Mission Statement

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

Available online
http://www.icddrb.org
The cover photograph depicts a memorable moment of 2001: Ms Melinda Gates of the Bill and Melinda Gates Foundation presenting the first ever Gates Award for Global Health to Prof. Marian Jacobs, Chairperson of the Board of Trustees and Prof. David Sack, Director of ICDDR,B in the Award Ceremony held in Washington, DC on 31 May 2001.
Preface

This twenty-third Annual Report of the Centre documents many aspects of the activities during 2001, including research, support for research, health services, training, dissemination, and administration.

Those who are regular readers of our annual report may observe a notable change in the style of presentation of material this year. Instead of describing the completed and ongoing research protocols with names of investigators, donors, and collaborating institutions as was done for the last several years, important findings have been presented this year as stories under the six research programmes of the Centre. However, a list of ‘ongoing protocols’ that contains all protocols (completed or incomplete during 2001) with the names of principal investigators and funding agencies has also been included separately to identify and recognize the scientists’ involvement in their work.

Scientific papers, abstracts, and other documents produced and published by the Centre’s 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. The studies that were completed during 2001 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.
# ICDR, B: Centre for Health and Population Research Annual Report 2001

## Preface

The Centre Over the Years

Board of Trustees 2001

**Director's Report**

**Achievements**

**Child Health**
- Integrated Management of Childhood Illness (IMCI)
- Child Health Promotion
- Child Development

**Reproductive Health**
- Toward Safer Motherhood
- Measuring the Unmet Need for Specialized Obstetric Services
- Reaching Men for Vasectomy Operation

**Nutrition**
- Micronutrient Interventions
- Low Birth-weight Initiative
- Moderate Malnutrition
- Severe Malnutrition
- Operations Research Management and Capacity Development
- Exclusive Breast-feeding

**Infectious Diseases and Vaccine Sciences**
- Enteric Diseases
  - Diarrhoea
  - Shigellosis
  - Helicobacter pylori infection
  - Amoebiasis
- Empiric Therapy for Severely-malnourished Children
- Acute Respiratory Infections
- Tuberculosis
- Dengue
- Sexually Transmitted Diseases
- Visceral Leishmaniasis

**Health and Family Planning Systems**
- Community Involves Itself in Delivery of ESP
- Costing and Financing of Service Provision

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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)
1969  Relationship between stopping breast-feeding and resumption of menstruation demonstrated
1971  Independence of Bangladesh
1973  Shift from Classical to El Tor cholera identified
1977  Maternal Child Health and Family Planning interventions began in Matlab
1978  Government of Bangladesh Ordinance establishing ICDDR,B signed
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 of 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* 0139 Bengal identified and characterized
1994  Twenty fifth anniversary of ORS celebrated. ICDDR,B 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 MoHFW
1999  Hon’ble Prime Minister Sheikh Hasina opens the week-long festivity to mark the 20th anni-
      versary of internationalization of ICDDR,B and calls upon all to support the Centre
      Protocolized management of severely malnourished child published in *Lancet*
2000  ICDDR,B assists GOB 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
Board of Trustees 2001

Chairperson: Prof. Marian E. Jacobs (South Africa)

Member-Secretary: Prof. David A. Sack (as Director, ICDDR,B)

Members

Mr. Rolf C. Carriere (UNICEF)

Prof. Rita R. Colwell (USA) till June
Dr. I. Kaye Wachsmuth (USA) from July

Dr. Ricardo Uauy Dagach (Chile)

Prof. N.K. Ganguly (India) from July

Dr. Maimunah Bte Abdul Hamid (Malaysia) from July

Dr. Tawfik A.M. Khoja (Kingdom of Saudi Arabia) till June

Prof. Peter McDonald (Australia) till June
Prof. Terence H. Hull (Australia) from July

Dr. Nobukatsu Ishikawa (Japan)

Prof. A.K. Azad Khan (Bangladesh)

Prof. Jane Anita Kusin (The Netherlands) from July

Dr. Claudio Franco Lanata (Peru) from July

Dr. Tikki Pang (WHO)

Mr. M. Moniruzzaman (Bangladesh) till October
Mr. M. Fazlur Rahman (Bangladesh) from November

Prof. Marcel Tanner (Switzerland)

Prof. Carol Vlassoff (Suriname)
ICDDR,B: Centre for Health and Population Research
Director’s Report 2001

This director’s report must start out with the obvious highlight of the year… perhaps the decade. On 31 May, in the presence of U.N. Secretary General Kofi Annan, His Excellency Ahmed Tariq Karim, ambassador to the U.S.A. from Bangladesh, many other dignitaries including five past directors of the Centre, many alumni of the Centre, and over 1000 persons attending the awards banquet of the Global Health Council, Ms Melinda Gates awarded the first ever Gates Award for Global Health to ICDDR,B: Centre for Health and Population Research.

In her award speech, Ms Gates spoke these words:

“This evening we’ve celebrated the lives and work of many unsung heroes. And that is precisely the idea behind the Gates Award for Global Health, to bring overdue recognition to the heroic people and institutions that have been fighting this fight for so long. The Gates Award for Global Health was created last December, providing a million dollars to an organization that has made a major and lasting contribution to global health. We asked for it when we wrote: ‘nominations may be submitted by anyone from any country.’ And we got it. Nominations came in from every continent, for organizations large and small, new and old, famous and obscure. You’ve never seen a more impressive list.

The decision was difficult, as you can imagine. So many of you have done such good work. With this Award, we are recognizing how much good science happens on the frontlines, where the need is greatest. And we’re celebrating an organization that has swiftly moved from one problem to another, helping sufferers and scientists with equal selflessness.

I’m proud to present the first Gates Award for Global Health to the Centre for Health and Population Research in Bangladesh. The Centre has been in existence since 1960. Many of you know it as ICDDR,B—the International Centre for Diarrhoeal Disease Research, Bangladesh…”

“…The Centre’s most famous achievement was their pioneering work in the development and dissemination of oral rehydration solution, a balance of sodium and glucose that is estimated to save the lives of three million children each year. Until ORS, one of the greatest killers in Bangladesh and across the developing world was diarrhea…”

“The simplicity of ORS should never obscure its brilliance or its impact. The Centre has also been in the forefront of the fight against cholera. As you heard in the video, the Centre has become an important resource for family planning, and nutritional information. And of course, they treat people — 120,000 a year — more than 300 a day — 80% of them under five. In both Dhaka Hospital and in Matlab, hours away by land and water, children are brought in all day long, more dead than alive. They often leave the same day, with a new lease on life. We may understand the science behind that, but it doesn’t make it any less of a miracle.”

“Best of all, the Centre’s remarkable trainees are drawn from around the world, and they take their lessons back to their countries. More than 20,000 trainees have come from and returned to 78 countries. Each is an emissary of hope…”

“It gives me great pleasure to present the first ever Gates Award for Global Health to Dr. David Sack, Director of the Centre for Health and Population Research in Bangladesh and Professor Marian Jacobs, Board Chair for the Centre.”
In his acceptance speech, Dr. Sack was able to read a letter he had received from the Prime Minister of Bangladesh. In her letter, she said the following:

“...I am happy to learn that the Gates Award for Global Health has been awarded to the International Centre for Diarrhoeal Disease Research, Bangladesh. This is the first award made by the Foundation...I am proud that an institution located in Bangladesh and created by our statute has been recognized for its excellence...”

“Globally, oral rehydration solution (ORS) is the main treatment for diarrhoeal diseases. This is a simple technology which the average household in Bangladesh and other low-income countries can administer. ORS was innovated in Bangladesh and has become celebrated knowledge — and an export from Bangladesh. I am confident that the Bangladeshi professionals together with international experts working at the Centre can continue to make similar contributions and that they will address new health issues in course of time...”

“Reciprocating the international recognition achieved by the Centre, I have the pleasure to inform you that the Government will match the award by making contribution of an equivalent amount—50 million taka—for which necessary budgetary appropriations will be made."

“On behalf of my Government and myself, I assure you of all help so that the Centre can continue to discharge its functions with efficiency.”

The letter was signed by Sheikh Hasina, the Prime Minister of Bangladesh.

The Gates and matching Bangladesh award gives renewed emphasis to the importance of our work and the energy to which we address our programmes. While the staff continues to ponder the meaning of this prestigious award, the funds have allowed for the establishment of a special Gates-Bangladesh fund that is being used over the next four years to support career development of Bangladeshi scientists at the Centre, to help to pay for hospital costs, to fund innovative projects of scientists, and to invest in future sustainable programmes at the Centre. The availability of the fund will allow the Centre to be more responsive to the needs of Bangladesh and the opportunities at the Centre. Already, we estimate that this fund has allowed the Centre to provide care to 40,000 acutely ill people in Bangladesh, saving the lives of the 4000 vulnerable people who would have died had they not received our care. It has also funded scholarships allowing two women scientists to earn advanced degrees, it has funded at least ten innovative projects, and has allowed the Centre to improve our diagnostic facilities that will continue to earn revenue for the Centre in the years to come. We look forward to the ongoing benefits from the award.

Clinical services: The Centre is generally known outside Bangladesh as a ‘research institute’, and our mission statement reflects our emphasis on research and finding solutions to problems. Our budget, which shows that about 10% of the overall costs are devoted to patient care, also suggests that our major emphasis is on the research rather than providing medical care. But this does not tell the whole story, and in fact, a unique feature of the Centre is the manner in which research and service are interwoven. The clinical research at the Dhaka and Matlab hospitals is only possible because of the large numbers who come for treatment of their very severe illnesses. Nearly every community-based research protocol also provides
clinical services as a part of the study. Studies on amoebiasis and phase I and II studies on new vaccines in the Mirpur community also include a clinic where the community benefits from their involvement with the Centre and where the procedures for the studies can be carried out efficiently. The Centre established a clinic in Kamalapur as part of the ongoing research project in this slum area of Dhaka. A similar clinic is operating in Nandipara. And the best example is that of Matlab where about 240,000 people in the HDSS area benefit from the community health workers, the sub-centres, and Matlab Hospital, all of which provide patient care 24 hours a day as part of their ‘research’ work. In Chakaria, the Centre assists the communities decide and carry out the plans that they themselves have prepared. Providing these services is a reflection of our commitment to work with the communities where we work and to participate with them in the research. This is the ethical approach, and from the scientific viewpoint, it is the most efficient way to answer the scientific questions defined in the protocol. The trusting relationship between the communities and the Centre, which constitutes another unique characteristic of the Centre, places an even greater responsibility on all of us to maintain high ethical standards and to avoid misusing the trust placed in us.

Also included among our services is the technical advice and consultancies that the Centre provides. Increasingly, the Centre’s staff is being called to provide assistance to programmes in Bangladesh and other countries. The Laboratory Sciences Division has ongoing collaborations with the Government of Nepal to upgrade their laboratories for the common acute infectious diseases, and consultants have travelled to Bhutan, Pakistan, and Africa as well as providing ongoing services to organizations in Bangladesh. We value these opportunities for networking.

**Leadership changes at the Centre:** Some changes in key scientific leadership took place in 2001. Three members retired after serving six years on the Board of Trustees, including Rita Colwell, Tawfik A.M. Khoja, and Peter MacDonald. New members joining the Board include Maimunah Bte Abdul Hamid, a Malaysian national, I. Kaye Wachsmuth, a US national, and Terence Hull, an Australian national. Professor Marian Jacobs continued as Chairperson of the Board through 2001.

Some significant changes in the senior management included the departure of Dr. George Fuchs, Head of the Clinical Sciences Division, who left the Centre in June to join the paediatric faculty at the University of Arkansas, Mr. John F. Winkelmann, Chief Finance Officer, who left the Centre in May to return home in British Columbia, and Dr. J. Bogaerts, a Belgian national, who left in December. Dr. Md. Abdus Salam, a Bangladesh national, became Acting Head of the Clinical Sciences Division and Mr. Stephen Sage, a US national, joined as the new Chief Finance Officer. Dr. G. Balakrish Nair, an Indian national, who was the Acting Head of the Laboratory Sciences Division, was appointed to head this division following an international search. Dr. Rob Breiman, a US national, was appointed Head of the Health Systems and Infectious Diseases Division (formerly known as the Health and Population Extension Division) in November. Mr. Peter Thorpe joined the Centre as Associate Director and Head of the newly-created Information Sciences Division in August 2001.

**Financial support:** The Centre wants to acknowledge the many donors who have made it possible for the Centre to carry out its mission, and especially to thank those donors who have provided unrestricted funds. These include both individual donors who responded to the Circle-Around-the-Centre campaign (these funds were used primarily for staff development) and to the larger donors, such as the governments of the Netherlands, the United States, Switzerland, Canada, Australia, Saudi Arabia, Sweden, Belgium, Australia, Bangladesh, and Sri Lanka whose unrestricted
donations are so crucial. Without these unrestricted gifts, it would be difficult for the Centre to continue as an institution. With these gifts, the Centre was able to balance its budget for the third year in a row, bringing the cumulative deficit to less than 3 million dollars for the first time since 1997. The Government of Japan again made a major contribution to the Hospital Endowment Fund along with their annual and very significant funding of important project work at the Centre. Other major agreements included an extension to the cooperative agreement with the United States Agency for International Development under the Family Health Research Project (formerly known as the Operations Research Project) and with the Department for International Development, U.K., for a five-year project on Poverty and Health. The Centre also negotiated new agreements with the governments of Sweden and Australia, and with UNICEF for specific projects. Each of these agreements will help provide more stable funding for some of the large initiatives at the Centre during the years to come.

The endowments continue to be an important element in the long-term stability to the Centre. Already the hospital endowment, which now stands at about 5 million dollars, is able to provide about US$200,000 per year to the operating costs for patient care. The benefit from this endowment is so apparent to anyone who visits the hospital; it saves the lives of about 10,000 vulnerable people each year, and this benefit is multiplied by the lives it saves through further research and training of persons who come to Dhaka to learn how to manage severely-ill patients at minimal costs. As one participant in the training course on Emergency Management of Cholera and Shigellosis Epidemics explained to me when I asked what she would do with the knowledge she gained from the course—"I will go back and organize training courses like this one for my organization. Now that I have seen with my own eyes how it can be done, it will help me teach these methods in Africa. Even if technology brings these training courses to the web, it will not replace the need to have this first-hand experience."

A problem we face as an institution that depends entirely on ‘soft money’ is the notion of common operating costs (sometimes referred to as ‘indirect costs’). These are institutional costs that must be covered if the Centre is to exist as an institution in a sustainable manner. These include such expenses as keeping the lights on and the telephone functioning, maintaining the physical facilities, and maintaining the administrative offices and functions of the Centre. When donors provide funding for a project but disallow the common operating costs, they are, in effect, saying that they are not willing to pay the full costs of the project that they have chosen to support, and they are expecting other (unknown and unrecognized) donors to co-fund the project (to the extent of paying the common operating costs). In discussing this issue with some donors who have policies against paying common operating costs, one gets the feeling that they are assuming that someone else (a government body, or an endowment, or unknown resource of the Centre) should pay these common costs. It does not seem, however, that many donors have taken seriously the implications of their policies against paying the full cost of the project. While the Centre is unique in being the only international health research centre in the developing world, it would seem that donors who wish to encourage medical research in the developing countries, should be willing to provide full funding for the projects they find of high priority, as long as the common operating costs are reasonable. It is only through collection of these common operating costs can institutions like ours be truly sustainable. In fact, the common operating costs at the Centre are actually quite low, compared to indirect costs of universities in the United States or UN agencies.
Changes in the physical facility: The Centre continues to improve its facilities, depending on financial resources. There has been a shortage of laboratory space, but during the year, the Tuberculosis Laboratory was completed, and a lab was constructed to house the flow cytometer (the first in Bangladesh), and a sequencer. Plans are underway to renovate some offices into laboratories for an STD lab and a virology lab. The Nutritional Biochemistry Laboratory was renovated, to meet specifications as a ‘clean room.’ The Centre will continue to improve lab, office and clinical facilities, both in Dhaka and Matlab as the needs grow.

During the year, the Centre improved the roof of the library building and developed its own ‘roof-top pavilion’ where larger parties and meals can be served in conjunction with events at the Sasakawa Auditorium. Also, during the year, the Centre opened a ‘corridor café’ where members of the staff can take a tea break, have an alternative to the canteen food, or meet with other scientists and staff for informal discussions. The larger project was the construction of the clinic building on the campus that will house the PSKP clinic, along with the follow-up nutrition clinics and offices for the Nutrition Programme.

The Board requested that the Centre undertake the preparation of a new master plan. The existing plan was developed more than 20 years ago, and there have been several deviations from the plan since then. Thus, a new master plan is under development. Completing the master plan will, of course, require a large investment, (perhaps US$15 to 20 million, but once the plan is developed, we can then proceed with identifying funding for this.

Human resources: With a large staff, many of whom have been with the Centre for ten and more years, and with an evolving programme and funding sources, there was need for re-examination of the methods used in human resources. Clearly, the Centre is a complex organization that requires many job skills, creativity, and reliability. With shrinking funds, the workforce must be efficient and perhaps more highly skilled than in the past. The Centre also wants to be sure that it is a fair and reliable employer. Thus, the Human Resources Department developed an ambitious agenda that will be implemented over the next two years. A major undertaking was that of a job classification of all positions at the Centre. This will then be coupled with upgrading skills with job training, including soft-skills training in such areas as supervision, evaluation, and team building. The Centre also insists on having policies that provide gender equity and is in the process of examining its policies and procedures to insure that these are fair and do not discriminate against women.

Finance Office: The Centre maintains a computerized record of all financial transactions. External auditors audit these annually, and specific accounts may also be audited according to donor requirements. During the year, the Centre underwent two special financial audits. To comply with USAID regulations and with the assistance of an external audit firm, the Centre developed methods for calculating indirect costs, and then these costs were audited. In the future, the indirect costs will be audited annually. A second audit was a review, again by an outside firm, of our financial systems to guard against any unperceived risks in our financial procedures.

Publication and Dissemination: The Centre has its website at www.icd.rb.org where news of the Centre can be seen. The Centre’s peer-reviewed and indexed journal—the Journal of Health, Population and Nu-
trition (JHPN)—is also freely available on the web. The JHPN is receiving increasing numbers of manuscripts in an expanding number of topics, and it appears to filling a need for rapid publication of papers relevant to the health needs of developing countries. Unfortunately, because of space constraints, we are no longer able to accept all the manuscripts being sent to us.

We continue to upgrade our computer systems and, during 2001, were able to establish a microwave link between Dhaka and Matlab, providing web and email to and from Matlab for the first time.

Publications are an important means for our communication in medical research, and in 2001, the Centre’s scientists wrote 73 papers published in peer-reviewed journals and 57 review articles, book chapters, reports, etc. Importantly, many of these articles are high-impact publications describing important findings that will form the basis for policy decisions around the world.

Dissemination of findings to national and international audiences is increasingly important. As part of this effort, over 30 scientists and senior members of the staff participated in the semi-annual Asian Scientific Conference on Diarrhoeal Disease and Nutrition (ASCODD) in Delhi in September. The secretariat for ASCODD will be housed at the ICDDR,B in the future, and this regional conference will be held in Dhaka in January 2004.

The Centre has a weekly seminar series—the Centre Scientific Forum—open to donors and other professionals every Monday at 12:30 pm. During 2001, as a part of the preparation for the strategic planning, the programmes organized seminars to summarize the major themes and directions for the Centre. This allowed scientists an opportunity to discuss these plans in a scientific forum. Additionally, each of the divisions has regular seminar series that allow scientists from the division to present their work in progress and also provide a forum for guest speakers.

**Training:** Training helps the Centre to communicate its expertise, ideas, and perspectives to a large audience as well. In 2001, the Centre hosted 247 trainees during 13 workshops. Some courses were specifically designed for Bangladeshi trainees, while others hosted participants from other countries, and we hosted individuals from 30 different counties.

**Divisions and Programmes:** The divisions continue as the administrative units of the Centre, while the programmes define the cross-cutting scientific themes of the Centre. Thus, the scientific infrastructure of the Centre are managed and administered through the divisions, the programmes are taking an increasingly visible role in defining the scientific objectives of the Centre. There are currently six programmes:

- Child Health
- Health and Family Planning Systems
- Nutrition
- Reproductive Health
- Infectious Diseases and Vaccine Sciences
- Population Sciences
Each of these programmes is housed in one of the divisions for administrative purposes, but they are intended to bring together the skills and resources of all the divisions. A benefit of the programmes is the ability to rapidly move from basic studies to applications of the studies to policy and action. In some cases, projects may fall logically into more than one programme. While this could appear to create a conflict between programmes, this, in fact, lends extra support to the effort since both programmes can provide input to it. Thus, when describing some of the key new initiatives, they are arbitrarily described in one of the programmes for convenience. Some important initiatives for the Centre should be highlighted.

**Child Health Programme:** With support and assistance from the World Health Organization, the Centre is undertaking a major evaluation of the Integrated Management of Childhood Illness (IMCI) approach to child health in the Matlab upazila, an area larger than the Matlab field area. The IMCI defines an approach for identifying the major causes of illness and death in children (diarrhoea, pneumonia, malaria, malnutrition) and teaches health professionals how to provide treatment and referrals to health centres when necessary. Although, most experts feel that the IMCI offers a sound basis for improving the health of children all over the world, evaluation of IMCI is needed in order to understand its constraints and continue to improve on it.

Child health activities also take place in our hospitals where children receive preventive as well as curative care. Children and their mothers receive EPI vaccines, parents take part in classes on how to prepare ORS and improve nutrition in the home, and mothers are taught exclusive breastfeeding. Very importantly, the severely malnourished are offered the chance for nutritional rehabilitation, with amazing results (see National Geographic, February 2002 issue, http://www.nationalgeographic.com/ngm/0202).

**Reproductive Health Programme:** Previously, the Matlab field area developed a very successful child health intervention, and this resulted in a dramatic improvement in the health and survival of children, especially in girls. Now, with financial assistance from the European Community and in cooperation with the Ministry of Health and Family Welfare of the Government of Bangladesh, the Centre has developed and expanded a method for essential obstetric care that includes provision for family planning, prenatal care, emergency obstetric care, and referral services. The Centre is now in a position to implement as a partner with the Government the entire package of services of EOC in order to understand the crucial components that can then be scaled up in other parts of the country.

Previously, other scientists at the Centre have assisted with establishing EOC services in the extension areas and have introduced specific components of the package (e.g. cards to teach mothers about possible complications of pregnancy) and have shown significant improvement in use of the EOC services. Work in the extension areas will continue to improve EOC services in those areas, but the new facilities in Matlab will provide the basis for a much-expanded reproductive health agenda.

Nationally, about 90% of deliveries take place in the home, mostly with unskilled birth attendants. While most experts recommend moving toward facility-based deliveries, we also understand that it will take many years before this is likely to happen, and thus, we are attempting to understand
what interventions can be undertaken to improve EOC services in the near term.

**Nutrition Programme.** Unfortunately, malnutrition is common in Bangladesh, especially among the patients coming to our hospitals for diarrhoea. In the past, nearly 20% of children who were ill with diarrhoea and severe malnutrition died, but the Centre has developed a “protocolized management” plan that has now lowered this case-fatality rate down to less than 5%—a remarkable achievement. This protocolized management of the severely-malnourished children is now successfully being implemented in the community, in clinics, day-care centres, and even in the home. The research agenda are to determine how to extend it into the community most effectively, and how to incorporate it into the Essential Services Package (ESP) of primary healthcare in Bangladesh. As with other major issues that the Centre has faced in the past, if answers to the problem can be found in Bangladesh, these can often be replicated elsewhere.

A zinc intervention trial in Matlab has led to some amazing findings. Children in Bangladesh are known to be zinc-deficient, and the problem was how to develop a strategy that would provide zinc to them in a practical manner. Unlike vitamin A, zinc is not stored in the body, so it was thought that zinc must be provided almost every day. Daily zinc seemed impractical, so another strategy was tested; that of giving zinc syrup for two weeks every time a child had an episode of diarrhoea. It was hypothesized that these illness episodes were times of stress when the child needed more zinc, and that the illness itself led to excessive loss of zinc. Also, since failing children have frequent episodes of diarrhoea, this treatment would target the failing child who needs it most. In a controlled trial in which children in some villages received standard treatment (e.g. ORS) and children in other villages received standard ORS plus zinc for two weeks, the children receiving the zinc experienced fewer episodes of subsequent diarrhoea and pneumonia, and remarkably, there were half as many deaths in those receiving the zinc (after excluding deaths due to drowning). This study, coupled with other studies that showed the benefit of zinc during diarrhoea episodes, has led Centre scientists and others attending a WHO consensus conference, to conclude that zinc treatment should become part of the routine treatment of diarrhoea in children. The summary of that meeting was published in the Journal of Health, Population and Nutrition.

Low birth-weight is part of the malnutrition problem in Bangladesh where about 45% of the babies are born weighing less than 2.5 kg. Children with a low birth-weight experience higher rates of illness and death than normal-weight babies; hence, there are major efforts to determine if nutritional supplements to pregnant mothers will increase the birth-weight of their children. While this is an important scientific medical question, it is also a major policy issue since very large and expensive programmes are targeted to pregnant mothers with the hope of improving the health of children. However, evidence of the effectiveness of these programmes is not convincing, and the nature of the most effective nutritional supplement is not known. Thus, the Centre, in cooperation with UNICEF, has started a very large and complex study of low birth-weight in Matlab. About 5500 pregnant mothers are being provided with nutritional supplements (according to a randomization schedule). The outcomes of the study will include birth-weight, foetal growth (as measured by ultrasound), and the subsequent health and development of the newborn for at least two years. This is destined to become truly a landmark study that could only be undertaken in Matlab.
**Infectious Diseases and Vaccine Sciences Programme:** This programme has expanded rapidly during the last two years. In addition to studies on diarrhoea and pneumonia, scientists at the Centre now have major projects on tuberculosis, dengue, sexually transmitted infections and HIV/AIDS. Importantly, a new laboratory for the study of tuberculosis was completed with financial assistance from UNOCAL. The new laboratory is already producing important results characterizing the antibiotic sensitivity patterns of the strains of tuberculosis in Dhaka city and in Matlab. Furthermore, it is providing a detailed description of the incidence and prevalence of tuberculosis in Matlab, laying the groundwork for possible vaccine evaluations in the future. Also the laboratory will allow for studies on basic microbiology and immunology of tuberculosis.

A large NIH-supported study on the epidemiology and ecology of cholera has been monitoring trends in cholera rates at four sites around the country. Although the general patterns are similar, the study has found distinct regional differences in seasonality and risk factors for cholera. For example, in Matlab and southern Bangladesh, cholera occurs year-round, albeit with seasonal peaks, while in the north, it occurs only during the months of October and November. A distinct peak of diarrhoea due to enterotoxigenic *E. coli*, with similar toxin and colonization factor types, occurs nearly every spring (April-May) in all parts of the country. Studies are continuing to understand better the underlying ecological factors leading to the seasons of cholera and *E. coli* diarrhoea.

The studies on sexually transmitted diseases are a new area of research at the Centre. An important finding from the work is the rapid development of antibiotic resistance that has occurred among strains of *N. gonorrhoeae*. Just in the last five years, the proportion of strains resistant to ciprofloxacin has increased from 7% to greater than 75%. Other studies have shown that women from Dhaka slums coming to prenatal clinics have a measurable risk of syphilis suggesting that screening for this treatable infection should be a routine part of the prenatal care being provided. Other studies from rural areas will be needed to determine the cost-effectiveness in these areas.

The Centre has been conducting the national sero-surveillance for HIV in cooperation with the Ministry of Health and Family Welfare. The second-generation surveillance is also coordinated with the behavioural surveillance. Taken together, the surveillance shows that Bangladesh is still a low-prevalence country, but it has a very high risk of a rapidly developing epidemic in the near future because of risky behaviours among intravenous drug users, and among sex workers and their clients. Already high rates of hepatitis C and high rates of sexually transmitted diseases exist among drug users and sex workers respectively. Especially worrisome is the number of individuals that are included in the bridging groups (e.g. sex workers that are also drug users). These bridging groups will allow for the transmission from one high-risk group to another, amplifying the epidemic.

Bangladesh has a little time to avert an HIV epidemic if major efforts are undertaken now. It would seem that the most cost-effective interventions would be those that are taken to prevent the epidemic, not control it after it happens. Global policy makers however, have generally not placed many resources toward this strategy, instead putting most efforts into those countries with already high rates of infection. The Centre, along with the Ministry, will hopefully have an opportunity to pioneer a preventive strategy.
Several vaccines are being studied at the Centre, including vaccines for rotavirus, enterotoxigenic *E. coli*, *Shigella*, *H. influenzae* type b, and *S. pneumoniae*. Plans are underway for studies of newer cholera vaccines. It is hoped that these phase I and II studies will soon lead to phase III studies to test the efficacy of the vaccines and will lead to new vaccines that can then be implemented.

In addition to the testing of new vaccines, the Centre has had an opportunity to examine the experience of the routine vaccine programmes that are being conducted in the country. Because of a single report from Africa of increased mortality following routinely-administered DPT, the World Health Organization requested the Centre to undertake an analysis of the mortality experience from Matlab. The Matlab data set was perhaps the only such complete data set on a large cohort of children where such an analysis could be carried out with such precision. The results showed that, even when adjusted for all possible confounders, the administration of DPT vaccine to children in Matlab provided a profound and sustained benefit to the children. Thus, the high-quality data from Matlab provided the answer to a critical question regarding vaccine policy and showed once again the value of maintaining the Matlab HDSS.

Studies of the basic biology of the infectious diseases are uncovering secrets as to how they evolved and spread. Several papers published in prestigious journals, like *Infection and Immunity* and *Journal of Infectious Diseases*, have been featured.

**Population Sciences Programme**: Population studies continue to define the demographic characteristics for Matlab, Abhaynagar, and Mirsarai. In Matlab, as in other parts of Bangladesh, the remarkable increases in the use of contraceptives and steady decreases in fertility have now levelled off at a fertility rate that is well above replacement levels. There are, however, differences in fertility rates within the ICDDR,B field areas. Studies are now underway to examine what factors explain this leveling of fertility as well as explaining the implications of this higher fertility rate to the country and the health of its people in the future.

A second major area of emphasis in population studies is the transition from a primarily rural population to one that is becoming increasingly urban. There is an urgent need to understand the push and pull factors that lead to the movement into cities as well as understanding the implications that urbanization will have for health and the need for health services in the future.

A third area for population study is the examination of the trends of mortality and the trends in overall population characteristics. Because of our detailed database, we now see that most of the infant deaths are occurring during the neonatal period, and this has led the Centre to redirect its research efforts toward solving health problems occurring during the first few days of life. It is also requiring us to examine the important issue of childhood drowning as a major cause of death and to consider possible interventions against drowning. Finally, the demographic data provide a tool to project the problems the country will face in the future with an increasingly ageing population where disability and dependency of the elderly will become major health issues. These are all problems we did not appreciate even a few years ago.

**Health and Family Planning Systems Programme**: During 2001, the Operations Research Project evolved into the Family Health Research
Project. In this evolution, the project changed from being exclusively a function within one division to being a Centrewide activity. This greatly expanded the potential for asking the full range of questions that can improve the national Essential Services Package. It also allows the programme to identify other opportunities for funding from sources other than USAID.

