 countries during September-December 2002 to review ongoing laboratory work carried out under the DOMI surveillance and vaccination programmes. The laboratories visited were: Public Health Laboratory at Hechi, China, National Laboratory for Infectious Disease at Hue and Pasteur Institute at Nha Trang, Vietnam, NAMRU-2 at Jakarta, Indonesia, and Aga Khan University Laboratory in Karachi, Pakistan. During the review, Mr. Ansaruzzaman participated in the laboratory work and reviewed different technical, methodological and logistic problems, and trained laboratory technologists and supervisors to improve their quality of work according to standard operating procedures.

Surveillance of antimicrobial resistance of selected pathogens in Nepal: technical cooperation

PIs: G.B. Nair, M.A. Hossain, and M. Rahman

Empirical treatment of clinically-diagnosed cases of infection frequently results in treatment failure, especially in developing countries, due to



Senior scientist Dr. Anowar Hossain interpreting the haematological microphotograph utilizing the computerized microphotographic system

Inaugural ceremony of the workshop on antimicrobial resistance in Nepal where Centre Director Professor David Sack is seen with the Health Minister, Secretary of Health and Director General of Health, HMG, Nepal

the increasing emergence of antimicrobial resistance. Treatment failures are more frequent in places where the capacity of the diagnostic microbiology laboratory is limited due to lack of technical manpower and inadequate support services. To help develop the capacity of the Ministry of Health, His Majesty's Government, Nepal, to fight infectious diseases, the USAID Nepal Mission launched an infectious disease programme. Laboratory-based surveillance of some selected infectious diseases was initiated in 1999 and is ongoing. Scientists of LSD have been providing technical support to 9 laboratories—5 in the Kathmandu valley, 3 in the Western region, and one in the Eastern region. The main objectives are: (a) to strengthen their diagnostic capacity for the surveillance of antimicrobial resistance of selected pathogens which includes *V. cholerae* and *Shigella* representing diarrhoeal diseases, *S. pneumoniae* and *H. influenzae* to represent acute respiratory infection, and *N. gonorrhoeae* to represent STD; and (b) to help develop an external quality-control network involving these 9 laboratories and train technical manpower as part of a transfer of technology. Initially, members of the technical staff were trained in Dhaka, essential laboratory supplies were provided, and follow-up technical visits were made to monitor and evaluate the progress of the activities. Additionally, problems were discussed, and remedies were suggested along with hands-on training at the bench. Yearly workshops were conducted to train and retrain the manpower as part of manpower development and transfer of technology. Previously-trained technical staff facilitated the workshops under the expert guidance of laboratory scientists from ICDDR,B. Bacterial isolates were obtained from participating laboratories for validation of their identification and antimicrobial susceptibility testing. In 2002, a hands-on training workshop was held in January in Kathmandu for 22 laboratory technologists and microbiologists working in various regions of Nepal. Two orientations were organized for 40 physicians and 40 nurses—one held in Kathmandu and the other in Pokhara in January and July 2002 respectively. The objective of these orientations was to make participants aware of the importance of the emerging antimicrobial resistance of various infectious disease pathogens. In total, 154 bacterial isolates were obtained, of which 115 were *V. cholerae*, 21 *Shigella*, 10 *S. pneumoniae*, 5 *H. influenzae,* and 3 *N. gonorrhoeae*. The validation scores of the laboratories ranged from 75% to 90%.

Acute Respiratory Infection Laboratory
Head: Mahbubur Rahman

The Acute Respiratory Infection Laboratory, recently established as a separate unit, is involved in studies on acute lower respiratory infections (ALRIs), primarily pneumonia, which is a leading cause of morbidity and mortality in children aged less than 5 years in Bangladesh. About

Dr. Mahbubur Rahman at work in the ARI Lab

25% of all deaths of children aged less than 5 years and about 40% of deaths in infancy in Bangladesh are associated with pneumonia. *S. pneumoniae* and *H. influenzae* frequently cause the disease. The Laboratory is studying the epidemiology, immune response, rapid diagnosis, and antibiotic resistance among bacterial pathogens of pneumonia in children aged less than 5 years for better case management, to disseminate the relevant information in a timely manner, and finally to improve the use of such data for policy decisions, particularly in the ARI control programmes of the Government of Bangladesh. Studies also include other emerging infections, such as dengue, resistant typhoid fever, and emergence, epidemiology, and mechanism of antibiotic resistance in enteric pathogens and meningitis. Technical facilities include culture of clinical samples, determination of antibiogram (MICs), manipulation of DNA, PCR, RT-PCR, plasmid analysis, gel electrophoresis, and serological techniques.

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 and environmental sources. Facilities are available to perform research in the field of diagnostic and molecular biology. The techniques used in this laboratory include gel electrophoresis (conventional agarose gel electrophoresis, pulsed-field gel electrophoresis, 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 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 also done using plasmid analysis, ERIC PCR, RAPD, PFGE, ribotyping, PCR-RFLP, and RFLP of O-antigen sequence by long PCR as an aid to epidemiological studies. Experiments with animal model for pathogenicity and antisera for bacterial identification are also raised in this unit. Extensive studies carried out by the investigators of this unit include the phenotypic and molecular epidemiology of *V. cholerae*, *V. parahaemolyticus*, *Campylobacter*, *E. coli* (especially on Shiga-toxin-producing *E. coli*), *Shigella*, *Salmonella*, *Aeromonas,* and *Helicobacter pylori.* Detailed studies on various areas are conducted to understand the basic mechanisms involved in the emergence of new epidemic strains. Studies on the mechanism of antibiotic resistance of *Shigella* and *S. typhi* are also ongoing. National and international fellows are frequently trained in various molecular biology techniques. MSc and MPhil students are performing research under the supervision of scientists in collaboration with various universities in Bangladesh.

Scientists in the Enteric Microbiology Laboratory are occupied with a variety of ongoing research

Demonstration of biofilm device in the Environmental Microbiology Laboratory

Environmental Microbiology Laboratory
Head: Md. Sirajul Islam

In 2002, the Laboratory successfully completed two major studies on cholera. One study was focused on the environmental intervention of cholera employing 8-fold sari material as a filtering device in 65 villages in the Matlab Health and Demographic Surveillance System (HDSS) area to filter surface water, which yielded a 48% reduction in cholera ($p < 0.005$) cases in study households compared to the control. The other was based on the ecology and epidemiology of *V. cholerae* in Bangladesh. Extensive data analyses were done to assess the role of phytoplankton, zooplankton, and physicochemical parameters in maintaining the endemicity and seasonality of cholera in Bangladesh and also to test the hypothetical model for outbreaks of cholera. Results obtained from the study fit well with the model and showed correlation with phytoplankton, zooplankton, and some physicochemical parameters of water at several sampling sites. A new collaborative study with Northumbria University, UK and the Ministry of Health, Mozambique, has been initiated in 2002 to see whether similar environmental factors that contribute to epidemics of cholera in Bangladesh also exist in Mozambique. In a separate study, we isolated the pandemic strains of *V. parahaemolyticus* (O3:K6) for the first time from the aquatic environment of Bangladesh. These studies are detailed in the chapter on Infectious Diseases and Vaccine Sciences.

Immunology Laboratory
Head: Firdausi Qadri

Studies extending from diarrhoeal diseases to respiratory infections, including tuberculosis and the effects of malnutrition on the immune response, are targeted. Rapid detection and diagnosis of infections using immunomarkers in the systemic and mucosal environment has always been a major focus in this laboratory. The production of specific monoclonal antibodies for the characterization of emerging and re-emerging pathogens is also an important area of study.

In addition to the study of natural infections in patients and in animal models, the aim of the Laboratory is to study means for adequate protection using available candidate vaccines and alternate medicines, including micronutrient interventions. The projects in this area, thus, include studies in patients with natural infection to understand the best correlate of protection in different diseases. Attempts are made to compare the responses observed after infection with that seen after immunization with candidate vaccines or after therapy with supplementation.

Rapid detection and diagnosis of infections using immunomarkers in the systemic and mucosal environment has always been a major focus in the Immunology Laboratory

Arsenic measurement using Atomic Absorption Spectrophotometer at the Nutritional Biochemistry Laboratory

At present, several projects are ongoing, including those on invasive and acute watery diarrhoea in children and adults, enterotoxigenic *Bacteroides fragilis*, micronutrient supplementation, live-oral cholera and killed whole-cell cholera, tuberculosis, and ETEC vaccines.

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. Besides performing research within protocols developed in this laboratory, it also provides technical support to different protocols from other divisions. This laboratory actively collaborates with the Public Health Sciences and Clinical Sciences divisions in materializing research protocols. The technical facilities available in this laboratory range from gel electrophoresis, nucleic acid preparation, hybridizations using both radio-labelled and non-radioactive probes, to the most sophisticated techniques of DNA-sequencing and DNA-amplification by PCR. 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 the emergence and evolution of pathogens.

The Molecular Genetics Laboratory is involved in the development and application of molecular techniques to identify and characterize diarrhoeagenic organisms

Nutritional Biochemistry Laboratory
Head: M.A. Wahed

The Nutritional Biochemistry Laboratory carried out 14,648 tests to support 15 research projects across the Centre during 2002. The Laboratory hosted 2 PhD students—one from the Human Nutrition Department, Royal Veterinary University, Denmark and the second one from the Institute of Nutrition and Food Science, University of Dhaka. Validation of serum retinol assay for the Aga Khan University, Pakistan, was carried out. Micronutrient analyses and a visit to the project site of the Society for Applied Studies, Kolkata, India, were carried out. A new atomic absorption spectrophotometer, with hydride generator, was procured with financial support from the World Health Organization. Anjan Kumar Roy of this unit attended the Graduate Course on Production and Use of Food Composition Data in Nutrition at the Institute of Nutrition, Mahidol University, Bangkok, Thailand. M.A. Wahed attended the Workshop on the "Use of stable isotopes to assess nutritional status" organized by the International Atomic Energy Agency in Vienna, Austria. The Laboratory continued its best performance with the external QA programme run by the National Institute of Standards and Technology, Washington, DC, USA.

Parasitology Laboratory
Head: Rashidul Haque

The Parasitology Laboratory is primarily working on amoebiasis. The disease caused by the protozoan parasite *E. histolytica* is the third

Scientists working in molecular parasitological research in the Parasitology Laboratory

leading parasitic cause of death worldwide. Our ongoing studies on human immunity to *E. histolytica* infection have shown that both innate and acquired immune response limit infection. Our recent studies have shown that anti-lectin IgG antibodies are a marker for an increased risk of amoebiasis or a contributor (via adherence-enhancing anti-lectin antibodies), while the presence of mucosal IgA against the lectin of *E. histolytica* was associated with the decreased incidence of new *E. histolytica* infection. We have also demonstrated that only a subset of children with serum anti-lectin IgG antibody responses produces neutralizing antibodies against the carbohydrate recognition domain (CRD) of lectin. The incidence of new *E. histolytica* infection is less in children who have antibodies against the CRD of *E. histolytica* lectin. We have also found that anti-lectin IgG is a phenotypic marker of susceptibility to amoebiasis, associated with an approximately 2-fold increased risk of future infection. We have observed familial clustering of this phenotypic marker. In our future research, we will focus on delineation of environmental and genetic contributions to familial aggregation observed.

Culture and serological tests for diagnosis of leishmaniasis are being done, which support a study on leishmaniasis conducted by the Public Health Sciences Division. Another area of interest includes the drug resistance of malaria parasites in endemic areas of Bangladesh.

RTI/STI Laboratory
Head: Motiur Rahman

The RTI/STI Laboratory is conducting research on the epidemiology of RTI/STI among different population groups in Bangladesh, monitoring the antimicrobial susceptibility of *N. gonorrhoeae*, provides diagnostic support to different RTI/STI projects, and is involved in training in the diagnosis of RTIs/STIs.

The Laboratory is currently conducting nationwide surveillance to: (a) study the prevalence of RTI/STI among different population groups, such as patients attending RTI/STI clinics, floating sex workers, hotel- and brothel-based sex workers, truckers, and males having sex with males; (b) set up an antimicrobial susceptibility surveillance of *N. gonorrhoeae* by establishing STI clinics in different parts of the country; and (c) establish a sustainable infrastructure for diagnosis of RTI/STI in different parts of the country. The project also aims at increasing trained manpower for diagnosis of RTI/STI.

As part of the project activities, the Centre has established four laboratories—two in Chittagong, one in Sylhet, and one in Jessore—with its partner NGOs. The laboratory technicians from the clinics are being trained at ICDDR,B.

Tuberculosis Laboratory
Head: Md. Zeaur Rahim

Tuberculosis (TB) is endemic in Bangladesh due to the sociocultural conditions prevailing in this country, but the real disease burden is not known due to the lack of proper laboratory facilities country-wide. The Tuberculosis Laboratory aims to update the knowledge on the culture and anti-TB drug susceptibility of *Mycobacterium tuberculosis* in collaboration with the National Tuberculosis Control Programme of Bangladesh. We are regularly processing sputum samples systematically collected from the Matlab Health and Demographic Surveillance System and from the Shyamoli TB Clinic. Sputum samples are initially screened by the acid-fast staining, and the acid-fast bacilli (AFB)-positive sputum samples are processed for conventional culture and sensitivity on Lowenstein-Jensen medium. Nine hundred and nine AFB smear-positive sputum samples were processed in 2002. In addition, several molecular and immunobiological studies were in progress for the rapid diagnosis and adequate therapy to stop the transmission of this deadly disease further in Bangladesh.

Virology Laboratory
Head: Tasnim Azim

The Virology Laboratory is mainly working on group A rotavirus and HIV and also on dengue, and has plans to work on influenza. In addition to diagnosis of rotavirus, studies are carried out on its epidemiology, immune responses to natural infection, and support for vaccine studies.

For HIV, surveys, research, and services are ongoing. The serological surveillance for HIV for Bangladesh continues to be conducted by this laboratory. A study on injecting drug-users is continuing, and services for HIV, including voluntary counselling and testing for HIV and determining absolute CD4 counts in people living with HIV, are being provided. Dengue typing by PCR and isolation by tissue culture are being done. Assays for culturing and detection of influenza are being set up.

Clinical Laboratory Services
Head: Md. Anowar Hossain

The Clinical Laboratory Services comprise: Clinical Pathology, Clinical Biochemistry, Clinical Microbiology, Outpatient Services Project in Dhaka, and Matlab Clinical Laboratory. Laboratory diagnostic support is provided to the patient-care activities of the Clinical Research and Service Centre at Dhaka and Matlab and paying-patients, including British Embassy medical unit, some selected tests for American Embassy medical unit, Japan JICA medical unit, and US peace corps. It also provides diagnostic support to clinical, community and field studies undertaken by the Centre's scientists. In addition to a heavy service load, the scientists carry out research, and train national and international fellows, graduate and postgraduate students in laboratory research and laboratory diagnostic procedures.

The major contribution is the provision of a safe blood-transfusion service for in-patients of Dhaka and Matlab hospitals. At Dhaka, the

Receptionists facilitating the paying-users in the new specimen reception area

The External Quality Assurance Scheme in routine haematology, coagulation, and parasitology continued to be assessed as excellent by the College of American Pathologists

outpatient service unit was shifted to the ground floor of the southwest corner of the hospital building with more physical facilities for paying-users.

The other achievements include community-based study on *Shigella* disease burden funded by IVI. The Clinical Laboratory Services supported 20 research protocols in 2002. New tests, such as serum level of cyclosporin, pre-albumin, estimation of IgA, blood gases, ionized calcium, magnesium, and microparticle enzyme immunoassay of HCV antibody were adopted in the Biochemistry Laboratory, while the estimation of viral load for hepatitis C is under trial for adoption in the Molecular and Serodiagnostic Unit. One microscope with a microphotographic system, one chemistry autoanalyzer, one blood gas analyzer, three refrigerators, three computers, two printers, and two 5 KVA stabilizers were purchased. The software for the laboratory management system is under trial for adoption in Clinical Laboratory Services, while negotiations are ongoing with JICWELS to obtain another atomic absorption spectrophotometer to estimate arsenic from biological specimens. The Laboratory supported the training of 46 fellows from national and international institutions and NGOs.