Bangladeshi adolescents need information if they are to make wise choices with regard to reproductive health. One of the important projects was one in which reproductive health questions that are important to adolescents were identified and answered. While seeming to be straightforward, in fact, this project required considerable effort to interview youths and to understand their questions, fears, and misperceptions, and also to find culturally-acceptable answers. These questions and answers now form a database that is being used in preparing educational materials and other forms of messages. An evaluation of the books is now underway, but we expect the same database will be a useful resource for mass media as well.

**Where are the needs?:** Several new scientific and service opportunities exist that can only be undertaken with additional resources. For example, we need to learn how to scale up the use of zinc treatment for diarrhoeal episodes to make this available more generally. We will need major co-funding in order to complete the low birth-weight study and follow the children for two years after their birth to take full advantage of this landmark study. We will need funds to fully utilize the potential for vaccine development from our field areas, including the surveillance for the target diseases to prepare for the actual vaccine efficacy studies. We will need support to continue the very innovative work of the self-help project in Chakaria where the communities themselves decide on their priorities and the Centre acts as a catalyst in their decision-making process. We need help to transform our Dhaka Hospital into the hub of a network for franchised diarrhoea treatment centres where patients can find care at their neighbourhood ESP clinic. Furthermore, the Dhaka Hospital needs to become a facility for other common acute life-threatening illnesses that can be easily treated. To paraphrase a statement from the speech of Ms Melinda Gates at the award ceremony, no child should die from an easily-treated or easily-prevented disease. We need help to turn that dream into a reality. We have already done it for diarrhoea; now we need to consider other common, easily-treated, potentially fatal diseases, like pneumonia, severe malnutrition, dengue, typhoid, and malaria. Finally, and perhaps even more important for the future of Bangladesh, we need to take HIV/AIDS seriously and carry out the formative research and treatment that will stop this infection before the epidemic becomes irreversible in Bangladesh. This will require voluntary counselling and testing centres, treatment of cases to help the individuals as well as prevent further transmission, and preventive strategies for high-risk groups. Prevention of an HIV/AIDS epidemic seems to be an impossible task for Bangladesh, but the Centre has taken on other impossible tasks in the past, like reducing fertility in a culturally-acceptable manner and finding a simple solution for diarrhoea. We are given the opportunity now with HIV/AIDS for the Centre, in partnership with NGOs and the Bangladesh Ministry of Health and Family Welfare, to take on another impossible task.

**Final word:** The Centre is developing its strategic plan to the year 2010, and this has been an exercise that has involved nearly all staff at the Centre. A plan will be presented to the Board in June 2002 that will outline the mission and values of the Centre for the next few years, and will prioritize
the areas for our research, service, and training. The Centre is truly an evolving and maturing institution, and as it evolves, it becomes more able to deal with the emerging health issues of developing countries. As you read this annual report, we trust you will appreciate the work of the scientific and non-scientific staff in making the Centre such a creative and exciting place. There is never a dull moment! The challenges are sometimes overwhelming, but the progress that we have seen in the last ten years has been remarkable. While it was wonderful to have received the Gates Award for Global Health in 2001, this award places an even greater responsibility on the Centre to be even more creative and productive. One does not know if there will be a discovery to match ORS again, but through a caring attitude, creative environment, prepared minds, and the best scientific resources and methods, I am convinced that the most productive years for the Centre continue to lie in the future.

David A. Sack, MD
Director, ICDDR,B
28 April 2002
Child Health

The World Health Organization (WHO) identifies five childhood illnesses as being responsible for over two-thirds of the mortality in children between the ages of 0 and 5 years in developing countries. In this age group, 19% of child mortality is associated with ALRI and 19% with diarrhoeal diseases. Malnutrition is a critical component affecting 55% of the children in this age group and vaccine-preventable diseases, such as measles, claim a significant number of lives. WHO presents statistics on childhood illnesses that reflect the disease prevalence in populations unlike the patient population that typically seeks treatment at the Centre’s hospitals and clinical treatment facilities.

The Centre, because of its location and unique setting, is equipped to undertake many of the challenges in developing child survival strategies. Many of the children admitted for treatment at the Centre’s hospital facilities have complications of infectious diseases and conditions in conjunction with diarrhoeal diseases. Many clinic patients live in intervention sites where epidemiological surveillance is ongoing and demographic data are readily available. Thus, the Centre directs its child health research and services to the broad spectrum of childhood illnesses typically affecting children in the developing world. Its intervention strategies and research focus on cost-effective and locally applicable solutions and include:

- monitoring levels, trends and patterns of childhood illnesses and causes of death
- improving child-caring and feeding practices to promote growth and development; ensuring effective routine newborn care in the community; and improving care-seeking practices for childhood illnesses
- strengthening the management of childhood illnesses, including evaluation of integrated interventions to improve perinatal and neonatal health, and the prevention and management of asphyxia
- strengthening and expansion of immunization programmes with a focus on reducing drop-outs and increasing coverage, and incorporating new vaccines into programmes
- strengthening health systems for the delivery of child health services; incorporating nutritional interventions in routine child health services; and evaluating the strategy described as the ‘Integrated Management of Childhood Illness (IMCI)’
- launching a major research initiative on evaluating interventions to reduce low birth-weight, which affects almost half of all births in Bangladesh
- understanding and responding to emerging child health problems, such as injuries and accidental deaths

Breakthroughs in the clinical management of diarrhoea and research on more effective treatment with ORS remain an important part of the Child Health Programme since over 70% of the patients treated with ORS in the Centre’s hospitals and clinics and in the community setting are children. Since its development, the Centre has:

- further improved and made more cost-effective ORS by using rice-based ORS routinely to treat over 100,000 patients annually at the ICDDR,B hospitals
- developed and refined treatments for dehydration by testing improved ingredients in the ORS and by testing antisecretory agents that may decrease fluid losses
- evaluated and implemented nutritional interventions aimed at preventing diarrhoea and reducing the duration of diarrhoea episodes

Although the health of children cannot be separated from health of the rest of the family, especially of their mothers, children do have a special priority for the Centre’s research. Their vulnerability and high risk from diseases and injury enforce the need for special interventions and programmes.
Integrated Management of Childhood Illness

The Integrated Management of Childhood Illness (IMCI) addresses health problems of children using a holistic approach. The IMCI strategy includes improvement of skills of service providers at the first-level facilities, improvements of health systems and of community and family practices. In Bangladesh, IMCI is in early implementation stage.

A few years ago, the World Health Organization (WHO) initiated the global multi-country evaluation of the IMCI strategy. As part of this effort, ICDDR,B, with support from WHO and USAID and in collaboration with the Ministry of Health and Family Welfare of the Government of Bangladesh, is conducting an evaluation of IMCI. This is a five-year study to evaluate the health impact and cost-effectiveness of IMCI when implemented. The study is using a randomized experiment design. Implemented in the part of Matlab upazila which currently receives only GoB services (population ~400,000), the study aims at determining the impact of IMCI introduced in the first-level health facilities, in association with a community-based intervention. The impact is assessed in terms of changes in health status, including mortality and nutritional outcomes.

The first-level facilities in this part of Matlab upazila were paired on baseline characteristics, especially child-mortality levels, and then one in each pair was randomly selected for IMCI intervention or comparison. The evaluation involves baseline and repeat surveys of households and facilities. The study also monitors quality, coverage and use of IMCI services, client-satisfaction, and family and community practices relating to IMCI. The study will also determine the costs of optimal implementation of IMCI and the economic impact of implementing IMCI.

Data collection for three baseline surveys was completed in 2000, and early findings from these surveys became available in 2001. The Household Demographic Survey covered 88,647 households in 367 villages. The figure shows baseline mortality levels in the areas randomized to IMCI and comparison. It is obvious that the two areas were comparable at baseline before IMCI was introduced.

A follow-on verbal autopsy survey is underway to assign causes of deaths of children aged less than five years identified from the demographic survey. This includes a social autopsy component investigating care-seeking prior to death. The Household Health and Morbidity Survey selected a systematic sub-sample of the households visited as part of the Demographic Survey. The survey includes information on nutritional status of children (weight and height/length), morbidity of children aged less than five years, care-seeking practices associated with the episodes of morbidity, practices relating to home-care and case management, compliance with healthcare advice, and costs of care for a sick child. Interviews were completed for 2,066 children.

We investigated reported morbidities among children aged less than five years and care-seeking behaviour. Sixty-three percent of the sick children received care from outside their home, but the vast majority of this care...
was from traditional or untrained local healers. In only about 8% of the children, did the caretakers first go to a trained service provider, i.e. health facility, trained doctor, paramedic, or a government or NGO field worker. Perceived severity and economic status were significantly associated with care-seeking (see figure). However, the use of preventive services was more equitable (see figure).

The baseline Health Facility Survey included all eligible first-level health facilities in Matlab upazila. Data covered quality of service, utilization, costs, and other process indicators. Data collection involved interviews with staff and clients, observations of client-provider interactions, extraction of service data, and assessment of facility operations and costs. Time allocation studies were done to apportion salary costs to different service components.

By the end of 2001, implementation of IMCI was initiated in the selected first-level facilities with training of staff and setting up systems for drug supplies, improved record-keeping, strengthened referral, and monitoring and supervision. The first in-country training of facilitators was organized by the Government during March-April 2001. This was followed by the first 11-day national training course on IMCI in April. The second set of training of facilitators and 11-day training course on IMCI was held in August-September. The first draft of the chart booklet and modules in Bangla was developed and used in the training of facility-based paramedics in December 2001. The IMCI team of ICDDR,B was actively involved in these activities.

In the IMCI intervention facilities, best possible implementation of IMCI service-delivery is to be ensured along with strengthening of referral linkages. The existing community-based field staff is expected to be involved in the implementation of an intensive community education intervention for improved care-seeking and home management of childhood illness in the catchment areas of the intervention facilities.

In the comparison facilities and their catchment areas, the existing government services will continue.

Child Health Promotion

To better provide prevention and promotional health services from the Dhaka Hospital of ICDDR,B, the Clinical Sciences Division started a programme of activities in 1988, which included the Nutrition Rehabilitation Unit (NRU), the Nutrition Follow-up Unit (NFU), an immunization centre, a health-education scheme, and a family-planning counselling unit coordinated by Dr. Tahmeed Ahmed. Most children and their mothers/attending relatives who visited the Dhaka Hospital for treatment of diarrhoeal diseases do not receive any prior preventive health services. This programme offers these services based on the concept of ‘missed opportunities.’ Training of healthcare providers and operations research in these areas are additional activities of the programme.

In total, 382 children with extremely severe malnutrition were treated during 2001 in the NRU where a standardized feeding protocol has been
successfully developed and tested using inexpensive, locally-available and culturally-acceptable diets. In total, 1,556 severely-malnourished children were treated in the Nutrition Follow-up Unit. Twenty children were diagnosed as having tuberculosis and received anti-TB treatment. In total, 16,595 group discussions were held on prevention and home management of diarrhoea, promotion of breast-feeding and prevention of malnutrition using appropriate complementary diets, promotion of birth-spacing, and on the importance of immunization with mothers and female caretakers of children, covering an estimated 99,570 individuals. Immunization against six vaccine-preventable diseases was provided to 3,989 (100% of the eligible) children; tetanus toxoid was administered to 3,535 women of childbearing age; vitamin A capsules were administered to 2,110 children who did not receive it during the previous six months; and family-planning services were provided to 543 parents of the children attending the hospital.

Current research activities of the unit include home-based management of severe malnutrition, efficacy of metronidazole in improving nutritional rehabilitation, and diagnosis and treatment of TB in severely-malnourished children. The success of this effort, as a model for dissemination of knowledge and practice of healthcare in the community, has made its activities and role a part of the training courses for national and international participants. Largely because of the success of the programme in treating and preventing severe malnutrition, the Centre is well-positioned to assist other countries in the region by providing training in collaboration with the World Health Organization.

**Child Development**

With declining infant mortality rates in developing countries and increased child survival in the recent years, attention is being increasingly focused on the quality of life as well as survival. Poor health and nutrition, along with lack of stimulation in the home, have a detrimental effect on children’s development. Consequently, an enormous number of children fail to develop to their full intellectual potential. Poor development in early childhood results in poor school performance, inadequate education, and reduced productivity. Cognitive and psychomotor development in children is, therefore, an important outcome of nutritional and other interventions, and is critically important for future prospects of the nation.

Four years ago, the Clinical Sciences Division formed a Child Development Group within the Division to undertake and facilitate research in child development, and this has recently been formalized into the Child Development Unit now led by Dr. Jena D. Hamadani. The unit currently has two scientists, while Dr. S.N. Huda of the Institute of Nutrition and Food Science, University of Dhaka, is a member, and Prof. Sally McGregor of the Institute of Child Health, London, is a consultant to the group. Over the years, this unit has developed psychologists, testers, and interviewers who are capable of performing various tests for assessment of cognitive and psychomotor functions of children. A new DFID grant to the Centre will help maintain and strengthen the infrastructure and develop necessary tools for the next three years. One member of the staff is currently enrolled in a doctoral programme, and the other in an M.Phil. programme at the Institute of Child Health, London. Both will be doing their theses on issues relating to child development. Efforts are being made to further strengthen

A national IMCI training course for managers and trainers. ICDDR,B assisted the Government in organizing several such courses in 2001.
the unit through training of additional staff, establishment of effective collaborations in the field of psychomotor development at the national and international levels, and development of simple child development assessment tools that can be used in community settings. The unit will be assessing the impact of community-based nutrition interventions on child development outcomes.

Poor health and nutrition, along with lack of stimulation in the home, have a detrimental effect on children’s development.
Reproductive Health

As part of its mission since its internationalization in 1978, the Centre developed its reputation as a field site and an operations research site for reproductive health issues. In this capacity, the Centre has gradually acquired a reproductive health portfolio with the following unique attributes:

- Long history (31 years) of conducting pioneering research in areas of population dynamics and family planning
- Ability to maintain longitudinal data on a rural population in Matlab that exceeds 240,000
- Key role in raising the contraceptive use rate among women of reproductive age in Bangladesh
- Rural family planning interventions in Matlab which provide a model for maternal and child health-family planning programmes throughout the world
- Matlab International Training Centre which frequently hosts visitors and conferences and conducts a variety of courses, including reproductive health
- Family Health Research Project (FHRP) of HSID that works in collaboration with the Government of Bangladesh, implementing strategies developed at the Centre to improve family planning, reduce population growth and promote safe motherhood
- Integrated family planning and child health programmes, improving child survival as well as lowering fertility rates
- Incorporation of male contraceptive and safe motherhood strategies as new components into the overall Matlab-based family planning strategy
- Introduction of control of RTIs and STIs, including HIV into its programme

Among its accomplishments, the Reproductive Health Programme:

- increased the contraceptive prevalence rate to over 60% in its field area, up from 2% when it started in 1978. This has resulted in a 50% reduction in fertility in the Matlab field area. Using the Matlab Model and working with the Government of Bangladesh, extended the essentials of the Matlab programme to other areas in Bangladesh. The national contraceptive prevalence is now over 50%
- integrated the family planning and child health programmes, resulting in a 75% reduction in the number of infant deaths in the Matlab field area since 1978 when the programmes started.
- defined the problem of STI/RTI and HIV infection in Bangladesh and is developing strategies to deal with them. The current programme includes solid epidemiological activities coupled with state-of-the-art laboratory research and a social and behavioural sciences component.
- developed strategies for safe motherhood and is evaluating them in rural and urban Bangladesh.

Bangladesh was considered the prime example of an overwhelming population explosion that was virtually unsolvable because of reluctance of people in a traditional society to accept or even discuss the use of contraceptives. The research and extension programmes at ICDDR,B have shown that the high rate of fertility is a problem, but is one that can be solved. People in Bangladesh are beginning to accept family planning and birth spacing as normal and appropriate for their society. Hence, the ‘population bomb’ can be diffused, but there is a danger of declaring success prematurely. Because of the population age structure, the population will continue to grow, and the family planning programmes must be sustained, and be made sustainable.

The experience in Bangladesh shows that family planning and child health programmes go hand-in-hand. Both are maximally successful when integrated. The challenges of safe motherhood, family planning, adolescent health and STI/RTI/HIV infections now lie ahead as priority areas for research and policy action.
Toward Safer Motherhood in Matlab

During 2001, the Reproductive Health Programme continued to address issues relating to reproductive health research in line with the Centre’s mission statement. The programme has been conducting research in critical and priority areas of reproductive health in various parts of Bangladesh. These include identification of determinants and consequences of reproductive ill-health, followed by appropriate interventions with the ultimate aim of improving reproductive health. The year 2001 focused on Safe Motherhood interventions as a means of reducing maternal mortality and morbidity.

A case in point is the Matlab-based Essential Obstetric Care (EOC) project that is establishing basic and comprehensive EOC services in government facilities in the Matlab upazila. The aim of this project is to promote utilization of basic EOC services at union level and comprehensive EOC services at the upazila level by women in need of those services, particularly those with obstetric complications.

This project is designed on the basis of the experiences of the ORP (now FHRP) of ICDDR,B in the extension areas of Abhoynagar and Mirsarai, which were initiated in 1993 and 1995 respectively. The success of the Miersarai Model, in particular, led to its replication by GoB in five other upazilas as reported in the chapter on Health and Family Planning Systems.

The project at the Matlab upazila is a joint venture of ICDDR,B and the Government of Bangladesh and has already upgraded all the eight Health and Family Welfare Centres (H&FWCs) in eight selected unions of Matlab to provide basic EOC services. The unions are: Sengarchar, Satnol, Upadi South, Narayanpur, Kalakanda, Farazikandi, Fetapur West and Baganbari. During the year, each of the two sequential batches of four Family Welfare Visitors completed their training in midwifery skills to provide basic EOC in their respective facilities.

Upgrading facilities

Upgrading of the H&FWCs involved structural improvements to replace dilapidated and disused facilities by functional units providing basic EOC. Each upgraded facility consists of a well-fenced compound with running water, electricity, equipment, drugs, and other essential supplies. In each centre, a hallway is able to accommodate large groups of patients seeking services, such as antenatal care and nutrition education. Each centre now has a delivery-room, a delivery-bed, and basic facilities and supplies to assist the midwife in conducting normal deliveries and resuscitating newborns whenever necessary. There is a maternity ward with two beds for those in labour and for post-delivery cases. Each centre has now an extra toilet for women.

As part of the intervention, the project was also upgrading the Upazila Health Complex (UHC) to provide comprehensive EOC to complement those at the H&FWCs and to receive referrals. As there was not sufficient room in the existing UHC, it became necessary to construct a maternity unit adjacent to it. Construction work progressed well during 2001, and the unit became functional in 2002.

Barriers to facility use

In Bangladesh, many barriers have been identified that significantly influence the use of health facilities. Some of these are: cultural stigma,
distance to the facilities, cost of accessing services, and perceived quality of services. Cultural barriers are particularly important for women trying to access services. First, it is often considered shameful for women to visit hospitals to be examined by male healthcare providers. Second, women prefer to deliver in the comfort of their relatives and not in the hands of strangers in health facilities. Third, the delivery position and the short delivery-beds used at home appear to be very convenient to them and to the traditional midwife. Fourth, when a pregnant woman attends a clinic, if at all, she is never shown around to see what facilities are available for her eventual confinement and delivery. All the above factors and others are being investigated using in-depth techniques. Preliminary analysis of survey data collected from Matlab during 2001 indicated that distance and cost, whether hidden or overt, were important barriers. However, transport was not an important barrier as most transport requirements were met within an average of 10 minutes.

Raising community awareness

Raising community awareness is an essential component of any well-intended interventions. In this intervention, one of the community awareness raising activities was to inform people about the existence of facilities and services. In addition, communities had to be informed about potential clients of the facilities and available service providers. Consequently, the project launched a community awareness-raising campaign to coincide with the Safe Motherhood Day on 28 May. This was a great day for the project since arrangements were made throughout the project area to celebrate the occasion at the premises of all upgraded centres and to inform the community about the objectives of the project. It was a day to initiate community awareness-raising about safe motherhood in Matlab.

The project staff and the local health staff disseminated educational messages through talks. Local politicians were invited to encourage people to use the services. Educational materials were distributed to raise awareness about pregnancy-related danger signs to alert pregnant women in the communities to seek care in those facilities so that delivery-related complications can be detected early and referred to appropriate facilities in time. Public rallies were also organized to relay messages to the community. Plans are underway to organize frequent campaigns using local political leaders. The Government and UNICEF provided all health-related educational materials used in the campaigns.

How timely is the decision to seek care for pregnancy-related diseases

Delay in accessing skilled service providers during delivery is a significant determinant of maternal mortality in developing countries. To identify the factors associated with delays in reaching health facilities and their possible implications for safe motherhood in rural Bangladesh, a study was initiated in Matlab under the Safe Motherhood project to collect baseline information on healthcare-seeking behaviour, transport needs, and healthcare expenditure in the area. Among other questions, enquiries were made on the perceptions of household heads regarding delays in decision to seek care for serious illnesses of household members, delays in accessing transport, and delays in reaching the facility. The survey was completed during 2001.
Results of the study showed that 41% of the households had at least one household member who experienced an illness which required hospital admission during a one-year period. Of these, 88% actually visited some facilities for treatment after decisions had been made to do so by various decision-makers in the household. Time taken to decide to seek care was the longest in the ICDDR,B intervention area and the shortest in the rest of Matlab, while it was intermediate in the EOC intervention area. Interestingly, the time to decide to seek care was the shortest for pregnancy-related conditions (median 24 minutes), followed by time taken for those with acute illnesses, such as accidents, poisoning, and diarrhoea (median 48 minutes), while it was the longest for chronic diseases, such as TB and leprosy (median 288 minutes). The majority (69%) of the respondents perceived a delay in deciding to seek care. However, perceived delay in seeking care did not differ significantly across economic levels, indicating that the need for healthcare is not dependent on socioeconomic status.

The study concluded that appropriate behaviour change communication (BCC) to raise community awareness about pregnancy-related danger signs is likely to reduce delays in making decisions to seek care. Such efforts are also likely to produce an additional effect of reducing the delay to reach health facilities, since the two components of delay are closely related. Findings of the study also suggest that this strategy could be combined with provision of skilled attendants for home deliveries in the community and provision of specialized care at strategically-placed facilities. This strategy is expected to reduce the existing high maternal mortality rate substantially.

The figure shows that, of the many serious illnesses suffered by members of the households in Matlab, time taken to decide to seek care was the shortest for pregnancy-related diseases. This may imply that a programme to raise community awareness in the community about pregnancy-related danger signs and about timely decision to seek care is likely to produce good results, since people are already aware of the need for timely decision to seek care for any pregnancy-related illnesses.

**Measuring the unmet need for specialized obstetric services**

Bangladesh is among the countries where use of antenatal care and safe-delivery services is exceptionally low: 67% of all pregnant women never have an antenatal care visit throughout their pregnancy; about 92% deliver at home; and 87% deliver without skilled attendant. This directly relates to the low social position of a woman in this society. Safe motherhood is, therefore, a priority in Bangladesh as an entry point for empowerment of women.

Since the beginning of 2001, ICDDR,B made an attempt to measure the total need and the unmet need for specialized obstetric services that involve surgical interventions for specific delivery-related complications in Bangladesh. This move has a long-standing history that borrows from the Unmet Obstetric Needs (UON) network in Antwerp, Belgium (Prof. Vincent De Brouwere and Prof. Wim Van Lerberghe), where previous attempts have had significant achievements in various other countries. After efforts to develop an indicator that would subsequently be used by countries for measuring their unmet need for specialized obstetric care, the network came up with an estimate of the so-called indicator or benchmark of 1%. This means that about one in every 100 deliveries is complicated by those specific obstetric conditions. It is generally agreed that basic obstetric care
facilities or midwives cannot deal with these complications. The chosen complications are also agreed to be fatal for a woman if she does not get a major life-saving obstetric intervention.

*Why use indicators?*

Indicators for safe motherhood are tools to monitor progress toward improved maternal health. Their assessment gives a picture of the reality for Bangladeshi women and points out problems, which then can quickly translate both into policy change as well as provider action. Each indicator has strengths and weaknesses. Direct measurements, like maternal mortality, are very interesting and useful, but unfortunately, also hard to obtain due to technical, practical and financial problems. Besides, large sample sizes are needed for valid measurements of maternal mortality. So, it cannot be routinely used for yearly monitoring of mortality trends in an area.

Other indicators have been used as complementary tools for monitoring safe motherhood interventions, for example, the percentage of deliveries with complications taking place in Emergency Obstetric Care (EOC) facilities, or the percentage of deliveries with caesarean section. These indicators use arbitrary target-benchmarks to be reached that have not really been validated. Moreover, their stability over time and across populations is questionable besides the fact that much controversy surrounds difficulties in standardizing definitions of certain obstetric complications and indications.

Various complications that are used in these indicators are prone to misclassification because these are difficult to standardize. Examples are prolonged labour, excessive bleeding, foetal distress, and others.

The new indicator is intended to estimate the number of women with specific delivery-related complications needing specialized obstetric care (say obstetric surgery) that one expects in any particular geographical area, say a district. Once the number of expected cases has been estimated for a particular district, this is taken to be the total need for specialized obstetric care for that particular district. Healthcare providers can, therefore, assess for themselves what percentage of this total need they have addressed over a one-year period, and what proportion remains unmet. The complications have been carefully selected for strict methodological reasons, and one can assume that the number of cases not being met, most probably died.

This new and other well-established indicators need to be validated in order that they can be used in places where needed. The rural Health and Demographic Surveillance System (HDSS) of ICDDR,B offers a unique opportunity for this kind of validation. It is for this reason that the UON project in Bangladesh was initiated within ICDDR,B in 2001.

*How is the indicator being validated?*

Matlab, a rural area in Bangladesh, is the site of a Health and Demographic Surveillance System for ICDDR,B, which has been in place since 1966. The system is unique in that it consists of long-standing and meticulous storage of records for a population of over 240,000 that is followed up for vital event such as births, deaths, migrations and a number of socio-demographic characteristics. This information enabled many scientists to evaluate health interventions that would otherwise be difficult in other places. Matlab is,
therefore, one of the few places in the world where this indicator can be validated.

The UON project has chosen this site to obtain information on (a) precise number of maternal deaths and their specific causes, (b) deliveries that took place in hospitals, and (c) total number of deliveries taking place every year. This exercise will enable the project to assess, in a large delivery-cohort, how often these specific delivery-related complications occurred. One part of the UON project is searching for information from all possible hospitals that admitted women of the Matlab area to determine the number of women whose lives were saved through a surgical intervention for pre-determined complications during the same period of time. This number of women would represent the met need for Matlab.

The figure shows that information on women from the Matlab HDSS area accessing various hospitals outside the area for specialized obstetric interventions can, at a later date, be retrieved from hospital records. Most women accessed hospitals in Chandpur district, but some in other cities.

**Process of Validation Exercise**

The met need is the total number of women with specific delivery-related complications, who were saved with obstetric surgery. The unmet need is the total number of women who died due to these complications. The total need is the sum of the met and the unmet needs. The risk for any delivery to be complicated with these specific conditions is the total need (number of women with complications requiring specialized obstetric care) divided by the total number of deliveries. This can then be extrapolated. The number of expected deliveries in each district can be estimated by applying the crude birth rate to the district population. Once the benchmark has been validated in Matlab, the expected number of pregnant women needing specialized obstetric care per year in each district can be calculated thus:

\[
\text{Total need in a year in a district} = \text{district population} \times \text{crude birth rate} \times \text{benchmark}
\]

This indicator would help estimate the absolute number of maternal deaths due to specific complications that would take place in any geographical area, (say a district) if no specialized obstetric care were available, by multiplying the benchmark with the estimated number of deliveries in that district.

Once a validated benchmark is in place, no more community-based data would be required. The number of complications attended can then be compared with the number of expected cases. The (un)met need can be monitored yearly by collecting information from the existing comprehensive EOC facilities (limited in number). In addition, it will be possible to estimate the number of deaths due to these complications per district and per year. The new UON indicator may then be used as a reference in other countries as well.

**How do we obtain the unmet need for specialized obstetric care?**

Once the total need and the met need are obtained, it is possible to get the unmet need by comparing the latter with the former. This is the information responsible service providers should have at the district level to enable
them to assess the unmet need and to inform policy for action in equitable resource allocation. Such information is also useful in assessing barriers to access and problems of referral so that these can be addressed.

The UON project is a three-year project funded by the Belgian Government, and is supporting one Belgian technical advisor Dr. Greet Dieltiens. In 2001, she made significant progress in being able to start up the project and in involving key stakeholders in the results of the study.

Aim of the project is to validate and introduce the new indicator to monitor progress toward improved maternal health. Although the indicator is already being used in a number of countries, for example, Morocco, Niger, Mali, Burkina Faso, Benin, Guinea Conakry, Haiti, Pakistan, Tanzania, Cambodia, Cameroon, and Mozambique, it has not been validated. Up to now, the indicator has been named MOI-for-AMI (major obstetric interventions for absolute maternal indications). The concept has become very attractive among scientists to develop further as it was considered crucial for estimating unmet need for specialized obstetric care.

What is special about this indicator?

For strict methodological reasons, the complications that are being considered for inclusion in this indicator have been limited to the following:

a. Delivery-related complications that need specialized obstetric care (a major obstetric intervention) to save life of the mother (absolute maternal indications)

b. Delivery-related complications that have a high reproducibility to diagnose

c. Delivery-related complications that are more or less stable across populations and over time

These complications will need to be discussed among key stakeholders and professionals to come up with a reasonable list of complications that will be applicable to Bangladesh. Tentatively, the project has considered placenta previa, abruptio placenta, ruptured uterus, clear mechanical obstructed labour, malpresentation and cephalo-pelvic disproportion (e.g. hydrocephalus) as the most likely candidates.

The merit of the MOI-for-AMI indicator is the ease with which it can be obtained. The following are some of the advantages: (1) the indicator only needs information to be collected from comprehensive EOC facilities; (2) it is relatively easy, cheap, and fast; (3) it has a high index of diagnostic reproducibility, because it uses least controversial indications for surgical interventions; (4) it will give relative values (percentages) of the met and the unmet needs, absolute numbers (burden or estimated numbers of deaths) and rates per district and per year; (5) it can be included in the unified management information system for national planning and can be used locally in the district to encourage local accountability and responsiveness; (6) it visualizes changes in a district over short periods of time (yearly); (7) it can be linked directly to maternal mortality, i.e. if the unmet need is high, maternal mortality is also likely to be high; (8) it is an indicator for the functioning of the health-system as a whole and an indirect measure of quality of care; (9) it involves the healthcare providers in the process; and (10) provides an excellent tool for decision-makers, healthcare providers, and donors.
What are the next steps?

The Government of Bangladesh has been upgrading some of its health services to function as comprehensive EOC facilities. 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. Bangladesh has the advantage that the district populations are large enough for this indicator to be used for yearly monitoring.

Once the new indicator is accepted, it will be introduced to the service providers for mapping the unmet need for specialized obstetric care in Bangladesh. So far, major stakeholders have been involved, and this process is ongoing. It is expected that further dialogue will be conducted to attract the interest of the stakeholders to facilitate the use of this indicator in improving maternal health.