As part of staff development, Dr. Dilruba Ahmed is continuing her PhD work on *H. pylori* in the Department of Microbiology at Otago University, New Zealand. Dr. Anowar Hossain visited Vietnam in November 2002 to attend the workshop on Data Management for *Shigella* Disease Burden study. Dr. Hossain, Mr. Khorshed Alam, and Mr. Sunil Kumar Sen visited Nepal as facilitators to conduct a workshop and orientations for physicians and nurses in connection with the surveillance of antimicrobial resistance funded by USAID Nepal Infectious Disease Programme. Mr. Ashish Kumar Chowdhury and Mr. Rahmatullah were trained in Germany on the operation and maintenance of the biochemistry autoanalyzer.

Clinical Pathology Laboratory
Head: Md. Anowar Hossain

The Clinical Pathology Laboratory comprises haematology, serology and microscopic units. The Laboratory performed 147,654 tests/assays on 72,338 specimens of blood, serum, plasma, stool, urine, cerebrospinal fluid (CSF), etc. The number of specimens increased, which was mostly contributed by the increased number of paying-cases (7%). The Laboratory worked for a total of 12,47,841 work-load units (WLUs) in 21,459 work-hours with a general index of 58.15 WLUs per person per hour. The seropositivity of some infectious diseases, such as hepatitis, showed high rates of antibodies, e.g. HAV 33.61% (41 of 122), HBsAg 10.14% (128 of 2,989), HCV 10.49% (45 of 429), and HEV 45.28% (96 of 212). Malarial parasites (*P. vivax* and *P. falciparum*) were detected in 4.13% (73 of 1,765) cases and dengue in 40.19% (170 of 423) cases. The External Quality Assurance Scheme in routine haematology, coagulation, and parasitology continued to be assessed as excellent by the College of American Pathologists.

Clinical Biochemistry Laboratory
Head: Ashish Kumar Chowdhury

In total, 141,488 tests/assays were performed on 37,216 specimens of blood, serum, plasma, stool, CSF, intravenous (IV) fluid, oral

A senior researcher of the Clinical Biochemistry Laboratory analyzing blood samples using the Hitachi 902 autoanalyzer.

rehydration solution (ORS), etc. The number of specimens increased by 12%, which was contributed mostly by the increased number of paying-cases (16%). The Laboratory worked for 12,88,000 WLUs in 22,400 work-hours with an index of 57.50 WLUs per person per hour. An atomic absorption spectrophotometer was received as a donation from JICWELS, Japan. Two workshops on Arsenic Estimation from Drinking-water were conducted for 14 engineers and chemists from the Department of Public Health Engineering, Government of Bangladesh, in collaboration with the Training and Education Unit of ICDDR,B and JICWELS from 27 August to 3 September. One senior staff member visited the Government Laboratory at Mymensingh for future collaboration in arsenic estimation from water and conducted a seminar on Quality Assurance of Arsenic Estimation. The External Quality Assurance Scheme, sponsored by WHO through Wolfson EQA Laboratory, Birmingham, UK, ranked this work to be of 'grade 1' standard. The Laboratory supported the Institute of Public Health, Government of Bangladesh, in the estimation of electrolytes, glucose, pH, lactate, and magnesium for assessing the quality of intravenous fluid product.

Clinical Microbiology Laboratory
Head: Md. Khorshed Alam

The Laboratory processed 33,795 specimens for culture and antimicrobial susceptibility testing of clinical isolates from a variety of samples that included blood, stool, rectal swab, urine, throat swab, sputum, CSF, pus, etc. The number of specimens increased possibly due to the increased number of paying-cases by 3%. The common diarrhoeal pathogens isolated from 17,681 faecal samples were: *Shigella* (n=1,735, 9.8%), *V. cholerae* O1 (n=1,592, 9.0%), *Aeromonas* spp. (n=928, 5.2%), *Salmonella* spp. (n=333, 1.9%), *V. cholerae* O139 (n=299, 1.7%), and *Plesiomonas* (n=224, 1.3%), while *Campylobacter* was isolated from 2,636 faecal samples (n=137, 5.2%). The most common blood isolate was *S. typhi* (3.5%, 175 of 5,026) and *N. menengitidis* (0.52%), while the most common urine isolate was *E. coli* (12.0%, 929 of 7,732). Of 342 rectal swabs collected by the Epidemic Control Preparedness Unit team of ICDDR,B, 34 were positive for *V. cholerae* O1 (9.9%), but no *V. cholerae* O139 was isolated. To accomplish the activities, 16,39,348 WLUs were produced in 29,015 work-hours with a general index of 56.50 WLUs per person per hour. The External Quality Assurance Scheme, through the College of American Pathologists, assessed the work as being within 95% confidence interval. The Laboratory has also been involved in validating the identification and antimicrobial susceptibility testing of bacterial isolates from the Nepal Antimicrobial Resistance project and conducting its external quality-control scheme from January 2000 and maintaining the microbial quality control of Matlab field laboratory.

The physical facilities of the Matlab Laboratory were upgraded by adding one computer, two air-coolers, and two deep freezers

Table 1. Research animals of different species and volume of blood issued with amount of waste materials incinerated from the Animal Resources Branch during 2002

Species/blood	No. produced	No./vol. issued/kg
Rabbit	627	413
Guinea pig	541	391
Mouse (Swiss Albino)	7,625	7,166
Mouse (Balb/C)	466	261
Sheep blood (mL)	-	38,919
Rabbit blood (mL)	-	1,439
Guinea pig blood (mL)	-	1,040
Chicken blood (mL)	-	105
Incineration of waste materials (kg)	-	4,538

Matlab Clinical Laboratory
Head: Md. Anowar Hossain

In total, 18,061 tests were performed on 13,797 specimens of blood, stool, urine, CSF, and other biological fluids submitted by the Matlab diarrhoea treatment centre and field-based research protocols and the staff clinic. The microbiological tests performed on 2,771 specimens included dark-field microscopy, culture, and antimicrobial susceptibility. The most common diarrhoeal pathogens were: *V. cholerae* O1 (62.09%), *Shigella* (24.75%), *Salmonella* spp. (7.87%), and *V. cholerae* O139 (5.29%). In total, 1,945 tests were performed on 1,203 specimens (61.85%) for electrolytes, renal function tests, blood glucose, routine haematological tests, urinalysis, and stool microscopy for parasites. Microscopy of 4,958 faecal specimens detected *E. histolytica* (1.13%) and *Giardia* (4.70%), while *Ankylostoma duodenale*, *Ascaris lumbricoides*, *Trichuris trichiura*, and *Strongyloides stercoralis* were 1.51%, 42.05%, 26.42%, and 0.80% respectively. The physical facilities of the Matlab Laboratory were upgraded by adding one computer, two air-coolers, and two deep freezers.

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, 3 officers from BCSIR and Acme Laboratories, and a postgraduate student from Bangladesh Agricultural University, Mymensingh. The number of research animals of different species and the volume of animal blood issued to different research protocols and incineration of waste materials are shown in Table 1.

With close collaboration of the scientists from Bangladesh Agricultural University, Mymensingh, Chittagong Government Veterinary College, Bangabandhu Sheikh Mujib Medical University, the Second Annual Conference of the Bangladesh Association for Laboratory Animal Science (BALAS) was held in the Sasakawa Auditorium of ICDDR,B on 27 June 2002.

Media and Lyophilization Unit
Head: Qazi Shafi Ahmad

The Media and Lyophilization Section comprises two units: Media Preparation and Bacterial Stock Culture. The Media Preparation Unit

The Second Annual Conference of the Bangladesh Association for Laboratory Animal Science (BALAS) held in the Sasakawa Auditorium of ICDDR,B on 27 June 2002

Table 2. Production of bacteriological media in 2002

Media	Production (litre) (n=4,676)
Culture media solid	3,770
Culture broth	20
Carbohydrate fermentation broth	66
Amino acid broth	20

has the primary responsibility for the preparation of media, collection of bacterial stock culture, and decontamination. This unit provides technical support to 41 research projects and clinical laboratories at Dhaka and Matlab by supplying different kinds of culture media required for the identification and growth of microorganisms.

In 2002, the Media Preparation Unit prepared 4,676 litre of bacteriological media which include liquid and semi-solid media as shown in Table 2. The Bacterial Stock Culture Unit has facilities to lyophilize bacterial cultures and various biological specimens. This unit supported 5 research projects by lyophilizing samples ranging from 0.2 mL to 500 mL. In 2002, this unit lyophilized 4,330 samples, which include clinical strains of *Shigella, Salmonella, V. cholerae, Neisseria,* and other specimens. The prepared media and lyophilized samples are tested for quality control before these are delivered to users.

Decontamination and proper disposal of various infected and biohazard materials are carried out by incineration, autoclaving, or burial depending on their risk as classified in the biosafety rules.

Biomedical Engineering Unit
Head: Syed Saiful Huq

The Biomedical Engineering Unit (BMEU) performs the job of repair, maintenance, and calibration service for analytical, clinical and other biomedical equipment of the Centre. The Unit offers a comprehensive preventive maintenance scheme which meets the professional maintenance standard. The BMEU, with a total manpower of three, maintains about 600 pieces of equipment and also provides training to our users for the proper and safe operation of various pieces of equipment. Some major repair of equipment in the Clinical Biochemistry Laboratory has been done successfully.

The problems of low voltage and power disruption were tackled by connecting the right type of voltage stabilizers and UPS, thereby protecting critical equipment from imminent damage.

Biomedical Engineers busy with the repair of various research equipment

As safety is an important issue for the laboratories, necessary measures are being taken regarding electrical, chemical and biohazard handling. The fire protection and fighting

plan has been chalked out for the laboratory area. For development of skills, one staff member received local training on laboratory safety conducted by the University of New South Wales, Australia, and one staff member was sent to Germany for maintenance training. The Unit provided training to the participants from various scientific institutions on maintenance of common laboratory equipment, sponsored by the Network of Instrument Technical Personnel and User Scientists of Bangladesh (NITUB).

As part of continued assistance to the national and other institutions, the BMEU provided technical assistance to the Bangabandhu Sheikh Mujib Medical University to set up their Biosafety level Class III laboratory which will be of the first of its kind in Bangladesh. Also some NGOs were provided with technical assistance to solve their problems.

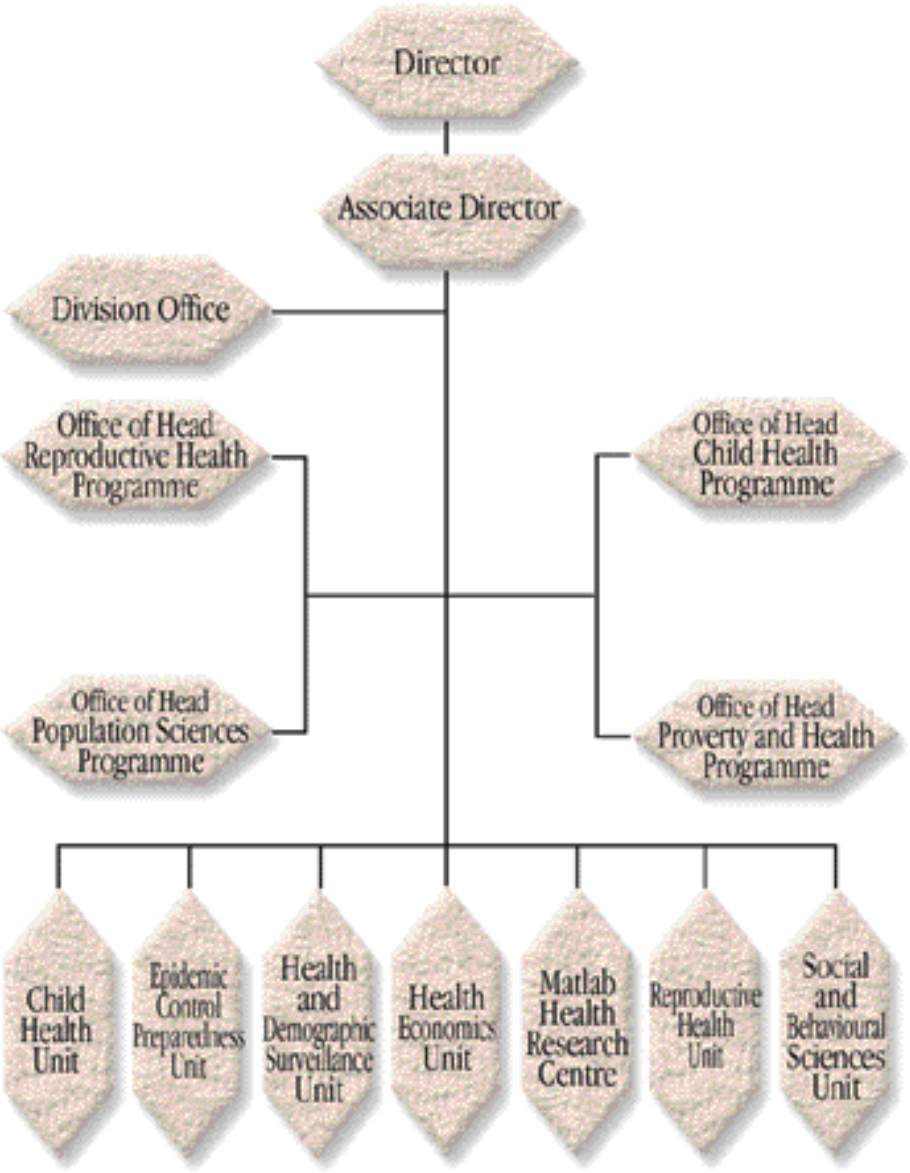
Logistics and Archives Section
Head: Md. Bodrul Ahsan Prodhan

The Laboratory Manager's Office coordinates the activities of logistic and archival support to the LSD. The Section assists in the management of the Division by providing managerial support. The Section coordinates the logistic support, such as installation, repair, renovation, security, and cleaning and oversees lighting and painting. It coordinates the procurement of scientific and other materials through local and overseas purchases for the Division. The section maintains cold chain activities, specimen bank, and cold room, and supervises oral cholera vaccine trial specimens and birth cohort study specimens stored in the cold room and freezers.

The Archive Unit plays a vital role in archiving and retrieval of data for the Centre's research work, and acts as a data-bank for the Centre by providing routine support to the Centre's scientists and researchers

The Archive Unit plays a vital role in archiving and retrieval of data for the Centre's research work, and acts as a data-bank for the Centre by providing routine support to the Centre's scientists and researchers. It computerizes data and produces monthly recovery reports for the Clinical Laboratory Services (Dhaka and Matlab) and preparation of media. In 2002, the Unit produced 64,367 records and added these to the existing database. The Unit also produced: (a) a weekly surveillance report on major diarrhoeal pathogens isolated from the stool/rectal swab samples collected from a systematic 2% sub-sample of all patients attending the Dhaka Hospital; (b) 52 weekly surveillance reports (with graphical representation) on diarrhoeal pathogens to assist the Government of Bangladesh; and (c) query reports. In addition to routine activities, the Unit performed data analyses for different scientists and researchers for different ongoing protocols.

Public Health Sciences Division



Associate Director
and Head
Lars Åke Persson

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 a variety of scientific skills and methods. Its research programmes contribute to understanding of how health and diseases are generated in the community, with a focus on 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. In Matlab, the Health and Demographic Surveillance System (HDSS) regularly updates demographic information on about 220,000 people. Besides the Matlab Health Research Centre and the HDSS, the Division has research units for reproductive health, child health, social and behavioural sciences, health economics, and epidemic control preparedness. The PHSD also houses the Centre-wide programmes on: Child Health, Reproductive Health, Population Sciences, and Poverty and Health.

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

The Matlab training centre provides facilities for local, regional and international training courses.

The scientific staff comprises public-health professionals, epidemiologists, social scientists, population specialists, and health economists. In 2002, the Division had 820 staff members on long-term and short-term contract, of whom 10 were at the international level, 71 at national officer level, and 729 in other categories.

Dr. Beena Varghese joined the Division as Head of the Health Economics Unit in October 2002. Before joining ICDDR,B, Dr. Varghese had worked with the Division of HIV/AIDS Prevention at the Centers for Disease Control and Prevention, Atlanta, GA, as Health Economist (Senior Service Fellow during 1999-2002 and Prevention Effectiveness Fellow from 1997 to 1999).

The Division continued to expand with a yearly budget of US$5.5 million in 2002, and 45 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 of the Centre. Combined intervention for low birth-weight and studies on the health consequences from arsenic in tubewell water and poverty and health have added to the research programme at the Centre.

In 2002, the Centre initiated two major intervention research projects on neonatal health. Both the projects aim at evaluating the impact of a package of pregnancy, delivery, and newborn-care interventions on

The Chakaria Community Health Project took a new direction with the formation of village health cooperatives. It is expected that it will eventually evolve as a social insurance owned and operated by the villagers

neonatal mortality. The first project started in 3 upazilas of Sylhet district (Beanibazar, Zakigonj, and Kanaighat,) and, by the end of 2002, formative research and baseline household surveys were completed, and staff training was started in phases. The second project was initiated in Mirzapur, Tangail, in late 2002.

The Chakaria Community Health Project took a new direction with the formation of village health cooperatives. It is expected that it will eventually evolve as a social insurance owned and operated by the villagers. The Swiss Red Cross extended its support to the Project for another 3 years.

Design and objectives of the combined intervention to promote maternal and infant health (MINIMat) were described in the last year's report. By the end of 2002, about 2,464 women were enrolled in MINIMat, and birth-weights of 976 babies were measured.

Under a grant from the Government of Japan through UNDP and Government of Bangladesh, the Matlab Health Research Centre conducted one international training course which was attended by participants from Bangladesh, Cambodia, India, Indonesia, Myanmar, the Philippines, Thailand, and Vietnam. Training was also conducted for family planning and population programme managers of the Government of Bangladesh and NGOs. Training for school teachers, community leaders, religious leaders, retired service practitioners, village heads, members of societies (clubs), and other individuals were also conducted under the same grant. In October 2002, the PHSD undertook a major office renovation at its Dhaka office on the top of the Library Building in Mohakhali. First phase included renovation of the top floor, and, at the end of the year, 90% of the renovation work was complete. In Matlab, one more floor on top of the Outpatient Department was built.

The study on "Cost-effectiveness of nutritional intervention activities in rural Bangladesh" concluded that the food cost component of the Bangladesh Integrated Nutrition Project (BINP) is so high that, irrespective of the delivery mode, policy-makers should carefully examine the components of BINP to find the most cost-effective mix of services. Unless the food-supplementation process generates other types of benefit (beyond supplying nutrients), such a high-level cost cannot be justified. From the programmatic point of view, allocation of money to improve targeting mechanisms and identification of true cases will save a significant amount of resources and are economically justifiable.

The study on "Situation assessment of male to male sex in Chittagong city for STI/HIV interventions" concluded that males having sex with males are also having sex with women, and are engaging in unsafe sexual behaviours. The rate of condom use is alarmingly low. The use of water-based lubricant is almost absent.

In 2002, thirty-four personnel visited 17

Planning Workshop on Community IMCI organized in BRAC Centre, Dhaka on 2-4 July 2002

Dengue viruses are circulating in other areas of Bangladesh besides Dhaka and Chittagong cities, and PCR tests indicate that the circulating serotypes are Den 2 and Den 3

countries to participate in 61 international conferences, seminars, and symposia and presented 17 papers.

Child Health Unit
Head: Shams El Arifeen

The mission of the Child Health Unit (CHU) is to contribute to the development of cost-effective child health and survival programmes by enhancing the understanding of causes of childhood morbidity and mortality and by testing cost-effective public-health interventions. The objectives of the Unit are to conduct programme and policy-relevant child health research; to collaborate 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.

The 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) childhood growth and development, including caring, 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.

Sraboni, the first MINIMat baby immediately after birth

Epidemic Control Preparedness Unit
Head: A.K. Siddique

The activities of the Epidemic Control Preparedness Unit (ECPU) in 2002 were centred around the surveillance of cholera at four rural sentinel sites and surveillance of dengue viral disease in Dhaka city and in three rural areas of Bangladesh. The results of the surveillance of cholera contributed to our understanding of the genomic profiles of *V. cholerae* O1 in cholera-endemic areas of Bangladesh. Furthermore, we have been able to establish the relationship between use-patterns of water and risk of cholera.

Results of the dengue study indicate that transmission of dengue in Dhaka city occurs almost throughout the year. Dengue viruses are circulating in other areas of Bangladesh besides Dhaka and Chittagong cities, and PCR tests indicate that the circulating serotypes are Den 2 and Den 3. The disease is currently more commonly distributed among the adults.

Health and Demographic Surveillance System
Head: Peter Kim Streatfield

The Health and Demographic Surveillance System (HDSS), designed to evaluate the impact of different population, health and socioeconomic interventions, has two functional units: (1) Health and

Workshop on Longitudinal Data Analysis of Demographic Surveillance System

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 35 years is the longest-running demographic surveillance system in the developing world.

Several changes have recently been made to the Matlab HDSS. The modernized surveillance will no longer make a geographic distinction between households into ICDDR,B service area and government service area. Potentially, all households may be cases or referent households in new studies. Since January 2000, the female Community Health Research Workers (CHRWs) have been collecting selected health-related data, in addition to demographic data directly throughout the entire surveillance area. The status of CHRWs has been upgraded in light of this heavier responsibility. The data-collection instruments, i.e. record-keeping system (RKS) books for health information, have been modified to permit direct data entry. New sets of census volumes and family visit cards have been printed using the concept of electronic census.

Several significant changes have been made in field management to maximize data quality, including the creation of an independent quality control team. There has been an increase in the number of routine group-visits to households by the CHRWs and their Field Research Supervisors (FRSs) and Field Research Officers (FROs). Integration of the RKS data into the DSS database has been completed for easier access to all data.

In 2001 for the first time, a high-speed microwave radio-link between Matlab and Dhaka was established. This enables telephone, email, fax, and Internet browsing from Matlab. There is a new communication (walkie-talkie) system within the Matlab area that greatly facilitates transport and communications between the various health facilities (sub-centres and hospital). After establishment of the radio-link, the Matlab HDSS database can also be accessed from Dhaka. Data-entry for special studies is now being done in Matlab, linked with the HDSS database, and this has increased the accuracy of entry, safety, and availability.

Several changes have recently been made to the Matlab HDSS. The modernized surveillance will no longer make a geographic distinction between households into ICDDR,B service area and government service area

In future, periodic door-to-door 'physical' censuses will not take place, but electronic censuses will be conducted

Documentation of the entire HDSS database is now complete. The data are being installed online. In future, periodic door-to-door 'physical' censuses will not take place, but electronic censuses will be conducted. However, socioeconomic and other information will be gathered through periodic modular surveys. To explore the complex relationships between poverty and health, plans are underway to improve the diagnosis of the causes of death and expand the variety of socioeconomic data.

The Matlab HDSS is playing an active role in the INDEPTH global network of surveillance sites. This network has evolved in response to the growing demand for settings that provide multi-level and longitudinal information on broad social, health and demographic processes. There is also a growing demand for sites suitable for clinical trials for forthcoming vaccines and drugs produced through genetic engineering and other innovative methods.

Health Economics Unit
Acting Head: Abbas Bhuiya (1 January-9 October 2002)
Head: Beena Varghese (From 10 October 2002)

The Health Economics Unit (HEU) conducts policy-relevant research, including economic evaluations of different interventions and programmes and analysis of cost, efficiency, and equity of different health interventions with a special focus on poverty and health. Some of the main activities included: gender inequity in health and healthcare with special focus on health insurance and cost-effectiveness of introducing new vaccines into existing EPI programmes.

In 2002, the HEU had a few changes in staff composition: 3 senior personnel left for higher degrees to overseas institutions. Two junior personnel joined in July.

Matlab Health Research Centre
Head: Md. Yunus

The Matlab Health Research Centre (MHRC), comprising a clinical research branch, a community health research branch, a longitudinal health and demographic surveillance branch covering a population of 220,000, a training centre of international standard, and an administrative support services branch, offers a unique facility for research and training on diverse issues concerning public health in developing countries. The research infrastructure of MHRC includes a team of well-trained village-based Community Health Research Workers (CHRWs), 4 sub-centre clinics (each serving 28,000 population) run

Workshop on Family Planning and People's Participation organized at Khadergaon Sub-Centre, Matlab, on 22-25 April 2002

Community Health Research Workers in a routine meeting in a rural sub-centre to discuss common problems

by paramedical staff, and a primary-care hospital with basic laboratory facility at Matlab. The MHRC is involved in conducting clinical and epidemiological research and provides health services for diarrhoea, acute respiratory infection (ARIs), malnutrition, other child health and reproductive health problems, including basic maternity care.

The services are provided at the community, sub-centre clinic and hospital settings.

The MHRC also implements various research protocols of all other units of the Public Health Sciences and other divisions of the Centre and provides medical back-up support for these projects.

During the reporting year, 10,763 patients with diarrhoea received treatment at the Matlab hospital. *V. cholerae* O1, *V. cholerae* O139, and *Shigella* spp. were isolated, respectively, from 173 (10.7%), 14 (0.9%), and 151 (9.3%) of 1,621 (15%) patients who came from the defined health and demographic surveillance area. Of the shigellae, 120 (79.5%) were *S. flexneri*, while no *S. dysenteriae* type 1 was isolated.

Another 45,051 patients comprising women of child-bearing age, children aged less than 5 years, and adult males from the ICDDR,B service area received care for various health problems, including male sexual health problems, at Matlab hospital and sub-centre clinics. During the year, 828 deliveries were conducted at the Matlab hospital (410) and in the sub-centre clinics (418).

The International Training Centre at Matlab hosted a number of local and international courses and seminars. Sixty-four international participants in various courses, fellows, and students spent time in Matlab learning about practical aspects of research, including methodology, process of implementation of projects, longitudinal data-collection system, data linkages, and analysis exercises with real dataset.

With a grant from Japan through UNDP, the MHRC organized 12 training courses for local and international health professionals in a rural set-up. Of these courses, three were conducted for 30 health professionals from the Government of Bangladesh and NGOs, 8 courses for 150 local council representatives, school teachers, and religious leaders. One course was attended by 12 international participants from Bangladesh, Cambodia, India, Indonesia, Thailand, Myanmar, the Philippines, and Vietnam.

Community-based arsenic mitigation option (purification of surface water)

A recent article in the New York Times made the following comments on the activities in Matlab:

"The people living in this place, primarily simple farmers and fishermen, are some of the world's poorest, but they have helped produce a wealth of knowledge about public health. They were at first a natural choice for research, living as they did in a little-studied, cholera-endemic area. Over time, they became an unrivaled one, as study led to more study, generating some 2,000 scientific papers in all."

"Since 1993, the work at Matlab has served as a model for a similar field site in Ghana, and provided the intellectual inspiration for the INDEPTH Network, composed of 29 field sites in developing countries with continuous evaluation of populations and their health. The technology developed at Matlab is now being used in Uganda for HIV research, in Mozambique for malaria research, and more."

Arsenic in tubewell water and health consequences

Household-based arsenic mitigation option (three-pitcher filter)

The study deals with general health effects to assess the burden of disease generated by contamination and to monitor the effects of intervention. It involves an assessment of arsenic concentration in 15,000 tubewells in the Matlab surveillance area, and screening for arsenic-induced skin lesions in a population of 220,000. These results will be stored in a database linked to the Matlab HDSS that is continuously updated.

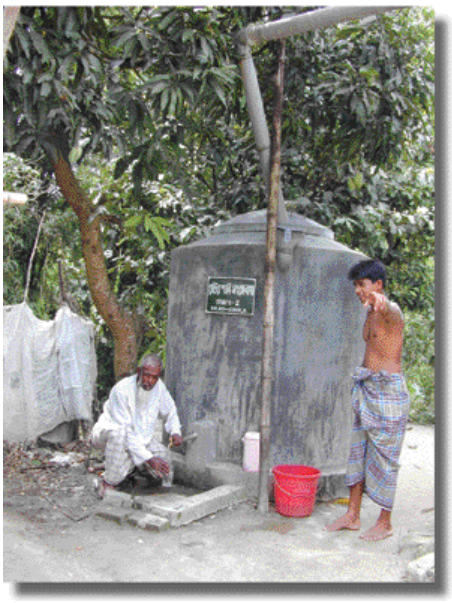
Field activities will be completed by June 2003, following which the data will be analyzed during the second half of the year.

A village-based arsenic mitigation study, in collaboration with BRAC, is an integrated part of the project, and priority is given to areas with the highest exposure. Reversibility of skin changes is being assessed. The consequences of a shift to other water sources will also be evaluated, including monitoring of diarrhoeal diseases, through the surveillance system in Matlab.

Arsenic-related study on reproductive health: does arsenic contamination of drinking-water result in foetal wastage, intrauterine growth retardation, and neonatal deaths, and are nutrition interventions reducing the risk?

This study focuses on the possible negative effects of arsenic on reproductive outcome (miscarriages, stillbirths, neonatal deaths,

Household-based arsenic mitigation option (rain water harvesting)



intrauterine growth, and birth-weight). We will be assessing the association between arsenic exposure (urine concentrations) during pregnancy (exposure measurement weeks 8, 14, 18, and 30) and the rate of pregnancy wastage (miscarriages, stillbirths), early neonatal deaths, intrauterine growth, and birth-weight, and impaired psychomotor development in early infancy. To identify susceptible individuals, we will investigate whether pregnant women with an efficient metabolism (methylation) of arsenic and low production of reactive intermediate metabolites are less susceptible to arsenic-induced foetal toxicity. The effects of early food supplementation in pregnancy (compared to later) and multiple micronutrient supplementation (compared to routine iron-folate) will also be studied (and whether this is related to arsenic methylation). This study is linked to the ongoing MINIMat project.

Efficacy of flocculent technology as an arsenic mitigation strategy

In cooperation with Centers for Disease Control and Prevention (CDC) and Procter & Gamble, this study in Matlab evaluates the effectiveness and assesses the acceptance and use-patterns of a point-of-use water treatment method to improve the microbiological and chemical composition of drinking-water. The investigation is undertaken in two phases: an initial stage that will consist of the collection of baseline data followed by an intervention stage that will evaluate the efficacy, acceptance, and use-patterns of chlorination-flocculent product as a means of improving the quality of drinking-water.

Reproductive Health Unit
Head: Japhet Killewo

The goal of the Reproductive Health Unit is to contribute to the improvement of reproductive health in Bangladesh and other developing countries through research and evidence-based policy recommendations for linking reproductive health activities with health delivery and care. Current priority areas of research are: (a) safe motherhood; (b) family planning; (c) adolescent reproductive health; (d) STI/RTI/HIV/AIDS/sexual health; (e) maternal nutrition; (f)

Health education sessions are an everyday event at the health facilities of Matlab with ICDDR,B interventions

ICDDR,B's health sub-centres in remote villages were upgraded to provide improved services

abortion care; (g) violence against women; (h) newborn's health and breast-feeding.

Some of the more specific objectives are to: (1) describe reproductive health needs and assess the unmet demand for reproductive health services; (2) evaluate reproductive health services available to the population through a multidisciplinary working group; (3) evaluate the cost-effectiveness of reproductive health interventions and recommend those that are cost-effective and sustainable for possible scaling up to improve reproductive health; (4) assess the level of equity in health and health provision and search for methods and strategies for equitable distribution of health and health services.