Reaching Men for Vasectomy Operations

The national family-planning programme of Bangladesh has achieved a tremendous success in increasing contraceptive use among women resulting in a sharp decline in fertility. The programme has been one of the most successful programmes worldwide with over 55% contraceptive prevalence rate nationally among the eligible population. However, over the past decade, the fertility rates have surprisingly stagnated, necessitating further research on ways to reduce fertility further to levels appropriate for a healthy population.

Unfortunately, much of the success has been due to an over-reliance on women-oriented approaches, such as the oral pill, contraceptive injections, and permanent sterilization methods for females. These methods have become over-stretched in terms of cost, sustainability, and effectiveness. For a long time, national programmes in developing countries have neglected the important role that men can play in reducing fertility further. It is obvious that men constitute the other half of the people who contribute to fertility, and if the contribution by women has brought us this far, involvement of men can lead to further progress. It is in this premise that the male involvement project of ICDDRB, with funds from the European Union was initiated to test the hypothesis that male involvement in reproductive health, particularly family planning, is dependent on an active programme targeting men. The project has been implemented in the Matlab intervention area where it is possible to target and follow up the eligible men.

How are men being reached?

The male involvement project is designed to provide clinical and counselling services to men with reproductive health problems in the Matlab intervention area. Four male clinics were constructed and equipped to provide the required services. The clinics are run by medical assistants and supervised by a medical officer who is also trained to perform male sterilization using the modern technique of non-scalpel vasectomy. Various methods are used for reaching men. These include written text and drawings on posters and leaflets and informal discussions by the local health workers and volunteers. These methods are designed to attract men with reproductive health problems to attend the clinics for advice and treatment. At the clinics, men with such problems consult medical assistants for treatment and counselling, if necessary.
Although the main functions of the clinics are to attend male patients presenting with disease symptoms of reproductive health problems, findings from recent studies indicated that other health problems are being dealt with as well. Analysis of survey data from the project conducted during 2001 indicates that reproductive health problems, other than sexually transmitted infections (mainly symptoms of genital itching), were the main reasons for coming to the clinics. Symptoms suggestive of sexually transmitted infections were reported in 10% of those attending the clinics. Only 21% had complaints, suggestive of problems other than those of reproductive health (see figure).

Who is reaching men?

The male involvement project has trained over 260 volunteers called peer promoters in the Matlab intervention area to provide information to peers in the community on the existence of the male clinics so that they can avail of services from there. The process of involving them started some two years ago when they were invited to the male clinics for day-long orientation sessions in small batches until all were trained. Day-long refresher courses have also been conducted at yearly intervals to refresh their knowledge and to motivate them to perform this voluntary work efficiently.

During 2001, a study was performed within the project to assess the extent to which the male promoters had involved their peers in reproductive health, particularly family planning and in the prevention and control of sexually transmitted infections/reproductive tract infections/human immunodeficiency viruses (HIV). The study showed that the peer promoters had referred the highest proportion of clinic attendees having non-reproductive health problems (see figure). For symptoms suggestive of STIs and urinary complaints, the Community Health Workers (CHWs) had referred a higher proportion than the peers. This observation was expected, as the CHWs are more medically oriented than the peers.

Of the male clinic attendees who were positive for vasectomy counselling, the majority had been referred to the clinic by the CHWs. This study concluded that peer promoters are potential agents for reaching men for vasectomy operations in places without CHWs.

How are potential vasectomy clients being approached?

CHWs are a group of female community workers who visit families each day to collect information on vital events, such as birth, death, migration, illness episode, and use of contraceptive methods. They also refer or advise patients to seek care about their health problems. Like the peer promoters, the CHWs are also asked to advise men with reproductive health problems to seek care from the male clinics. In addition, they identify men who are eligible for vasectomy and advise them to visit the clinic for counselling on ways to take advantage of available family-planning methods for men. For purposes of the project, eligible men for vasectomy were those who were married and had two or more children, of whom the youngest one was at least two years old.
Eligible men attending the male clinics are counselled and those who agree to undergo the operation are given appointment for the procedure. During vasectomy operations, complete addresses are taken to facilitate follow-ups. Each client is awarded a piece of traditional cloth, in addition to cash payment of an amount equivalent to wage for a day according to government policy.

What are the achievements so far and the way forward?

The project aimed at about 100 vasectomies per year. However, within one year of establishment ending in May 2001, a total of 81 vasectomies could be performed. Despite inability to meet the set target, this number was seen to be a great achievement considering the many factors/barriers to vasectomy in this rural area. Some of these were investigated in the project, and the following conclusions were made:

Misconceptions about vasectomy operations existed in the community and were more prevalent among the wives than the clients themselves. These misconceptions included loss of physical strength for economic production and loss of libido. Interestingly, no stigma appeared to be attached to being vasectomized. The CHWs were important change agents for reaching men for vasectomy operations. Support of wife was important in the decision to undertake a vasectomy operation and should be respected by service providers. Pre- and post-vasectomy counselling is necessary to allay anxiety and to clear misconceptions for sustainable vasectomy operations. Men were misinformed about female fertility and human reproduction and hence, efforts should be made to increase awareness among them.

The existing focus of reaching women in family planning tends to reinforce gender norms and deny the potential role of men in fertility reduction. Involvement of men is, therefore, a potential strategy for further reduction of fertility in Bangladesh and other countries with high fertility. However, further research is needed to understand the male perception of reproductive health and family planning and how males could get more involved in aspects of family planning, whether as users or simply to support their partners in contraceptive use.
Nutrition

In Bangladesh, over 60% of children aged less than 5 years suffer from malnutrition. About 45-50% of children are born with a low birth-weight (LBW), sometimes well below 2500 g. Treatment for, and prevention of, malnutrition are key to the Centre’s child survival strategies and are critical for maternal health and treating children brought to the Centre for medical care. Nearly all studies and activities must consider malnutrition. One cannot treat diarrhoeal diseases or pneumonia without including treatment for malnutrition as part of the overall care. Even without acute infections, malnutrition is a major cause of mortality in Bangladesh. Indicators for child stunting, maternal nutrition, and low birth-weight are also astonishingly high. In response to malnutrition and micronutrient deficiencies, the Nutrition Programme of the Centre:

- conducts interdisciplinary nutrition research
- provides clinical services to treat malnutrition by providing appropriate treatment for acute illnesses and providing nutritional rehabilitation
- collaborates with academic partners worldwide on micronutrient research, including extensive works in vitamin A and zinc for application in the treatment of diarrhoea, pneumonia, malnutrition, and in disease prevention
- trains health professionals in Bangladesh and from other South Asian countries in the clinical management of severe malnutrition
- established a world class nutrition biochemistry laboratory to support nutrition research using the latest technologies
- examines social and behavioural aspects of nutrition in the household with emphasis on its impact on women and children

Scientists at the Centre developed the Standardized Management of Severe Malnutrition at the Centre’s Dhaka Hospital. This protocol for the acute-phase treatment for severe malnutrition reduces both death rate and the cost of treatment. The following features of the protocol have recently been described in an important paper in *The Lancet*:

- Slower rehydration with an emphasis on oral rehydration
- Immediate feeding using defined locally-available and inexpensive foods
- Routine micronutrient supplementation
- Broad-spectrum antibiotic therapy
- Expedient management of complications

The Centre is expanding its nutrition activities by introducing the standardized protocol to other hospitals in Bangladesh as well as to other countries and to situations outside the hospital. Additionally, the Centre’s experience with nutrient-dense low-cost diets, micronutrient supplementation, and breast-feeding counselling is now being applied to many clinical settings.

The Centre carries out research appropriate for rural Bangladesh, including its Matlab site. Here, nutrition interventions are administered through its community-based clinics and the sub-centres and the clinical unit at Matlab Hospital. The interventions include:

- nutrition education at the community and health facilities
- nutrition surveillance
- feeding programmes for malnourished children at community day-care facilities as well as nutrition rehabilitation unit at the Matlab Hospital
- micronutrient supplementation to pregnant and lactating mothers and children aged less than five years and follow-up of malnourished children to understand long-term consequences of treatment
efficacy and effectiveness studies of micronutrients to treat and prevent common childhood infections and mortality

low birth-weight interventions to determine the effectiveness and efficacy of micronutrient supplementation in reducing the incidence of low birth-weight.

Malnutrition can be prevented and managed by appropriate programmes and interventions. Further emphasis on prevention strategies, such as improving maternal nutrition, reducing low birth-weight, improving exclusive breast-feeding, improving complementary feeding practice, controlling infection, reducing family-level poverty with food security, disease control, and improving caring practices, are among the approaches investigated in nutrition research. With more research and development, these interventions can be refined, scaled-up, and implemented.

The Centre established its Nutrition Centre of Excellence (NCoE) in 1998 with a three-year fund support from the World Bank. The establishment of programmatic approach to research resulted in the formation of the Nutrition Programme among several others.

The Nutrition Programme is the focal point for Centre’s nutrition research activities. The role is persuaded through leadership and coordination of nutrition-related activities in the Centre and is executed through a Head of the Programme.

Its objectives include guidance and further strengthening of nutrition research through (i) identification of research priorities, (ii) facilitation of inter-divisional, national and international collaboration, and (iii) capacity building. The programme is currently housed within the Clinical Sciences Division (CSD).

During 2001, the programme continued to facilitate interactions, develop capacities, and support inter-divisional collaboration of nutrition researchers that enabled the Centre to respond rapidly and efficiently in addressing important nutrition problems of Bangladesh, many of which are also relevant to other developing countries. Additionally, the programme provided a platform for interaction between the scientists of the Centre, the GoB, non-governmental organizations (NGOs), and donor agencies to undertake concerted efforts in the field of nutrition.

Research

For more focused research initiatives and wider participation from all scientific divisions of the Centre, the Nutrition Programme developed six themes: (i) Maternal nutrition and LBW, (ii) Severe and moderate malnutrition, (iii) Infectious diseases and nutrition interrelations, (iv) Infant and child-feeding practices, (v) Child development, and (vi) Micronutrient research and intervention. Each of these themes is led by an expert scientist as theme leader coming from any of the divisions. In 2001, the Nutrition Programme successfully conducted 18 research projects using the World Bank grant, and coordinated and conducted another 18 nutrition-related operations research projects supported by the Bangladesh Integrated Nutrition Project (BINP-WB)

The programme developed an effective Strategic Plan, including identification and prioritization of research topics for the next 10 years. The current research issues under the above six themes include: strategies to im-
prove maternal and adolescent nutrition; strategies to understand determinants of maternal and adolescent nutrition; strategies to improve and manage LBW; understanding the determinants of moderate and severe malnutrition; clinical studies to improve treatment of complications of severe malnutrition; extension of treatment of severe malnutrition to the community; strategic studies to improve breast-feeding practices; understanding of, and behavioural study on, complementary feeding; improving complementary feeding and child growth; studies on physiology, magnitude, and determinants of development; studies on growth and development of children with malnutrition and different biological and social implications; impact and determinants of micronutrients deficiencies; testing strategies for improving nutrition status through micronutrient interventions; studies on impact, magnitude, and determinants infection-malnutrition interrelations; and strategic studies on prevention and curative measures of infection-malnutrition cycle.

**Micronutrient Interventions**

**Zinc research at ICDDR, B**

ICDDR,B: Centre for Health and Population Research has been among the frontline research organizations conducting zinc research for many years, and has also been able to stimulate other national and international organizations to conduct research in this area. The Centre’s research work has shown that children receiving zinc supplementation have better growth, 25% reduction in diarrhoeal duration and stool volume as well as reduced diarrhoeal morbidity during the subsequent period. A large-scale community-based study in Matlab observed similar reduction in diarrhoea in children receiving zinc along with 47% reduction in deaths and reduced need for antibiotics during the one-year period following supplementation. These findings significantly influenced the WHO in recommending zinc supplementation to all cases of acute diarrhoea. Studies done in ICDDR,B have also demonstrated an enhancement of vaccine immunogenicity with zinc supplementation among more malnourished infants. Additional studies are underway to examine the absorption of zinc and its effect on cholera and bacillary dysentery (shigellosis) that are expected to document further benefits of zinc. Studies in the Centre show that infants of mothers who received zinc during pregnancy had reduced risk for acute diarrhoea, dysentery, and impetigo at 6 months of age of their children. Recent findings at the Centre and research results from around the world were reviewed at a WHO-organized meeting in New Delhi. The meeting concluded that “there is now enough evidence demonstrating the efficacy of zinc supplementation on the clinical course of diarrhoea, with regard to the severity and duration of the episode” and recommended that “effectiveness studies to assess the feasibility, sustainability, and cost-effectiveness of different strategies for delivering zinc supplementation should be undertaken.” Plans for such studies are already underway at the Centre.

**Zinc with a micronutrient mix**

The effects of weekly supplementation of iron, zinc, simultaneous iron and zinc, and a micronutrient mix on diarrhoea and acute lower respiratory infection morbidity in infants of Matlab were evaluated. Simultaneous supplementation of iron and zinc was associated with a significantly lower rate of severe diarrhoea and severe ALRI. Iron supplementation alone had
no effect on diarrhoea and ALRI morbidity. Zinc alone was associated with lower diarrhoea and ALRI morbidity in less-nourished infants, but the differences were not significant. Supplementation of micronutrient mix resulted in higher rates of diarrhoea and ALRI in nearly all analyses, but only for diarrhoea did these analyses achieve statistical significance. On average, infants experienced a reduction in motor development from 6-12 months of age.

In general, the benefits of the micronutrients appear to be seen relatively in the poorly-nourished but not in the well-nourished children.

**Bioavailability of iron from a traditional food**

To investigate whether bioavailability of iron (Fe) from a traditional cereal- and legume-based complementary food (khichuri) could be improved by intake of human milk immediately following the complementary food, thirty infant (<18 months)-mother pairs, with mothers having breastmilk ascorbic acid concentration of >20 mg/L, were enrolled. Bioavailability of iron was determined by a double isotope technique employing administration of labelled iron via test-meal. The geometric mean of iron bioavailability (erythrocyte incorporation of stable isotopes of iron 14 days after intake) after administration of water and human milk following complementary diet was 6.5% and 6.1% respectively, indicating no influence of human milk on bioavailability of iron from traditional infant foods in Bangladesh.

**Vitamin A**

A study is underway to determine the improvement in vitamin A status after supplementation of vitamin A-rich small fish to marginally vitamin A-deficient Bangladeshi children aged 3-7 years. Of 506 households mapped at four urban slums in Mirpur, Dhaka, having children of the target age, 610 children were identified for screening their vitamin A level.

**Low Birth-weight Initiative**

*Improving foetal growth and maternal malnutrition: are pregnancy nutrition interventions effective?*

Foetal under-nutrition results in a wide range of consequences in perinatal life, in infancy and later, and there is growing evidence of causal links to chronic diseases much later in life. The magnitude of the immediate consequences as well as the generational and inter-generational effects of foetal growth retardation are enormous in South Asia, and especially in Bangladesh, where reportedly 45% of infants are born with a weight below 2500 g. This forms the background for ambitious nutrition programmes in the region, where large investments have been made to break the cycle of malnutrition through food and micronutrient supplementation and related activities to pregnant women and infants. Pregnancy is one of the logical target periods for nutrition interventions, potentially providing combined opportunities to treat or prevent maternal depletion as well as undernutrition of the foetus. From 2001, a large community-based randomized trial with combinations of food and micronutrient supplements to pregnant women is running in Matlab, Bangladesh, where pre-pregnancy weight measurements, careful monitoring and assessment over the entire pregnancy cycle are enabled by the running health and demographic surveillance system. This trial, supported by UNICEF, is named MINIMat – an acronym for Maternal and Infant Nutrition Interventions in Matlab.
As part of the surveillance for reproductive events, pregnancy is identified within 6-8 weeks of conception. After obtaining informed consent, women are randomly assigned to receive advice to begin the government’s supplementation programme immediately after diagnosis of pregnancy (early assignment) or at the time of their choosing (later assignment; usual care in this community). It is postulated that women in the early assignment group will have higher-birth-weight infants than those in the usual assignment group.

It is thought that an inadequate diet makes a considerable contribution to maternal anaemia. The government programme addresses two of the primary causes of nutritional anaemia, deficiencies of Fe and folic acid, but it is possible that deficiencies of other micronutrients limit the effects of the current iron and folic acid supplementation on haematologic status and birth-weight. Within each of the 2 groups described above, women are assigned to 60 mg Fe and 400 mg folic acid (current practice) or 30 mg Fe, 400 mg folic acid and additional micronutrients (equivalent in composition to UNICEF’s multiple micronutrient formulation that is currently being evaluated in a number of developing countries) or 30 mg Fe and 400 mg folic acid. It is postulated that the multiple micronutrients will increase haemoglobin concentration and birth-weight compared to the current iron-folate supplement.

Bacterial vaginosis (BV) produces chorio-amnionitis, decreases foeto-placental circulation and produces scarring of the endometrial lining. This inflammation prevents expansion of the endometrial cavity and adds to the rising pressure within the cavity near mid-pregnancy making it incompatible with full duration of gestation. Within each of the 6 groups described above, asymptomatic women who are diagnosed with BV are assigned to receive a course of 250 mg metronidazole given orally thrice daily for 7 days or (b) lactose tablets given orally thrice daily for 7 days. It is postulated that women in the metronidazole group will have longer gestation than women receiving the lactose tablets.

Breast-feeding (BF) is nearly universal in the population group, but the duration of exclusive breast-feeding (EBF) is much shorter than is optimal for infant health. During the months before delivery, all of the subjects are assigned to receive either (a) counselling for EBF or (b) a different health education message of equivalent intensity. It is postulated that those who receive counselling for EBF will have a longer duration of EBF than those who did not receive this counselling. As a result, it is postulated that this treatment will increase infant growth and reduce infant morbidity during the period of extended EBF. In as much as this trial will be conducted among women who also received the 2 sets of treatments described above, it is possible to examine the interactions among these various amounts and types of supplementation and women’s ability to extend the period of EBF.

With these interventions multiple outcomes are studied: the intrauterine growth (repeated ultrasound assessments), size at birth, as well as the weight development of the mother during the whole pregnancy cycle. Further, the haemoglobin changes during pregnancy, the micronutrient status of the mother and the infant will be followed. The infants will be followed regarding growth, psychomotor development, immune function and morbidity. Three thousand women are initially recruited into the study, and an interim analysis will guide if the cohort will be increased to 5000. A large team of scientists from across the ICDDR,B divisions and from Cornell
University, London School of Hygiene & Tropical Medicine, and the Institute of Child Health in London, are collaborating in the project.

**Impact of nutritional supplementation to mothers with respect to nutritional status in pregnancy, maternal weight gain, and foetal growth as detected by ultrasound**

The goal of this study is to determine whether nutritional supplementation (food and micronutrients) to mothers introduced during the first trimester of pregnancy will have a more positive effect on foetal growth assessed by ultrasound compared to the usual timing for introduction of maternal supplementation (late second or third trimester). Although, the study is undertaken as a part of the Low Birth Weight Initiative (MINIMat), the goal is principally programmatic. A number of very important biological questions about the aetiology and consequences of intrauterine growth retardation may be addressed through this supplementation trial.

Ultrasound machines were introduced in 2001 in all four sub-centres in Matlab, and 5 paramedics have been trained for foetal growth measurements as well as recognition of important signs for emergency obstetric needs.

The rate of low birth-weight (LBW) in Bangladesh is exceeding high and among the highest in the world; nearly half of the children are born with LBW. Efforts are, therefore, necessary to reduce the rate of LBW. Improvement of maternal nutrition and supplementation of selected nutrients are among the ways to address the issue. An earlier and recent study failed to observe any beneficial effects of supplemental zinc and fish-oil during the last trimester of pregnancy on the incidence of LBW. However, infants born to mothers receiving zinc had lower incidence of dysentery and ARI during the first 6 months of life.

Another study was taken to see the association of size at birth with childhood blood pressure, fasting glucose and insulin concentrations, lipid profile and insulin-like growth factor-1 (IGF-1) in preschool children of rural Bangladesh

Nutritional insult during a critical period of foetal life has been reported to have permanent effects on wide range of structural, metabolic and physiologic functions. Results of epidemiologic studies in developed and developing countries suggest that smaller size at birth is associated with an increased risk of mortality and morbidity due to coronary heart disease, hypertension, non-insulin-dependent diabetes mellitus. Changes in blood pressure and glucose metabolism in relation to size at birth have been reported in preschool and school children.

The present study looked at whether there was any association of size at birth with blood pressure, fasting glucose and insulin concentrations, lipid profile, and insulin-like growth factor-1 (IGF-1) in a group of preschool children who had size at birth data available from our previous study. The study was implemented in Matlab. Fasting blood samples were collected from 362 children—173 low-birth-weight (<2,500 g) and another 189 normal-birth-weight (≥2,500 g)—and analyzed for fasting glucose, insulin, and insulin-like growth factor-1 (IGF-1) concentrations and lipid profile. Data were compared between low-birth-weight and normal-birth-weight groups. Results of preliminary analysis showed no significant difference between low- and normal-birth-weight groups in most parameters, including fasting glucose: mean±SD 4.62±0.45 vs 4.68±0.45 mmol/L; insulin 1.6±1.2 vs 1.7±1.2 µU/mL; IGF-1:34.07±17.89 vs 32.04±17.48 ng/mL; plasma total cholesterol 3.24±0.67 vs 3.25±0.77 mmol/L; LDL 1.98±0.61
vs 1.96±0.73; triglycerides 1.18±0.43 vs 1.8±0.43 mmol/L. However, the HDL concentration tended to be lower in low-birth-weight than in normal-birth-weight group (HDL 0.71±0.17 vs 0.75±0.18 mmol/L; p<0.06). Further analyses of data are underway to confirm the findings and to test the hypotheses.

**Moderate Malnutrition in children**

The Bangladesh Integrated Nutrition Project funded the first ever study to explore what can reduce and prevent moderate malnutrition in infants aged 6 months to two years who constitute about 40% of children aged less than 5 years in Bangladesh. A study done in a rural upazila showed that intensive nutrition education using the UNICEF triangle of food security, disease control, and caring practices could result in a significant improvement (85%) in malnutrition compared to the control group within 6 months. Subsequently, the strategy was further tested in four other geographic areas, which showed similar success. The results showed that malnutrition can be prevented when nutrition education is applied early in life.

The crucial tool for combating malnutrition was a home-based locally-made complementary feed called *khichuri* prepared with 2 fistful of rice, one fistful of pulses, one egg, 5 tea spoonfull of soybean oil and one fistful of different coloured vegetables giving about 680 calories and 15 g protein. This low-cost complementary feed resulted in a very fast gain in weight and height among the moderately-malnourished children. The project results are being used in the BINP.

**Severe Malnutrition**

The Centre uses a standardized protocol for management of severely-malnourished children with diarrhoea and other acute illnesses, and this has resulted in a 68% reduction in case-fatality rate (CFR) over a four-year period. Conceptually, the protocol is nearly identical to the recently-published World Health Organization guidelines for treatment of severe malnutrition, based on the unique treatment requirements of these children.

The key elements of the protocol are early initiation of appropriate feeding, broad-spectrum antimicrobial therapy, supplementation of micronutrients, slow rehydration with emphasis on oral rehydration, and expedient management of complications. The following table describes the fall in the case-fatality among severely-malnourished children between 1996 and 2001:

<table>
<thead>
<tr>
<th>Period</th>
<th>No. of severely-malnourished children treated</th>
<th>No. of children died</th>
<th>CFR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January-June 1996</td>
<td>293</td>
<td>49</td>
<td>17</td>
</tr>
<tr>
<td>January-June 1997</td>
<td>334</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>May 2000-May 2001</td>
<td>3045</td>
<td>164</td>
<td>5.4</td>
</tr>
</tbody>
</table>

Chi-square for linear trend=57.1, p=0.0000

The Nutrition Programme hosted the operations research component of the Bangladesh Integrated Nutrition Project funded by the World Bank. The objective of the Bangladesh Integrated Nutrition Project Operations Research (BINP-OR) was to conduct and coordinate necessary operations research and to help the project to reduce malnutrition among Bangladeshi women and children through community-based nutrition interventions, undertake comprehensive national and inter-sectoral initiatives for micronutrient supplementation, promote breast-feeding and ensure household food security, and undertake implementation strategy. The Nutrition Programme, in collaboration with the Government of Bangladesh under its BINP-OR, has completed 14 research projects. Results of these research projects have been made available to BINP and also have been published in five booklets, and the additional 4 projects are in progress, to be completed by 30 June 2002. These include: (1) Community-based protocolized management of severe child malnutrition in urban Bangladesh. PI: P. Osinski; (2) Feasible means to address moderately-malnourished children within BINP communities. PI: S.K. Roy; (3) Testing of tubewell water for arsenic in community nutrition centres under BINP. PI: Md. Zakariya, BRAC; Coordinator: S.K. Roy, ICDDR,B; and (4) Process and impact study of BINP garden and poultry activities. PI: Rezaul Karim, Institute of Nutrition and Food Science, University of Dhaka. Coordinator: S.K. Roy, ICDDR,B.

Exclusive breast-feeding

It was found that exclusive breast-feeding (EBF) counselling by qualified counsellors and peer counsellors residing in the respective communities increased the rate of EBF from about 7-8% to 60-70% at the hospital and urban community settings of Dhaka city.

Further study in a rural community of Bangladesh observed group counselling to be as effective as individual counselling. Results of these studies indicate the need for effective implementation of EBF-counselling at appropriate health facilities of the country, such as at the ESP clinics for improving health of infants.
2001 was an exciting and busy year for the Programme on Infectious Diseases and Vaccine Sciences (PIDVS). The PIDVS, founded in August 2000, facilitates and focuses on the Centre’s expanding role in the prevention and control of infectious diseases important to Bangladesh and other developing countries, with particular emphasis on epidemiology, clinical and laboratory research, and evaluation of vaccines.

Given the Centre’s already prominent role in the area of diarrhoeal disease research, the Programme particularly emphasizes priority research within other emerging areas, including respiratory, mycobacterial, vector-borne and parasitic, and sexually transmitted infectious diseases. While the Centre has a long history of conducting important vaccine research, the Programme provides a focal point and forum for use and strengthening the existing resources from all divisions within the Centre, and when necessary, filling gaps through collaborations with institutions outside the Centre for carrying out vaccine studies of substantial local, regional and global relevance.

The PIDVS functions to establish priorities, identify resources, and enhance collaboration, communication, and use of the existing resources to boost the Centre’s capacity to conduct investigations relevant to prevention, suffering and mortality from key infectious diseases. During 2001, the Centre’s studies on dengue, Shigella, and tuberculosis served as examples of the value of connectivity created by the Programme.

Dengue and dengue haemorrhagic fever appeared in epidemic form in the summer of 2000; previously, dengue occurred only sporadically. With the recognition of dengue as a serious emerging problem faced by Bangladesh, the PIDVS led a multi-faceted research programme contributed to by each of the scientific divisions of the Centre. Activities were strengthened in 2001 and were led by researchers of Health Systems and Infectious Diseases Division (HSID), Laboratory Sciences Division (LSD), Public Health Sciences Division (PHSD), and Clinical Sciences Division (CSD). These included: hospital surveillance for dengue in urban and rural settings with systematic evaluation of clinical factors associated with severe illness; population-based surveillance for dengue in an urban slum in Dhaka city; evaluation of factors associated with presence and high density of the mosquitoes responsible for the transmission of dengue viruses (Aedes aegypti and Aedes albopictus); detection of dengue in blood by polymerase chain reaction (PCR), and culture and genetic sequencing of strains detected. Over 1,000 patients with suspected dengue were identified during surveillance at two of the largest hospitals in Dhaka—two-thirds of these patients were identified to have dengue by serology and PCR. Clinical and epidemiologic data from these patients are currently being analyzed.

During 2001, eleven cases of dengue were identified from among 20,000 urban slum population of Kamalapur in Dhaka for a rate of 55 per 100,000 persons per year. A case-control study involving these patients is currently being conducted to learn more about risk factors for dengue. The National Institutes of Health of USA awarded a grant to the ICDDR,B to learn more from this population-based site in Kamalapur about factors associated with transmission so that strategies for prevention can be developed and tested.

With funding from the International Vaccine Institute in Seoul, Korea, the Centre is exploring a panoply of factors critical to introduction of vaccines to prevent shigellosis. For many new vaccines developed in recent years, there has been an insufficient burden of disease, social, behavioural and
economic data to provide decision makers with the information they need to support purchasing and using the new vaccines. The study on Shigella will collect data earlier in the process of vaccine development. The PIDVS is coordinating this study in Kamalapur, which includes a microbiologic and epidemiologic component (led by LSD), an economic assessment (led by HSID), and a socio-behavioural component (led by PHSD). It will precisely define rates for incidence of Shigella infections, its complications and sequelae, mortality, and individual and societal costs of illness. Information being collected on attitudes of people living in the community and of community leaders toward the disease and prevention will be relevant for education and communication messages needed to encourage immunization once a vaccine is available. The study will continue for two years.

Preparations for field studies of exciting vaccines against rotavirus and influenza were in swing. The rotavirus vaccine is an oral formulation derived from a strain of rotavirus that was isolated from a child in Cincinnati, USA. The vaccine has been shown to protect well against rotavirus in children in Cincinnati, and it is hoped that it will perform well and be well-tolerated and safe in Bangladesh. The influenza vaccine, a nasal spray formulation, is highly effective against influenza illness in children in the United States. Both vaccines will be studied initially in ICDDR,B’s field settings in Mirpur and Kamalapur slums in Dhaka city.

Plans to evaluate other strategies to prevent pneumonia (via pneumococcal vaccines given to mothers in their third trimester) and Haemophilus influenzae type b (Hib) given in a single dose to infants progressed in 2001, as did plans to evaluate vaccines to prevent cholera and enterotoxigenic Escherichia coli infections. These studies are expected to begin in 2002.

An ongoing demonstration project to evaluate the feasibility and impact of introducing Hib vaccine to the routine infant immunization programme continued in Mirpur. More than 25,000 children have been immunized thus far.

The Centre began new research on the epidemiology, diagnosis, and clinical spectrum and progression of visceral leishmaniasis, often called kala-azar. Kala-azar is a devastating parasitic disease which attacks the liver and spleen, resulting in very high mortality. It is particularly common in northern Bangladesh. The ICDDR,B study is being carried out in Mymensingham district in collaboration with the Centers for Disease Control and Prevention (CDC), Atlanta, which is also funding the investigation. The CDC epidemiologists, entomologists, and parasitologists have participated actively with the ICDDR,B scientists in this investigation. This study is expected to identify useful and practical diagnostic tests and clinical parameters that can be used in the field for identifying patients early for aggressive therapy. Such an aggressive therapy can be toxic, yet effective, especially if treatment is begun early in the course of illness. By defining epidemiologic characteristics of illness and factors relating to the vector (the sandfly), this study also aims at identifying and evaluating effective prevention strategies.