Social and Behavioural Sciences Unit
Head: Abbas Bhuiya

The Social and Behavioural Sciences Unit (SBSU) continued to fulfill its mandate to institutionalize social and behavioural science research by carrying out relevant research, providing support to other studies, developing capacity of staff, and participating in national and international activities. Twelve studies, ongoing in 2002, were either led or participated by the SBSU researchers. Research activities included diverse topics ranging from community development, poverty alleviation, nutrition, health and equity, HIV/AIDS, violence against women, arsenic contamination of ground water, safe motherhood, and various other health system-related topics, including testing of rapid monitoring tools for programme managers. Currently, 4 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

The purpose of the study was to assess whether and how much villagers can be mobilized to take their own initiative to improve their health. The study was done in six unions of Chakaria upazila of Cox's Bazar district. Since its inception in 1994, the project could demonstrate that, with the increase in health awareness, villagers felt the necessity of quality curative services. As an outcome of this felt-need, they have established 7 village health posts in 6 unions with a population of 150,000. The project doctors and paramedics have been providing the services complemented by the community midwifery services by the trained community health workers. On sustainability consideration, they have introduced a family health card which is sold to the villagers, introduced a consultancy fee, and antenatal and prenatal care services. Drugs are also made available at the health posts. Money generated from these is being deposited in the bank accounts of the village health

A village health post in Chakaria

posts. At the end of 2002, they have started to form village cooperatives aiming and mobilizing savings and income which can be used by the members to buy healthcare services. It is expected that the health cooperatives will eventually take up the shape of social insurance owned and operated by the villagers.

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

This collaborative project of Bangladesh Bureau of Statistics, Bangladesh Institute of Development Studies, BRAC, and ICDDR,B aims at generating and/or compiling data that reflect the socioeconomic, gender, and other forms of health inequalities existing in Bangladesh. The current activities include a regular survey of a nationally-representative sample, publication of working papers and a newsletter, capacity-building of young researchers, and advocacy and dissemination. As of now, two working papers have been published.

Rapid assessment tool for better health: helping essential service package managers to be more effective

This project aimed at testing a rapid assessment tool (lot quality acceptance sampling) in Matlab and comparing results with data from the HDSS. The method, if it works, should take less than 30 samples to identify the inadequately-performing work areas of the grassroots-level workers. This will enable the programme managers to act quickly to improve the situation in deficient areas.

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

The study continued to assess the joint and independent effects of health and non-health development programmes in Matlab. Findings suggest that the poverty-alleviation programmes, such as microcredit, with other capacity-development programmes, have a net positive effect on the health of the programme members.

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

This study has been carried out in both rural and urban areas. It aims at understanding male sexual behaviour in this society so that informed

A community midwife providing antenatal care at a village health post

interventions can be developed to control epidemics of HIV/AIDS in Bangladesh. Data collection was completed in 2002.

Women's health and domestic violence against women in Bangladesh: summary findings

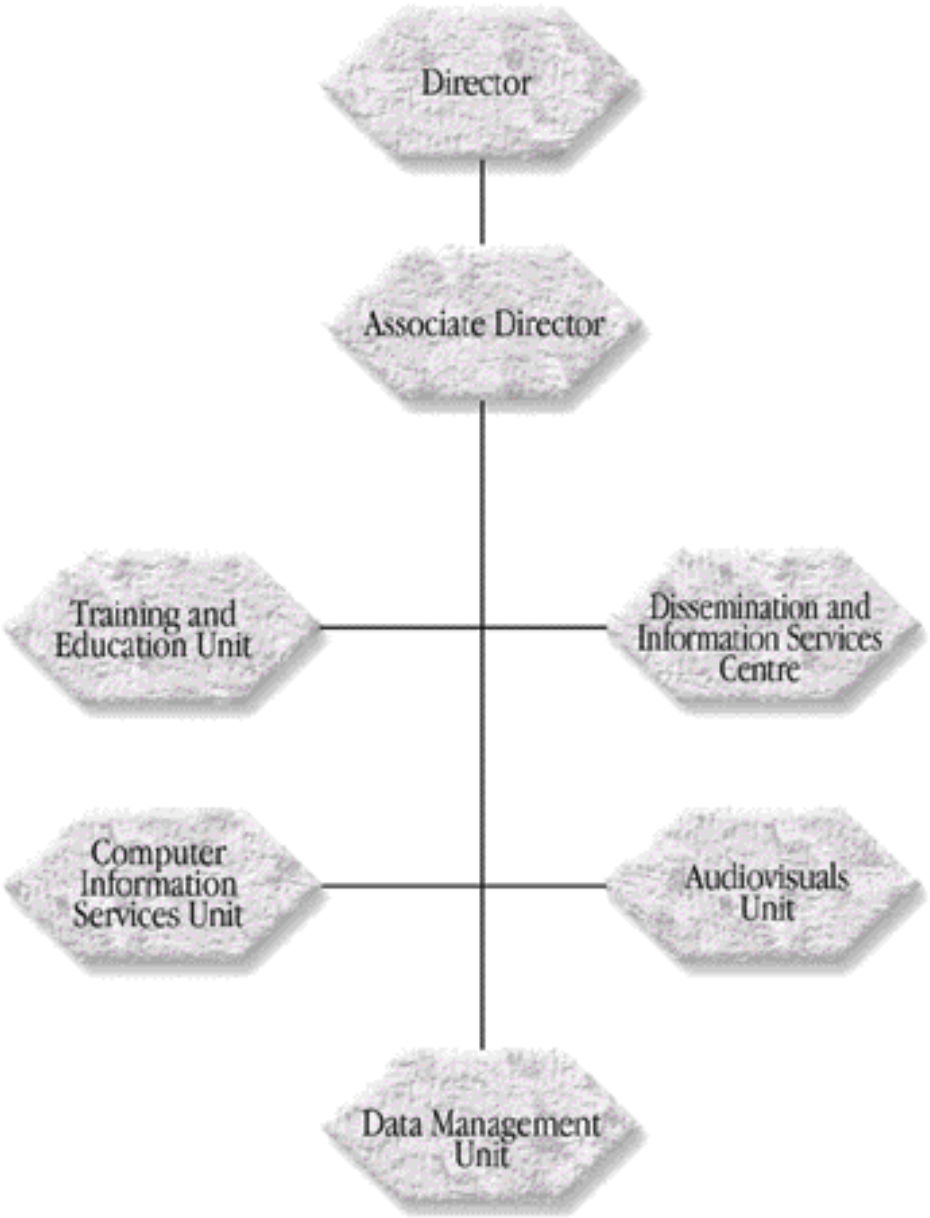
Sporadic studies and media reports indicate that domestic violence against women (DVAW) is a serious problem in Bangladesh, but reliable estimates of its magnitude and precipitating factors and consequences on women's health are absent. The paucity of information on the determinants and precipitating factors for domestic violence has impeded the formulation 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 physical and mental health problems of women has resulted in missed opportunities in addressing the issue effectively and directly within the existing health and reproductive health programmes. The present population-based study, a part of the multi-country study by WHO on women's health and domestic violence, addresses the issues 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.

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, 39% in Dhaka and 41% in Matlab reported being physically assaulted by their husbands. Thirty-seven percent of women in Dhaka and 50% of women in Matlab reported ever being sexually assaulted by their husbands. Sixty-nine percent of ever-married women in Dhaka and 81% in Matlab reported psychological abuse by their husbands. Lower age at marriage, involvement of dowry in marriage, income-earning by women, frequent verbal disagreements with the husband, and a history of physical violence among adults in both the spouses' families were identified as risk factors for physical violence by husbands in the study. Education of husband, perceived natal family support in crisis, and greater within-spouse communication were the protective factors against physical abuse to the wife. 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 was that the family structure did not contribute to physical violence, and when controlled for other factors, income did not have a significant effect on physical violence.

The paucity of information on the determinants and precipitating factors for domestic violence has impeded the formulation of sound and effective programmes to address this issue

Information Sciences Division



INFORMATION SCIENCES DIVISION

Associate Director
and Head
Peter Thorpe

The Information Sciences Division is responsible for the two-way flow of information and knowledge transfer into and out of the Centre.

During the year, there have been two minor changes in the administrative structure of the Division. The Audiovisuals Unit has been separated as an independent unit from the Dissemination and Information Services Centre (DISC), and a new Data Management Unit (DMU) has been established. AVU will continue to function as before in support of the Centre's publications and production of promotional materials, and will now report directly to the Division Head. DMU has been established to provide support to those parts of the Centre, which have no data management staff of their own. The Unit reports directly to the Division Head, but day-to-day administrative and technical supervision is provided by Computer Information Services Unit (CISU). The Division is, therefore, now made up of the Training and Education Unit (Head: Dr A.N. Alam), the Dissemination and Information Services Centre (Head: M. Shamsul Islam Khan), the Computer Information Services Unit (Head: Farhad Hossain), the Audiovisuals Unit (Head: Asem Ansari), and the Data Management Unit (Head: Farhad Hossain).

The Division has been active during 2002 in the DFID-supported Poverty and Health Project, being responsible for two components of the Project: communications and training. Infrastructural work during 2002 focused mainly on the development of the Computer Training Laboratory, which opened in July 2002. Since then, Human Resources Department has used the lab intensively for their staff training courses on the use of MS Office software and Internet searching. In addition, a number of the training courses organized by TEU, such as the courses on epidemiology and biostatics and the health and demographic surveillance system, have also benefited from use of this facility. The lab is fitted with eighteen computer workstations for students, plus a teacher's desk with PC and multimedia projector. Other work carried out during the year under the Poverty and Health Project included the complete redesign of the Centre's website. The new site will provide easier navigation and access to more news and

Installation of a microwave system facilitated Dhaka-Matlab communication

The Centre's Library enriched its collections by acquisition of new books and journals. These books were donated by the British Medical Association

information about Centre's activities. Links to full text of documents will also be provided whenever possible.

The Centre's periodical publications: the peer-reviewed quarterly *Journal of Health, Population and Nutrition*, and the English newsletter *Glimpse* and the Bangla health magazine *Shasthya Sanglap*, met with continued success during the year. The *Health and Science Bulletin*, a new quarterly publication, jointly produced by the Health Systems and Infectious Diseases Division and ISD, joined these periodicals in November 2002. HSB reports on the Centre's surveillance activities and plans to publish three or four short reports in each issue. Material is being solicited from all divisions in the Centre for this new publication. All periodicals will continue to be available in full text on the new website.

A group of trainees from Japan

Work has started on planning the renovation of the computer network maintained throughout the Centre by CISU. Initially, work will concentrate on improving both antiviral and intruder security at the gateway, and in upgrading the switches and hubs to improve speed and reliability. The increased number of users connected to the

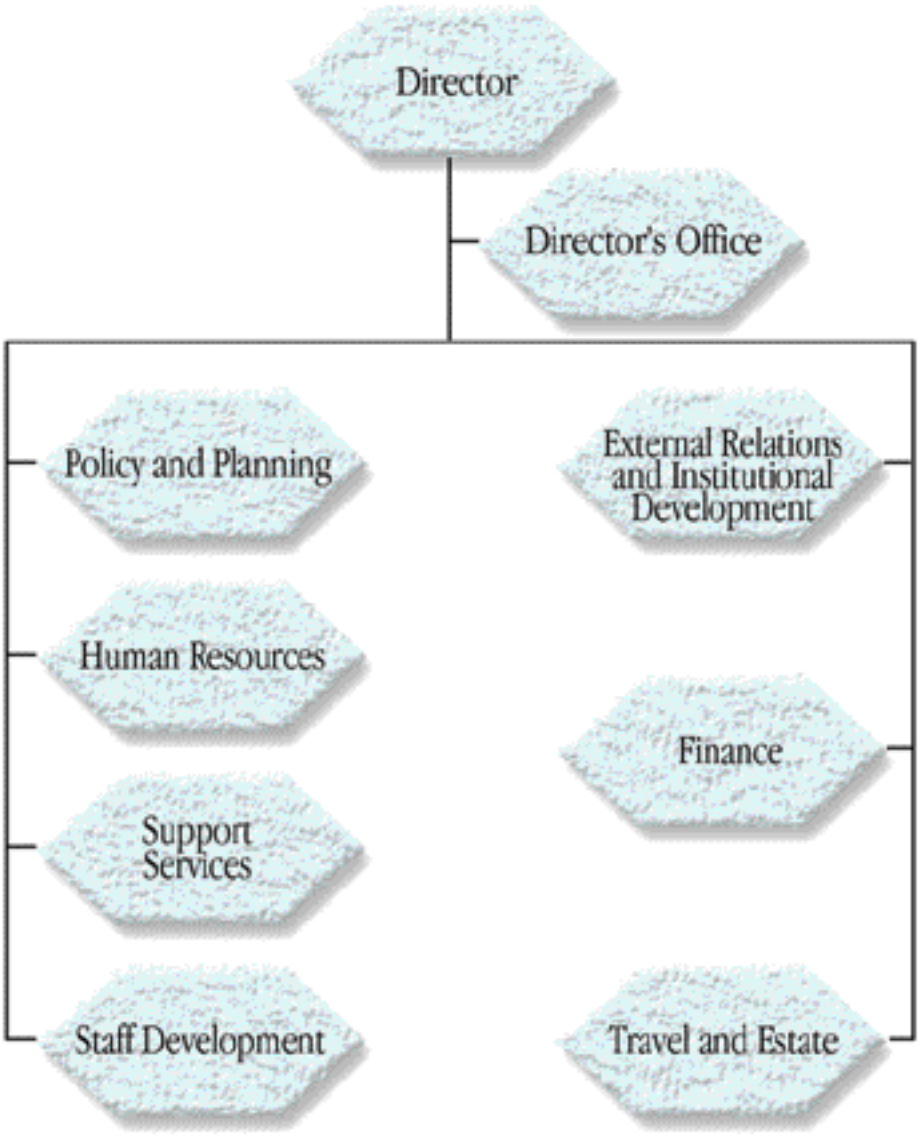
network recently has resulted in a marked slowing of network traffic. Upgrading the equipment will counteract this tendency and provide a more secure environment for the system.

Work has started on planning the renovation of the computer network maintained throughout the Centre by Computer Information Services Unit

The Division also played an important part in the planning and management of the 10th Annual Scientific Conference (10th ASCON), held in June 2002. The theme of the conference was "Malnutrition: Meeting the Challenges in South Asia." This was the first time that ASCON had had a regional flavour, with participants and speakers from a number of South Asian countries. It was generally agreed that this year's conference was a great success and that the regional flavour should be retained in future conferences.

Installation of a G4 AppleMac with a high-resolution printer ensured in-house pre-press processing and quality production of Centre's publications and graphics material

Director's Division



Director
David A. Sack

DIRECTOR'S DIVISION

Division Highlights

- The Centre's scientists published 136 original papers, review articles, book chapters, letters, etc., in addition to 8 working papers, scientific report, and special publication published internally. Besides, 122 abstracts appeared in abstracts books of various conferences.
- Revenue contributions increased by 9.2% over 2001. Core contributions increased by US$1,264,000. The operating surplus was US$73,000 (US$191,000 in 2001). An amount of US$2,757,000 was spent to procure scientific and other materials from home and abroad.
- At the end of 2002, the Centre had a total staff of 1,150 personnel, in addition to 20 Community Health Workers and 89 Health Workers. Eleven personnel joined international-level positions, 4 key personnel left the Centre, 3 personnel retired, 27 personnel received long-service awards, and 2 personnel died.
- The Centre received US$1,845,000 as core contribution from the Netherlands.
- The Centre's Winter Ball and the Art Auction contributed US$30,000 to the Hospital Endowment Fund.
- The Centre's Strategic Plan to the Year 2010 was finalized.
- About 400 biomedical and social science researchers, health professionals, policy-makers, and health administrators from home and abroad attended the 10th Annual Scientific Conference.

Human Resources Department
Head: Diann M. Hill (until 5 September 2002)
Interim Head: Ann Gauvin Walton (from 8 September 2002)
Chief Personnel Officer: Wahabuzzaman Ahmed

The Human Resources Department, with 13 staff members, is responsible for employment, compensation and benefits, employee relations, and training and development. The Department also looks after the well-being of the employees of the Centre and their dependants by providing free medical treatments through its Staff Clinic.