Several vaccines are given routinely to infants to prevent diseases, such as diphtheria, pertussis, tetanus, measles, paralytic poliomyelitis, and tuberculosis. While these vaccines are all efficacious in pre- and post-licensure clinical evaluations, little data are available on the long-term impact...
of immunization programmes to maintain high coverage. Recently, a team from Guinea-Bissau used minimal surveillance data to suggest that some vaccines might increase the risk of mortality. Recognizing that comprehensive data on immunization history, socioeconomic status, and outcome are available from Matlab throughout the time during which infant immunization has been promoted through WHO’s Expanded Programme on Immunization (EPI), the PIDVS set out to evaluate the impact of infant immunization on mortality in Matlab. Modelling detailed available data from Matlab to control for factors which influence immunization, this study has shown that the use of diphtheria-tetanus-pertussis vaccination is strongly associated with improved survival of children. In addition to the utility of this study to immunization programme managers, this study demonstrates the utility of demographic surveillance to answer unanticipated, yet very important, questions.

Both PIDVS and ICDDR,B as a whole are an active participant in the WHO’s Global Outbreak Response Network. In addition to the extensive research response to dengue outbreaks recently, the ICDDR,B joined the MoHFW and the WHO in investigating an outbreak of fatal encephalitis in a village of western Bangladesh. After extensive laboratory studies at the CDC-Atlanta, cause of the outbreak was likely to be Nipah virus, a newly-emerging paromyxovirus first described in Malaysia in 1999. Additional studies to evaluate risk factors, mode of transmission, and scope of the problem are planned. It is anticipated that ICDDR,B will assist WHO and the MoHFW in future investigations of emerging and epidemic diseases in Bangladesh and globally (where our expertise is particularly unique, such as with cholera epidemics).

As the Centre expands its horizons into priority infectious diseases, it is clear that there are many practical questions which must be answered to enhance the health and well-being of the people of Bangladesh. Scientific enquiry must be supported to gather information which can be applied to develop strategies to prevent illness, complications, loss of productivity, and death from malaria and tuberculosis. Focused implementation and evaluation of strategies are urgently needed to prevent epidemics of human immunodeficiency virus (HIV), which will be particularly devastating in Bangladesh. Greater efforts in the areas of pneumonia, sexually transmitted diseases, and some vector-borne diseases, such as Japanese encephalitis, West Nile encephalitis, and filariasis, will provide foundations upon which disease-prevention efforts can continue to evolve to be priority-based and cost-effective. Expanding horizons will require financial and human resource investments, and collaboration and cooperation with a variety of partners.

**Enteric Diseases**

**Diarrhoea**

*Clinical and physiologic studies on cholera*

We are always looking for new ways to improve the therapy of cholera, a form of acute watery diarrhoea. An ICDDR,B study assessed the effects of L-histidine as an adjunct to standard treatment of 126 patients with cholera. In addition to receiving ciprofloxacin (500 mg 12 hourly for 3 days), 62 patients received a rice-based ORS (Ceralyte 90) with 2.5 g/L of L-histidine (histidine group), and another 64 patients received the same ORS but without L-histidine (control group). During the initial 24 hours, the stool volume in the histidine group was reduced by 12-20% (p=NS), and for the
entire study period, the reduction was 22% compared to the control group. The reductions of stool volume in the histidine group during 32-48 hours, 40–48 hours, and 56-64 hours were significant (p<0.05 for all comparisons). The intake of ORS (mL/kg) was consistently less in the histidine group during the study. The mean duration of diarrhoea and the proportion of patients requiring unscheduled intravenous fluid therapy was significantly (p<0.05) less in the histidine group. No major adverse event was noted among the study patients. The results indicate the potentials of histidine for use as an adjunct to the standard therapy for cholera.

Cholera is a secretory diarrhoea that predominantly affects the function of the small intestine. However, colonic dysfunction was demonstrated in a recent study at ICDDR,B. A study assessed the effect of short-chain fatty acid (SCFA) on colonic absorption of water and salts in an adult rabbit model of secretory diarrhoea. Perfusion of ligated loops of the animals resulted in net secretion of water and salts, and SCFA significantly reduced colonic secretion of water and salts; reduction in water secretion was the highest with butyrate (95%), followed by propionate (90%) and acetate (80%). Butyrate reduced secretion of sodium (96%), potassium (75%) and chloride (80%) but not bicarbonate; propionate and acetate produced similar effects.

In-vitro studies in rat, rabbit, and guinea pig showed that intestinal administration of cholera toxin significantly reduced serum concentrations of copper, zinc, and ceruloplasmin, probably by enhancing intestinal loss of these trace elements.

Cholera genetics

*V. cholerae* includes a wide variety of strains and biotypes, receiving and transferring genes for toxins, colonization factors, antimicrobial resistance, and new surface antigens. Understanding the horizontal transfer of these virulence genes can provide insights into how bacterial pathogens emerge and evolve to become new strains with epidemic potential. Devastating diarrhoea, which is characteristic of cholera, is mainly caused by the cholera enterotoxin produced by toxigenic strains of *V. cholerae*. The genes for cholera toxin (CT) reside in the genome of a bacteriophage known as CTX phage which infects non-toxigenic *V. cholerae* and converts them to toxigenic strains. Our studies have confirmed that some naturally-occurring non-toxigenic strains of *V. cholerae* are infected by CTX phage and converted to toxigenic strains. These strains produced cholera toxin and caused moderate to severe diarrhoea in adult rabbits.

Following entry into the recipient cells, the CTX phage genome either integrates into the chromosome of the host cell at a specific attachment site (attRS) forming stable lysogens or exists as a plasmid referred to as the replicative form (RF) of the phage genome. Attenuated live vaccine strains are supposed to be protected from lysogenic conversion by CTX phage if the attRS sequence is deleted, thus impairing the chromosomal integration of CTX phage genome. Recently, potential vaccine strains have been developed, which lack the entire CTX element, including attRS sequences. To determine whether vaccines produced using this approach are protected from reversion to toxigenicity by CTX phage, we infected naturally-occurring attRS-negative non-toxigenic *V. cholerae* or attenuated (CTX attRS) derivatives of wild-type toxigenic strains with CTX phage, and examined the diarrhoeagenic potential of the strains carrying RF of CTX phage genome using the adult rabbit diarrhoea model. Under laboratory conditions, strains

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**Prof. John Mekalanos of Harvard Medical School came as a Visiting Scientist to work on V. cholerae genetics with Dr. S.M. Faruque in the Molecular Genetics Laboratory**
carrying the RF of CTX phage produced more CT compared to corresponding lysogens as assayed by fluid accumulation in ligated ileal loops of rabbits.

However, when tested for diarrhoea in rabbits, the attR5-negative strains (which carried the CTX phage genome as RF) were either negative or produced mild diarrhoea, whereas the attR5-positive strains with integrated CTX phage produced severe fatal diarrhoea. Analysis of the strains after intestinal passage showed that the attR5-negative strains lost the phage genome at a ~5-fold higher frequency compared to that under in vitro conditions, and 75-90% of cells recovered from challenged rabbits after 24 hours were CT-negative. These results suggest that strains carrying the RF of CTX phage are unable to cause severe disease due to rapid loss of the phage in vivo. Thus, the gastrointestinal environment provides a milieu for selection of toxigenic strains with integrated CTX phage genome. These results have implication in the development of live *V. cholerae* vaccine candidates. These findings may also contribute to understand the aetiology of diarrhoea occasionally associated with non-toxigenic *V. cholerae* strains.

*V. cholerae* belongs to a group of organisms whose major habitats are aquatic eco-systems. In an attempt to understand the origin of epidemic *V. cholerae* strains, we carried out comparative genetic fingerprinting of toxigenic *V. cholerae* strains isolated from cholera patients and non-pathogenic strains from the aquatic environment to understand the lineage of the clinical strains. These studies suggested that toxigenic clinical strains possibly originated from non-toxigenic environmental strains of *V. cholerae* O1 or non-O1 by acquisition of virulence genes and serotype-specific genes. Furthermore, of a large number of clones of environmental vibrios, only a few have evolved into strains with the potential to cause epidemic outbreaks of cholera. Our efforts are directed toward understanding the genetic basis that determines what factors within clones of environmental vibrios enable them to acquire pathogenic potential and evolve into epidemic strains.

**Cholera and the environment**

Over the years, various studies on the environmental reservoir of cholera, including the role of physicochemical parameters supporting the persistence of *Vibrio cholerae* in association with plankton in the aquatic environment and related issues have been undertaken in the Environmental Microbiology Laboratory of ICDDR,B. At present, five projects are in progress with the collaboration of the University of Maryland Biotechnology Institute, USA; Johns Hopkins University, USA; Stanford University, USA; Dartmouth Medical College, USA; and University of Newcastle Upon Tyne, UK.

In one ongoing project investigating the bases for endemicity and seasonality of cholera in Bangladesh, environmental samples, including water, zooplankton, phytoplankton, aquatic plants, and sediments, were collected from the surface water bodies of four different areas of Bangladesh with multiple sampling sites at a 15-day interval. All samples were processed in the laboratory using culture, fluorescence microscopy, and molecular biological analyses to detect the presence of epidemic strains of *V. cholerae* O1 and O139. *V. cholerae* O1 was isolated in culturable form and was also detected by direct fluorescence antibody (DFA), polymerase chain reaction (PCR), and colony-blot hybridization with DIG-labelled DNA probe from water and plankton. A representative selection of isolated strains was sent to the University of Maryland for further molecular studies.
In another study, we investigated waste-stabilization ponds as possible reservoirs of cholera. Wastewater samples of the Pagla Wastewater Treatment Plant, Dhaka, were collected over the last two years and tested for the presence of toxigenic *V. cholerae*. Samples of raw sewage, settled sewage, and those from stabilization-ponds were collected for culture, molecular biological and chemical analyses. Results showed that *V. cholerae* O1 was always present in the raw sewage in a culturable form. These findings show that raw sewage of Dhaka city contains *V. cholerae* O1 throughout the year. However, the non-O1 and non-O139 *V. cholerae* were also isolated in culturable form throughout the year from waste-stabilization ponds. These results indicate that the bio-physicochemical parameters of a typical waste-stabilization pond are favourable for maintenance of *V. cholerae* non-O1, non-O139.

*V. cholerae*, an autochthonous member of marine and brackish-water environment, is also present in fresh-water habitats. Biofilm, a special kind of microbial niche, provides protection for bacteria in aquatic systems. Studies are being done to determine whether there is evidence of *V. cholerae* O1 undergoing biofilm formation for survival in fresh-water habitats. Samples were collected from three sources of surface water: ponds, canal, and river of the Matlab HDSS area. Standard biofilm sampling devices were installed at a specific depth in all the water bodies to allow biofilm formation. Samples were processed for culture and preserved for direct fluorescence microscopy, detection of mRNA corresponding to the exopolysaccharide (EPS) gene-cluster and also for further analysis of other members of the biofilm consortium by rRNA species-specific characterization. *V. cholerae* O1 was isolated in culturable form and also detected in viable but non-culturable form from the biofilm on several occasions.

A three-year study on environmental persistence of *V. cholerae* has been initiated to determine the temporal dynamics of gene expression, and regulation under different environmental conditions. The microarray technique will be employed to detect genes responsible for metabolic activity, dormancy, and pathogenicity that are expressed in response to environmental conditions, whether culturable or non-culturable.

In Bangladesh, a large proportion of the population in villages and remote areas depend on untreated surface water for household use. In a Matlab study, we are attempting to motivate members of study households to filter surface water prior to drinking or for any other household purpose. The overall objective of the study is to establish a simple water-filtration technique for cholera intervention in the villages of Bangladesh. The study has been conducted, with three treatment groups, for the last two years. Two different types of filtering devices: eight-fold sari cloth and a nylon material were provided to the study households of intervention groups to filter surface water. The third group, having no device to filter water, served as the control or non-intervention group. After successful completion of the first phase of the study with 2,250 households from 18 villages, the study was extended to a second phase involving 8,250 households, including nearly 60,000 individuals, from 65 villages of the Matlab HDSU area. At a 15-day interval, the field workers visited each study household in the intervention areas and delivered health messages regarding the use of filters for collection of surface water. Water and plankton samples were collected weekly from 10 different sampling sites and analyzed in the laboratory as a quality control measure for the filtration device. A significant percentage of respondents accepted both filtration device and use of filtered water for household purposes. A reduction in the incidence of cholera was observed for both sari and nylon intervention areas compared to control areas.
The Environmental Microbiology Laboratory provides inter-departmental services for microbiological and chemical analysis of environmental samples received from the Clinical Sciences Division and Public Health Sciences Division of ICDDR,B. In addition, this laboratory also extends services to national and international institutions for microbiological and chemical analysis of environmental water samples and for processed fish and food samples. In total, 1,586 samples, including surface water, tubewell water, bottled water, rectal swabs, processed fish, fruit-juice, etc., were tested in the laboratory for the presence of pathogenic bacteria during 2001.

**Surveillance of cholera for epidemic control preparedness**

Cholera is an ancient disease. The history of cholera in the Ganges river delta, the larger part of which is known today as Bangladesh, is also very old. The region was thought to have been the source of origin of two of the seven cholera pandemics that invaded the world in the last 190 years. Despite improvements in understanding the disease and its treatment, the disease has remained worldwide and continues to be a persistent public-health problem in many developing countries.

The disease remains highly endemic in Bangladesh. With 1 to 5 hospitalizions per thousand people in Matlab for more than 20 years, an estimated 100,000 to 600,000 cases of cholera occur in Bangladesh every year. Additionally, there are many more mild and asymptomatic infections, suggesting that several million cholera infections occur each year. In 1991, there were approximately 220,000 documented cases of cholera with over 8,000 deaths during a 12-week period, more than what occurred in all of Latin America, during its highly-publicized outbreak that year.

Very few countries have a history of cholera which is more complex than that in Bangladesh. For decades, epidemics of cholera have produced contrasting pictures of appearance and disappearance of *Vibrio cholerae* (the organism responsible for the disease), which until 1992 remained confined to the biotypes and serotypes of *V. cholerae* O1. Then for the first time in history in the late 1992, a new strain designated *V. cholerae* O139 synonym Bengal produced a large epidemic of cholera in Bangladesh. The strain first characterized at ICDDR,B was thought to have the potential to start the next (8th) pandemic of cholera.

Despite many years of study, it is still not clear how *V. cholerae* spreads around the world, what determines its seasonality, and what determines evolution of the cholera strains. Answers to these questions would contribute to the ongoing global efforts to eliminate the scourge of cholera.

Enterotoxigenic Escherichia coli

Over the last five years, the burden of disease caused by enterotoxigenic *Escherichia coli* (ETEC) in Bangladesh has been assessed, and there have been advances in molecular epidemiology of ETEC. Over 10,000 samples of stools from diarrhoeal patients who attended the ICDDR,B hospital in Dhaka, and other surveillance sites of ICDDR,B all over Bangladesh were
examined. On an average, the prevalence of ETEC ranged from 16% to 20% in the different surveillance sites, and the highest incidence was observed in children. These studies have shown that ETEC is almost as common as *Vibrio cholerae* O1 in causing acute watery diarrhoea. Over 60% of ETEC infection cases were children aged three months to three years. Dehydrating and severe disease due to ETEC was also observed in adults in the hospitals.

Two pathogens—ETEC and *V. cholerae*—share similar seasonality patterns and clinical features, which may result in misinterpretation of diarrhoea due to ETEC as infection due to *V. cholerae*, especially during outbreaks and epidemics (see figure). At certain times of the year, especially in the spring, there may be more cases of ETEC diarrhoea than that of *V. cholerae*-associated infections. Strains expressing the heat-stable (ST) phenotype are the most common, and of the colonization factors (CFs), CFA/I, CS1 to CS6 are predominantly isolated.

Since infections due to ETEC may spread through water contaminated by faeces from infected persons, studies were carried out to better understand the transmission of ETEC in the environment by screening surface-water samples. The bacteria were isolated from 34% of 99 tested surface-water samples from ponds, rivers, and lakes obtained from around Matlab and Dhaka city. The phenotype of ETEC isolates, i.e. colonization factors, and the toxin types were similar to those isolated from patients from all over Bangladesh. About 82% of the strains were positive for ST alone (68%) or in combination with heat-labile toxin (LT) (14%). Of ETEC, 44% were positive for different CFs, namely CFA/I, CS1-CS6, CS8, and CS21. Most of these phenotypes are also commonly isolated from hospital patients and are candidates for incorporation in protective vaccines. The strains isolated from the surface-water samples were compared with clinical isolates from patients in Dhaka or Matlab of the same phenotype using molecular typing, including pulsed-field gel electrophoresis (PFGE). Analyses showed that an ETEC of a particular CF type, a similar clone was also detected in the clinical cases if a certain PFGE pattern was detected in the environment (see figure). Most ETEC serotypes detected within the environment were also detected in the clinical samples, and multidrug-resistant strains were isolated from both the sources.

In addition to these studies, it was also observed that ETEC strains demonstrate an acid tolerance response (ATR), and acid-adapted mimic bacteria that have been shed in stool. Under these conditions, they show increased virulence and also colonize better in infant suckling mice. This suggests that ETEC from the human host contaminating water have accentuated colonizing abilities, making it a more successful pathogen to potentiate spread, outbreaks, and epidemics and to maintain endemicity. The bottom line is that contaminated water is a potent reservoir and vehicle for transmission of ETEC and forms a vicious cycle for the perpetuation of ETEC infections in Bangladesh.

**ETEC vaccine trial in Bangladesh**

One of the strategies for the prevention of diarrhoea due to ETEC is to design a suitable and protective vaccine. Infants and children suffer from the consequences of repeated episodes of the disease, which not only cause death but also retard and falter growth. These infants and children will, therefore, benefit most from such a vaccine. A candidate vaccine that has been evaluated over the last few years is the oral inactivated ETEC vaccine,
consisting of recombinant cholera toxin B subunit (BS) and a mixture of formalin-inactivated whole-cell ETEC bacteria expressing six colonization factors (CF-BS-ETEC vaccine). Results of a safety and immunogenicity study (Phase I) in adults and children in Bangladesh showed that the vaccine was safe and gave rise to significant mucosal and systemic antibody responses. It was hypothesized that the vaccine should also be suitable for infants and younger children in Bangladesh. To validate the hypothesis, the vaccine was tested among 316 children in the field setting (Phase II) with a double-blinded placebo-controlled design. The vaccine was safe and immunogenic in children aged 18-36 months. Vomiting was, however, observed in younger children (p=NS) aged 6-17 months in both vaccine and placebo recipients. Results of dose-finding studies showed that a one-quarter of the full-dose vaccine was appropriate for younger children. A double-blinded placebo-controlled trial of the vaccine was completed in children aged 6-17 months where the reduced dose of the vaccine was found safe and immunogenic. Results obtained with the reduced dose are now being compared with results of the full dose in older children.

Based on the observations made in Bangladesh, the course and plans of the study required to be changed. In moving from a developed to a developing country scenario and in shifting from adults to progressively younger age groups, there may be different requirements for vaccines. Our study led to awareness that dose-finding studies are very important, especially for infants and children in developing countries, who are malnourished and nutritionally deprived. We are now planning to further optimize the use of the CF-BS-ETEC vaccine in preparation for a possible protective efficacy trial (Phase III) in Bangladesh. Since children aged 3-36 months are very susceptible to repeated ETEC infections and also suffer most from its consequences, they will be the focus of vaccine trials.

Volume depletion induced by diarrhoea

An animal model of dehydration, malnutrition, and infection was developed at ICDDR,B, to be used in the assessment of responses of the kidneys and the intestine (both small and large) to dehydration, malnutrition, and infection with E. coli and RDEC-1. One study, using this model, focused on the response of the small intestine to dehydration and the influence of nutritional status and composition of rehydration solution to the response. Compared to control animals, the dehydrated animals lost 12% body weight associated with 87% reduction in urine volume and increased osmolality (1287±45 mOsm/L), and 94% increase in Blood Urea Nitrogen (BUN), a marker for dehydration. In the colon of dehydrated animals, short-circuit current (Isc) and net trans-epithelial flux of sodium (J Na Net) were increased, and electrical trans-epithelial conductance (G) was decreased. In the jejunum, there were significant net increases in the absorption of water, sodium, and potassium. In vitro, Isc, J Na Net and G were increased. The loss of body-weight, reduction in urine volume, and increase in the urine osmolarity and BUN were similar in the dehydrated control and dehydrated malnourished animals. The brush-border enzyme activities and intestinal permeability were also similar in control and malnourished animals infected with RDEC-1. The absorption of water from the WHO-ORS and ReSoMal (a special ORS developed for rehydration of malnourished dehydrated children) was similar. However, the absorption of sodium was significantly lower and absorption of potassium was significantly higher (p<0.01) in dehydrated malnourished animals compared to dehydrated healthier animals. The results of this study indicate that the kidney functions remain
intact, and that ReSoMal is more efficient in reducing sodium overload and in maintaining concentration of potassium in malnourished animals. The results also indicate the need for controlled clinical trials to compare efficacies of the WHO-ORS and ReSoMal in the management of dehydration in malnourished children.

**Rotavirus vaccine trial**

A safe and effective vaccine is needed to reduce the enormous public-health burden associated with rotavirus illness, especially in developing countries. About 40,000 children with rotavirus diarrhoea are treated each year at the ICDDR,B hospitals. Globally, there are an estimated 600,000 to 1000,000 deaths annually. Unanticipated adverse events (intussusception) experienced with the rhesus rotavirus vaccine have accelerated efforts to develop and evaluate alternative vaccine candidates.

ICDDR,B has initiated a study in urban Dhaka to assess the reactogenicity and immunogenicity of a live, attenuated rotavirus vaccine (RIX4414) among young children. Reactogenicity and adverse events will be assessed after a single dose in 90 toddlers (2-4 years old) through daily home visits for the first 2 weeks and then twice weekly for another 4 weeks, and thereafter, monthly active surveillance to complete 6 months of follow-up. If the evaluation in 2-4 years old children reveals no unacceptable reactogenicity, two and three doses of the study vaccine will be evaluated in 476 infants aged 6-14 weeks to determine its safety and immunogenicity.

All preparations for the trial had been completed by 2001, and the work is in progress. The study will form the foundation for conducting Phase III studies of effectiveness and safety of the vaccine in Bangladesh.

**Shigellosis**

**Clinical and physiologic studies**

An important recent study compared the efficacy of a three-day course of ciprofloxacin (15 mg/kg q 12 hours, maximum 500 mg) with that of the standard five-day (10-dose) course in 132 children (128 eligible for analysis) with shigellosis of ≤72 hours due to *S. dysenteriae* type 1, who did not receive any effective antimicrobial therapy. Therapy was clinically effective in 43 (65%) of 66 children on three-day therapy, and in 43 (69%) of 62 children on five-day therapy (difference 4%, 95% CI 12-20%, p=0.75). All *Shigella* isolates were susceptible to ciprofloxacin, and bacteriological efficacy was 100% in both the groups. There were no signs of arthropathy in any patients. As a result of the findings of this study, a three-day course of ciprofloxacin may now become the standard for treatment for childhood shigellosis.

Fermentation of unabsorbed carbohydrates in the colon leads to production of short-chain fatty acids (SCFAs), which are a major source of energy for the colonocytes and promoters of NaCl absorption. One study set out to ascertain the effects of SCFA in the treatment of colitis induced by *S. flexneri* 2a in the rabbit model. After 24 hours of infection, the colon of the animals was infused with solution containing SCFA (acetate, propionate, n-butrate; 60:30:40 mmol) or SCFA-free solution for six hours, and animals were killed at 24-hourly intervals for clinical, histologic and bacteriologic evaluations. Significant reduction in the characteristics of shigellosis, including presence of blood and mucus in stools, severity of mucosal
inflammation, and the numbers of *Shigella* strains in faeces were observed among animals receiving infusion of SCFA-containing solution compared to controls. Results of this study indicate that SCFA could be clinically useful in the treatment of shigellosis.

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

In recent years, the importance of *Shigella* as an enteric pathogen with global impact has been increasingly recognized. There is concern about potentially-devastating consequences if resistant strains outpace the availability of affordable and effective antimicrobial therapy. Given its particularly important role within very poor developing countries and the potential for it to be neglected by vaccine companies focused on the developed world, shigellosis is included as one of the “diseases of the most impoverished” (DOMI), along with typhoid and cholera. WHO and the International Vaccine Institute (IVI) have concluded that special efforts will be needed to stimulate development of vaccines against these diseases. Bangladesh is participating along with five other Asian countries in an IVI-sponsored study supported by the Bill and Melinda Gates Foundation to estimate the burden of shigellosis.

A community-based surveillance for *Shigella* cases was begun in July 2001 in Kamalapur, southeastern part of Dhaka city, in collaboration with the International Vaccine Institute (IVI), South Korea. This surveillance will facilitate estimation of the incidence and prevalence of shigellosis and its complications and age- and cause-specific mortality in the community among all ages and gender, estimation of the distribution of serotypes and sub-serotypes, and monitoring of the antimicrobial resistance patterns and the predictor of epidemic due to *Shigella dysenteriae* type 1 and *S. flexneri*. This clinic-based (passive) surveillance completed its pre-surveillance activities in November 2001, and diarrhoeal patients are attending the Kamalapur diarrhoea clinic from December 2001. It is expected that this study will continue for two years.

**Immune responses**

Shigellosis is one of the major causes of morbidity and mortality in developing countries, including Bangladesh. Although available antimicrobial drugs effectively treat the disease, the prevalence of drug-resistant strains is very high and is increasing at an alarming rate. Thus, there is a great interest in the future possibilities of using alternative approaches. Antimicrobial peptides are effectors of the immediate defense system. A mixture of these peptides drenches the mucosal epithelial surfaces that participate in the regulation of normal flora and are induced for eliminating the invading micro-organisms. Recently, it was shown that *Shigella* down-regulates the expression of one such peptide, namely LL-37, in the colon of adult patients during acute shigellosis, thereby facilitating the proliferation of *Shigella* in the gut. In addition, increased production of LL-37 in the cultured epithelial cell lines was seen when treated with butyrate, a short-chain fatty acid. Butyrate also decreases the severity of infections due to *Shigella* in rabbit experimental model aiming at evaluating probable candidate antigens of *Shigella* that can down-regulate LL-37. The capacity of sodium butyrate as an anti-inflammatory drug to enhance the production of LL-37 in humans and in rabbit model of shigellosis is also being investigated at the Centre.
Findings of earlier studies indicate that antigen-specific immune responses in paediatric patients with shigellosis are delayed and reduced in magnitude compared to adults. Adult patients with shigellosis had a higher number of neutrophils infiltrating the site of infection, while the numbers were reduced in children. An early trafficking of mast cells and eosinophils was observed in adult patients in contrast to a delayed response in children. Ultrastructural analysis suggested increased degranulation and activation of arachidonate metabolism in mast cells in both the groups of patients. However, in adults, degranulation in eosinophils occurs most prominently in the acute stage of illness, while in children, this phenomenon occurs in late convalescence. Activation of eosinophils was linked with necrosis during the acute illness among adults and children; this effect rapidly declined during convalescence in adults only. The regulatory mediators of these non-specific cells also persisted in the convalescent stage and were reduced in magnitude in children, suggesting that initiation of innate immune responses in children is also delayed and prolonged compared to that in adults.

Molecular epidemiology of Shigella flexneri isolated in Bangladesh

In developing countries, S. flexneri is the dominant species of Shigella causing diarrhoeal disease. Species and serotype distribution of Shigella changes with time and can be influenced by epidemics, which are often caused by S. dysenteriae type 1. Currently, S. flexneri (72.2%) occurs most commonly, followed by S. boydii (11.8%), S. sonnei (7.9%), and S. dysenteriae type 1 (2.1%). Serotyping of 2477 strains of S. flexneri over the last 24 years (1978-2001) in Bangladesh has shown that serotype 2a is the dominant serotype except during 1997-2000 when S. flexneri serotype 2b was most common. However, S. flexneri serotype 2a (45.2%) has again become predominant among strains isolated between July 2000 and December 2001. Over 40% of the cases of S. flexneri infections over the last 24 years have been documented as serotype 2 (serotype 2a and 2b). The plasmid profile, pulsed-field gel electrophoresis (PFGE) and ribotyping pattern of serotype 2a and 2b are closely related (see figure). When the rest of the serotypes were analyzed using the same molecular techniques, different types with numerous subtypes were obtained.

When we analyzed antibiotic resistance pattern of the isolates during 1997-2001, multidrug-resistance was more common in serotype 1b, 2a, and 2b. Serotype 3a was found to be highly resistant (>80%) to a single drug sulphamethoxazole-trimethoprim. Resistance to nalidixic acid was found only in serotype 1b, 2a, 2b, 3a, and Y, while previously-reported untypeable strains (23%) of serotype 1c, 4, and 4X were resistant to ampicillin and sulphamethoxazole-trimethoprim separately. It is interesting to note that serotype 1a, 5a, and X were sensitive to all antibiotics. Prevalence of serotype 1a, 5a, and X is decreasing drastically. Another interesting trend is that previously-identified S. flexneri serotype 3b, 3c, 4a, and 4b were not detected during 1997-2001. Overall, it appears that there is a changing profile in the prevalence of various serotypes of S. flexneri. This adds a challenge to the development of a vaccine to prevent Shigella infection in Bangladesh.

Previous studies have shown that 12.4% of S. flexneri strains were untypeable. Of these, 4.6% (n=21) agglutinated only with the type antigen factor 4 but did not agglutinate with any group factors; these were arbitrarily designated as type 4. Two major biotypes were obtained based on biochemical reactions, which were consistent with molecular typing (plasmid analysis, PFGE, and ribotyping); these were completely different from that of the 4a and 4b strains (see figure). Most of the strains harbored a
self-transferable middle-order ranged (35-62 MDa) plasmid with multiple antibiotic resistance markers. Laboratory experiments showed that all the strains were invasive. This study suggests that type 4 is a new sub-serotype of *S. flexneri* and needs further serological classification.

**Characterization of new *Shigella* boydii isolated in Bangladesh**

None of the twenty *Shigella*-like organisms isolated from stool cultures of diarrhoeal patients at the Dhaka Hospital of ICDDR,B reacted with any antisera of the established *Shigella* serovars. Of these, 7 strains had the typical biochemical characteristics of *Shigella* species and were biochemically identical. All the strains were invasive. Antisera were raised against these strains in rabbit. None of the existing serovars of *Shigella* species agglutinated with these antisera. The results of antigenic analysis revealed that they did not belong to any of the recognized or provisional serovars and were serologically indistinguishable. The pattern of plasmid profile, pulsed-field gel electrophoresis (PFGE) and ribotyping was identical to *Shigella boydii* 1 but were completely different from that of entero-invasive *E. coli* (see figure).

**Helicobacter pylori** infection

About 80% of the population in Bangladesh is infected with *Helicobacter pylori*, with infections occurring during the first months of life. The bacteria are known to cause peptic ulcer, gastritis, and gastric cancer. Research work at the Centre is currently focused on its relation to ion absorption and anaemia.

Gastric acid is among the most important luminal factors for iron (Fe) absorption. A recent study aimed at: (i) measuring gastric acid output (GAO) and Fe absorption in *Helicobacter pylori*-infected young Bangladeshi children, and (ii) evaluation of the impact of treatment for Hp-infection on their gastric acid secretion (GAS) and Fe absorption. One-hour basal gastric acid output (BAO0) and 1-hour stimulated gastric acid output (SAO) with subcutaneous pentagastrin were measured in asymptomatic children aged 2-5 years with (n=30) and without (n=28) Hp-infection as diagnosed by 13C-urea breath test. Absorption of Fe from ferrous fumarate was compared with a highly bioavailable, water-soluble Fe compound (ferrous sulphate) using a double isotope technique in which labelled iron (57 Fe and 58 Fe) was administered via test meals in subsets of Hp-infected and non-infected children (12 in each group) with proven Fe-deficiency anaemia. In Hp-infected children, both GAO and Fe absorption were re-assessed 60 days after anti-Hp therapy. In Hp-infected children, the geometric mean of Fe absorption from ferrous sulphate and ferrous fumarate was 17.1% and 4.7% (p<0.0001) before treatment and 18.2% and 5.1% after treatment (p<0.0001). The corresponding values for non-infected children were 12.6% and 4.4% (p<0.001). Compared to non-infected children, the BAO and SAO were significantly lower in Hp-infected children, which significantly increased after treatment. Anti-Hp therapy significantly increased the mean haemoglobin and serum ferritin levels without concomitant improvement in the mean absorption of either Fe compounds. This study observed that, contrary to healthy western adults, Bangladeshi children absorb iron better from ferrous sulphate than from ferrous fumarate. Results of this study suggest a causal relationship between Hp-infection, low gastric acid output, and Fe-deficiency anaemia, and also that Fe-fortification programmes using ferrous fumarate might not be ideal in addressing iron-deficiency anaemia (IDA) in young children in developing countries.
**Molecular characterization of Helicobacter pylori strains isolated from patients with duodenal ulcer, non-ulcer dyspepsia, and gastric cancer**

*Helicobacter pylori* strains, isolated from patients with duodenal ulcer, gastric cancer, and non-ulcer dyspepsia, were analyzed for the presence of virulence factors by studying the cagA pathogenicity island and genotyping of vac gene. In total, 57 isolates were cultured from 115 subjects (65 with duodenal ulcer and 50 with non-ulcer dyspepsia). The isolation rate of *H. pylori* from patients with duodenal ulcer was 56% (37/65) and from non-ulcer dyspepsia was 40% (20/50).

Among the isolates from patients with duodenal ulcer, 75% were cag PAI-positive compared to 55% from patients with non-ulcer dyspepsia; 81% and 60% of the isolates from patients with duodenal ulcer had vac s1 signal sequence and m1 middle region compared to 60% and 40% of the isolates from patients with non-ulcer dyspepsia respectively.

All isolates were examined for antimicrobial resistance to metronidazole, tetracycline, amoxicillin, and clarithromycin. Among the isolates, 75% (43/57) were resistant to metronidazole, 40% (24/57) to tetracycline, and 5% (3/57) to amoxicillin.

**Amoebiasis**

*Human immunity to amoebiasis in Bangladesh*

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

All *E. histolytica* strains express a 260-kDa surface galactose/N-acetyl-D-galactosamine (Gal/GalNAc) lectin which is antigenically conserved and immunogenic. The lectin is required for adherence to human intestinal epithelial cells and contact-dependant killing of immune effector cells. The purified 260-kDa *E. histolytica* lectin dissociates under reducing conditions into heavy (170 kDa) and light (31-35 kDa) sub-units. To examine the roles of human mucosal and systemic immune responses to *E. histolytica* in protection from *E. histolytica* infection and disease, a field study in Mirpur, an urban slum in Dhaka city, was initiated.

Two hundred eighty-nine preschool children aged 2-5 years were studied. The area is densely-populated with poor sanitary and hygiene conditions. An investigation was done to determine whether protection from intestinal infection correlated with mucosal or systemic antibody responses to the *E. histolytica* GalNAc adherence lectin. Stool specimens were collected every month for detection of *E. histolytica*-associated infection and antibodies, and blood samples every four months for detection of antibodies. Children with stool IgA lectin-specific antibodies at the beginning of the study had 64% fewer new infections due to *E. histolytica*. In contrast, children with serum IgG lectin-specific antibodies by 12 months had 53% more new infection due to *E. histolytica*. A stool anti-lectin IgA response was
detected near the time of resolution of infection of closely-monitored new infections. It is concluded that a mucosal IgA anti-lectin antibody response is associated with immune protection against colonization of E. histolytica. The demonstration of naturally-acquired immunity offers hope for a vaccine to prevent amoebiasis.

Empiric therapy for severely-malnourished children with pneumonia and diarrhoea

An open, randomized clinical trial examined the efficacy, pharmacokinetics and toxicity of once daily versus thrice daily-dosing regimen of gentamicin in 310 moderately- or severely-malnourished children aged less than five years with diarrhoea and pneumonia. In addition to receiving 75 mg/kg once daily dose of parenteral ceftriaxone, the study children received 5 mg/kg of gentamicin intramuscularly either as a single, once daily dose (OD, n=148) or in three equally-divided doses (TD, n=162). Complete and partial clinical recovery occurred in 64% vs 54% and 25% vs 27% of the children in the OD and the TD group respectively \( (p=\text{NS for both comparisons}) \). Five patients in each treatment group died and clinical response could not be evaluated in the remaining children. Toxicity was not observed in any children. In the once daily dose group, the mean±SD serum gentamicin concentrations at 1 hour, 3 hours, 5 hours, 8 hours, 23 hours, and 24 hours after the dose were: 11.7±4.1, 4.4±1.2, 2.08±0.9, 1.01±0.6, 0.2±0.1 and 0.23±0.1 mg/L respectively. In the TD group, the mean±SD serum gentamicin concentration at 1 hour was 4.7±1.8 mg/L, and the trough level was 0.45±0.2 mg/L. Although the trough level of gentamicin was significantly lower in the OD group \( (p<0.001) \), the peak level was significantly higher \( (p<0.001) \), which is more important for antimicrobials that exert post-antibiotic effect, including gentamicin. Results of the study indicate that once daily regimen of gentamicin is effective and safe for use in malnourished children, and this would comprise a more cost-effective regimen with other benefits.

Acute Respiratory Infections

Acute lower respiratory infection (ALRI), primarily pneumonia, is a leading cause of morbidity and mortality in children aged less than five years in Bangladesh. About 25% of deaths occur in children aged less than five years, and about 40% deaths in infancy in Bangladesh are associated with pneumonia. *Streptococcus pneumoniae* and *Haemophilus influenzae* frequently cause pneumonia; respiratory viruses, like respiratory syncytial virus and influenza are also important.

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 five years. In total, 1,369 children with pneumonia were enrolled during 25 March 1999-December 2001. A bacterial pathogen was detected in 136 (9.9%) cases by blood culture; *S. pneumoniae* was detected in 21 (1.53%) cases, *Haemophilus type b* in 21 (1.53%) cases, *Acinetobacter* in 25 (1.83%), and *Moraxella* in 7 cases (0.51%). Most (75%) *S. pneumoniae* isolates were resistant to co-trimoxazole, one (4.8%) isolate to penicillin, and another (4.8%) to chloramphenicol. *H. influenzae* strains were resistant to co-trimoxazole, one (4.8%) isolate to penicillin, and another (4.8%) to chloramphenicol. *H. influenzae* strains were resistant to many common antimicrobial drugs: co-trimoxazole 72%, ampicillin 33%, chloramphenicol 44%, and erythromycin 11%. All isolates were susceptible to ceftriaxone. The high resistance rate to the first-line antimicrobial agent, co-trimoxazole, among invasive *S. pneumoniae* isolates and multi-

Acute lower respiratory infection, including pneumonia, is the leading cause of childhood morbidity and mortality in Bangladesh and also the leading cause of death at the Clinical Research and Service Centre (CRSC). A mother is anxiously observing her severely-malnourished child receiving treatment at the Special Care Unit of the CRSC for pneumonia.
drug resistance to three conventional drugs among *H. influenzae* are concerning, although the clinical correlation of in vitro resistance with clinical failures is not clearly defined.

*Haemophilus influenzae* type b (Hib) is the leading cause of meningitis in Bangladeshi children. The emergence of antimicrobial resistance in Hib strains significantly increased treatment cost, duration of hospitalization, risk of mortality, and serious sequelae in non-immune children suffering from meningitis in Bangladesh, since the Hib vaccine is not included in the national immunization programme. A prospective study was undertaken in three hospitals in Dhaka, Bangladesh, to examine epidemiology and antimicrobial resistance of Hib infections in children aged less than five years, clinically-diagnosed to have meningitis. Cerebrospinal fluid (CSF) analysis was done on these children on admission from April 1999 to October 2001. Of 290 children, 120 (41.4%) had bacterial meningitis based on results of Gram stain and biochemical tests. *H. influenzae* type b was detected in 43 (35.8%)--(36 by culture, 7 by latex agglutination) of the 120 children and was the most common cause of bacterial meningitis, followed by *S. pneumoniae* 34 (28.34%)--(31 by culture, 3 by latex agglutination), and *Neisseria meningitidis* 10 (8.34%)--(6 by culture, 4 by latex agglutination). Hib meningitis occurred predominantly (91%) among children aged 4-12 months. Twelve (33.3%) of the 36 Hib isolates were multidrug-resistant, simultaneously resistant to ampicillin, chloramphenicol, and co-trimoxazole by the disc-diffusion test. None was resistant to ceftriaxone. The overall case-fatality rate was 19%. The high prevalence of Hib meningitis associated with increased multidrug-resistance in infants and high case-fatality rate emphasizes the importance of introduction of a cost-effective Hib vaccination programme for young children in Bangladesh to prevent this serious infection.

**Tuberculosis**

*Drug-sensitivity pattern of Mycobacterium tuberculosis*

Tuberculosis is highly prevalent in Bangladesh due to over-crowding, malnutrition, and poverty. The impact on the health of the population and on society is huge but poorly defined. Due to lack of proper laboratory facilities, there has been no systematic information on the culture and susceptibility of *Mycobacterium tuberculosis* in Bangladesh. With financial assistance from UNOCAL and USAID, we have developed excellent laboratory facilities for conventional culture and sensitivity. To fill information gaps in drug susceptibility pattern in Bangladesh, we have recently started culture of *M. tuberculosis* and testing of its sensitivity both at ICDDR,B and at Shyamoli TB Clinic in Dhaka. Specimens are being collected from Matlab and TB patients attending Shyamoli TB Clinic. Studies are in progress to develop efficient molecular techniques for rapid diagnosis of drug-resistance in TB patients. Molecular techniques will also be applied to determine the transmission mechanism and prevalence of primary and secondary drug-resistance of *M. tuberculosis*.

Studies on incidence and risk factors for tuberculosis are being conducted in Matlab and are also being planned for an urban setting in Dhaka. The goal is to provide information that will improve therapy for tuberculosis in the country, including ways to optimally administer directly-observed therapy (DOTs).
Dengue surveillance of dengue viral disease in Bangladesh

Dengue fever and dengue haemorrhagic fever are caused by dengue viruses, transmitted by *Aedes* mosquitoes. Dengue occurs in nearly 107 countries placing two-fifths of the global population at risk. Recently, dengue haemorrhagic fever has emerged as a significant global health problem, resulting in frequent hospitalization and deaths in many countries. The magnitude of dengue infection in Bangladesh was largely unknown until epidemic dengue fever and dengue haemorrhagic fever occurred in June 2000. Since then, dengue has become endemic in Bangladesh. Over 8,000 patients were hospitalized with more than 100 deaths during 2001.

Surveillance for dengue fever and dengue haemorrhagic fever was begun in October 2000 to monitor the changes in transmission pattern, focal clustering, and prediction of outbreak and seasonal pattern. This hospital-based surveillance was an outcome of collaboration between the Dhaka Medical College Hospital and the Holy Family Red Crescent Hospital. The surveillance that started on 21 October 2000 is continuing. In total, 1,456 blood samples were obtained during January-December 2001 from patients admitted to the Dhaka Medical College Hospital (49%) and the Holy Family Red Crescent Hospital (51%); 1,270 (88%) specimens were analyzed by MAC-ELISA using reagents from the Armed Forces Institute of Medical Sciences in Thailand. In total, 920 specimens (72%) had evidence of dengue antibodies. Of these, 209 (23%) had IgM/IgG ratios, suggesting that this was their first infection with dengue viruses (primary infection), while 711 (77%) had evidence of previous dengue infection (secondary infection). The analyses of clinical and epidemiologic data are ongoing; preliminarily, lower socio-economic status and multiple sites of bleeding were predictors for mortality.

Additional surveillance for dengue fever by scientists of ICDDR,B was begun in the Dhaka Shishu Hospital and National Medical College Hospital, Dhaka, among febrile patients. In 2001, 185 cases were enrolled in the study. Of them, 54 (29.2%) were positive for dengue infections. The majority (65%) of dengue patients had secondary infection. Results of the study showed a high prevalence of dengue infections among febrile patients attending the hospitals for treatment. Nearly one-third of the febrile outdoor patients in hospitals of Dhaka city were treated with symptomatic therapy without prescribing any antibiotics. The study will generate further interesting data on dengue infection.

To define the burden of dengue disease, a population-based active surveillance study for dengue illnesses is ongoing in Kamalapur among a cohort of 20,000 people where field research assistants visit each of about 5,000 homes once weekly and ask whether anyone in the home is experiencing fever. People with febrile illnesses that week are asked to visit the ICDDR,B field site in Dhalpur (within Kamalapur) where a standardized questionnaire is administered and acute-phase serum is collected. Convalescent-phase sera are collected 10-14 days later. Sera are tested for dengue viruses at ICDDR,B laboratories using the MAC-ELISA technique. During 2001, 11 cases of dengue fever were detected providing an incidence rate of 55 per 100,000 cases per year. A case-control study to evaluate risk factors for dengue was conducted, and the collected data are being analyzed.
Aedes mosquito is the intermediate host for the transmission of the dengue virus. A large number of cases of dengue fever were reported within Dhaka metropolitan area in 2000. ICDDR,B conducted a large mosquito-larval survey during the outbreak period and identified key reservoirs of the Aedes mosquito. This study in 2001 evaluates how community mobilization and household-level motivation work to sustain low population-density of Aedes mosquitoes in urban settings during the epidemic-prone period (June-October) in Bangladesh. This is a small-scale community-based intervention study to identify ways for effective vector control through targeting techniques of possible source reduction. The sensitivity and fear of an outbreak in the community was high enough to mobilize the public to accept and carry out a simple intervention package.

Aedes mosquito surveillance of selected wards with low, moderate and high vector-density has been conducted since 2000.

Factors associated with increased Aedes mosquito burden are being analyzed and interventions to reduce mosquito-density were being planned in 2001. Presence of concrete water-containers and discarded tyres were among factors identified to increase density of Aedes mosquitoes. Use of copepods within water containers and aggressive community efforts to reduce breeding sources are among the interventions being considered for evaluation.

Sexually Transmitted Diseases

Epidemiology and aetiology of sexually transmitted infections and antimicrobial susceptibility surveillance of N. gonorrhoeae in Bangladesh

The Centre has recently initiated a 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-based sex workers, 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; (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 in ICDDR,B. Enrollment of subjects for the epidemiology part of the study has recently been started.

The RTISTI laboratory of ICDDR,B has been monitoring antimicrobial resistance of N. gonorrhoeae since 1997. In total, 691 gonococcal strains isolated during 1997-2001 from males and females in general population, street-based and brothel-based sex workers, male truckers, and males having sex with males were examined. The antimicrobial susceptibility to, and minimum inhibitory concentration for, penicillin, tetracycline, ciprofloxacin, ceftriaxone, and spectinomycin is determined by disc-diffusion method and E-test respectively. In 1997, 9% isolates were resistant to ciprofloxacin, which has increased to 87% in 2001 (see figure). Approximately 2% of the isolates in 2001 were susceptible to ceftriaxone.
Diagnosis of RTI/STI in Bangladesh

The RTI/STI Laboratory of ICDDR,B has recently initiated an RTI/STI diagnosis service (on cost-recovery basis) to different national initiatives working in the field of RTI/STI. In 2001, the project has supported RTI/STI diagnostics facility to a project initiated by Menstrual Regulation Training and Service Programme (MRTSP), Dhaka, Bangladesh. The project is currently providing diagnostic support to a project titled “Treatment of urethral discharge with azithromycin alone and in combination with cefixime single oral dose regimens” initiated by Social Marketing Company (SMC) and Dhaka Medical College Hospital.

Antimicrobial susceptibility of \( N. \) gonorrhoeae strains

Antimicrobial susceptibility of, and minimum inhibitory concentrations for azithromycin and cefixime for, \( N. \) gonorrhoeae strains isolated during 1997-2000 were analyzed retrospectively. In total, 334 gonococcal strains isolated from males and females in general population, street-based and brothel-based sex workers, male truckers, and males having sex with males during 1997-2000 were examined. The antimicrobial susceptibility to, and minimum inhibitory concentration for, azithromycin and cefixime was determined by disc-diffusion method and E-test respectively. All isolates were susceptible to azithromycin and cefixime. However, 15 isolates from 1999 showed reduced susceptibility to azithromycin (MIC \( \geq 0.25 \leq 0.5 \) mg/L).

Sero-surveillance of HIV and syphilis in Bangladesh

Bangladesh is still a low-prevalence country for HIV. The surveillance for HIV in Bangladesh has, thus, concentrated on selected groups of individuals known to have risky behaviours conducive to acquiring HIV infection. A third round of the second-generation surveillance, carried out in Bangladesh since 1998, was conducted during July 2000-June 2001. During this third round, the Org.Marg Quest, in collaboration with Family Health International, conducted the behavioural surveillance and, similar to the earlier rounds, ICDDR,B conducted the serological surveillance and testing. In the third round of serological surveillance, blood samples of more than 7,000 people were tested. Blood samples were collected from female sex workers of eight brothels located in different parts of the country, female and male sex workers on the streets of central Bangladesh, men who had sex with men (MSM) in central Bangladesh, injecting drug-users (IDUs) attending a detoxification clinic in central Bangladesh, and three needle/syringe exchange programmes (NEP) in central and northwestern Bangladesh. In addition, bridging population groups who were all men were also sampled and included truckers from central and southwestern Bangladesh, rickshaw-pullers, and dock-workers in southeastern and southwestern Bangladesh, and patients with sexually transmitted diseases (STDs) attending the skin and VD clinics in southeastern, northeastern and northwestern Bangladesh. The prevalence of HIV was the highest among IDUs from the NEP in central Bangladesh (1.7%), and the rates of syphilis were also high in this group (18.2 %). In other groups of IDUs, no HIV was detected. The prevalence of HIV ranged from 0.3% to 0.5% among the female sex workers, and the rates of syphilis were the highest in this group ranging from 32.2% to 43.2%. Only one STD patient from a group of several hundred samples was HIV-positive. The rate of syphilis was 18.2% in male sex workers, 5.3% in MSM (non-sex workers), and none had HIV. Truckers, rickshaw-pullers, and dock-workers had no HIV, but the rates of syphilis varied from 3.7% to 6.6%. Between the three rounds of surveil-
lance, the prevalence rates of HIV have not changed. The rates of syphilis have decreased in female sex workers from the first round to the second and the third rounds, but no changes have taken place between the second and the third rounds. Given the presence of HIV, particularly among IDUs and the interaction of IDUs with highly sexually active commercial sex workers and also with other members of the community, including spouses and other contacts, it appears likely that an epidemic of HIV is ahead. AIDS will have catastrophic impact in Bangladesh because of the poverty, malnutrition, and the already high incidence of diseases that are exacerbated by AIDS, like tuberculosis, diarrhoeal diseases, and pneumonia.

The prevalence of hepatitis C and current hepatitis B (IgM antibodies to core antigen) was also measured in the samples from IDUs collected during the second round. In IDUs from the NEP in central Bangladesh, 66.5% were hepatitis C positive, and 7.7% had current hepatitis B infection. These rates are very high and confirm that sharing of injection equipment is taking place in Bangladesh.

In contrast to the low prevalence rates of HIV, risk behaviour among all population groups surveyed were highly prevalent. This, along with the high rates of syphilis and hepatitis C, has raised fears for an impending HIV epidemic in Bangladesh. This is especially true now, since several countries in the region, such as Nepal and Indonesia, which had been low-prevalence countries for HIV but had risky behaviour, are now experiencing epidemic diseases. Many in Bangladesh feel that Bangladeshis are ‘protected.’ One such protection may be genetic. A genetic factor that is associated with protection from infection from HIV and slows the progression of disease is a 32-base pair (bp) deletion of the beta-chemokine receptor 5 (CCR5) gene. To see whether this genetic mutation is present, 101 samples collected from IDUs in the NEP in central Bangladesh during the second round of surveillance were randomly selected, and the DNA samples were assayed by polymerase chain reaction. The 32-base pair deletion was not detected in any of the 101 samples tested, suggesting that genetic protection is unlikely.

In summary, although the prevalence of HIV is still low in Bangladesh, the high rates of syphilis and hepatitis C and risky behaviours, and no apparent genetic protection against HIV infection suggest that Bangladesh is at a great risk of an HIV epidemic.

Visceral Leishmaniasis

Community-based epidemiologic study of visceral leishmaniasis in Bangladesh

Visceral leishmaniasis (kala-azar) is a chronic infection of the liver, spleen, bone-marrow and other lymphoid tissue, caused by the protozoan parasite *Leishmania donovani*, transmitted by sandflies. Untreated kala-azar is felt to be nearly universally fatal. Protein-energy malnutrition is associated with a high risk of kala-azar. Kala-azar is endemic in northern Bangladesh.

In 2001, we began a collaborative study with CDC-Atlanta and the malaria and vector-borne disease control unit, Directorate General for Health Services, MoHFW to identify individual and household risk factors for visceral leishmaniasis and to assess entomologic factors for transmission. The study also assesses factors which impact progression from infection with *L.*
donovani to kala-azar and evaluates utility of a variety of rapid diagnostic tests for leishmaniasis. Ultimately, the goal is to develop a sustainable strategy to address kala-azar in Bangladesh. It is hoped that the findings from this study will be applicable to other areas where leishmaniasis is endemic. The study is ongoing in Fulbaria in Mymensingh district.
Health and Family Planning Systems

The Programme on Health and Family Planning Systems (PHFPS) is a Centrewide initiative to support activities on integrated delivery of essential health and family-planning services within the national programme of Bangladesh. This is being accomplished through identification of priority problems, design, implementation, evaluation, and replication of cost-effective and sustainable interventions. The PHFPS promises delivery of maximum health benefits to the community by optimal use of available knowledge and resources.

Many Asian nations are currently facing the crucial tasks of implementing new approaches in their response to the paradigm shift effected by the International Conference on Population and Development (ICPD), held in Cairo in 1994, to link health and population activities more closely to poverty reduction, overall socioeconomic well-being of women, and human development. The common thrust in this respect involves integration of family planning, maternal health, child health, and prevention of communicable diseases to ensure better family health. While a generalized consensus on the future direction of the national primary healthcare programme was reached within the ICPD framework, the main challenge is, however, to address the practical issues to implement the new reformative approach.

Some most pressing questions for developing countries in restructuring the health systems include: (a) how to align health systems to address the essential health and family-planning needs of the population efficiently and effectively?; (b) how are the health systems and policies equipped to deal with the complicated issues emerging from the proposed integration?; (c) how to mobilize the needed resources?; (d) what are the cost, effectiveness, equity, poverty-reduction, and sustainability implications of the new approach?; and (e) what type of policy and programmatic technical assistance is needed to implement research results in practices successfully?

In absence of any straightforward answer or any quick-fix solution to the above issues, the solutions ought to be home-grown, arguably, on experimentation and evidence-based research. Having many similarities attributed from the regional commonality, solid findings derived in one country may help other countries in a region replicate these through needed adaptations/modifications, as warranted by the country-specific conditions.

Long-standing experience of the Centre in conducting operations research along with availability of the required infrastructure and logistic facilities provide the Centre with unique opportunities to undertake health systems research on the challenging issues relating to integration of essential health and family-planning services. The Centre has the expertise to undertake basic research and full-cycle operations research interventions (problem identification, intervention development, field-testing, monitoring and evaluation, and facilitating replication of the promising findings) on various health systems issues.

Past and present work of the Centre on health systems research has been instrumental in designing and implementing the new health reform programme in Bangladesh, namely the Health and Population Sector Programme (HPSP). One of the most visible activities of the Centre in health systems research is the Family Health Research Project (FHRP). The PHFPS coordinates the activities of FHRP and assists in strengthening op-
erations research skills of the Centre and in making them coherent to the national programme needs, with emphasis on the delivery of the essential services package (ESP).

The FHRP encompasses studies on: fertility decline, development and evaluation of community-based integrated management of childhood illness (IMCI) interventions, community-based interventions to reduce neonatal mortality, cost-effectiveness of nutritional interventions by urban non-governmental organizations (NGOs), meeting the unmet family health needs of clients, rapid assessment tool for ESP managers, determinants of low EPI coverage, addressing the reproductive health needs of adolescents, prevention and management of respiratory tract infections/sexually transmitted diseases (RTIs/STDs) at the primary healthcare facilities, and strengthening the provision and use of essential obstetric care (EOC).

All these are aimed at lowering the fertility rate to replacement level within the shortest possible time, reducing maternal and child mortality rates, planning and implementing the Community Clinics (CCs) in the best possible way by setting appropriate strategies for improved family health, improving vaccine coverage rates, increasing the use of emergency obstetric services and resources thereof, tuning service-delivery systems to the customers’ need with more efficient, cost-effective and sustainable high-quality services and emphasis on socioeconomically-disadvantaged sub-populations.

The PHFPS attaches high importance to speedy translation of research findings into policies and practices and, therefore, combines in it a range of activities comprising programmatic research, technical assistance, and policy advocacy.

Some major research work on health and family-planning systems completed in 2001 are highlighted in the following sections:

**Community Involves Itself in Delivery of ESP**

*Operationalizing delivery of ESP from rural and urban first-level clinics: an operations research on establishing partnership between local communities and service providers*

The study sought to identify and address the practical issues relating to operationalization of the ESP-delivery strategies proposed in the Health and Population Sector Programme of the Government of Bangladesh. The operations research particularly focused on appropriate and feasible approaches pertinent to establishment of rural Community Clinics (CCs) through a partnership of the local communities and the government service-delivery systems. The study was conducted during October 1998-June 2001 in the two rural fieldsites of the Operations Research Project (now renamed FHRP) at Abhoynagar upazila in Jessore district and Mirsarai upazila in Chittagong district. The programmatic issues on the delivery of ESP in urban areas were also studied at the Sher-e-Bangla Nagar fieldsite in Dhaka city. The study was carried out in collaboration with the Ministry of Health and Family Welfare (MoHFW) and its relevant agencies to: (i) operationalize the restructured/reorganized system for ESP service-delivery in rural and urban areas; (ii) document the operational process; (iii) monitor, analyze, and evaluate the programme performance of the restructured/reorganized system for ESP service-delivery; and (iv) suggest measures to improve the implementation of the restructured/reorganized system for efficient and sustainable delivery of ESP.

To achieve the above objectives, the methods followed included: (i) in-
depth and key-informant interviews to examine the perspectives of service providers and clients about the new service-delivery system; (ii) participatory workshops with the community representatives and service providers; (iii) review of service records; (iv) observations with structured checklists to examine client-provider interactions; and (v) household interviews to measure the use of services and to understand the guiding factors in the choice of service outlets for ESP-related needs. Community-based surveys were conducted in the rural and urban households within the project’s surveillance system.

The operations research could identify and address the field-level practical issues critical to implement the CC-based ESP-delivery strategies and related reorganization of the service systems. The local communities were motivated to donate lands for CCs and to form Community Groups to facilitate community supervision and management of CCs. Each CC was aimed at catering to the basic health and family-planning needs of an average population of 6,000 through providing the ESP. The suggestions put forward by the study for effective operationalization of ESP delivery resulted in: (i) development of guidelines on sensitization and orientation of the local managers, providers and community representatives on the ESP and the HPSP; (ii) generation of reports on solution of practical problems at the local level involving the community representatives and concerned government functionaries; (iii) development of a well-laid manual on the modus operandi of the community-government partnership; and (iv) development of strategies for transition from the old to the new service-delivery systems.

Appropriate orientation of all related stakeholders on the new strategies is critical to implement the health reform programme. It is imperative to involve the stakeholders and activate them while implementing the reorganized service-delivery systems.

The findings of the study were useful to the policy-makers and programme managers in formulating/modifying the national guidelines on ESP and CC-based service-delivery. The operations research was quite successful in quick translation of the research findings into policy and practice. The findings of the study, with due acknowledgement to ICDDR,B, have been incorporated into the national “Guidelines on Operation, Management and Functioning of Community Clinics” published by the MoHFW, Government of Bangladesh (GoB). The findings from the urban component of the research were adapted within the Urban Primary Healthcare Project and urban service-delivery programmes. The recommendations of the study on transition of the service-delivery systems from the domiciliary and outreach-based to CC-based one-stop provision of ESP have also been recently endorsed by the MoHFW, GoB, for inclusion into the related national policies. The findings were disseminated through scientific reports, working papers, and special publications, and were presented at a number of national and international workshops/conferences.

The study was completed by the Operations Research Project with funding from USAID/Bangladesh. Several investigators of HSID were involved in the study conducted in collaboration with Planning Cell, Ministry of Health and Family Welfare (MoHFW), Government of Bangladesh; Policy Research Unit, MoHFW; Programme Coordination Cell, MoHFW; Management Change Unit, MoHFW; Directorate General of Health Services, MoHFW; Directorate of Family Planning, MoHFW; and Health Department, Dhaka City Corporation.
Costing and Financing of Service Provision

Health economics is critical to the future of health programmes in making them more efficient, cost-effective, sustainable, and equitable. The Centre, over the last few years, has expanded its research efforts to costing, cost-effectiveness, financing, and related economic issues of the health and family-planning systems in Bangladesh. Also of growing interest to the Centre is to look into health equity issues and fairness of health-financing mechanisms. In 2001, three studies entitled "Healthcare-seeking behaviour, willingness, and ability to pay for selected health services in urban NGO areas," "Cost of providing services and willingness and ability to pay for ESP services in rural NGO areas," and "Cost-recovery of ESP delivery through systematic pricing and revenue management in the public sector" were completed.

The first two studies were carried out to understand the healthcare-seeking behaviour, willingness, and ability-to-pay for health services of the people living in the catchment areas served by the Urban Family Health Partnership (UFHP) and the NGOs of the Rural Service Delivery Partnership (RSDP). The UFHP and the RSDP are respectively the urban and rural service-delivery partners within the USAID/Bangladesh-supported programme, namely the National Integrated Population and Health Programme (NIPHP). The RSDP study also estimated the production cost of various services provided by their NGOs. The purposes of these studies were to help the UFHP and RSDP policy-makers in deciding on the level of user-charges for their services and to ascertain the possible impact of increasing user-charges on use of services.

The studies were conducted in areas served by 10 different UFHP and 18 different RSDP-funded NGOs providing ESP services. Households were selected from the catchment area of the static and satellite clinics of selected UFHP and NGOs of the RSDP for the survey. Households located within one-mile radius from the selected clinics were listed. About 300 households were included in the census list for each static/satellite clinic for the survey and were used as the sampling frame for the study. Four satellite sites were selected for each static clinic. The survey was carried out in the catchment area of 112 satellite and 28 static sites. Data on basic household characteristics from about 42,000 households residing in the catchment areas of 140 sites were collected to identify the eligible households for an in-depth household survey. The RSDP study collected information on cost of providing services from 18 facilities.