The Department carries out the HR agenda, developed in 2000, to incorporate a streamlined system for administration and management of HR issues with the goal of improving performance, better coordinating resources, and increasing efficiency in the management of employee-labour and benefit costs. As part of the HR agenda, the Job Classification Project was completed in 2002. Under the project, all posts in the Centre were evaluated, classified, and organized into Job Families to provide a career structure for employees.

At the end of 2002, the Centre had a total staff of 1,150 personnel—183 were National Officers and 967 were in the General Services category, in addition to 20 Community Health Workers and 89 Health Workers. The Centre also had up to 800 staff members employed as daily wagers or short-term contractuals and 30 international-level staff members, 6 of whom were on secondment.

Five Bangladeshi personnel were promoted to have international professional positions

New International Professional Staff

1. Ms Mary Hadley, a British national, joined as Project Coordinator on 24 January 2002 on a short-term contract.

2. Ms Julia Ackley, an American national, joined as Senior Associate on 21 August 2002 on a short-term contract.

3. Ms Ann G. Walton, a Canadian national, joined as Interim Head, Human Resources on 8 September 2002 on a short-term contract.

4. Mr. Alec Mercer, a British national, joined as Operations Research Scientist on 29 September 2002.

5. Dr. Beena Varghese, an Indian national (currently US immigrant), joined as Health Economist on 10 October 2002.

6. Mr. Aniruddha Neogi, an Indian national, joined as Head, Finance on 18 November 2002.

The following Bangladeshi personnel were promoted to have international professional positions. All of them joined on 1 July 2002:

1. Dr. G.H. Rabbani, Scientist, CRSC, CSD

2. Dr. M.A. Salam, Chief Physician, CRSC, CSD

3. Dr. Firdausi Qadri, Senior Scientist, Immunology Laboratory, LSD

4. Dr. Shah Md. Faruque, Scientist, Molecular Genetics Laboratory, LSD

5. Dr. Ishtiaque A. Zaman, Head, ER&ID Office, Director's Division.

Separations

Mrs. Judith Bennett Henry, Executive Assistant to Director, left the Centre on 30 September 2002. Dr. Radheshyam Bairagi, Senior Scientist, Health and Demographic Surveillance Unit, Public Health Sciences Division, left the Centre on 30 June 2002. Ms Diann M. Hill, Head, Human Resources, left the Centre on 5 September 2002. Mr. Stephen E. Sage, Chief Finance Officer, left on 21 November 2002.

Retirement

The following three staff members retired from the Centre during the year:

Mr. Monir Hossain, Ward Attendant, CRSC, CSD; Mr. Md. Shahidur Rahman, Clerk, Grade-I, Matlab Administration, PHSD; and Mr. Jerome D. Cruze, Cook, Staff Canteen, DD.

Long-service award

During 2002, one staff member was awarded meritorious increase in pay for completion of 30 years of service. Twenty-six staff members were also awarded meritorious increase in pay for completing 25 years of service in the Centre.

Obituaries

With deep sorrow, we record the deaths of the following staff members:

Md. Abdur Razzak, Speed Boat Driver, Matlab Administration, MHRC, served the Centre for 34 years and 9 months, and Abul Kalam Sikder, Despatcher, Matlab Administration, MHRC, served the Centre for 17 years and 3 months.

Staff Clinic

The Staff Clinic provides curative and preventive healthcare services to staff members and their entitled dependants. In 2002, a total of 22,469 patient-visits took place in the Clinic. Of them, 21,747 were treated successfully in the Clinic; 722 required referral to outside clinics/hospitals/consultants; 495 were vaccinated; 128 were hospitalized; 51 were emergency cases; 247 required minor surgery; 90 had ECG examination; 235 antenatal and postnatal check-ups; 16 had pap smears; and 56 were provided family-planning services. Pre-employment medical examinations were carried out for 120 employees. Three health-education seminars were organized to orient the staff on serious health problems, such as tuberculosis, AIDS, and dengue fever. Hepatitis B vaccination programme for all fixed-term staff and at-risk CSA staff has been continuing.

Staff Development Office

Manager: Bejoy R. Saha

Under the Staff Development Programme, the Centre regularly organizes internal workshops and training courses and sends staff to local and overseas institutions for higher studies and focused training aiming 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, 161 staff members were benefited in 2002 with financial support from the Bill & Melinda Gates-Bangladesh grant to the Centre, Circle-Around-the-Centre Fund, and fellowships from several agencies and various projects of the Centre.

***Foreign training*:** Sixty-one personnel attended training courses/study programmes in Australia, Belgium, Finland, France, India, Italy, Japan, New Zealand, the Netherlands, Peru, Singapore, South Africa, Sweden, Thailand, UK, and USA. Thirty-three completed their studies and training. Two of them received PhD degree, 4 returned after completing the partial requirement for the doctoral studies, 7 obtained masters degree, and another 20 completed non-degree training in various disciplines. During the year, 32 staff members left to begin their higher studies or training abroad. At the end of the year, 26 were studying abroad—19 for PhD degree, 6 for masters degree, and one for non-degree focused training.

***In-country training*:** Sixty members of the staff received in-country training in various disciplines. Of them, 9 were sent for long-term training/study programme—PhD (1), masters (3), BSc in nursing (1), and Certificate in Computer Programming (7).

***In-house training*:** Under the in-house training programme, 40 personnel attended several workshops and training courses organized by the Training and Education Unit and Staff Development Office.

Under Staff Development Programme, 161 personnel were benefited in 2002 with financial support from the Bill & Melinda Gates-Bangladesh grant to the Centre, Circle-Around-the-Centre Fund, and fellowships from several agencies and various projects of the Centre

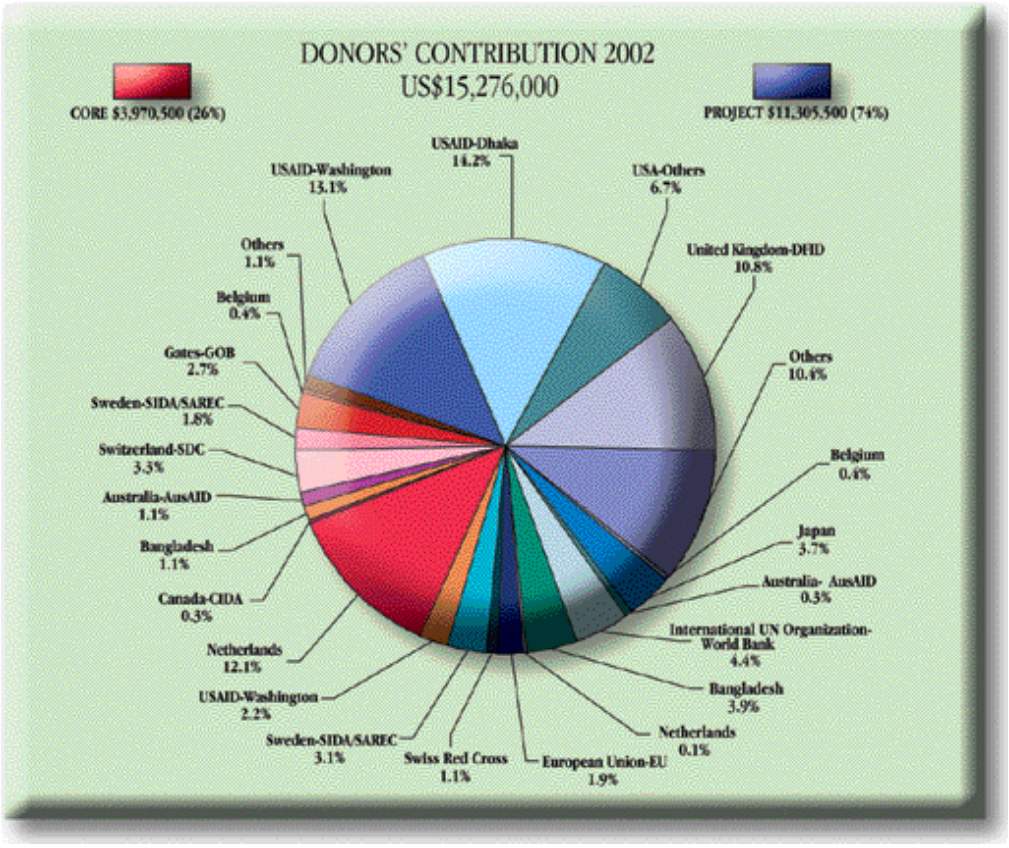
Thirteen persons attended the Introductory Course on Epidemiology and Biostatistics; 12 staff members attended the Course on Measuring Poverty: Economic Dimensions, and 2 staff members attended the WHO-supported Inter-country Training Workshop on Management of Severe Malnutrition.

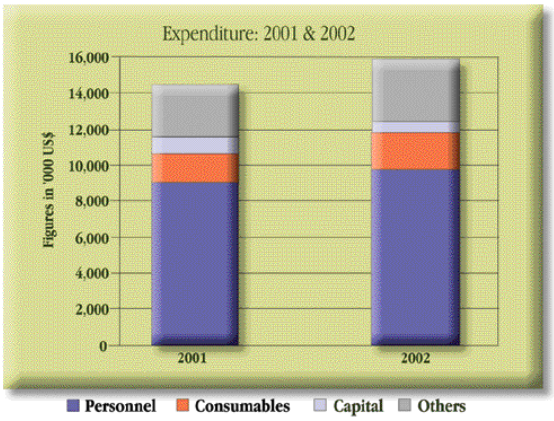
In addition, a training workshop on Scientific Writing was organized in collaboration with the University of California-Davis, USA, on 10-19 December. The objectives of the workshop were to improve the knowledge and skills of the participants in organizing text of the scientific papers intended for publication in international peer-reviewed journals. Sixteen participants, including 10 from ICDDR,B, attended the training workshop. The Centre has plans to run the course next year as well.

***Symposium*:** A symposium was organized on 27 October 2002 where 13 staff members who acquired PhD and masters degrees during January 2001-October 2002 through the Centre's Staff Development Programme, made a brief presentation covering: (a) degree acquired and the name of the institution with country, (b) knowledge and skills gained during the study programme, (c) title and objective of the dissertation submitted and major findings, and (d) how they are using their improved knowledge and skills in their job to contribute towards strengthening the research activities of the Centre. Three personnel acquired PhD degree in Gastroenterology, Population Science, and Nutrition; and 10 acquired masters degree in Health Development, Public Health, Epidemiology, Demography, Medical Anthropology, Mother and Child Health, and Population and Reproductive Health from India, the Netherlands, Sweden, Thailand, UK, and USA.

Finance Department
Chief Finance Officer: Stephen E. Sage (until 21 November 2002)
Head, Finance: Aniruddha Neogi (from 18 November 2002)

The Finance Department, with 45 staff members, has the overall responsibility for financial operations, procurement along with





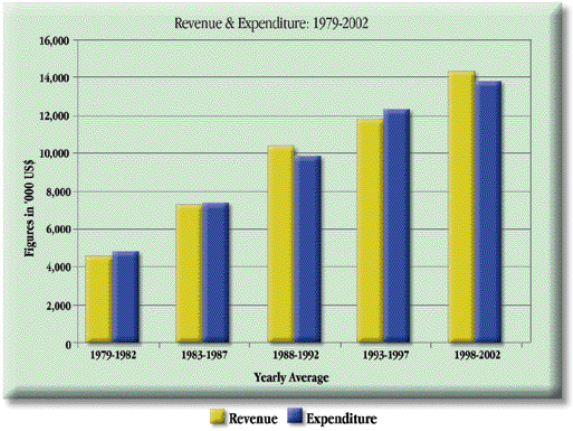
inventory control and management of fixed assets. The financial operations include: cash management and custodianship of all funds, management of staff compensation, preparation of annual budget, recording of all financial transactions and commitments, and preparation of financial reports for the Board of Trustees, management, and donors. Procurement Office was placed under the Finance Department in November 2002. This office facilitates purchase of sophisticated scientific equipment, perishable and non-perishable chemicals and reagents, drugs and medicines, consumables, etc., from overseas and local markets, and facilitates processing of contracts for logistics and support services. The Finance Department is also responsible for ensuring the annual audit and audits for contributions of all donors.

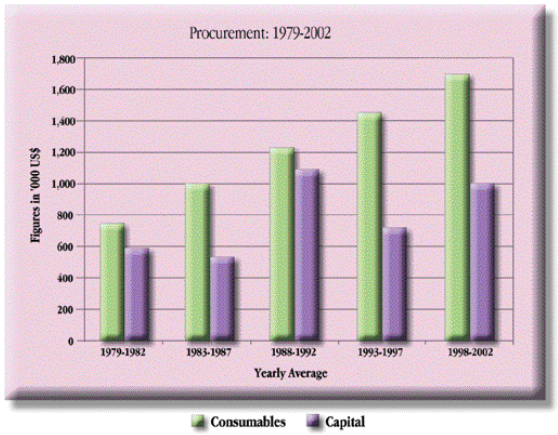
Financial highlights for 2002 are given below:

- Total contribution from donors was US$15,276,000, which was 9.2% greater than the previous year.
- Core contributions increased by US$1,264,000, while the project contributions remained almost the same. The Centre received US$1,845,000 as core contribution from the Netherlands.
- Total expenditure was US$15,918,000; this was US$1,336,000 or 9.4% greater than the previous year.
- Personnel costs for national and international staff were 61.3% of total revenue compared to 60.6% of the last year.
- Procurement of consumables and capital was US$2,757,000, which was 4% greater than the previous year.
- Operating surplus for the year was US$73,000 or 0.5% of total revenue compared to US$191,000 or 1.3% of the last year.
- Effective cost-control measures were taken during the year to curtail core expenditures, and the resultant benefit was the decrease in cumulative deficit.
- Cumulative deficit of the operating account decreased to US$2,815,000.
- Market value of endowment fund declined by 9.2% over the previous year due to the global economic downturn

Milestones during the last 24 years (1979-2002) are as follows:

- Average revenue vis-à-vis expenditure rose from a yearly average of US$4,600,000 and US$4,826,000 during 1979-1982 to US$13,551,000 and US$13,866,000 respectively during 1998-2002.
- Procurement of consumable and capital items increased from a yearly average of US$1,346,000 during 1979-1982 to a sum of US$2,701,000 during 1998-2002.
- Endowment fund began with US$15,577 in 1991 and reached US$8,093,306 in 2002.





List of Contributors to the Cent and Circle-Around-

Individuals
(In alphabetical order)

Alvin I. Mushlin
Barkat-e-Khuda
Begum Saleha Khan
C. Duggan
Carol Vlassoff
David A. Sack and Jean C. Sack
Doris L. Storms
Edward C. Smith
Edward T. Ryan and Krista B. Ryan
Faisal Hossain
G. Balakrish Nair and Ranjita Nair
Henry B. Perry, III
James W. Metzger and Mary Jane Metzger
Jane Anita Kusin
Julia Schillinger
Kh. Anowar Hossain
Leonard D. Andrew and Helen F. Andrew
Md. Hasan Zaki
Md. Tajul Islam
Michael Bennish and Marie Christine Ryckaert
Ralph Breiman and Ruth Breiman
Rekha Palma
Richard Hamilton
Rita Colwell
Robert C. Terry, Jr.
Sarah E. Coghlan
Scobie and Claire Mackinnon Trust
Shawkat Ali Bhuiyan
Timothy S. Rothermel
and
Family, friends and patients of the Dhaka Hospital
(Donations made through the collection box in hospital lobby)

ndowment, Hospital Endowment
Centre Funds in 2002

Corporations and Associations
(In alphabetical order)

American Express Bank, Ltd.
Duncan Brothers (Bangladesh), Ltd.
ICDDR,B Hospital Women's Cooperative Society
Japanese Women's Association Dhaka
Opsonin Chemical Industries, Ltd.
Procter & Gamble
Reliance Insurance, Ltd.
Square Pharmaceuticals, Ltd.
Texgate, Ltd.
United Insurance Company, Ltd.
Zonta International Club Dhaka

We also thank the numerous local corporations and associations whose in-kind contributions of raffle and door prizes made the 2002 Hospital Endowment Ball a success and over 400 attendees of the Ball, whose support to the Centre is greatly appreciated.

In addition, we thank the 49 artists of the 2002 Art Show and Silent Auction who generously contributed their artwork and patrons whose purchases helped to support the Hospital Endowment Fund.

On behalf of all of us at the Centre, we thank our donors for their generous support and continued commitment to our work.

David A. Sack, Director

Prof. A.K. Azad Khan, Chair of the Finance Committee of the Board of Trustees, signing the 2002 Annual Financial Statements at Dhaka, together with Acting Director Prof. Barkat-e-Khuda, Head, Finance Mr. Aniruddha Neogi, senior personnel of the Finance Department, and the auditors. In the inset, Director Prof. David A. Sack is seen signing the document at Baltimore

AUDITORS' REPORT

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

We have audited the financial statements of INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH (ICDDR,B) for the year ended December 31, 2002, from which these abridged financial statements were derived. In our report of same date we expressed an opinion that the financial statements from which these abridged financial statements were derived, present fairly the financial position of the Centre in all material respects, except for non-recognition of "ICDDR,B Employees Separation Payment Fund" balance as at December 31, 2002 of US$11,195,720 and corresponding investments with Generali Worldwide Insurance Company Limited of Guernsey, Channel Islands, in these accounts.

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.

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

Price Waterhouse
Chartered Accountants

Dhaka, March 19, 2003

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH
STATEMENT OF FINANCIAL POSITION AS AT DECEMBER 31, 2002 (US $ 000) - ABRIDGED

	2002	2001
Total Assets	**19,430**	**20,279**
Assets	**19,430**	**20,279**
Cash and bank	3,281	4,026
Accounts receivable	2,862	2,282
Hospital Endowment Fund Investments	4,962	5,160
Centre Endowment Fund Investments	3,131	3,418
Inventories	532	476
Fixed assets	4,662	4,917
Total Liabilities and Fund Balances	**19,430**	**20,279**
Current Liabilities	**7,486**	**7,703**
Fund Balances	**11,944**	**12,576**
Fixed Assets Fund	4,662	4,917
Fixed Assets Acquisition and Replacement Fund	-	-
Hospital Endowment Fund	4,962	5,160
Centre Endowment Fund	3,131	3,418
Reserve Fund	2,004	2,007
Operating Fund	(2,815)	(2,926)

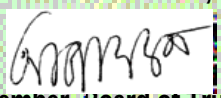
STATEMENT OF ACTIVITY (OPERATING FUND) (US$ 000) - ABRIDGED

Income	**15,991**	**14,773**
Contributions	15,276	13,992
Other items	715	781
Expenditure	**15,918**	**14,582**
Salaries and benefits	9,749	8,953
Supplies and materials	2,055	1,743
Capital expenditure	702	914
Other items	3,412	2,972
Surplus for the year before depreciation	**73**	**191**
Depreciation (without effect on Operating Fund)	956	964
Deficit for the year after depreciation	**883**	**773**

STATEMENT OF CASH FLOWS (US$ 000) – ABRIDGED

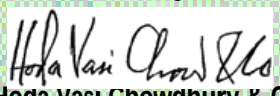
Cash flows from operating activities	(100)	1,119
Cash used in investing activities	(646)	(907)
Net Increase/(decrease) in cash and cash equivalents	**(746)**	**212**
Cash and cash equivalents at beginning of the year	**4,027**	**3,815**
Cash and cash equivalents at end of the year	**3,281**	**4,027**

Director, ICDDR,B
Baltimore, March 18, 2003

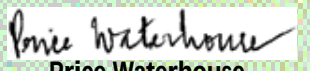


Member, Board of Trustees
Dhaka, March 19, 2003

This is the abridged form of the Financial Statements referred to in our report of same date.



Hoda Vasi Chowdhury & Co
Chartered Accountants
Dhaka, March 19, 2003



Price Waterhouse
Chartered Accountants

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

DONORS' CONTRIBUTIONS (US$ 000) – ABRIDGED

	2002	2001
Contributions (Restricted and Unrestricted)	**15,276**	**13,992**
Australia - AusAID	214	259
Bangladesh	766	654
Belgium - BADC/BTC	128	241
Canada - CIDA	48	192
European Union	293	758
Ford Foundation	243	284
Gates - GoB Award	413	-
Howard Hughes Medical Institute	38	48
International Vaccine Institute (IVI)	352	118
Japan	564	1,002
Japan - JICWELS & Others	67	80
MGH and Harvard Medical School (a)	151	144
Netherlands	1,856	1,011
New England Medical Center (NEMC)	147	126
Saudi Arabia	53	50
Sri Lanka	-	4
Sweden - SIDA/SAREC	741	508
Swiss Red Cross	162	174
Switzerland - SDC	500	761
The Johns Hopkins University (a)	29	87
The Rockefeller Foundation	63	49
Thrasher Research Foundation	226	52
UNICEF	230	218
United Kingdom - DFID	1,656	879
United States - AID	4,498	4,977
University of Basel - SDC	77	1
University of Newcastle - DFID	35	68
University of Virginia (NIH) (a)	63	76
UNOCAL Foundation	56	70
WHO	439	176
World Bank	(1)	758
Disaster Fund (UNOCAL, Shell, Cairn, Others)	5	20
Endowment Fund - Centre	71	69
Others (b)	1,093	78

a) Includes subcontracts from the National Institutes of Health (NIH), USA.

b) Contributions in 2002 from "Others" for project and central funds include Canadian HC-Local Fund Management Office (LFMO), CDC-Atlanta, Cytos Pharmaceuticals Inc., Dartmouth College, Ellison Foundation, George Mason Foundation, The INDEPTH Network, International Atomic Energy Agency, International Science & Technology Institute Inc., National Institute of Ageing, Nestle Foundation, Pathfinder Int'l, Procter & Gamble, Pennsylvania University, SBL Vaccines, Umea University, UFHP, UNAIDS, UNOPS and Wyeth.

Director, ICDDR,B

Member, Board of Trustees

HUDA VASI CHOWDHURY & CO

PRICE WATERHOUSE

Support Services Department
Manager: Colonel Tajul Islam Ghani (Retired)

The Support Services Department comprises those components that develop, support, and sustain the infrastructure and the facilities of the Centre. The staff consists of skilled to highly-skilled technicians and operators who provided the most valuable technical and logistic support to the scientific divisions and other departments to carry out their operations most effectively. The Department, with 207 members of fixed and contractual staff in 2002, provided administrative, logistic and engineering support for planning, construction, and maintenance of the physical facilities. It also organized and coordinated operations and maintenance of vehicles in the transport pool and management of logistics for conferences, organized security of the premises and personnel, and provided messenger/mail services and cleaning services to the Centre.

Engineering and Maintenance Branch
Senior Assistant Engineer: Rabindra Das (Civil)
Assistant Engineer: N. Sayem Uddin Ahammed (Electrical)

The Branch routinely maintains utility services, electrical and telecommunication equipment and facilities. It plans and initiates numerous renovation and new construction work within the Centre to accommodate different departments in new settings to facilitate their functioning. Following are the major activities done in 2002: renovation of the office room of Clinical Sciences Division (CSD) on the ground and the second floor of the main building, Study Ward and Metabolic Wards of the CSD, Staff Clinic, Animal Resources Building, laboratory space/office in the old specimen reception area for Laboratory Sciences Division (LSD), and Director's Office to increase working space; construction of Diagnostic Unit of LSD, STD laboratory on the second floor of the main building, store-room for Finance Department on the roof, parking area to the west of the main building, and Data Nest for LSD and installation of Workstation; fixing of false-ceiling in the corridors of LSD; and shifting of the PABX to the main building and operation of the central reception area.

Transport Management Branch
Senior Transport Officer: M. Hamidullah

The Branch coordinates transport operations, using Centre's vehicles and those hired from contractors. It provides pick-up and drop services for approximately 350 personnel every day. The vehicle maintenance workshop provides minor and major repair facilities for all the vehicles.

General Services Branch
General Services Officer: M. Mujibur Rahman

The Branch coordinates and controls the security services for the grounds and the property by coordinating the Centre's guards and those contracted from outside. It also provides services for cleaning, receipt and dispatch of mail, and logistic management of conferences and training activities of the Centre.

Staff Cafeteria
Staff Cafeteria Supervisor: M. Rafiqul Islam

The catering services are provided to the staff by maintaining the main Cafeteria and the Corridor Café for lunch, morning and afternoon tea.

A view of the November 2002 Meeting of the Board of Trustees

An average of 400 members of the staff used the canteen facilities every working day. Besides, the catering services also arranges meals for patients in the hospital and for participants at most events organized by the divisions/departments of the Centre.

Travel and Estate Office
Manager: Kh. Shafiqul Hossain

The Travel Services section of the Travel and Estate Office provides all travel-related services to all expatriate personnel, local staff members, members of the Board of Trustees, Director, Division Directors, visitors, and trainees. During arrival and departure of expatriate personnel, Director, and Division Directors, staff members of the Travel Services section receive and see them off at the airport. The section maintains liaison with concerned ministries and departments and different high commissions/embassies for obtaining clearance for long-term visas to facilitate their stay in Bangladesh and to visit abroad. This section also maintains a guesthouse for visitors and guests. Recently, the guesthouse was thoroughly renovated. The section arranges parties for different occasions.

The Estate Office looks after the operation of the telecommunication system of the Centre. Assistance is provided in hiring/leasing offices for projects and houses for international staff. The office is also responsible for the payment of utility bills and taxes and for other services provided by the Government of Bangladesh.

COMMITTEES

Board of Trustees
Chairperson: Prof. Ricardo Uauy Dagach

The general direction, management and administration of the affairs of the Centre vests in the Board of Trustees which has full authority to determine and execute the policies and undertaking of the Centre within the framework of the Ordinance. 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. Other trustees include three members nominated by the Government of Bangladesh, a 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.

In November 2002, the Executive Committee of the Board met in Dhaka with Prof. Ricardo Uauy Dagach as Chairperson. The deliberations of the meetings were, however, finalized with the concurrence of the entire Board via a teleconference following their comments on issues raised at the Board meeting which were circulated at the end of the meeting of sub-committees.

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 research protocols of the Centre and evaluates their scientific merit, competence of principal investigators, and relevance of protocols with the objectives and priorities of the Centre.

The Committee is composed of clinicians, epidemiologists, nutritionists, social scientists, laboratory scientists, gynaecologists, social scientists, and demographers/population scientists from both within and outside the Centre. In 2002, the Committee, in its 12 meetings, considered 38 new protocols, approved addendum proposals and time extension for a number of already-approved protocols, and reviewed the reports of already-completed protocols.

Ethical Review Committee
Chairperson: Prof. Mahmudur Rahman

The Ethical Review Committee (ERC), responsible to the Board of Trustees, is the sole body for giving ethical clearance for research protocols involving human subjects before any activity of the protocol starts. The Committee comprises 15 members: four 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 seven members selected by the Committee on an individual capacity. 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.

The Committee followed the ethical principles laid down in the ERC Guidelines and made risk/benefit analysis and scientific merit of the protocols while reviewing the protocols. The protocols were approved ensuring the welfare and rights of the subjects participating in the research projects. The Committee kept in view that, in research on humans, the interests of science should never take precedence over the well-being and human rights of the subjects.

BOT meeting is ususally followed by a meeting of the Donors Support Group

The Ethical Review Committee decided to establish Data Safety Monitoring Boards (DSMB) for overseeing the implementation of the research protocols involving trials of vaccines and new drugs, and developed a brief 'Terms of Reference' for their functioning

In 2002, the Committee, in addition to monthly meetings, convened two special meetings to consider research protocols needed for urgent consideration. 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, 27 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 and an emergency outbreak investigation proposal were approved during the year.

The ERC developed and implemented an 'Annual Report/Completion Report Form' for annual review of the ERC-approved ongoing research protocols.

The Committee also decided to establish Data Safety Monitoring Boards (DSMB) for overseeing the implementation of the research protocols involving trials of vaccines and new drugs, and developed a brief 'Terms of Reference' for their functioning. The Committee constituted five DSMBs, responsible to the ERC, for overseeing the implementation of such research protocols.

All proceedings of the ERC meetings were minuted, and the records were kept properly in order for any future reference. During the year, literature/documents relating to bioethics were circulated to the ERC members to update them in the field.

In 2001, the Centre had received Federalwide Assurance (no. FWA 00001468) from the Office for Human Research, US 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. The AEEC comprises five members representing national institutions involved in research and rearing of laboratory animals, three members on individual capacity, and two from the Centre.

The AEEC met twice during the year and considered four research protocols; all of them were approved after modification to address the issues raised by the Committee.

During the year, the Committee reviewed and modified the AEEC Guidelines and Application Form for submission of research protocols for consideration of the AEEC to the ICDDR,B Board of Trustees for its approval. The Committee also reviewed and suggested modification of the '*Manual for Care and Use of Laboratory Animal.*'

Dr. Md. Sirajul Islam, Head of the Environmental Microbiology Laboratory and President of the Centre's Staff Welfare Association briefing a group of local media personnel about Centre's activities

Staff Welfare Association
President: Dr. Md. Sirajul Islam

The ICDDR,B Staff Welfare Association (SWA) is a body of elected staff representatives and is recognized by the management for the purpose of maintaining good relationship between the staff and management, and dialogue with the management and Board of Trustees. Several accomplishments were made in 2002. Some of those are continuous efforts to enhance the staff salaries, encouraging the provision of vaccination for hepatitis B to Centre staff, educational stipends provided to children of the low-paid employees, condolence meetings for deceased personnel, and organizing the annual picnic and various games. During the year, the SWA played an important role in maintaining harmonious relationship between the staff and management of the Centre.

External Relations and Institutional Development Office
Head: Ishtiaque A. Zaman

ICDDR,B primarily relies on financial support from the development partners. The tasks of identifying new sources of funds for new initiatives and maintaining levels of support for continuing programmes are largely the responsibility of the External Relations and Institutional Development (ER&ID) Office.

The ER&ID Office maintains effective liaison with the development partners, Government of Bangladesh (GoB), non-government organizations (NGOs), press, and other media. The Office is orchestrated for increased communication with the donors, GoB, NGOs, business community, and different institutions throughout the world to raise the profile of, and the funding for, the Centre and to address management issues that arise during the implementation and interpretation of agreements between the Centre and its development partners.

Other external relations activities included: coordinating press conferences and briefings; publicising the achievements of the Centre in scientific fora; organizing special events; and developing fundraising initiatives and sponsorships for programmes and special events. The Office organized tours of the Centre's hospitals, laboratory and training facilities, and urban and rural field research sites for visiting ambassadors and other dignitaries to ICDDR,B.

The ER&ID Office serves as the Secretariat for the Centre's Donor Support Group (DSG) and assisted in the preparation of donor-related materials for the Board of Trustees meetings in June and November 2002. It continued to spearhead efforts and campaigns for the growth of the Centre Endowment Fund and the Hospital Endowment Fund.

Major accomplishments

- ***Additional core grants received from the Netherlands Government*:** The Netherlands Government provided an additional fund of 1.5 million euro as a core grant to the Centre. This was in addition to their regular one million dollar contribution.

A meeting of the development partners of ICDDR,B, with Mr. Anisul Huq Chowdhury, Secretary of the Economic Relations Division of the Ministry of Finance in the chair

Mr. Yohei Sasakawa, President of the Nippon Foundation (formerly Sasakawa Foundation), paid a visit to the Centre, with an eight-member delegation

- ***A paradigm shift: seeking bilateral fund from the development partners:*** The Centre is working with GoB to secure bilateral funding. At the November 2002 meeting of BoT, the Secretary of the Economic Relations Division (ERD), also a Trustee of the Centre, played a key role. Invitations to the development partners were made by the GoB, and the Secretary, ERD, made a passionate appeal on behalf of the Centre to supplement the appeals made by the BoT Chairperson. The appeals formally opened the door for the Centre to be considered for bilateral support from the development partners through the GoB.