Eighty of the 300 households selected in each clinic area (the main static clinic and 4 satellite clinics) were randomly drawn by categorizing them into different criteria/conditions for selection. The conditions were: currently-pregnant women and women who delivered recently, currently-married women of reproductive age, and children aged less than five years. In total, 8,400 households in 28 clinic areas were interviewed for the in-depth survey on knowledge about health, healthcare-seeking behaviour, pattern and use of health facilities, and willingness to pay for medical care.

Using a definition of a basic health service package (which included antenatal services: 3 visits per pregnancy; immunization of children: 4 visits for a child aged 12 months; family-planning services: Pill: 13 cycles per year or condom: 144 pieces per year requiring 36 visits a year or injectables: 4 times per year; illnesses of children aged less than five years: 2 visits per year; and adult illnesses 1 visit per year), cost was estimated for each
household in the UFHP areas depending on its demographic characteristics. If the median price is used, about 23% of the households will not be able to pay for the basic package defined. If the modal price is used, less than 4% will not be able to pay. In general, results of analysis indicated that an expenditure of Tk 2,000 per household per month should be used as the cut-off level to define inability to pay for the basic package. If this definition is used, 14-17% of the households will require price subsidy. Using any other price levels, the programme managers can simulate the results to examine the impact of change in price of services.

In the RSDP clinics, the cost of provision of services was too high compared to the government facilities, and it would not be possible to recover even the recurrent costs of clinics by imposing user-fees. To make the healthcare-delivery system relatively more sustainable, it is important to improve efficiency in resource-use. Organizing satellite clinics may be a means of increasing service-use more effectively. Human resource mix of clinics should also be considered carefully. Current mix is too costly. Providing services through paramedics and depot-holders should be considered to reduce the cost of service provision. It is unlikely that the recovery rate for basic ESP will be more than 10% in the near future. To increase the cost-recovery rate above 10%, service mix provided through the clinics should be expanded to include the wide range of curative services. The possibility of cross-subsidization of one service by another will also be limited without the curative services. Cross-subsidization of one group by another is also limited among the basic services considered here. The findings of the study indicate that the relatively better-off households prefer using private facilities.

The findings were presented at the Centre Scientific Forum and dissemination seminars organized by the UFHP, RSDP, and USAID/Bangladesh. The findings were also published in the form of technical reports.

The team of researchers comprised both external and internal health economists and programmers.

The study on “Cost-recovery of the ESP delivery through systematic pricing and revenue management in the public sector” sought to review the existing experiences in cost-recovery of health and family-planning programmes in Bangladesh and other developing countries, examine the current household healthcare expenditure, assess the healthcare demand functions, and ascertain the willingness and ability-to-pay for healthcare at the public-sector facilities in rural and urban Bangladesh. Accordingly, an extensive review of the government and NGO cost-recovery practices was completed, and a survey of 2,408 rural and 1,638 urban households within the ORP’s surveillance systems was conducted. Bivariate and multivariate analysis techniques were used for examining the determinants of demand for health and family-planning services. Review of the existing experiences showed that, although various cost-recovery strategies, such as charging of user-fees, insurance schemes, and drug-revolving funds, have been adopted by the health and family-planning programmes, pricing (charging user-fees for services and commodities) has been the most commonly-used cost-recovery strategy.

Review of national and international experiences on cost-recovery through pricing demonstrates that Bangladesh’s national programme could potentially charge moderate prices to recover costs, without adversely affecting the use of services.
affecting the use of services. Besides, the income generated from such a scheme and simultaneous reduction in commodity wastage would help enhance the sustainability of the programme. Differential pricing facilitated the higher use of services at the static sites and acted as a ‘safety-net’ for the poor. However, a systematic economic approach toward pricing and appropriate accounting and revenue-management procedures are critical in these cost-recovery activities. Possibilities with regard to cross-subsidization for services also need to be examined further.

Results of analysis of the demand for healthcare among rural households showed that about 80% of the study people were willing to pay for child immunization, tetanus toxoid, healthcare for children and women. The price elasticity of demand was quite low. Even a large change in the rate of proposed fees reduced demand only marginally. Income elasticity was considerably higher; rate of proportion of households who were willing to pay were much higher in the higher income classes than in the lower income classes. Even among the households (20%) that were unwilling to pay due to financial constraint, only 2% were poor in the context of rural Bangladesh.

Data on expenditure for healthcare received for the last illness condition of children and of women revealed that a rural household spent Tk 100 per illness episode for children and Tk 67 per illness episode for women. The amount of expenditure varied with change in income, type of disease, and type of provider. An attempt to conduct multivariate analysis was not successful. Logit regression used for analyzing willingness-to-pay behaviour of the households could not identify the variables that are theoretically expected to determine willingness-to-pay. The expenditure for healthcare equation estimated using ordinary least square (OLS) had a very low explanatory power. Although the study showed a considerable amount of willingness-to-pay for healthcare, it could not adequately identify the determinants of demand or estimate the demand elasticities for rural Bangladesh, due mainly to paucity of appropriate and relevant data.

Analysis of healthcare expenditure behaviour of the urban households demonstrated that the amount of monthly healthcare expenditure was low: an average household spent only 2% of its income or Tk 120 (approximately US$2.5) per month on healthcare. Type, incidence, and severity of diseases were related to healthcare expenditure. However, the number of workdays lost due to illness had the most pronounced relationship with expenditure pattern. Multivariate regression analysis (OLS) showed that the income elasticity of demand was lower than 0.5, and duration of disease, number of workdays lost due to illness, and education were significant determinants of the demand for healthcare. The elasticity of demand with respect to the duration of disease was the highest, followed by the number of workdays lost and income. To design the financing policies for the health sector appropriately, there is a need to obtain more insights into the key determinants of healthcare demand and the magnitude of influence of each of the important determinants on the overall demand for healthcare.

Results of analyses of current expenditure and willingness-to-pay for healthcare services in the public facilities showed that a considerable number of households reported paying for family planning and healthcare. Forty-one percent of the family-planning method users were paying a mean amount of Tk 4.00 (range Tk 2.00-23.00) for the method (pill, condom, and injectables). Sixty-one percent of the maternal and child healthcare (antenatal care, TT, and child immunizations, sick mother, and childcare) users were paying, on an average, Tk 77.00 (range Tk 12.00-181.00) for
every episode. Eighty percent of the family-planning and 42% of the maternal and child healthcare-seekers were using the public facilities. Seventy-six percent of the respondents were willing to pay at least Tk 3.00-5.00 for family-planning methods/services and 83% to pay Tk 3.00-8.00 for maternal and child healthcare for each episode. A notable amount of willingness-to-pay (83% of those willing to pay for family-planning services and 57% of those for maternal and child health services) was evident for the public facilities as well. Interestingly, socioeconomic and demographic determinants showed no statistically significant association with the likelihood of resource allocation across the households for healthcare services. The findings suggest a considerable scope of enhancing financial sustainability of the government programme through introduction of moderate prices (user-fees), without having adverse effects on service use. However, field-intervention operations research needs to be conducted to examine the actual payment behaviour of customers.

The issues of health financing have been emphasized in the HPSP document. Keeping in mind the existing gap between the demand and the supply of resources for the health sector, efficient and effective mechanisms of direct household financing have emerged as critical research topics. The findings of the study provided some important insights on the determinants and elasticities of demand for healthcare, thereby pointing out some practical issues that are important in planning appropriate financing schemes based on charging user-fees/prices for healthcare and family-planning services.

The findings of the study were disseminated at the Third Conference of the International Health Economic Association held in York, U.K., and several publications were produced in the form of ICDDR,B working papers and scientific reports.

The study, funded by USAID/Bangladesh, was accomplished by the Operations Research Project by involving both external and internal investigators.

The Community’s Voice is Heard in Health Management

How the community’s voice can be incorporated to facilitate transparency and accountability in the Health and Population Sector Programme

Participation of stakeholders in healthcare, a major policy theme and a fundamental principle of the Alma-Ata Declaration (1978), is still considered an essential part of health development. The roles of stakeholders, i.e. service-users, civil society, and NGOs, in systematic monitoring of the health sector activities are critical for improved governance.

The MoHFW developed a mechanism for participation of stakeholders at both local and national level through the National Stakeholder Committee (NSC). At the local level, the committees consist of users of ESP, primarily the poor and women, and includes members of civil society to play an advocacy role in health issues.

The achievements of the NSC were to facilitate the incorporation of the community’s voice into the health programmes; to establish their rights to transparency and; to build a foundation for programme accountability. It was initially introduced in nine upazilas and 16 unions through the stakeholder committees.
At least two-thirds of the committee members understood and agreed on the purpose of the committees and their role in the committees. Most meetings were held as planned (90%), were well-attended (90%), and facilitated an equal participation.

The benefits of the NSC were two-folds. First, it provided a forum to raise awareness of availability of health services, including National Immunization Days (NIDs) and cultural practices that were detrimental to healthy life-styles. Second, it empowered committees to address issues to improve healthcare provision, resulting in improved accountability of service providers to their clients.

The committees regularly monitored the activities of local health centres, resulting in regular attendance and a longer period of stay of service providers, elimination of the practice of charging money illegally from clients, and serving poor patients with respect. Most users of health services reported improvements in cleanliness, waiting arrangement, waiting time, and service-providing hours after the formation of committees.

Although there was no major opposition from the service providers, the upazila-level managers of the MoHFW were reluctant to cooperate with the committees. Some managers felt that the idea of monitoring the activities of local health centres by the committees was disgraceful. The stakeholder committees did not follow any standard procedure in implementing their activities. Absence of monitoring by the NSC and lack of necessary funds affected the implementation of the committee activities.

Considering the shorter period of operation of the stakeholder committees, it was too early to expect any significant change in terms of quality of services, transparency, and accountability. However, the committees successfully addressed the commonly-discussed barriers to quality of care, such as negative attitudes/behaviour of service providers, poor interactions between clients and service providers, and lack of essential drugs and supplies in the facilities. Although it was not possible to assess the level of sensitivity of committee members on gender issues, their efforts to minimize social barriers to acceptance of TT immunization during pregnancy and the effects of adolescent marriage had positive impression on the committee activities.

Partnership between the GoB health service providers and the civil society is a new concept and as such requires mentoring. The results of this research showed that the committee members were willing to take an active role in improving the health of their members, formerly passive recipients of health services. The potential of involving the poor, particularly females, in the committees as a new dimension in incorporating community’s voice into the HPSP to establish their rights is worth testing.

The findings of the study were presented at the National Workshop on Strategy Development for Stakeholders’ Participation in the Health and Population Sectors held on 31 July 2001, organized by the Policy Research Unit of MoHFW. The findings were also published as an ICDDR,B working paper (No. 148).
Caesarian Sections in Rural Bangladesh

Emergency obstetric care interventions

The emergency obstetric care (EOC) activities at Upazila Health Complexes (UHCs) at Abhoynagar and Mirsarai were initiated in 1993 and 1995 respectively by the ORP (now renamed FHRP). Based on the findings of low predictive value of the screening check-list used for detecting high-risk pregnancy by the field workers and necessity of community awareness regarding life-threatening obstetric complications, a pictorial card was developed and distributed among pregnant women through the field workers in 1993 at Abhoynagar. The results of a review of this intervention showed that women’s knowledge on complications had increased, but the facility for management of these complications were not available at the UHC. The ORP took an initiative to test the feasibility of establishing comprehensive EOC services at the upazila level. The implementation of comprehensive EOC services began in Mirsarai under the intervention “Strengthening maternal and neonatal health: referral and linkages at all levels” in 1995. The Mirsarai UHC was upgraded and renovated by the Government of Bangladesh with technical assistance from the FHRP. The Pictorial Card was modified and distributed to all pregnant women, and a Pregnant Women Register was introduced to formalize the referral process. The first caesarian section at the upazila level was performed in Mirsarai on 22 June 1996. It was observed that, although the knowledge of women on obstetric complications and availability of EOC services at the UHC significantly increased, the use of EOC facility for managing the complications did not increase up to the expected level. Women still visited the untrained village quack first for management of their complications, and, in the majority of these cases, husbands were the decision-makers for care-seeking.

Within the modified intervention activities, the village practitioners and traditional birth attendants (TBAs) were included for strengthening the referral along with the government service providers. In each intervention union, 15 village practitioners and 15 TBAs were oriented with the life-threatening obstetric complications and immediate referral of these cases to the hospital without any delay. In addition, various formal and informal community leaders were also tried to involve them in awareness-raising activities for using EOC services. A survey was conducted in the intervention areas during April-June 2001 to assess the effects of the intervention. The findings of the survey showed that about 80% of the respondents received some care during their pregnancy, and the majority received care from the trained providers. Analysis showed that those women who had the Pictorial Card received antenatal care 10% higher than those who did not have such a card. The trained providers attended a higher proportion of deliveries among Pictorial Card holders. The deliveries conducted at the institutional facilities increased from 8.3% in 1998-1999 to 14% in 2001. The findings also showed that there was an increase in the percentage of deliveries attended by the TBAs over time. In Mirsarai, 54% of the respondents reported of encountering at least one complication, of which half of them went to the trained care providers for managing their complications. The involvement of village practitioners and TBAs in the referral mechanism and awareness-raising activities in the community had a positive effect for such an increased use of EOC services. Admissions at the maternity unit of the UHC also showed an increasing trend in the use of EOC services from 1995 to 2000 (see figure). Forty-three caesarean sections have so far been done at the UHC. Some
selected village practitioners and TBAs were also interviewed to know the number of women with obstetric complications they referred for better services. The information they provided was subsequently checked with mothers in the community. It showed that, of the women who were referred, 90% accepted the referral of village practitioners. The mothers were happy with the EOC services they had received from the facility. With regard to involvement of different groups, it was observed that more efforts and commitments from the higher-level officials of the respective groups are required for their active involvement in the awareness-raising campaign.

The implementation of comprehensive EOC at Mirsarai was a success to such an extent that it is now referred to as the ‘Mirsarai Model.’ The Government has decided to replicate the model in five upazilas of five administrative divisions initially and subsequently to other selected upazilas in phases. The Government has already adopted the Pictorial Card as an awareness-raising tool for nationwide use. To make the comprehensive EOC programme fully functional at the upazila level, commitment of local-level officials, particularly of those who have been involved in the delivery of EOC services, is essential. In addition, strong monitoring and supervision of such activities from the higher authority is also essential for success of the EOC programme.

The project was funded by USAID, Dhaka, for the research component and the Government of Bangladesh for infrastructure development.
Population Sciences

Population remains a central issue in Bangladesh. While the country experienced a major fertility decline during the 1980s, the plateauing of that decline in the 1990s at over three children per woman or one child above replacement fertility level, has resulted in a renewed concern about future growth. The United Nations has recently revised its mid-century (2050) rational population projection from 218 to 265 million, a level previously not expected for another 100 years (i.e. in 2150). This increase in Bangladesh has contributed to the upward revision of the global mid-century projections from 8.9 to 9.3 billion.

Thus, it is vital to know whether this is a temporary plateau, possibly due to some timing factors in childbearing and the decline will resume soon. Or, will the plateau continue for a considerable time. If the latter is likely, there may be policies or interventions that need to be implemented to stimulate further fertility decline. More than four-fifths of the population growth to 2050 will be due to population momentum resulting from the youthful age structure in Bangladesh. These policies would invariably include social changes, such as increasing education and employment opportunities for young women, to delay early childbearing.

Fertility and Family Planning: The Centre has made substantial contributions to understanding how maternal and child health-family planning (MCH-FP) services can meet the demand of Bangladeshi couples to manage their childbearing. While continuing to further improve FP services and to reduce unwanted fertility and abortion, the challenge now is to explore new approaches to social change to minimize the potential impact of the very high momentum within the young Bangladeshi population. If fertility is to reach replacement levels, the following social interventions will need to be better understood:

- **Empowerment of women and fertility:** One potential approach to reducing population momentum is: raising average female age at marriage and age at childbearing. This can either be through legislation or more effectively by empowering young women by providing them with alternatives to early childbearing. Bangladesh is currently experiencing a major transformation in both secondary schooling and employment opportunities for young women. The Population Programme is actively examining data from the Centre’s field sites and national sources to determine the impact of these changing social forces on marriage and fertility.

- **Urbanization:** The desperate search for employment in the developing world is enhancing a massive migration from rural to urban areas, where almost all future population growth will occur. This results in the conventional rural health problems of infectious diseases, compounded by extreme population densities, insecurity, and social alienation with rising stress, crime rates, drug-use, etc. Understanding the dynamics of these global movements and finding ways to ameliorate resulting problems require investigation among both sending (rural) and receiving (urban slum) areas. The Centre is well-equipped with its rural and urban field sites and surveillance systems and research resources, to throw light on this phenomenon.

- **Aging and adult health:** The outmigration of young people from rural areas, combined with the rapid fertility decline, will result in an ageing rural population with weakened traditional family support networks. This has implications for the health of the elderly and requires attention.
to chronic adult diseases and care of the disabled. The Population Programme is using the Centre’s morbidity and mortality surveillance to focus on this poorly-understood area.

**Population, Health and Poverty:** There is a growing recognition that the interrelationship between health, poverty and development is complex and dynamic. This recognition implies the need for continuous longitudinal data, rather than relying only on cross-sectional data. The Centre has the largest health and demographic surveillance system collecting longitudinal data on health and population in the developing world. Through the INDEPTH Network of surveillance systems, the Centre is working with the other 28 member-sites around the world to develop and refine research systems to better understand how health can be improved and made more equitable, particularly among the poor.

**Equity Analysis:** In Bangladesh, there has been a tendency to consider rural populations as basically homogeneous in economic status. Recent advances in comparable indicators of economic status suggest that this is not so, and that many preventive and curative health services are not being accessed equitably by both poor and relatively better-off groups. While some services, particularly child immunization and family planning, are used relatively to the same degree by ‘rich’ and ‘poor’, any services involving access to trained medical staff, such as assisted delivery, tend to favour the better-off groups.

**Health and Demographic Surveillance Systems**

There is growing recognition that maintenance of good health is a complex process affected not only by access to health services and facilities but by economic forces, social determinants, such as decision-making power, freedom of movement, accountability of service providers, etc. The recognition of the complexity of this matter has led to greater support for the development of health and demographic surveillance systems around the developing world. While these appear relatively expensive to establish and maintain, they generate the kinds of insights that are simply not available from cross-sectional surveys, and other data-collection approaches that do not take into account the immediate context, and cannot consider the various levels of factors influencing health behaviours. The ICDDR,B field sites have been the models and training grounds in the evolution of a global network of such sites in Africa and Asia – the INDEPTH network (INDEPTH Inc.).

ICDDR,B operates a number of surveillance systems in different parts of the country. They are organized differently and collect similar but not identical data. The oldest surveillance site is the HDSS in Matlab. More recent rural sites are those of the Family Health Research Project (FHRP) in Abhoynagar in Jessore district and Munsarai in Chittagong district. Under a different project, there is a large urban site in Kamalapur in Dhaka city.

**Family Health Research Project Surveillance System**

The Family Health Research Project (FHRP), formerly known as Operations Research Project (ORP) focuses on finding solutions to problems in reproductive health and child survival and on promoting the wider availability and use of services included in the nationally-adopted Essential Services Package (ESP).
The rural field sites were chosen to represent one low-performing area—Mirsarai—in respect of reproductive health and child health indicators and one high-performing area—Abhoynagar (started in 1982). The present sample size of each site is approximately 6,000 households. Teams of Interviewers visit sample households at a 90-day interval and collect programmatic data, e.g. use, change, and source of contraceptive methods, vaccination coverage of children aged less than 5 years, and use of outreach services.

Vital demographic data, such as birth, death, and marriage, are also collected. The urban site in Kamalapur, is much larger, with a sample size of approximately 33,000 households.

The research in these field sites falls into three categories:

1. Studies that provide an understanding of the health status and health behaviour patterns at the population level.
2. Evaluation of ongoing health and family-planning programmes and provision of assistance in improving their performance and effectiveness.
3. Studies designed to examine the impact and feasibility of extending the findings of basic research in a ‘natural’ population setting.

Contraception, fertility, mortality, morbidity rates, and coverage of child immunization at Mirsarai and Abhoynagar in 2001 are presented in the table.

**Contraceptive prevalence, fertility, mortality, morbidity and immunization rates in the FHRP field sites as of 2001**

<table>
<thead>
<tr>
<th>Sites</th>
<th>CPR</th>
<th>Fertility</th>
<th>Mortality</th>
<th>Morbidity</th>
<th>FIC*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GFR</td>
<td>TFR</td>
<td>IMR</td>
<td>1 - 4</td>
<td>ARI</td>
</tr>
<tr>
<td>Mirsarai</td>
<td>45.0</td>
<td>86.7</td>
<td>2.8</td>
<td>52.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Abhoynagar</td>
<td>56.4</td>
<td>81.0</td>
<td>2.4</td>
<td>38.0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*Full-immunization coverage*

During the reporting period, the FHRP Surveillance Team also provided support for computerization, data analysis, and fieldwork to the following studies/activities:

a. Intervention on strategies to improve Reproductive Health services for Adolescents
b. Intervention (EOC and CC) Evaluation Survey 2001
c. Validity Assessment of RTI/STD Management 2001

**Health and Demographic Surveillance System in Matlab**

The Health and Demographic Surveillance System (HDSS) in Matlab, a rural fieldsite in the Chandpur district of Bangladesh, is designed to evaluate the impact of different health and socioeconomic interventions. Demographic surveillance in Matlab started in 1966, and the surveillance of health conditions was added in 1978 in one half of Matlab (MCH-FP or
treatment area). A 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 HDSS in Matlab. The modernized surveillance will no longer make a geographic distinction between households into treatment and comparison areas. 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 all health-related data in addition to all 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 supervising Field Research Assistants (FRAs) 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.

Documentation of the entire HDSS database is now complete. The data are being installed online and being made available in hard copy also. 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 the quality of socioeconomic data.

The HDSS in Matlab 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.

Some ongoing studies that are using data from the health and demographic surveillance systems are listed below. These are ‘in-house’ studies and the list does not include many other studies carried out by collaborators outside ICDDR,B.
Family Planning Services Limit Abortion: Evidence from Bangladesh

Intuitively, it seems that increasing contraceptive use would reduce the number of abortion cases by reducing the number of unintended pregnancies, but in fact, abortion and contraceptive use sometimes increase simultaneously in developing nations. For example, fertility in one rural area of Bangladesh has fallen by about half, while both abortion and contraception nearly tripled in the past two decades. As social and economic development produces changing ‘value of children’, the numbers of children desired by couples decline. If couples are unable to effectively limit their child-births through contraception, they may also resort to abortion. In developing countries, where abortion is associated with high maternal risks, this is undesirable. This study examined the relationship and interaction between abortion and family planning use.

It is difficult to determine if effective family-planning services substitute for abortion due to lack of good data on abortion. To determine if family-planning services can reduce abortion, Mizanur Rahman, Julie DaVanzo, and Abdur Razzaque analyzed the high quality data from Matlab, Bangladesh, on nearly 150,000 pregnancy outcomes, including 4,100 abortions, since 1979. By comparing two areas in Matlab that differ only in their family-planning services, the researchers were able to control for other factors, e.g. social and economic change that might affect abortion rates. They also used data on contraceptive use and fertility preferences from women interviewed in several surveys to analyze abortion rates for women who did and did not want more children. Their results, published in The Lancet, indicate that women who had access to better family-planning services were more likely to use contraception and less likely to have unintended pregnancies and, therefore, had fewer abortions. The better family-planning services prevented abortion rates from increasing in a setting in which these otherwise might have increased.

Estimating effects of family-planning services on abortion

Since 1977, the Maternal and Child Health-Family Planning (MCH-FP) project in Matlab has provided more accessible and higher-quality family-planning services in a ‘treatment’ (MCH-FP) area than those provided in an otherwise-similar ‘comparison’ area. Both the areas are typical of rural Bangladesh, and in both, desired family size has been similar and declined at nearly equal rates from about 4.5 children in 1975 to 2.5 children in 2000. The better family-planning services in the MCH-FP area resulted from more frequent visits by the community health workers to provide counselling and to deliver contraceptives and because of availability of special clinics providing MCH-FP services. Families in the comparison area received standard government contraceptive services. The differences in access and quality of contraceptive services led to consistently greater contraceptive use in the MCH-FP area (see figure).

The differences in contraceptive use led to differences in unintended pregnancy, i.e. pregnancies to women who said they did not want any more children (see figure). In both the areas, unintended pregnancies have declined as contraceptive use has increased, with the greater decline...
occurring in the MCH-FP area. A number of these unintended pregnancies were aborted. In both the areas by the 1990s, one in ten unintended pregnancies were terminated by abortion. The likelihood of these pregnancies being aborted increased between the mid-1980s and the early 1990s in both the areas, reflecting the growing desire by couples to limit their number of child-births.

In the MCH-FP area, the low and declining incidence of unintended pregnancies has offset the increase in the likelihood that unintended pregnancies would be aborted. This has resulted in a low rate of abortion that has not changed much over time (see figure). By contrast, the likelihood of abortion of unintended pregnancies has increased in the comparison area more than the incidence of such pregnancies has declined. As a result, the abortion rate has been increasing there. When the MCH-FP project began, abortion rates were very similar in the two areas. Shortly afterward, the abortion rate in the MCH-FP area dropped below that for the comparison area. The difference in abortion rates for the two areas has grown steadily; by the late 1990s, the abortion rate was three times greater in the comparison area. When the areas are compared at a point in time, it is evident that the abortion rates were significantly lower in the area where better family-planning services were available.

Role of better family-planning services in limiting abortion rates

These changes have occurred as Bangladesh underwent a fertility transition. From the mid-1980s to the late 1990s, fertility declined by nearly one-third in both the areas, but these declines were achieved in different ways. Couples in the MCH-FP area were more likely to use contraception to regulate their fertility. Those in the comparison area, lacking the same family-planning services available in the MCH-FP area, had more unintended pregnancies and more abortions. Despite similar desired family sizes in both the areas, fertility remained about 20% higher in the comparison area, indicating the greater effectiveness of contraception over abortion in regulating fertility in Matlab.

Bangladesh has managed to maintain a very low abortion rate during this fertility transition, but it faces increasing challenges in doing so in the face of continuing social transformation and population crowding. Abortion can increase during the fertility transition in developing countries as the intensity of desire to limit family size increases. The widespread availability of quality family-planning services, however, by helping couples better limits unintended pregnancies, helps keep abortion rates lower than would be otherwise. Policy-makers should be wary of drawing erroneous conclusions about contraceptive use and abortion in studies that do not use appropriate comparative data. It is only through such data that the true effects of family-planning services on abortion, independent of other variables, are evident. This research demonstrates that better family-planning services can help abortion rates remain low in situations where these might otherwise rise. Efforts to reduce abortion by increasing contraceptive use can also pay public-health benefits by reducing the health problems and burdens on health-service resources that result from unsafe abortions in particular.
Ageing and the Aged in Bangladesh: Case of Rural Matlab

The elderly people (60 years and older) have never accounted for more than one in twenty (5%) of the total Bangladesh population. More as a result of dramatic fertility decline than extension of older-age survival, this proportion will exceed one in four (26%) by the end of the present century. In absolute terms, the number of elderly people will increase almost 10-fold, from 6.8 million today to over 65 million.

In itself, this may not appear to be problematic, but in the overall context of population growth, the numbers of young people aged less than 15 years will remain as it is today, around 47 million. Most importantly, the working-age population will increase less than twice, from 78 million today to 136 million. This signifies that, whereas today there are over eleven persons of working-age to potentially support each elderly person, by the end of the century there will be only two persons of working-age to support each elderly person.

As there is growing evidence that the elderly in developing countries like Bangladesh will experience more chronic diseases than previously believed, their potential disease burden will place enormous pressures on any health system, including health insurance schemes that the country may develop over time. The costs of prevention and treatment of such non-communicable chronic diseases are much greater per capita than the costs of managing many infectious diseases. So, much of the burden of caring for the burgeoning elderly population will fall on the immediate families rather than the state. This study explores issues, such as ‘active life’ of the elderly and the current social support networks for the elderly and speculates on what the future arrangements might be.

Analysis of the living arrangements of the elderly people shows that a large proportion live with kin, spouse, and/or children. A positive interpretation of these findings would be that the living arrangements of Bangladeshi elderly are favourable for their overall well-being, since co-residence with kin is a reliable source of assistance and support. At the same time, along with socioeconomic development, family structure is also changing. This will reduce opportunities for providing support in traditional ways.

Analysis of perceived health status has documented that a higher proportion of males and married elderly reported their health status as ‘good’ compared to females and widows. Chronic morbidity was higher for females than males, and there was a higher prevalence of disability among females than males, but married males are most likely to be dependent on their wives for care. The widows and the female elderly are worse-off than the elderly who are married and males. Active life expectancy declined sharply with an increase in age for both males and females, but the proportion of life spent in a healthy status is considerably higher for male than female elderly. In other words, widows and married female elderly, with their shorter healthy life expectancy and higher prevalence of morbidity, have to take care of the male elderly. The number of years free from disease was lower than the years expected in perceived healthy life expectancy for both males and females.

Among elderly couples, husbands can expect help from their wives. The same is not true in the case of wives expecting help from their husbands. From the above, one can reasonably conclude that there is gender inequality even among the elderly, an important fact which has largely been neglected.
by researchers addressing gender issues. Death rates due to all causes, as expected, greatly increase with age, and the major causes are cardiovascular and malignant diseases, acute respiratory infection, and diarrhoea.

An elderly male faces a much higher risk of dying than an elderly female. The risk of dying is much lower among the married elderly than widows and widowers. An elderly person who had a higher level of education experienced lower mortality than an elderly person with no education, and individuals who were household heads experienced a lower mortality rate than others. The presence of children proved to be more beneficial for the survival of the elderly people.

The welfare of the aged will, therefore, require the strengthening of family support systems and development of supplementary community-based programmes concerning matters, such as employment, subsistence income, health, nutrition, medical care, housing and living arrangements, and personal social services.

Risk of Child Mortality Due to Drowning in Rural Bangladesh

Child survival in Bangladesh has improved remarkably in the past few decades. The risk of death before fifth birthday has fallen by half since the early 1980s and two-thirds since the 1960s. It is an important achievement of the late 20th century that more than 90% of children now attain their fifth birthday safely.

In earlier times, the major individual causes of death of children were diarrhoeal disease, followed by acute respiratory infections (ARIs). In the late 1970s, diarrhoea accounted for about 32% and ARI for 8% of deaths of children aged 1-4 year(s) in Matlab. Remarkable progress has been made, and these causes have fallen dramatically such that by the late 1990s, absolute diarrhoeal death rates had declined by three quarters, while ARI-related death rates were unchanged.

While the death rates due to infectious diseases have been falling impressively, 'drowning' is now the major single cause of child death in Matlab and, possibly, elsewhere in the country. While the absolute death rate due to drowning has remained unchanged at around 2.2 per 1,000 children aged 1-4 year(s), drowning (as a proportion) has risen from less than one in ten deaths in the early 1980s to over one in three in the late 1990s.