- ***GoB is set to increase its support for the Centre:*** The regular yearly core contribution of the GoB to the Centre is being doubled to nearly US$350,000 by next year. In addition, the ERD has requested the Ministry of Health and Family Welfare (MoHFW) to include the Centre in the Financing Plan/Work Programme of Health, Nutrition and Population Sector Programme (HNPSP) for the July 2003-June 2006 period. The Centre is also collaborating with the GoB in the submission of country proposals to the Global Fund for AIDS, Tuberculosis and Malaria (GFATM).

Preparation of project proposals

The Office assisted in the preparation and submission of concept papers and project proposals for research initiatives from Centre scientists.

Dr. Ruth Frischer, Health Science Expert of the USAID/W, during her visit in connection with a seminar on zinc

Monitoring of grants

The Office routinely reviewed the terms and conditions of agreements entered into by the Centre to ensure that standards of scientific and ethical review and rights to publish research findings were consistent and that the work of the Centre's scientists was protected.

Communication

The ER&ID Office disseminated information materials to donors, press, and collaborating institutions throughout the world, organized press conferences, and arranged media coverage of the major scientific accomplishments of the Centre. The most important event was the press release on the success of the 'zinc study', the findings of which were published in the British Medical Journal on 9 November 2002. The leading national dailies published the news on the breakthrough of zinc research. The BBC World Service also highlighted the findings of zinc research.

The Office joined hands with media people in New York to organize a press event in Dhaka on the success of "ORS

H.E. Dr. David Carter, British High Commissioner to Bangladesh, paid a visit to ICDDR,B, accompanied by Dr. Neil Squires, Senior Adviser (Health & Population) of DFID; Dr. Jacqie Howell, Elizabeth House; and Dr. Chris Vickery, Save the Children (USA)

saving 40 million children", which was well-covered by the local media. The Office publicised other achievements of the Centre in scientific fora, leading to more national and international coverage of the Centre's work in the electronic and print media.

A new video was produced to promote the new activities and initiatives of the Centre. The Office continued to produce and distribute the bi-monthly newsletter 'the Grants News' to the donors, Trustees, and friends.

Profile-raising initiatives

The profile-raising events focused on bringing the achievements of the Centre since its inception as the Cholera Research Laboratory 43 years ago to a broader audience of global health-research initiatives. The profile-raising events highlighted the new research themes of the Centre and demonstrated how the Centre had evolved to address the present priorities of the global health community with special emphasis on addressing the health needs of the poorest and most vulnerable populations of the planet.

Inauguration of the PSKP Clinic within the Centre's Mohakhali campus by H.E. Mr. Jiro Kobayashi, the Japanese Ambassador to Bangladesh

The CDC Foundation, as co-sponsor with the Centre, organized the first profile-raising event in Atlanta, Georgia at the Carter Presidential Center on 25 March 2002 which coincided with the International Conference on Infectious Disease Research (ICIDR). Invited were the participants of the ICIDR and investigators of the Centers for Disease Control and Prevention, whose collaborative work with the Centre expanded significantly in 2002.

The profile-raising event in New York was held on 17 May, following the UN special session on children. Invited were the members of the UN community, corporate and academic communities of New York, and the foundation community. At the event, the Centre Director announced the launching of a new initiative, '100 Partners', where the Centre will aim to bring in at least 100 new partners who would support the Centre's endowment at a level of $10,000 annually. Following the announcement, the Centre received the first contribution of $25,000 of an initial unrestricted grant from Procter & Gamble. A new brochure is being developed for presentation to potential participants in the 100 Partners programme.

At the invitation of the International Health Solutions Trust (IHST), the UK fundraising arm of ICDDR,B, the Centre provided an update

H.E. Mr. Abdullah Bin Mohammad Al-Obaid Al-Namlah, Saudi Ambassador to Bangladesh, handing over their annual core contribution to ICDDR,B Director

to IHST Board members, similar to the presentation at the United Nations, in July 2002 at the House of Lords, UK. The Trust discussed the prospects for funding a research programme through the Community Trust Fund of the UK and sponsoring a fundraising event in London. Expanding partnerships in the UK will be a future focal point for the fundraising effort of the Centre.

Grants and Contracts Administration
Grants and Contracts Administrator: Vanessa Brooks

Beginning in July 2002, Grants and Contracts Administration became a separate function within the Director's Office and reports to the Director of the Centre. This shift reflects the expanding and diverse nature of agreements entered into between the Centre and its growing number of partners.

In 2002, major funding and support for collaboration came from well-recognized institutions, including the Wellcome Trust, as a new donor, to support research on neonatal infections, Thrasher Research Fund on nutrition research, Ellison Medical Foundation on molecular genetics, in collaboration with the Harvard Medical College, and Procter & Gamble on testing of new technology for arsenic mitigation. The NIH awarded a grant for laboratory research and surveillance on dengue fever. In the area of vaccine research, collaborations were expanded with the International Vaccine Institute, Wyeth Lederle Pharmaceutical Company, CDC, SBL Vaccin AB, and Avant Immunotherapeutics, Inc.

Collaborations were also expanded in the scientific divisions bringing into the Centre new research partners and extending agreements with the existing collaborators. The WELL Project (UK), Northumbria University (UK), Ministry of Health, Mozambique, are among such collaborators. Through NIH sub-contracts, additional research will be conducted in collaboration with the Johns Hopkins Bloomberg School of Public Health, New York University School of Medicine, Stanford University School of Medicine, and University of Maryland Biotechnology Institute, to name a few. Expanded collaborations continued with international partners, including WHO, US Office of Federal Disaster Assistance, Howard Hughes Medical Institute, Fogarty International Fellows Program, New England Hospital and Medical Center, KVL University (Denmark), Karolinska Institute (Sweden), World Bank (Washington, DC), and with local partners, such as BRAC, Kumudini Hospital, Dhaka Medical College Hospital, Holy Family Hospital, Radda MCH-FP Centre, Dhaka Shishu Hospital, Progoti Samaj Kallyan Protisthan (PSKP), NGO Clinic Network, USAID, and other US Government partners, and Asian Development Bank. This list

Mr. Joan Boer, Deputy Director General in charge of the International Cooperation at the Netherlands Foreign Ministry, being briefed by Centre Director about a rice-based ORS developed by the Centre

Dr. Frances Davidson, Chief of USAID/W's Nutrition Program, talking to the Centre Director and Chief Physician of the Dhaka Hospital about some nutrient-rich common foods

represents the network of collaborating partners that entered into new agreements in 2002 and does not reflect the full range of collaborations and partner organizations of the Centre.

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 ownership of data, specimens, and the right to publish results in accordance with international guidelines and standards of review. The Centre has also entered into a number of sub-contracts with local community-based NGOs that deliver healthcare services as a component of research projects of the Centre.

VISITORS IN 2002

The ER&ID Office arranged visits of dignitaries in 2002 which included the visit of the President of the Nippon Foundation Mr. Yohei Sasakawa, the British Parliamentary Under-Secretary of State and the Head of DFID Ms Sally Keeble, MP. Comprehensive visits were organized for ambassadors/high commissioners, senior civil servants, policy-makers, academicians, and researchers to tour the Centre's facilities in Dhaka, Matlab, Mirpur, and Kamalapur. Winning of the first-ever Gates Award for Global Health in 2001 created a special interest among many to get to know the Centre even better. Following is a list of the distinguished visitors to the Centre in 2002:

Austria: Dr. Markus Mikl and Dr. Eszter Nagy, Research Collaborators, InterCell Biomedical research and Development AG, Vienna

Bangladesh: A group of journalists from the leading national dailies; a team from National Defense College; and a team from the British Women's Association, Dhaka; Ms Anne Marie Minder, Deputy Resident Coordinator, SDC, Dhaka; Mr. Anthony Goodwin, Counsellor, Mr. Hans Rhein, Second Secretary, and Mr. Jaap Hamel, Health Adviser, Delegation of the European Commission, Dhaka; H.E. Mr. Jiro Kobayashi, Ambassador to Bangladesh, Mr. Yutaka Nakamura, First Secretary, and Mr. Shafiqur Rahman, Development AID, Embassy of Japan, Dhaka, along with a 40-member team of media representatives from the leading dailies, weeklies, and international news agencies; Ms Renate Pors, First Secretary, Netherlands Embassy in Dhaka; Dr. Gerard Reddingius, the Dutch Foreign Affairs Physician, Dhaka; Dr. Kayode Oyegbite, Chief of Health and Nutrition, UNICEF, Dhaka; Dr. Mehtab Curry, Deputy Head of DFID, Dhaka; H.E. Dr. David Carter, High Commissioner, British High Commission, Dhaka; Dr. Neil Squires, Health and Population Advisor, DFID, Dhaka; and Dr. Jackie Howell, Resident Physician, British High Commission, Dhaka; Mr. Christopher Webster, Deputy Chief of Mission, US Embassy, Dhaka, accompanied by a group of journalists;

Dr. Viveka Persson, Senior Research Officer of SIDA-SAREC during her visit to ICDDR,B

Belgium: Prof. Vincent De Brouwere, Department of Public Health, Prince Leopold Institute of Tropical Medicine, Antwerp

Canada: Mr. Victor Carvell, Director of Bangladesh Program, and Ms Janik Bouchard, Senior Program Manager, CIDA, Ottawa, Canada; Mr. Ken Graham, Sleeping Children Around the Word; and Jesse Rideout, McGill University, Montreal

China, People's Republic of: A team of Chinese health professionals and health administrators comprising Mr. Wu Shuwen, Director of Health Bureau, Mr. Xie Xinyyu, Primary Health Care and MCH Division, Ms Feng Ruizhen, Director of MCH Hospital, Yangbi County, Ms Yang Bo, Yunun MCH Hospital, Mr. Kang Jun, Dali MCH Hospital, Ms Zhao Shufang, Director of MCH Hospital, Ligiang County, Ms Duan Shuyu, MCH Hospital, Jianchuan County, and Ms Chen Yingxian of Melian County

Denmark*:* Dr. Shakuntala H. Thilsted, Human Nutrition, Royal Veterinary and Agricultural University (KVL), Copenhagen

Ethiopia*:* Dr. Sileshi Lulseged and Dr. Ato. N. Nega

France: Mr. Michel Lescanne, CEO and Ms Isabelle Sauguet, Legal Advisor, Nuriset; Dr. Paul Equipart, Rodael Pharmaceuticals; Professor Jehan-Francois Desjeux, CNAM, Paris; Mr. J.M. Fournier and Ms Farida Nato, Institut Pasteur

India: Dr. Paritosh Keertikar and Dr. Yashesh Mehta, Quintiles, Mumbai; Dr. M.K. Bhan; Dr. N. Bhandari; Professor N.K. Ganguly, Director General, Indian Council of Medical Research, Delhi; Dr. N. Selvakumar, Deputy Director, Tuberculosis Research Centre (ICMR), Chennai; Dr. T. Ramamurthy, Assistant Director, NICED, Kolkata

***Indonesia*:** Dr. Iqbal Anver, Counsellor, Regional Medical Officer, Embassy of the Federal Republic of Germany, Jakarta

***Japan*:** A 10-member team from the Nippon Foundation, Japan, headed by its President Mr. Yohei Sasakawa; Prof. Tsutomu Mizota, Chair, Department of Social and Environmental Medicine, Sakamotao University; Ms Victora Dunning, Programme Officer, Reproductive Health, UN Foundation; Dr. Hirofumi Ando, Professor, College of International Relations, Nihon University; Mr. Ryoichi Suzuki, Assistant Executive Director, Japanese Organization for International Cooperation in Family Planning (JOICEFP); Ms Kayoko Mizuta, Special Technical Adviser and a three-member medical team headed by Ms Yunie Inoue, Medical Coordinator, JICA; Shinobu Kikuchi, JICE Researcher, JICA; Mr. Michiro Ozaki, Senior Adviser, Institute for International Cooperation (IFIC); Prof. Yoshifumi Takeda, Faculty of Life Sciences, Jissen Women's University, Tokyo; Dr. Shinji Yamasaki, Division Chief, Appropriate Technology Division, Research Institute, International Medical Centre; Prof. Sumio Shinoda, Dean and Professor, Graduate School of Natural Science and Technology, Okayama University; Dr. Mitsuaki Nishibuchi, Centre for Southeast Asian Studies, Kyoto University; and a ten-member delegate from Japan Scout Association headed by Mr. Sora Hamada

Mexico: Lynnette Neufeld, Head, Department of Child Nutrition and Health, National Institute of Public Health, Cuernavaca, Morelos

Myanmar: Lwin Mar Aye, Clinical Research Associate, Glaxo SmithKline, Myanmar

Nepal: Ms Cathy Thompson, USAID Mission in Nepal; Dr. Pandu Wijeyaratnae, Residence Advisor, EHP; Dr. Mahendra Bahadur Bista, Director, EDCD/DHS; Dr. Sarala Mallah, Director, NPHL/DHS; and Mr. Prem Kumar Shrestha, Section Officer, Ministry of Health

***The Netherlands*:** Mr. Joan Boer, Deputy Director General, International Cooperation of the Netherlands Foreign Ministry; Dr. F. Ch. Schiereck, MIS Consultant, Netherlands Interdisciplinary Demographic Institute, Ugchelen

Pakistan: Dr. Zulfiqar Bhutta and Dr. Q. Nizami

Singapore: Dr. Joseph Cinanni, Regional Medical Officer, Overseas Medical Services, Canadian High Commission

South Africa: Dr. Alexandra Bambas, Coordinator of the Global Equity Gauge Alliance, Health Systems Trust, Durban

South Korea: Dr. Lorenz von Seidlein, Mr. Andrew Nymmete, Dr. Christine Poulos, Dr. Mardiate Nadjib, and Ms Eunsik Park, International Vaccine Institute

Sweden: Professor Marie Vahter, Division of Metals and Health and Prof. Bengt Winblad, Karolinska Institute; Zarina Nahar Kabir, Stockholm Gerontology Research Centre; Dr. Samar Basu, Associate Professor, Sections of Geriatrics and Clinical Nutrition Research, Faculty of Medicine and Prof. Gunilla Lindmark, Head of the International Maternal and Child Health, Uppsala University; Professor Ann-Mari Svennerholm, Department of Medical Microbiology, University of Göteborg; Dr. Ake Wahlin, Psychologist, Division of Geriatric Epidemiology; and Dr. Viveka Persson, Senior Research Officer, SIDA, Stockholm

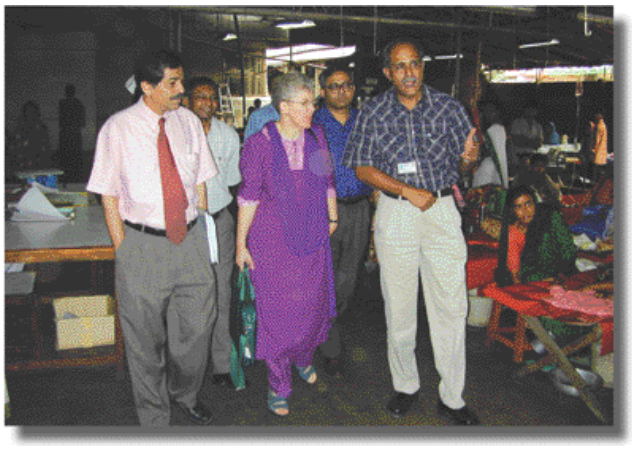
Switzerland: Dr. K. Gyr, Professor of Medicine, Department of Internal Medicine, University Hospital, Basel and Ms Suzanne Zumstein, Programme Officer, Asia Division, SDC, Geneva

Tanzania: Dr. Gideon Kwesigabo, Department of Epidemiology, Muhimbili University College of Health Sciences and Dr. Aldin Mutembei, University of Dar es Salam

Thailand: Prof. Wanpen Chaicumpa, Faculty of Tropical Medicine, Mahidol University

UNICEF: Mr. Morten Giersing, UNICEF Representative

United Kingdom: Ms Sally Keeble, UK Parliamentary Under-Secretary of State for International Development and Head of DFID; Dr. Carine Ronsmans, Maternal and Child Epidemiology Unit, Department of Epidemiology and Population Science, Dr. Damian Walker, Research Fellow, Health Economics, Health Policy Unit, Dr. Julia Fox-Rushby, Department of Public Health & Policy, Health Economics, Dr. Elizabetta Pegurri, Dr. Vivian Valdmanis, Prof. Andrew Collinson, Public Health



Dr. Milla Maclachlan, Head of Nutrition Program at the World Bank in Washington D.C., during her visit to the Centre. Dr. Iqbal Kabir of the Bank's Dhaka Office is also seen

ICDDR,B maintains institutional linkage with various national, regional and international organizations, in addition to the donor community. The activities range from collaborative research to fundraising initiative

Nutrition Unit, Dr. Colin Sanderson, Reader in Health Services, Health Services Research Unit, Public Health and Policy Research Unit, Prof. Graham Hitman, London School of Hygiene & Tropical Medicine; Prof. Subrata Ghosh, Department of Gastroenterolgy, Imperial College, London; Prof. Sally Grantham-McGregor, Child Health and Nutrition, Centre for International Child Health, Institute of Child Health, University College, London.

***United States of America*:** Mrs. Mary Metzger, wife of Vice Admiral James Metzger, Commander of the 7th Fleet, US Navy; a four-member USAID team headed by Mr. Charles Llewellyn; Dr. Frances Davidson, Head of Nutrition and Dr. Ruth Frischer, Health Science Specialist, USAID/Washington, accompanied by Mr. Neal Brandes and Ms Gina Coco; Ms Margaret Marshall and Dr. Mark Dilloway, Wyeth Lederle Vaccines; Dr. Robert E. Black, Dr. Peter Winch, Dr. Abdullah Baqui, and Dr. Peter Winch, Johns Hopkins Bloomberg School of Public Health; Dr. Mahmud Khan, Associate Professor, Department of Health Systems, International Health and Development, Tulane University; Prof. Stephen P. Luby MD, Foodborne and Diarrheal Diseases Department, National Center for Infectious Diseases, Atlanta; Dr. Bruce H. Keswick, Section Head, Personal Health Care (R&D), Christy Olsen, P&G; Dr. Kathleen M. Rasmussen, Professor, Division of Nutritional Sciences, Hall, Ithaca, NY; Prof. Robert Suskind (Ex-Director, ICDDR,B), School of Medicine, University of Alabama at Birmingham; Dr. Adam Cohen, a resident in Pediatric Gastroenterology from Children Hospital, University of Seattle, Washington; Dr. Karl Naumann of Harvard; Prof. J. Mekalanos, Department of Microbiology and Molecular Genetics, Harvard Medical School; Prof. W.A. Petri, Jr., University of Virginia; Dr. Beth D. Kirkpatrick, University of Vermont; Dr. Anwarul Huq and Ms Shelly Lewis, University of Maryland Biotechnology Institute; Prof. Steve Calderwood, Harvard Medical School and Chief, Division of Infectious Diseases; Dr. Ed Ryan, Division of Infectious Diseases, Massachusetts General Hospital, Boston; Prof. R. Bradley Sack, Johns Hopkins University; Dr. Jill G. Conley, Director, International Pre-college Science Education and Resources Programs and Dr. Laura L. Kinkead, Program Officer, Research Resources Programs, Howard Hughes Medical Institute, Washington; Prof. Jorge Tolosa, Coordinator, Global Network for Perinatal and Reproductive Health and Professor, Department of Obstetrics and Gynecology, Thomas Jefferson University, Philadelphia; Mr. Jeff Schaffer, Senior Program Officer, Conrad Hilton Foundation; Dr. A. Dean Byrd, President, and Mr. Justin Brown, Programme Manager, Thrasher Research Foundation; Dr. Lyle Peterson, Dr. Carolyn Bridges, Dr. Pauline Terebuh, Dr. Ellen Dotson, Ms Maureen Phelan, Dr. Steve Luby, Dr. Andi Shane, Dr. Julie Schillinger, and Dr. Othmar Kehl, CDC, Atlanta

World Bank: Dr. Milla McLachlan, Nutrition Advisor

World Health Organization: Dr. Olivier Fontaine, WHO, Geneva; Thomas Cherian, Department of Vaccines & Biologicals, WHO Secretariat, Geneva, Switzerland;

Institutional Collaboration in 2002

ICDDR,B maintains institutional linkage with various national, regional and international organizations, in addition to the donor community.

A team of DFID officials from Asia, Africa, its headquarters, and other areas visiting the Centre

Mrs. Susan Carter, wife of the British High Commissioner to Bangladesh, and the members of the British Women's Association paid a courtesy visit to the Centre

The activities range from collaborative research to fundraising initiative. Following is a list of institutions that the Centre collaborated with during 2002:

International Level
(In alphabetical order)

Acambis Research Limited, UK; African Centre for Health and Population Study, Kenya; Aichi Medical University, Japan; Albany Medical College, USA; Applied Science Institute, India; Armed Forces Research Institute of Medical Sciences, Thailand; Arysta Life Science Corporation, Japan; Bayer AG, Germany; Centers for Disease Control and Prevention, USA; Centre for Southeast Asian Studies, Kyoto University, Japan; Chiba University, Japan; Cornell University, USA; Dartmouth Medical School, Germany; Department of Immunology and Parasitology, Fukui Medical University, Japan; Department of Medical Technology, School of Health Sciences, Japan; Department of Medicine, Microbiology and Pathology, University of Virginia, USA; Department of Microbiology and Immunology, Mahidol University, Thailand; Department of Microbiology, B.P. Koirala Institute of Health Sciences, Nepal; Department of Microbiology, Institute of Medicine, Tribhuban University, Nepal; Emory University, USA; ETH-Zurich, Switzerland; Faculty of Human Life Sciences, Jyssen Women's University, Japan; Harvard Medical School, USA; Harvard University, USA; Hellen Keller International, USA; Howard Hughes Medical Institute in Stanford University, USA; Howard Hughes Medical Institute, USA; Indian Institute of Population Sciences; INSERM, France; Institute of Child Health, UK; InterCel Biomedical Research and Development AG, Austria; International Vaccine Institute, Korea; Johns Hopkins University Bloomberg School of Hygiene and Public Health, USA; Karolinska Institute, Sweden; Laboratory of International Prevention of Epidemics, Osaka Prefecture University, Japan; London School of Hygiene & Tropical Medicine, UK; McGill University Medical School, Canada; Massachusetts General Hospital, USA; Ministry of Health, His Majesty's Government of Nepal; Monipal Medical College, Nepal; National Institute of Cholera and Enteric Diseases, India; National Institutes of Health, USA; National Institute of Immunology, India; National Institute of Infectious Diseases, Japan; Netherlands Interdisciplinary Demographic Institute. The Netherlands; New England Medical Center, USA; New York University School of Medicine, USA; Nutriset, France; Oxford University, UK; Institut Pasteur, France; Pfizer Inc., USA; Population Studies Center, University of Pennsylvania, USA; RAND Corporation, USA; School of Medicine, University of Tokushima, Japan; Southampton University, UK; Stanford Medical School, USA; Tokushima University, Japan; Tuberculosis Research Centre, India; Tufts University, USA; UNICEF; United States Agency for International Development (USAID), Washington, USA; United States Agency for International Development (USAID)-Nepal; University of Alabama at Birmingham, USA; University of Basel, Switzerland; University of California-Davis, USA; University of Edinburgh, UK; University of Göteborg, Sweden; University of Leuven, Belgium; University of Maryland, Baltimore, USA; University of Maryland Biotechnology Institute, USA; University of Newcastle upon Tyne, UK; University of Texas at Galveston, USA; University of Umea, Sweden;

Mrs. Metzer, wife of Vice Admiral and Commander of the 7th Fleet of the US Navy Mr James Metzer, visiting the Dhaka Hospital of the Centre

A twenty-member team of high-ranking government and military officials from the National Defense College during a visit to the Centre

Uppsala University, Sweden; USC Canada; Wageningen Agricultural University, The Netherlands; Wagner College, USA; World Bank; World Health Organization; Wyeth-Lederle-Praxis, USA.

National level

American International School, Dhaka; APOSH; ARI Control Programme, Government of Bangladesh (GoB); Ashar Alo; Bandhu Social Welfare Society; Bangabandhu Sheikh Mujib Medical University; Bangladesh Agricultural University, Mymensingh; Bangladesh Association of Voluntary Sterilization; Bangladesh Breastfeeding Foundation; Bangladesh Bureau of Statistics; Bangladesh Center for Communication Programs; Bangladesh Institute of Development Studies; Bangladesh Integrated Nutrition Project (BINP); Bangladesh Livestock Research Institute; Bangladesh National Nutrition Council; Bangladesh Rural Advancement Committee (BRAC); Bangladesh Women Health Coalition; Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine & Metabolic Disorders (BIRDEM); CARE Bangladesh; Central Drug Treatment and Rehabilitation Centre; Central Skin and Social Hygiene Centre, Chittagong; Chittagong Medical College Hospital; College of Home Economics; Concerned Women for Family Planning; Department of Public Health Engineering, GoB; Dhaka City Corporation; Dhaka Medical College Hospital; Dhaka Shishu (Children's) Hospital; Directorate of Family Planning, MoHFW, GoB; Directorate General of Health Services, MoHFW, GoB; Durjoy Nari Sangha; Family Health International; EPI Programme, GoB Field Laboratory at Refugee Camp in Chittagong Hill Tracts; Gonoshasthya Kendra; Health Economics Unit, MoHFW, GoB; Holy Family Red Crescent Hospital; Institute of Epidemiology and Disease Control Research; Institute of Health Economics, University of Dhaka; Institute of Mother and Child Health; Institute of Nutrition and Food Science, University of Dhaka; Institute of Public Health; Jahangirnagar University; Jatiya Jubo Sangha; Karmajibi Kallyan Sangha; Kumudini Welfare Trust (Kumudini Hospital); Lamb Hospital; Marie Stopes Clinic Society; Ministry of Health and Family Welfare, GoB; Mukti Lawrence Foundation; Mukti Mahila Samity; Mymensingh Medical College Hospital; Nari Moitree; Nari Mukti Sangha; National Institute of Population Research and Training; National Institute of Preventive and Social Medicine; National Nutrition Project (NNP); NIPHP Partners; NOVA Medical Centre; Paricharja; Partners in Population and Development, Bangladesh; Pathfinder International; PIACT Bangladesh; Plan International; Popular Diagnostics; Population Council, Dhaka; Prochesta; Progoti Samaj Kallyan Protisthan (PSKP); Proshika; Radda MCH-FP Centre; Rangpur Medical College Hospital; Rajshahi Medical College Hospital; The Salvation Army; Save the Children Fund (Australia), Dhaka; Shishuk, Bangladesh; Sir Salimullah Medical College Hospital; Social Marketing Company; Square Pharmaceuticals Limited; Sylhet M.A.G. Osmani Medical College Hospital; TB/Leprosy Control Programme, GoB; University of Dhaka; World Bank, Dhaka; World Vision, Bangladesh

Ms Suzanne Zumstein, Program Officer of Asia Desk at the SDC Headquarters, and Ms Ann Marie Minder, Deputy Resident Coordinator of SDC-Dhaka, visiting the Centre's Dhaka Hospital

ICDDR,B Publications 2002

A. Internal Publication Series

1. ICDDR,B Annual Report 2001. May 2002. 168 p.

Working Papers

1. Khanum PA, Islam A, Quaiyum MA, Millsap J. Use of obstetric care services in Bangladesh: does knowledge of husbands matter? / edited by M Shamsul Islam Khan. 2002. iv, 27 p. (ICDDR,B working paper no. 153)
2. Khanum R, Hossain SAS, Sarker S, Musa SAJ, Routh S. Operations research on ESP delivery in urban areas: meeting additional health and family-planning needs of clients by addressing missed opportunities: an urban experience / edited by M Shamsul Islam Khan. 2002. iv, 29 p. (ICDDR,B working paper no. 152)
3. Rahman S, Khan AI, Razzaq R, Shams I. Operational aspects of syndromic management of RTIs/STIs at a primary healthcare-level clinic / edited by M Shamsul Islam Khan. 2001. iii, 25 p. (ICDDR,B working paper no. 151).*
4. Uddin AHN, Kabir H, Mahbub-ul-Alam, Alam S, Ashraf A. Assessment of the upazila-level record-keeping and reporting system of the Bangladesh Health and Population Sector Programme / edited by M Shamsul Islam Khan. 2002. vi, 64 p. (ICDDR,B working paper no. 154)
5. Uddin MJ, Kabir H, Mahbub-ul-Alam, Uddin AHN, Ashraf A. Assessment of the record-keeping and reporting system of the Bangladesh Health and Population Sector Programme at the union level / edited by M Shamsul Islam Khan. 2002. iv, 33 p. (ICDDR,B working paper no. 155)

Scientific Report

6. Health and demographic surveillance system—Matlab. V. 33. Registration of health and demographic events 2000. 2002. x, 102 p. (ICDDR,B scientific report no. 89)

Special Publication

7. Malnutrition: meeting the challenges in South Asia; programme and abstracts of the 10th Annual Scientific Conference of ICDDR,B: Centre for Health and Population Research, Dhaka, 11-13 June 2002 / chief editor: M Shamsul Islam Khan, editors: Peter Thorpe, MA Rahim, SK Roy. xxxii, 168 p. (ICDDR,B special publication no. 113)

Specialized Bibliography Series

8. Bibliography of nutrition research at ICDDR,B, 1997-2001 / editor: S.K. Roy, compilation and documentation: M. Shamsul Islam Khan, Md. Nazimuddin, M. Al Mamun, Syeda Ayesha Parveen, Md. Anisur Rahman. 2002. 59 p. (Specialized bibliography series no. 18)

Journal and Newsletters

1. Journal of Health, Population and Nutrition. V. 20, no. 1-4, 2002
2. Glimpse. V. 24, no. 1-4, 2002
3. Shasthya Sanglap. V. 10, no. 3, and V. 11, no. 1-2
4. Health and Science Bulletin. V. 1, no. 1, 2002

B. Original Scientific Papers (*including short reports*)

1. Ahmed SM, Rana AKMM, Chowdhury M, Bhuiya A. Measuring perceived health outcomes in non-western culture: does SF-36 have a place? J Health Popul Nutr 2002 Dec;20(4):334-42
2. Akramuzzaman SM, Cutts FT, Hossain MJ, Wahedi OK, Nahar N, Islam D, Shaha NC, Mahalanabis D. Measles vaccine effectiveness and risk factors for measles in Dhaka, Bangladesh. Bull World Health Organ 2002;80(10):776-82
3. Alam MA, Miah MRA, Rahman M, Sattar H, Saleh AA. Comparison of PCR method with the culture method for identification of gonococci from endocervical swabs (brief communication). Indian J Med Microbiol 2002 Jan;20(1):37-9
4. Ali M, Emch M, Yunus M, Sack RB. Are the environmental niches of *Vibrio cholerae* O139 different from those of *Vibrio cholerae* O1 El Tor? Int J Infect Dis 2001;5(4):214-9*
5. Ali M, Emch M, Donnay JP, Yunus M, Sack RB. Identifying environmental risk factors for endemic cholera: a raster GIS approach. Health Place 2002 Sep;8(3):201-10
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8. Arends-Kuenning M. Reconsidering the doorstep-delivery system in the Bangladesh Family Planning Program. Stud Fam Plann 2002 Mar;33(1):87-102. (ICDDR,B data used)
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