Unlike other causes, such as diarrhoeal diseases, showing a distinct gender discrimination, often with rates for female children being double the rates for male children, drowning shows no inequity for female children. If anything, as with most accidental childhood deaths, males are at a greater risk.

It is not surprising that deaths from drowning of children are a significant problem in Bangladesh, given the geographical features of the country. Much of Bangladesh is flooded during the rainy season, and ponds are very common at all times of the year.

Research in Matlab has shown that the risk of death due to drowning is especially high during the second year of life, probably because that is the age when children become more independent and start to move around freely. Most drowning-related deaths occur before noon, which is the time when mothers and relatives remain busy with household work and are likely to be separated from their children.
This research has also demonstrated that there is a significant effect of childbearing patterns on the risk of child death due to drowning. If a particular (index) child has a younger sibling relatively close in age, the risk of drowning and death is higher for that index child. The closer in age the younger sibling is to the index child, the higher the risk of death. Earlier analysis by the same author suggests that when a mother has two young children close in age, with the burden of household chores, she is likely to have less time to supervise the activities of the older (index) child. Even if there is a sibling older than the index child, who could potentially supervise the index child, s/he does not appear to afford significant protection. With a long preoccupation with infectious diseases as causes of childhood illness and death, there is a policy vacuum with respect to risks of drowning. In Bangladesh, there are no parental awareness-raising campaigns, no education programmes to teach responsible adults how to respond to a potential drowning (i.e. resuscitation procedures), nor any interventions to protect children by fencing wells and ponds, etc. While there are widespread activities to promote child-spacing through family planning, there is little emphasis on the potential benefits for parents to care for and supervise their children in the context of competing demands.

Family Size and Education in Matlab

In the past, fertility was high in Bangladesh because demand for children was relatively high and family-planning methods were largely unknown. Levels of education, especially for women, were also low. Since the early 1980s, fertility has declined dramatically primarily as a result of increasing contraceptive use. In the context of this rapid rise in contraceptive use, the role of socioeconomic development versus the effectiveness of the national family-planning programme, is a subject of ongoing debate.

One argument in favour of the importance of an effective family-planning programme is that demand for children (expressed as average number of children desired by couples) began declining before contraceptive use increased. One possible explanation for this trend is that couples perceive that their long-term interests are better served by investing in fewer but ‘higher-quality’ children, than in larger families. ‘Quality’ in this context is generally reflected in aspirations for greater education of children to improve their employment prospects.

Educational levels of children have always depended, to an extent, on the economic status of the family, although, in the past, wealthy families often had many children and could afford good education for them. So, educational levels were not strongly correlated with family size. Data from Matlab show that, in the early 1980s, about one in three children completed at least one year of schooling, regardless of family size. At that time, children from larger families (with 7 or more children) were slightly more likely to complete primary schooling than those from smaller families.

Over the past two decades, fertility has halved as has desired fertility. At the same time, average educational levels of children have increased substantially. So, at present, a strong inverse relationship has developed between fertility and education such that the children of couples with small family size have more education, on an average, than children of couples with larger family size. By the late 1990s, more than one in three children of small families with 1-3 child(ren) completed primary schooling compared to only one in five children from larger families (7 children and more). This pattern supports the hypothesis that couples who limit their family
size are more able to achieve higher educational levels or higher ‘quality’ for their children. Of course, economic factors play an important intermediate role in this process, but even when these factors are controlled for, the trend persists.

An important extension of this change is that, several decades ago when education was confined more to well-off families, there was a tendency for boys to have much greater opportunities for schooling than girls. As family sizes have fallen, and educational levels have risen, this gender inequity in education has virtually disappeared. Girls are now equally likely to be educated as boys within the same family. This is not to say that there are no longer any differences across families, but these differences, probably due to economic status, affect boys and girls equally and do not discriminate according to gender.

**Treating Sick Children in Rural Bangladesh: Roles of Access and Quality of Care**

Future improvements in child survival will depend more on use of effective facility-based curative health services than of the widespread preventive programmes, like EPI. The primary healthcare (PHC) facilities in rural areas are an under-used source of curative services, partly because of low quality. A study in the Matlab treatment and comparison areas examined the effects of access to PHC facilities on seeking treatment to combat acute illnesses of children.

The treatment area is a proxy for more and better PHC facilities relative to the comparison area. It has the ICDDR,B’s Matlab Hospital and four sub-centres that provide treatment for common illnesses of women and children. The usual range of public- and private-sector health facilities serve the comparison area.

Despite the provision of better health facilities in the treatment area, most children with acute illnesses are treated either by family members at home (45%) or by untrained village doctors (39%). In the treatment area, parents consulted doctors or paramedics for 15% of episodes where children had acute illnesses compared to 5% in the comparison area, at the expense of home-care. Untrained village doctors are available in most villages around the clock and do not have to be paid right at the time of treatment. They have been, and will remain, the first choice for treatment of illnesses of great majority who are mostly illiterate and poor.

Medical doctors are few in a rural community, and distance is a barrier to their use in the treatment area but not in the comparison area. Children with illnesses that limit their daily activities are more likely to be treated by healthcare providers in the treatment area than in the comparison area. While there is a gender inequality in favour of boys in the comparison area, sick boys and girls are treated by similar type of healthcare providers in the treatment area.

The findings reveal that the provision of better quality of PHC services can bring changes in seeking treatment for sick children, but to a limited extent in absence of any other development.
Population-based data collected by the Ministry of Health and Family Welfare can be useful for programme improvement at local level

Each year, the Bangladesh Ministry of Health and Family Welfare (MoHFW) routinely collects population-based data under the rubric of Geographical Reconnaissance (GR). This information provides many programme and impact indicators that are also generated through the Demographic and Health Survey (DHS). Although the national policy-makers can access the DHS data easily, the operational managers at the district and sub-district level do not have access to the DHS data for their areas. They, instead, rely on data collected by the nationally-designed GR information system. Data generated from the GR have never been adequately validated. Selected demographic and programme indicators from GR were compared with high-quality indicators from the Operations Research Surveillance System (ORSS) in two fieldsites. These are presented in the table.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Abhoynagar (5 unions)</th>
<th>Mirsarai (7 unions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GR 2000 (^1)</td>
<td>ORSS(^2)</td>
</tr>
<tr>
<td>Population</td>
<td>123,994</td>
<td>17,679</td>
</tr>
<tr>
<td>Child birth rate</td>
<td>21.0</td>
<td>22.6</td>
</tr>
<tr>
<td>Child death rate</td>
<td>4.2</td>
<td>6.5</td>
</tr>
<tr>
<td>Infant mortality rate</td>
<td>15.7</td>
<td>57.8</td>
</tr>
<tr>
<td>Coverage of immunization with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPT3</td>
<td>99.8</td>
<td>89.3</td>
</tr>
<tr>
<td>Measles</td>
<td>99.8</td>
<td>89.3</td>
</tr>
<tr>
<td>Contraceptive prevalence rate</td>
<td>62.8</td>
<td>59.0</td>
</tr>
</tbody>
</table>

\(^1\) All households; \(^2\) Every 6th household; \(^3\) Every 4th household

Variation in birth rate ranged from 1.6 to 3.2 and child death rate ranged from 2.3 to 5.0 percentage points between the two sources. In the GR system, the infant mortality rate was grossly under-reported, while the coverage of child immunization for children and contraceptive prevalence rate was over-reported. The MoHFW is expected to continue the time-consuming collection of the population-based GR data in the coming years. However, improvement in the quality of data is needed if it will be of value to the local managers. The findings of the study were presented at the Second International Conference of INDEPTH Network held in Addis Ababa, Ethiopia, on 21-25 January 2002.
ONGOING RESEARCH PROTOCOLS 2001

Clinical Sciences Division

Ahmed T. Home-based nutritional rehabilitation of severely-malnourished children recovering from diarrhoea
Starting date: 1 January 2000
Funded by: Swiss Agency for Development and Cooperation (SDC), Switzerland

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

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: SmithKline Beecham Pharmaceuticals, UK

Alam NH. Evaluation of a dietary treatment algorithm as a home-based management of children with persistent diarrhoea: a community-based study
Starting date: 1 January 1999
Funded by: SDC, Switzerland

Alam NH. Evaluation of the effect of a soluble fibre (Sun Fiber)-supplemented comminuted chicken diet in the treatment of persistent diarrhoea in children
Starting date: 1 April 1998
Funded by: Novartis Nutrition, Switzerland

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

Faruque ASG, Fuchs GJ. Randomized placebo-controlled double-blind trial to prevent shigellosis in family contacts with single-dose vitamin A
Starting date: 1 January 2000
Funded by: SDC, Switzerland

Fuchs GJ. Community-based protocolized management of severe malnutrition
Starting date: 1 December 1999
Funded by: World Bank and Government of Bangladesh

Fuchs GJ. Study iron supplementation and growth
Starting date: 1 May 1997
Funded by: United States Agency for International Development (USAID)

Hamadani JD, Huda SN. The 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) and John Snow Inc., USA
Hossain MI (Rabbani GH: Temporary PI). Clinical evaluation of green banana (amylase-resistant starch) in the management of childhood shigellosis
Starting date: 15 August 2000
Funded by: USAID

Islam S. Studies on intestinal ion transport with high potassium and low sodium-containing electrolyte solution in malnourished rabbits during diarrhoea induced by *Escherichia coli*
Starting date: 1 September 1999
Funded by: Core (ICDDR,B)

Jamil KMA. Assessment of carotenoid bioavailability from plant sources
Starting date: 1 April 1999
Funded by: University of California, Davis, USA

Jamil KMA. Release of toxins from *Shigella dysenteriae* type 1 in response to different antibiotics
Starting date: 1 January 2000
Funded by: USAID

Kabir AKMI. The efficacy of fish-oil supplementation to pregnant mothers on birth weight of their babies
Starting date: 10 January 2000
Funded by: World Bank

Kabir AKMI. Promotion and support of exclusive breast-feeding and lactational amenorrhoea methods by peer counsellors in rural Bangladesh
Starting date: 1 October 1999
Funded by: SDC, Switzerland

Khan WA. Molecular epidemiology of cryptosporidiosis
Starting date: 16 May 2001
Funded by: United States Agency for International Development (USAID) and National Institute of Health (NIH), 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 (NEMC), USA

Rabbani GH. Clinical trial of an improved rice-based ORS (Ceralyte-90) supplemented with amino acid (L-histidine) in cholera
Starting date: 1 August 1999
Funded by: Cytos Pharmaceuticals, USA

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
Roy SK. Clinical trial of zinc supplementation in cholera patients
Starting date: 1 October 2000
Funded by: World Bank

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

Salam MA. Diagnosis of pneumonia in children with dehydrating diarrhoea
Starting date: 22 March 1999
Funded by: USAID

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

Sarker SA. Is *Helicobacter pylori* infection a cause or treatment failure of iron-deficient anaemia in children in Bangladesh?
Starting date: 1 December 1997
Funded by: NIH, USA

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

Sarker SA. Iron bioavailability from a traditional complimentary food: the effect of human milk
Starting date: 1 March 2000
Funded by: Nestle Research Foundation, USA

**Health Systems and Infectious Diseases Division**

Ashraf A. Technical assistance to strengthen management support systems for the effective delivery of the essential services package
Starting date: 1 January 1999
Funded by: USAID

Breiman RF. ICDDR,B emergency research programme to enhance dengue prevention and control programmes in Bangladesh
Starting date: 16 August 2000
Funded by: Duncan Brothers, USA and Amex Foundation, USA

Breiman RF. A prospective, randomized, partially-blinded, placebo-controlled, Phase-III, multicenter trial to assess safety, tolerability and immunogenicity of liquid influenza virus vaccine, trivalent, types A & 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 Vaccines, USA
Brooks WA. Efficacy of zinc in the treatment of pneumonia in hospitalized infants less than 2 years of age
Starting date: 1 March 1999
Funded by: Johns Hopkins University, USA and USAID

Khan AI. Strategies for improving the quality and performance of clinical contraceptive services
Starting date: 1 January 1999
Funded by: USAID

Mazumder MA. Cost-recovery of the ESP delivery through systematic pricing and revenue management in the public sector
Starting date: 1 January 1998
Funded by: USAID

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

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

Quaiyum MA. Modified strategies for ensuring referral linkage for essential obstetric care
Starting date: 1 February 1999
Funded by: USAID

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: USAID

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

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

Routh S. Operationalizing a cost-effective tiered system for delivering the essential services package in the public sector
Starting date: 1 October 1998
Funded by: USAID

**Laboratory Sciences Division**

Azim T. Cellular and humoral immune responses to rotavirus infections in Bangladeshi infants and relevance to rotavirus vaccine studies
Starting date: 10 January 1998
Funded by: USAID
Azim T, Salam MA. Identification of risk factors and study of the outcome of Shigella-associated haemolytic-uramic syndrome
Starting date: 30 July 1999
Funded by: Government of Japan and USAID

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

Bogaerts J. The aetiology of RTI among women attending the Bangladesh Women’s Health Coalition and Marie Stopes Clinic Society clinics in Taan Bazar and Dhaka, Bangladesh
Starting date: 21 December 1998
Funded by: Directorate General of International Cooperation (DGIC), Belgium

Bogaerts J. Studies on GUD in males: a hospital-based study in Dhaka, Bangladesh
Starting date: 1 April 2000
Funded by: DGIC, Belgium

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

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

Haque R. Establishment of techniques for in vitro culture and drug sensitivity of malaria parasites
Starting date: 1 August 2000
Funded by: Ministry of Science and Technology, Government of Bangladesh

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

Haque R. Mechanism of acquired immunity to E. histolytica infection and disease in Bangladesh
Starting date: 1 September 2000
Funded by: Howard Hughes Medical Institute, USA

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

Islam D. Cellular and humoral immune responses in children during acute respiratory infection (ARI) due to Streptococcus pneumoniae or Haemophilus influenzae type b
Starting date: 1 October 1998
Funded by: USAID
Islam D. The influence of innate immune mechanisms on T cells stimulation in shigellosis
Starting date: 1 January 1999
Funded by: SIDA/SAREC, Sweden

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

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: Nisian 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

Nair GB, Wentraub A. Studies on virulence of *Vibrio cholerae* 0139 Bengal
Starting Date: 1 January 1999
Funded by: SIDA/SAREC, Sweden

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

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

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

Qadri F. Phase I/II Safety and immunogenicity studies of Peru 15, a live-attenuated oral vaccine candidate for *Vibrio cholerae* 01 in Bangladeshi volunteers both adults and children
Starting date: 1 January 2001
Funded by: USAID

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
Rahman M. Field evaluation of multiplex PCR-based diagnosis for control and prevention of sexually transmitted infection/reproductive tract infection among female sex workers
Starting date: 1 July 1999
Funded by: Ministry of Science and Technology, Government of Bangladesh

Rahman M. Molecular characterization and antimicrobial resistance of Helicobacter pylori strains
Starting date: 30 September 1998
Funded by: SIDA, Sweden

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

Raqib R. Comparison of immune responses in children born with low birth-weight and full-term with normal birth-weight: a pilot study
Starting date: 1 January 2001
Funded by: World Bank

Raqib R, Roy SK. Effect of zinc supplementation on the immune and inflammatory responses of children to Shigella dysenteriae type 1 infection, and correlation with clinical severity of illness and growth following recovery
Starting date: 1 June 1999
Funded by: USAID

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

Raqib R. To study immune responses in Bangladeshi infants randomly allocated to iron and/or zinc or a micronutrient mix supplementation
Starting date: 1 May 2000
Funded by: World Bank

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

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

**Public Health Sciences Division**

Ahmed S. Health care-seeking-behaviour, willingness and ability to pay for health services and costing of the ESP components delivered through NGO-run facilities of RSDP
Starting date: 1 July 1999
Funded by: Pathfinder International/USAID
Ahmed S. Cost effectiveness of nutritional intervention activities in rural Bangladesh
Starting date: 1 January 2000
Funded by: World Bank

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

Alam N. Prevalence and risk factors for STDs among residents at Tejgaon truck stand
Starting date: 15 September 1999
Funded by: SDC, Switzerland

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. 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

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

Baqui AH, Black RE. (Local PI: 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

Baqui AH (Local PI: Zaman K). A community-based, randomized controlled trial to assess the efficacy of iron and/or zinc or a micro-nutrient mix supplementation to reduce anaemia and morbidity and to improve growth and development in Bangladeshi infants
Starting date: 1 August 1999
Funded by: USAID

Baqui AH (Local PI: 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: Water Reed Army Institute of Research and National Vaccine Programme, USA

Bashir I. Unmet need for major obstetric interventions in Bangladesh
Starting date: 8 January 2001
Funded by: DGIC, Belgium
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 gauge-Phase I
Starting date: 1 July 2001
Funded by: Rockefeller Foundation, USA

Bhuiya A. The use of recording scale to involve mothers in monitoring the growth of children in rural Bangladesh
Starting date: 15 December 1999
Funded by: World Bank

Blum LS. Sociocultural and behavioral component for dysentery study
Starting date: 1 June 2001
Funded by: IVI, DOMI Programme of WHO, South Korea

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

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

Khan SI. Situation assessment of male to male sex in Chittagong for STD/HIV intervention
Starting date: 1 December 1999
Funded by: SDC, Switzerland

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

Muna L. Explanatory model of risk perception: adolescents of Bangladesh
Starting date: 1 October 1999
Funded by: SDC, Switzerland

Persson LÅ. Arsenic in tube-well water and health consequences
Starting date: 1 November 2001
Funded by: SIDA, Sweden, WHO, and USAID

Persson LÅ. Combined interventions to promote maternal and infant health
Starting date: 1 November 2000
Funded by: United Nations Children's Fund (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

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/Asian Development Bank (ADB)

Shaheen R. A study on the effect of menstrual regulation service provision on induced abortion morbidity in Matlab
Starting date: 1 February 1999
Funded by: SDC, Switzerland

Shahid NS. Study of the immunogenicity of conjugate pneumococcal vaccine in infants of mothers who have and who have not been immunized with polysaccharide vaccine
Start date: 8 June 1998
Funded by: USAID, Thrasher Research Foundation and Gates Foundation

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

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

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

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

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, National Vaccine Programme Office, USA, and WHO
Policy and Planning

Strategic Plan

The strategic planning process has moved forward in 2001. The first draft plan was presented at the June 2001 meeting of the Centre’s Board of Trustees and the second draft at the November 2001 Executive Committee meeting of the Board.

The Strategic Plan was drafted with input from staff across the Centre and those of the donor community and the Government of Bangladesh in the course of various informal and formal discussions. The Board felt that the Centre should have formal consultations with the Government before finalizing the Strategic Plan.

Priority Areas

The Strategic Plan has identified priority research areas for the Centre under six major themes: Child Health, Reproductive Health, Infectious Diseases and Vaccine Sciences, Nutrition, Health and Family-planning Systems, and Population Sciences. The priority areas are projected for 2005 and 2010.

The Board, in its last meeting, felt that more work is needed to prioritize further the major focus of the Centre’s activities, and the timeliness of priority setting should also be reviewed and made more realistic, keeping in view the comparative advantage of the Centre and feasibility of implementation. The issues of poverty and equity should be prominent in the Centre’s priorities, which would attract donors who have great social consciousness on the issue. The Centre is currently working to finalize the priority areas of the Centre’s research activities.

Divisions and Programmes

The issues concerning relations between the divisions and programmes have been settled for now by agreeing that programmes are, indeed, cross-divisional and thematic, but that a programme is housed within a particular division. The relevant division head is responsible for insuring that a programme acts on behalf of the Centre and not just for benefit of his division. Currently, there are six programmes, but there is a need to include two more programmes to cover ‘HIV/AIDS’ and ‘Safe Water’. The latter was originally thought of as a programme on environmental health. However, the concept of safe water, including chemical and microbial safety, is more realistic, since the Centre has considerable expertise in this area, but perhaps does not have so much expertise in the full range of issues it would take to claim an environmental health programme.

Changes in Management Systems

In contrast to the rather modest changes in the organogram, the Centre is working toward making changes in management systems to improve efficiency. One change is to decentralize financial responsibilities, and from a financial perspective, the goal is for each unit of the Centre to become self-supporting, or nearly so. Decentralization will require greater responsibility from those having the most knowledge of the unit.
Hospital Plans

The Strategic Plan also presents a vision for the hospital as evolving into a self-supporting model 'Urgent Care Facility' for patients with certain diseases that fit the criteria of being 'common', life-threatening and easy to treat. As Melinda Gates indicated in her award banquet speech in May 2001, no child should die from an easily-preventable or easily-treatable disease. We need to characterize the 'easily-preventable deaths' and design a treatment centre around this concept.

In Bangladesh, the common and easily-treatable diseases are: diarrhoea, pneumonia, dengue, malaria, typhoid, and severe malnutrition. Unfortunately, the primary care system is not optimally equipped to deal with these diseases, at least not those of sufficient severity as to be potentially lethal. However, the experience with the ICDDR,B hospitals has shown that inexpensive care for diarrhoea or severe malnutrition, if given on an urgent basis, can save many lives at a very low cost. The same is true for pneumonia and dengue, but the model for this new type of urgent care facility must be developed and be made sustainable economically.

Other Aspects of the Strategic Plan

Other aspects of the Strategic Plan include identification of specific strategies for further strengthening of clinical services, training, communication and dissemination, identifying strategies to strengthen South-South collaboration, developing linkages with Government of Bangladesh and non-government organizations for capacity-building of local institutions, and putting greater emphasis on translation of research into policy and action.

Monitoring of Project Activities

Currently, different projects within the Centre have their own monitoring systems. However, there is no central monitoring system to track their performance. There is also a need to develop a central database for preparing reports for donors.

The objectives of the proposed monitoring system are to help facilitate timely reporting to donors, monitor implementation of the Strategic Plan, and keep programmes on track. This management tool will enable the managers at different levels, such as Director, Associate Directors, Programme Heads, and Principal Investigators, to determine the progress of work, problems/difficulties encountered in carrying out the work, and ways of resolving the problems, and to provide the needed guidance to facilitate smooth implementation of the work.

Centre Handbook

A handbook has been prepared to assist the Centre staff and consultants, especially newcomers, in knowing about the Centre and its various activities, services, and procedures. The handbook describes the Centre’s institutional profile, types of donor support, review process of research proposals, procedures relating to developing scientific proposals and getting funded, external relations, recruitment policy, procurement services, staff
clinic services, library and information services, publishing and dissemination, computer information services, travel and estate, transport, fellowship programme, and staff development. The manual is available on the ICDDR,B Intranet.

Centre Scientific Forum List 2001

Holding inter-divisional scientific forum is a regular activity of the Centre. These fora are intended to generate ideas to undertake collaborative research work involving a multidisciplinary approach. In total, 32 inter-divisional scientific fora were organized for the scientific divisions of the Centre in 2001. A list of these fora is presented below:

Ahmed T, Arifeen SE. Neonatal mortality and morbidity: interventions at ICDDR,B

Ahmed T, Osinski P, Blum L, Nahar B. Severe malnutrition in children: the ICDDR,B experience


Ashraf A. Introduction of unified management information systems (UMIS) in the Health and Population Sector Programme of Bangladesh: preliminary findings

Azim T. HIV and AIDS in Bangladesh

Bhuiya AU, Routh S. Health equity research in ICDDR,B: current status and future directions

Breiman R, Hossain A, Wagatsuma Y. Dengue in Bangladesh: emergency research programme to address a new challenge

Breiman R, Zaman K, Quadri F, Raqib R. Vaccines against diarrhoeal diseases

Fuchs GJ. Nutrition programme at ICDDR,B

Hossain S. Risk factors for mortality among children aged less than five years admitted at Dhaka Hospital of ICDDR,B due to acute respiratory infections

Howlader SR. Determinants of household demand for healthcare: a theoretical analysis and evidence from two ORP areas of Bangladesh

Islam D. Down-regulation of bactericidal peptides in enteric infections

Killewo J, Quaiyum MA, Bashir I. Safe motherhood

Nahar Q, Killewo J. Adolescent health research at ICDDR,B: where to go?

Osendarp S. Zinc supplementation in pregnancy and infancy: effects on pregnancy outcome, growth, morbidity, and immune response

Persson LÅ. Arsenic and health—a priority for ICDDR,B

Persson LÅ and LBW Study Group. Low birth-weight (LBW)
Rabbani GH. Plant polyphenol (apple extract) inhibition of cholera-toxin-induced intestinal secretion in rabbit

Rahim Z. Laboratory diagnosis of pulmonary tuberculosis

Rahman ASMH. Use of laboratory animals in biomedical research

Rahman M, Sack DA, Faruque SM, Rahman M. Antimicrobial resistance

Rahman M. Outbreak of dengue haemorrhagic fever in Bangladesh: a hospital-based study

Roy SK. Evaluation of an osmotic ultra-filtration device for the preparation of therapeutic feeds in urban slum

Roy SK, Brooks A, Raqib R, Arifeen SE. Zinc research at ICDDR,B: where do we go from here?

Routh S, Ahmed S, Saha KK. Healthcare financing: research priorities for Bangladesh

Sack DA, Rabbani GH, Alam NH, Zaman K, Khan AM. Panel discussion on ORS

Sack DA. Presentation of results of Board of Trustees meeting and other updates on the Centre

Sack DA. Presentation to Board of Trustees

Saha KK. Utilization and expenditure of healthcare services and household coping strategies for cost-recovery: issues of entitlement and ability-to-pay

Salam MA, Kabir I, Shaheen R. Ethical issues in health research in developing countries

Streatfield K, Mels CV, Mozumder K, Bairagi R. Fertility

Winkle JL. Good clinical practice for investigators
Training and Information Dissemination

Training and Education Unit

Training and Education Unit (TEU), formerly Training and Education Department, conducted 13 training courses and workshops (Table) in 2001 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 are designed to provide participants with the knowledge and skills applicable to their needs.

The participants in the 13 training courses and workshops included 247 scientists, physicians, health administrators, trainers, and health professionals from 30 countries (215 from Asia, 15 from Africa, one from Australia, 7 from North America, and 9 from Europe). Another 280 persons received orientation training on different aspects of diarrhoeal diseases and reproductive health.

The Government of Japan, Japan International Corporation of Welfare Services (JICWELS), Swedish International Development Cooperation Agency (SIDA), and the Directorate General for International Cooperation (DGIC), Belgium, provided support to conduct most training programmes.

Some of the major training programmes are described below:

International Workshop on the Health and Demographic Surveillance System and Longitudinal Data Analysis

The International Workshop on the Health and Demographic Surveillance System and Longitudinal Data Analysis was conducted at the Centre during 2-13 December 2001. In total, 16 participants from Bangladesh, Japan, Kenya, Mali, Nicaragua, Tanzania, and Vietnam attended the Workshop.

The participants spent the first week in Matlab, and the second week in Dhaka. The participants, many of whom came from Demographic Surveillance System sites in Africa and Asia, had the opportunity to visit the Matlab communities and see data collection by the Community Health Research Workers (CHRWS), the sub-centres, and the data-management operations of the Health and Demographic Surveillance System (HDSS), together with the hospital. Other Matlab sessions included service-delivery and simple approaches to accessing the HDSS databases.

Toward the end of the first week, Prof. Lars Åke Persson, Associate Director of Public Health Sciences Division of the Centre introduced the participants to cohort analysis using Matlab longitudinal data, as a preparation for the second week of more intensive longitudinal data analysis in Dhaka.

In the second week, Prof. Edward Frongillo of Cornell University, USA, made considerable use of anthropometric nutrition data to introduce concepts and approaches to longitudinal data analysis. In this series of classes, Prof. Frongillo initially exposed the participants to developmental curve approaches using multi-level models. This was followed by dynamic approaches using structural equation modelling (path analysis), with discussion of dropouts and missing data, the issues common to this type of data analysis.
<table>
<thead>
<tr>
<th>Course/workshop title</th>
<th>No. of courses/workshops (n=13)</th>
<th>No. of participants (n=247)</th>
<th>Countries represented (n=30)</th>
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<tbody>
<tr>
<td><strong>Health Research Training</strong></td>
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<tr>
<td>Introductory Course on Epidemiology and Biostatistics</td>
<td>2</td>
<td>38</td>
<td>Bangladesh</td>
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<tr>
<td>International Workshop on the Health and Demographic Surveillance System and Longitudinal Data Analysis</td>
<td>1</td>
<td>16</td>
<td>Bangladesh, Japan, Kenya, Mali, Nicaragua, Tanzania, and Vietnam</td>
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<tr>
<td>Postgraduate fellowship for students of Bangladeshi universities</td>
<td></td>
<td>2</td>
<td>Bangladesh</td>
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<tr>
<td><strong>International Workshops/Courses</strong></td>
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<tr>
<td>Emerging and Re-emerging Pathogens</td>
<td>1</td>
<td>12</td>
<td>Japan</td>
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<tr>
<td>Clinical Management of Diarrhoeal Diseases</td>
<td>1</td>
<td>12</td>
<td>Bangladesh, Bhutan, Cambodia, Indonesia, Lao Republic, Korea, and Pakistan</td>
</tr>
<tr>
<td>Course on Laboratory Diagnosis of Common Diarrhoeal Disease Agents</td>
<td>1</td>
<td>11</td>
<td>Bangladesh, Bhutan, Cambodia, India, Laos, Nepal, Sri Lanka, and Vietnam</td>
</tr>
<tr>
<td>Improving Effectiveness, Quality of Services and Sustainability in Reproductive Health Programmes through Operations Research</td>
<td>1</td>
<td>11</td>
<td>Bangladesh, Indonesia, Kenya, Mexico, Pakistan, the Philippines, Senegal, Tanzania, Zambia, and Zimbabwe</td>
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<tr>
<td><strong>National Training Courses/Workshops</strong></td>
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<tr>
<td>Clinical Management of Diarrhoeal Diseases for FCGP students</td>
<td>1</td>
<td>17</td>
<td>Bangladesh</td>
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<tr>
<td>Feasible Means to Address Moderately-malnourished Children</td>
<td>1</td>
<td>30</td>
<td>Bangladesh</td>
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<tr>
<td>Orientation Course on Arsenic Measurements of Drinking Water in Bangladesh (Chemists, Analysts/ and Engineers of DPHE)</td>
<td>4</td>
<td>25</td>
<td>Bangladesh</td>
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<tr>
<td><strong>Fellowship Programme</strong></td>
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<tr>
<td>International Fellowship (elective training and training for postgraduate degree and diploma students)</td>
<td>-</td>
<td>29</td>
<td>Australia, Bangladesh, Canada, India, Japan, Malaysia, Netherlands, Singapore, Sweden, UK, and USA</td>
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<tr>
<td>Training of Fellows from SAARC countries</td>
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<td>Bangladesh, Bhutan, Maldives, Nepal, Pakistan, and Sri Lanka</td>
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<td>DGIC Fellowship Programme</td>
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<td>Clinical Fellowship</td>
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<tr>
<td>Nursing Fellowship</td>
<td>-</td>
<td>15</td>
<td>Bangladesh</td>
</tr>
</tbody>
</table>
Considerable time was spent on the analysis of categorical data with logistic and other forms of regression as well as the analysis of clustered categorical data using generalized estimating equations and generalized linear models.

The participants evaluated the course and found it very useful and relevant to their work. They greatly appreciated the opportunity for spending time in Matlab, probably the most well-known of the growing number of demographic surveillance sites globally.

**Introductory Course on Epidemiology and Biostatistics**

As part of the Centre’s effort to assist national institutions in developing human resources for conducting research in collaboration with several national institutions, training of 38 professionals from government and non-government organizations of Bangladesh in two batches under a four-week Introductory Course on Epidemiology and Biostatistics was completed. The participants were trained on 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 as a group exercise for implementation in their institutions.

**Emerging and Re-emerging Pathogens**

A four-week training course on Emerging and Re-emerging Pathogens was conducted during 4 February–1 March. The course, sponsored by the Japan International Corporation of Welfare Services (JICWELS), was attended by 12 participants selected by JICWELS from different hospitals and medical schools of Japan.

The course included didactic lectures, practical sessions, and field visits. Besides, 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 that are 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.

**Reproductive Health Programme through Operations Research**

The International Workshop on Improving Effectiveness, Quality of Service and Sustainability in Reproductive Health Programme through Operations Research was organized during 9-20 September. Based on its experience and lessons learnt from Matlab and the Family Health Research Project (formerly Operations Research Project) field-sites, the Workshop was designed to: (a) familiarize participants with operations research activities and lessons learnt in the field of reproductive health by the Centre’s scientists, (b) acquaint them with innovative interventions by service-delivery agencies working in reproductive health in Bangladesh, and (c) disseminate the experiences of linking operations research with the process of policy formulation to improve reproductive health programmes. Eleven participants from Bangladesh, Indonesia, the Philippines, Pakistan, Mexico, Kenya, Senegal, Tanzania, Zambia, and Zimbabwe attended the Workshop.
In addition to lecture sessions, the course curriculum included visits to the Matlab Health Research Programme and Mirsarai and field-sites of different NGOs and presentation of, and discussion on, profiles of the family-planning programmes in the home countries of the participants. They felt that such workshops can greatly contribute toward strengthening the maternal and child health and family-planning programmes in developing countries.

**Laboratory Diagnosis of Common Diarrhoeal Disease Agents**

A two-week course on Laboratory Diagnosis of Common Diarrhoeal Disease Agents was conducted from 12 to 22 August 2001 with support from the Government of Japan. Eleven participants from countries of the region, including two from Bhutan sponsored by UNICEF-Bhutan, attended the course. The course was designed to meet the needs of microbiologists who are running or setting up clinical laboratories for identifying causative agents of diarrhoeal diseases. The course comprised lectures and practical demonstration sessions in conventional techniques of clinical microbiology, molecular biology, serology, and animal experimentation. The participants were given an opportunity to work in the Centre’s laboratory setting with adequate resources and faculty support.

At the end, the participants evaluated the Workshop, using a questionnaire. Results of the evaluation indicated that the course was very useful, and the objectives of the course were fully achieved.

**Orientation Course on Arsenic Measurements in Drinking Water**

Under an orientation course on Arsenic Measurements in Drinking Water of Bangladesh, twenty-five engineers, chemists, and analysts from the Directorate of Public Health Engineering (DPHE), Government of Bangladesh, received training in four batches. The course was jointly organized by JICWELS and ICDDR,B. The course included lectures and practical demonstrations on different aspects of arsenic measurements, including quality assurance procedures using atomic absorption spectrophotometer in the clinical biochemistry laboratory.

**Future Strategy**

The future strategy of the Unit is to: (a) strengthen collaboration with universities within and outside Bangladesh, which 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.
Dissemination and Information Services Centre

The Dissemination and Information Services Centre (DISC) is an arm of ICDDR,B to provide information services and disseminate relevant information through publications and the website. As the Centre’s gateway for storage and retrieval of global information and for diffusion of its research findings, DISC is the combination of three components: (1) Information Services Branch, (2) Publications Services Branch, and (3) Audiovisuals Unit. The mission of DISC is to diffuse results of global health, nutrition and population research, especially in the context of the developing world.

DISC organizes information resources on health, population, nutrition, environment research, and related areas of interest of the Centre and encourages their use and application. Within its mission and objectives, DISC strives to offer efficient information services and disseminate the Centre’s research findings.

Thirteen personnel managed the activities and services of DISC in 2001. A few changes took place in the staffing pattern. Mr. M. Anisur Rahman joined DISC as Information Officer.

One library advisory committee and 3 editorial boards provided continued guidance in the improvement of information services, dissemination of information, and quality of publications. DISC contributed in the preparation of the Centre’s Strategic Plan by developing its own plan for five years. The major proposals included: electronic archiving of documents, digitization of information resources, improved access to international electronic resources, organization of a modern library at Matlab, further development of databases, training programme for information users, upgrading of computer facilities for library patrons, staff development, and space requirement.

In 2001, DISC earned about US$12,000 from sale of services and publications.

Information Services Branch

Librarian: Md. Nazim Uddin

The Information Services Branch, equipped with the modern tools of information technology, including online literature search facility, has now a total collection of over 35,250 books, project protocols, bound journals, and 13,130 reprints and other documents, including information resources and databases in CDs.

Collection of books, journals and other periodicals, and CD-ROMs through purchase and as gifts and under exchange programmes continued in 2001. Referral services, bibliographic and photocopying services, online dissemination of information, and Internet services were strengthened during the year.

In 2001, the total number of reader-visits was 14,325. The Centre’s scientists and health professionals and researchers of other organizations, university teachers and students, trainees, and visitors equally used the library facilities. The library introduced the membership system in 2001 and enrolled 287 members, which resulted in an earning of Tk 145,145 as membership fees. Beginning in January 2001, outsiders who are not members of the library cannot use the facility. The library staff met 1,827 formal and informal queries of library patrons.
The library collection was enriched by adding 1,121 new books (163 purchased) and bound journals, 326 current journals and other periodicals (217 titles on subscription), and one CD-ROM database. The library added 21 new journals and discontinued subscribing 5 journals during 2001. The library staff processed 1,199 books, journals, project protocols, and reprints. The 5 in-house databases were updated, using the CDS/ISIS software. Computerized literature searches were sought by, and provided to, the scientists of the Centre and 238 external users. The total number of pages of photocopies done and supplied to users was 65,653; of these, 32,268 pages were supplied to outside library users.

The Centre’s staff borrowed 13,964 books and journals from the library. The library maintained inter-library loan relationship with several libraries of Dhaka city, including National Health Library and Documentation Centre, and libraries of the Bangladesh Institute of Development Studies, Institute of Nutrition and Food Science of the University of Dhaka, and Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine & Metabolic Disorders (BIRDEM). Seven hundred seven books and bound journals were lent to these organizations. Under corporate membership, the library borrowed books and videos from the British Council Library in Dhaka. As usual, the Nuffield Library of the British Medical Association provided photocopies of journal articles, free of charge.

The Centre’s scientists were kept informed of the incoming learning resources through the weekly electronic DISC Bulletin. The Bulletin covered information on specific subjects. A monthly New Acquisition List under Current Awareness Service was introduced to disseminate information on new books, documents, reports, etc.

Under the national collaboration programme, one employee Masammat Mothesana, Librarian of the Centre for the Rehabilitation of the Paralysed, Bangladesh Health Professions Institute (BHPI), successfully completed a one-month training on Micro-CDS/ISIS at the Centre’s library.

**Publications Services Unit**

*Branch Head/Senior Publications Officer (Acting): M. Shamsul Islam Khan*

The Publications Services Branch edited, published, and disseminated the Centre’s research findings and other output information through its internal publication series.

In 2001, the Branch edited and published the Annual Report for 2000, four issues of the Journal of Health, Population and Nutrition; four issues of the English newsletter Glimpse; three issues of the Bangla newsletter Shasthya Sanglap.

The new peer-reviewed Journal of Health, Population and Nutrition (JHPN), started in 2000, begins with high expectations. In 2001, the Journal in its four issues published 42 articles (30 original papers, one short report, five editorials, three letters-to-editor, one meeting report, and two supplements). The Editorial Board included one new Deputy Editor-in-Chief and one Section Editor, and two members of the Editorial Advisory Board. The Journal succeeded in providing rapid publication of original research of relevance to developing countries. It has attracted the attention of scientists around the world at all levels. The Journal was made freely available through the Internet. An illustrated brochure was published to promote the Journal globally and nationally.
Glimpse attracted the attention of more readers during the year for its coverage of emerging and re-emerging health problems and its improved production quality.

For the first time in 2001, the Branch composed and laid out pages of the Centre’s Bangla news magazine Shasthya Sanglap using the in-house DTP facilities, and uploaded it to the Centre’s website in PDF. Thirty thousand copies of this widely-read news magazine are circulated among health workers at all levels, including the upazilla health complexes.

Under the Editorial Advisory Service, different departments and individual scientists of the Centre were given assistance in editing their articles and documents. To ensure the quality of publications, DISC rendered editing services to the scientists for 34 papers and publications (1,225 pages).

The web pages of the Centre’s publications were further reorganized, updated, and expanded to make these more useful to the users.

During the year, 112,142 copies of different publications were distributed/mailed to over 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.

Audiovisuals Unit

*Head: Asem Ansari*

The Audiovisuals Unit (AVU) continued to provide support to the Centre’s scientists and members of the management team by preparing graphics material for their documents and audiovisual presentations. These included: slides, pictures, microphotography, gels, animal dissection photography, graphs, and charts. The Unit arranged audio- and video-recording of important meetings, seminars, symposia, and conferences organized at the Centre, in addition to taking photographs of important visitors to the Centre. In 2001, the Unit designed covers, laid out pages, and processed DTP output for the Annual Report 2000, all issues of the English newsletter Glimpse and produced the Centre’s calendar for 2002 and a number of brochures, posters, and other display materials. The Unit earned an amount of over US$700 from the sale of above services during 2001.

Head of the Unit Mr. Asem Ansari took an active part in fundraising activities. One memorable event was the Silent Auction of artwork and paintings collected from eminent artists in the country. The auction contributed a total amount of over US$18,000 to the Hospital Endowment Fund in 2001.

Participation of DISC Personnel in Workshops, Seminars, and Training Courses

Head of DISC Mr. M. Shamsul Islam Khan attended and participated at the 9th Asian Conference on Diarrhoeal Diseases and Nutrition, held in New Delhi. He also attended and delivered his lectures at two workshops in Dhaka. He (as President of the Library Association of Bangladesh) served as a member in the organizing committee of the Dhaka Book Fair 2001. The committee was constituted by the Ministry of Cultural Affairs, Government of Bangladesh.

Four members of the library staff attended a workshop on Health Science Libraries and Librarianship in the Millennium held at the Centre for Medical
Education during July-August 2001. The workshop was organized by the National Health Library and Documentation Centre, Dhaka. Three of the DISC staff also attended and delivered lectures at the workshop.

Librarian and Information Officer of DISC attended a Business English Certificate Course (BEC1), organized by the British Council, Dhaka. Information Officer also attended a two-day workshop on Population Information Network, organized by the UNFPA, Dhaka.

DISC, in collaboration with the Library Association of Bangladesh, organized a seminar on Libraries in the Millennium on 14 July. Ms Shamima Amin, Deputy Director, Robert W. Woodruff Library of the Atlanta University, USA, presented the keynote address in the seminar. About 300 professional librarians, including the Centre staff, attended the seminar.

**Computer Information Services Unit**
Manager: Abu Sufian J. Alam (till 14 March)
Acting Manager: A.K.M. Enamul Haque (from 15 March)

The Computer Information Services Unit (CISU) provides a fully-integrated IT infrastructure based on established technology standards and manages and delivers information in accordance with defined requirements. Its objectives are to: (a) develop a fully-integrated IT infrastructure throughout the Centre; (b) provide end-users with a seamless interface to all applications; and (c) provide direction and strategy to fulfill these requirements. The Unit carries out its various activities in 2001 with 9 personnel.

**Major activities and services offered**

A microwave communication system using integrated VoIP (Voice over IP) technology has been established for voice and data communication between Dhaka and Matlab station. A local wireless network communication system has also been implemented for use around Matlab. Email and web-browsing facilities at Matlab, and data transfer between Dhaka and Matlab are now possible using the microwave link. Fibre optic links between the training building and the hospital building at Matlab, and between the IPH building and the main Centre network have been established. The process of replacing old low-speed hubs by high-speed switches continued in 2001.

The Centre’s website (www.icddrb.org) has been developed to be more interactive by adding user forms, database links, etc. The intra-website (http://Centre) has also been developed. The site announces weekly activities, such as seminars, visitors’ schedules, internal vacancies, etc.

A new database providing information on DNA sequence and protein analysis for the Laboratory Sciences Division has been loaded on the Centre’s mid-range Sun Solaris RISC server, which already hosts the Demographic Surveillance System’s Oracle database. New database systems have been developed for the Clinical Sciences Divisions (Project Information System), Research Review Committee, External Relations and Institutional Development Office, and Travel and Transport offices.

Software standardization is being done at the Centre for everyday activities of users. Similarly, standard hardware architecture for workstations is also in place. CIS also hosts an independent central print server for general usage and when local printers are not available.
A local area network of 700 computers has been maintained across the Centre. The network is connected by 34 network switches/hubs located in different areas.

Services relating to repair of, and support for, computers and printers were provided. Network-related issues were also dealt with both in Dhaka and Matlab. For prompt service, hardware support teams worked both with users and in the computer hardware lab. Operating systems, MS Office, anti-virus software, email systems, and other customized software relating to specific users’ needs have been installed.

**Future Planning**

A software-based security firewall will be replaced by a hardware-based firewall in the coming year. The Internet and Intranet web pages will be upgraded and redesigned to provide easier access to more information about the Centre and its research activities. A new email server will be introduced, which will increase security and reliability for users. A high-capacity LAN printer will be installed to enhance the central printing facilities available to the Centre staff.
Clinical Sciences Division

The Clinical Sciences Division (CSD) carried out its research, patient care and training activities in 2001 with the support of 196 fixed-term and 66 project staff. Another 63 health workers, 165 personnel on contractual service agreement (CSA), 15 trainee doctors, and 15 trainee nurses significantly contributed to fulfill the mandate of the Division. Two paediatricians and a consultant radiologist facilitated training of the staff and clinical fellows in 2001.

The CSD also provided administrative, logistics, and other support to the Nutrition Programme which is currently housed in the Division.

Clinical Research and Service Centre (Dhaka Hospital)
Pl. Mohammed Abdus Salam
Funded by: Core (ICDDR,B)

In total, 93,300 patients (14,174 or 13.2% less than in 2000) attended the Clinical Research and Service Centre (CRSC) for treatment of diarrhoeal diseases alone or in association with other health problems. Of these seriously ill patients only 0.3% died. We estimate that about 10-15% of these patients would have died without treatment. The death rate was similar to that in 2000. In total, 38,126 (40.9%) patients with mild diarrhoea were referred to the Progoti Samaj Kallyan Protisthan (PSKP) clinic, and 4,471 (11.7%) of them were referred back to the CRSC for further treatment. Of the total patients, 58,501 (62.7%; 7.2% higher than in 2000) were admitted to the Short Stay Ward. Sixty-six percent of them (67% in 2000) were discharged within 24 hours, and 9 (0.02%) died. Another 7,083 (7.6%) patients (compared to 7,521 or 12.3% in 2000) required admission to the longer-stay wards: General Ward, Special Care Unit, Research Wards, and Nutrition Rehabilitation Unit. Of them, 545 (compared to 627 or 7.7% in 2000) patients were admitted either to the Clinical Study Ward or to the Metabolic Study Ward under 15 (16 in 1999) different research protocols conducted by the CSD alone or jointly with the Laboratory Sciences Division; 2,299 (35.2%; 1,735 direct admissions and 564 internal transfers) were admitted to the Special Care Unit for very severe disease, of whom 294 (12.8%) died. Of the 4,239 patients treated solely in the General Ward, only 8 (0.2%) died. Of 7,083 patients admitted to the longer-stay wards, 218 (3.1%) absconded, 258 (3.6%) took discharge against medical advice, and 93 (1.3%) were referred to other hospitals for management of complications. A total of 61,296 litres (71,556 litres in 2000) of intravenous fluids (0.66 litres/patient), and 366,006 litres (3.92 litres/patient; 448,031 litres in 2000) of oral rehydration fluids (ratio of ORS to I.V. 1:6, the same as in 2000) were used at the CRSC during the year.

Franchising Patient Care Services of ICDDR,B
Coordinators: Md. Shahadat Hossain, Hassan Ashraf, and Mohammed Abdus Salam

Since March 2000, Progoti Samaj Kallyan Protisthan (PSKP), a JSI-supported NGO under the Urban Family Health Partnership (UFHP), has been providing patient care services at a clinic established within the Centre pre-
mises. This clinic provides treatment to uncomplicated mild diarrhoeal patients, in addition to other essential services. In 2001, the clinic successfully treated 38,126 patients (41% of total patients vs 38% in 2000), of whom 4,471 (11.7%) were referred back for further treatment at the CRSC. With financial support from the Government of Japan, a new building has been constructed in the Centre premises adding significantly to the improvement of facilities at the PSKP clinic.

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

This project has been developing an efficient team with counselling and lactational management skills to promote breast-feeding practices and provide practical help for lactational management. After initiation of the project in February 2000, in total 2,365 mothers were counselled and were provided practical help. Nine hundred eighty-five (42%) infants were reverted to exclusive breast-feeding, and another 369 (17%) were predominantly breastfed due to the fact that they continued to receive oral rehydration solution (ORS) for their treatment after discharge from the CRSC.

Nursing Programme
Nurse Manager: Mohammad Ullab

The members of the nursing team in the CRSC are dedicated to providing care to patients with diarrhoea and associated health problems and also to render services to patients enrolled in different research protocols at the CRSC. The team consists of a nurse manager, four nursing officers, 39 senior staff nurses, 4 aid nurses, and 4 assistant staff nurses. In addition, 15 trainee nurses, receiving practical training on nursing management of diarrhoeal diseases, significantly contributed to patient care services. Under the Staff Development Programme of the Centre, 4 senior staff nurses and 2 fellow nurses were trained on advanced cardio-pulmonary resuscitation at BIRDEM Hospital, Dhaka.

X-ray Unit

Two radiographers of the X-ray Unit, CRSC, performed 11,052 X-ray examinations that included 9,889 chest X-rays, 780 abdominal X-rays, and 369 X-rays of other body parts. In total, 368 EKG examinations were performed during the year. A new Siemens X-ray machine, an auto processor, and a new portable X-ray machine were installed.

Fellowship Programmes

For over a decade, the CSD has established case-management training programmes for medical doctors and nurses. The Clinical Fellowship Programme is aimed at providing further training to young medical graduates with demonstrated initiatives for career development in Paediatrics or Internal Medicine. Fifteen fellows receive hands-on training on case management of diarrhoeal diseases and associated problems for 1-2 year(s). 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, the programme for providing hands-on training to 15 nurses at the CRSC continued in 2001.
Physiology Laboratory  
Pl: Golam H. Rabbani  

The Physiology Laboratory was established in 1995 with the objective of providing opportunity for CSD and LSD scientists to conduct pathophysiologic studies on intestinal and metabolic disorders in selected fields with direct relevance to clinical research. Equipped for clinical and animal experimentations, research activities in 2001 were focused on the following areas:

**Rabbit model of shigellosis**: The Laboratory continues to carry out studies with an animal model of shigellosis that mimics human disease, providing an opportunity for a wide range of investigations, including molecular, therapeutic, immunologic and pathophysiologic evaluations.

**Antioxidants to reduce arsenic toxicity**: One-week administration of arsenic trioxide to rabbits resulted in decrease in the concentration of whole blood glutathione (GSH) and an increase in the serum level of thiobarbituric acid (TBARS) compared to baseline values. Treatment with apple polyphenols or vitamins reverses these effects of arsenic.

**New assays**: Nitrite and nitrate, thiobarbituric acid-reacting substances (TBARS), glutathione (GSH), total antioxidant status, myeloperoxidase (MPO), and catalase assays have been established at the physiology laboratory. In collaboration with the Nutritional Biochemistry Laboratory of the Centre, it also set up an assay for short-chain fatty acids (SCFAs) using high-pressure liquid chromatography.

Clinical and physiologic studies on cholera conducted at the Laboratory are reported under the Infectious Diseases and Vaccine Sciences Programme.

**Hospital Surveillance Programme**  
Diarrhoeal Disease and Enteric Infection Surveillance  
Pl: A.S.G. Faruque  
Funded by: USAID  

Each year, thousands of patients attend the CRSC, Dhaka and Matlab Hospitals for treatment of diarrhoeal illness and associated problems. The objective of the Hospital Surveillance Programme is to collect information on clinical, epidemiological and demographic characteristics of these patients attending these facilities. The programme provides useful information to the Government for development of health policies; enables the Centre to monitor the emergence of new enteric pathogens; changes in the population and disease patterns, and antimicrobial resistance. It provides a database for conducting epidemiological studies, helps identify and develop new research areas, define improved patient care strategies, and introduce preventive programme.

A systematic 2% sub-sample of the patients attending the CRSC, Dhaka, and all patients attending the Matlab Hospital are enrolled in this surveillance. Trained personnel interview the patients and/or their attendants to obtain information on patients’ socioeconomic and demographic characteristics, housing and environmental conditions, feeding practices (particularly of infants and young children), and the use of drugs and fluid therapy at home. The clinical characteristics,
anthropometric measurements, treatments received at the facility, and outcomes of the 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 following table shows diarrhoeal pathogens isolated in 2001. Not shown in the figure are the results of the testing for enterotoxigenic \textit{E. coli} since results of these assays are delayed in being reported. During July 2000 to June 2001, however, among 2114 patients in the sample, 312 (15\%) ETEC patients were identified.

<table>
<thead>
<tr>
<th>Aetiology of Diarrhoea-surveillance, Dhaka and Matlab (January-December 2001)</th>
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<tbody>
<tr>
<td><strong>Aetiology</strong></td>
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<tr>
<td>----------------</td>
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<tr>
<td><strong>Pathogen Identified</strong></td>
</tr>
<tr>
<td>\textit{V. Cholerae} 01</td>
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<tr>
<td>\textit{V. cholerae} 0139</td>
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<tr>
<td>Other vibrios</td>
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<tr>
<td>Shigella</td>
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<tr>
<td>Rotavirus</td>
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<tr>
<td>*\textit{E. coli} * \textit{ETEC}</td>
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<tr>
<td>*\textit{EAggEC}</td>
</tr>
<tr>
<td>*DA</td>
</tr>
<tr>
<td>\textit{Campylobacter}</td>
</tr>
<tr>
<td>\textit{Salmonella}</td>
</tr>
<tr>
<td>\textit{E. histolytica}</td>
</tr>
<tr>
<td>\textit{Giardia lamblia}</td>
</tr>
<tr>
<td>Cryptosporidium</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>No pathogen identified</td>
</tr>
<tr>
<td>Mixed pathogen</td>
</tr>
</tbody>
</table>

*ETEC, EPEC, EAggEC and DA for Dhaka are shown during July 2000-June 2001 for 2114 patients. ETEC for Matlab are not shown.

\textbf{Nandipara Clinic}

\textit{Coordinator: S.A. Sarker}

Established in 1985, the Nandipara Clinic, situated in periurban Dhaka, provides the opportunity to CSD scientists to carry out community research. It has a population of 3,500 in an area of 2.5 square kilometers. The Clinic provides support for minor illness to the family members of subjects enrolled in research protocols. 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, to examine the role of \textit{Helicobacter pylori} infection as a cause of iron-deficiency anaemia. Ongoing research in this com-
Community-based clinic is assessing the prevalence of low gastric acid secretion (hypochlorhydria) relating to *H. pylori* infection in childbearing women and its potential role in causing iron-deficiency anaemia.

**Other Accomplishments**

*Strategic Plan*: The CSD held two retreats in 2001 to develop and refine its strategic plan for the 2001-2005 period.

*Organogram*: The CSD is currently involved in modifying its existing organogram with the objectives of improving efficiency through sharing of responsibilities, establishing a clear line of authority, and establishing effective appraisal system.

*Formation of research interest groups*: Since 2000, the CSD has formed several research interest groups (Drug Trial Group, Respiratory Infections Study Group, Neonatal Health Study Group, and *H. pylori* Study Group) within the Division. The objectives of the groups are to facilitate interactions among divisional scientists leading to the identification of research topics, to define and develop the means of addressing research questions in an efficient and timely manner, assess the need and develop required expertise and infrastructure, and to help each other in developing and executing protocols.

*Case-management manual*: The development of a case-management manual was in progress during 2001 to help establish unified treatment guidelines and train the staff and fellows on the management of common illnesses and complications of diseases at the CRSC. This would help assess the interventions and develop new interventions/strategies.

*Improvement of physical facilities of CRSC*: Following discussions during the development of strategic plan, steps have been initiated to improve the physical facilities of the CRSC, which include the following:

a. *Improved Bed-space for Hospitalized Patients*: The CRSC has 180 planned inpatient beds, including 30 in its two research wards. The number of patient visits has more than doubled since the construction of the new hospital leading to overcrowding of patient-beds associated with serious inconvenience to patients, their attendants, and the hospital staff. Plans are underway to upgrade the patient-care areas.

b. *Improvement of Special Care Unit (SCU)*: Patients with critical/life-threatening illnesses are more closely observed and managed in nine beds. Plans are being made to shift and upgrade the SCU.

c. *Establishment of a Respiratory Ward*: Acute respiratory infection (ARI) is a leading cause of childhood death and morbidity in Bangladesh and is the most commonly-associated illness among children attending the CRSC with diarrhoeal diseases. Plans are underway to establish a separate ward for management of longer-stay patients with respiratory infection. This will improve care of patients and facilitate research on ARI.
d. Special Procedure Clinic: This clinic mostly performs endoscopic examinations for research projects of CSD and LSD and is also used for diagnostic purposes. Renovations are being made to further improve the clinic to establish comprehensive ‘diagnostic laboratories’ that would be of immense help to the community.

Advanced Training on Cardio-Pulmonary Resuscitation: In two batches, 2 CSD personnel, 4 clinical fellows, 2 nurses, and 4 nurse fellows were trained on advanced cardio-pulmonary resuscitation, organized by and conducted at BIRDEM. This programme is expected to improve the life-support activities of the CRSC and will continue in the coming years.

Current Research

In 2001, the CSD had 28 ongoing research protocols, covering child development, enteric diseases, ARI and TB, nutrition, and clinical drug trials. The CSD has 4 ongoing collaborative protocols with LSD: These are: (i) Identification of risk factors and study of the outcome of Shigella-associated haemolytic uraemic syndrome—PIs: T. Azim and M.A. Salam; (ii) Immune response to V. cholerae in Bangladesh—PIs: F. Qadri and S.M. Akramuzzaman; (iii) Surveillance of invasive Haemophilus influenzae (Hi) and Streptococcus pneumoniae (Spn) diseases and the antimicrobial resistance and serotype patterns of Hi and Spn isolates in Bangladesh—PIs: M. Rahman, S. Hossain, and K. Zaman; and (iv) Effect of zinc supplementation on the immune and inflammatory responses of children to Shigella dysenteriae type 1 infection, and correlation with clinical severity of illness and growth following recovery—PIs: R. Raqib and S.K. Roy.

Conference/Seminar/Workshop Attended by CSD Personnel

Nineteen scientists of the CSD attended 13 international meetings/conferences held in various countries in 2001.
Health Systems and Infectious Diseases Division

Director

Associate Director

Division Office

Family Health Research Project Coordination Unit

FHRP Administration and Dissemination

Office of Head Infectious Diseases and Vaccine Sciences Programme

Office of Head Health and Family Planning Systems Programme

Infectious Diseases Unit

Urban Interventions Unit

Rural Interventions Unit

Health and Economics Policy Unit

Data Resources Unit
Background of the Division

The newly-created Health Systems and Infectious Diseases Division (HSID) incorporates the Health and Population Extension Division (HPED). The Division has a new focus on infectious diseases along the line of the Centre’s expanding emphasis on emerging and re-emerging infectious diseases in Bangladesh. The USAID-funded Operations Research Project (ORP), the principal component of HPED, has been re-designed and renamed Family Health Research Project (FHRP).

The mandate of the HSID is to strengthen the national health systems through supporting operations research and to design, test, and facilitate replication of cost-effective and sustainable research outcomes for rural and urban settings with emphasis on the prevention and control of emerging and re-emerging infectious diseases.

What HSID Does

The HSID provides infrastructure and expertise for Centrewide operations research with adaptation and implementation of benefits of interventions identified in ‘research work’ into ‘real world’ applications and, thus, accelerates evolution of policy through research. The Division also provides an epidemiological and operational focal point for infectious diseases research.

To fulfill its mandate, the Division focuses on a multidisciplinary approach of inquiry through both quantitative and qualitative methods. It works in partnership with the Ministry of Health and Family Welfare (MoHFW) of the Government of Bangladesh (GoB) and non-government organizations (NGOs) to facilitate successful interventions field-tested in the Division’s research sites at Abhoynagar upazila of Jessore district and Mirsarai upazila of Chittagong district and Dhaka city. The Division has 12 ongoing projects in total.

Centrewide Programmes and Major Activities Housed within HSID

The HSID houses the following Centrewide cross-divisional activities:

- Programme on Infectious Diseases and Vaccine Sciences
- Programme on Health and Family Planning Systems
- Family Health Research Project
Staff

By the end of 2001, the Division had a staff of 233 personnel, of which 2 were international, 42 national-level and 189 general services and field-level staff. Prof. David A. Sack, Director of the Centre, continued as Chief of Party, FHRP, till 17 August and Acting Head of the Division until Dr. Robert F. Breiman took over responsibilities as Acting Head of the Division from 18 August 2001. Dr. Breiman was appointed Associate Director and Head of the Division on 1 November 2001.

Visitors/Consultants

In 2001, 24 scientists and other academics from different universities and institutions visited the Division and its activities on different collaborative and other purposes. Some of these scientific personnel visited the divisions on several occasions.

Degree Courses, Conferences, and Seminars Attended by HSID Scientists

Scientists and researchers of the Division actively participated in various scientific conferences, seminars, etc. both at home and abroad during 2001. These include collaborative activities and different extended courses and degrees.
Laboratory Sciences Division
Laboratory Sciences Division

The mission of the Laboratory Sciences Division (LSD) is to adopt, develop, and use the best scientific technology to address infectious diseases and related health problems of disadvantaged populations in partnership with other divisions of the Centre and with national, regional and international institutions which share our commitment to maintain healthy populations. The mandate of the Division is to apply science to alleviate diseases.

The Division has two international scientists, 30 national scientists, and 233 technical and support service staff, of whom 101 are female and 164 are male, comprising 142 fixed-term employees, 78 on CSA, and 45 daily-wagers.

Dr. G. Balakrish Nair was appointed Associate Director and Head, LSD, on 13 December 2001. Dr. Nair joined the Centre on 9 April 2000 as Research Microbiologist and was Acting Head of LSD since 1 December 2000. Dr. Dilara Islam, Assistant Scientist, left the Division and joined the Armed Forces Research Institute of Medical Sciences, Thailand, on 1 October 2001. Dr. Mahbubur Rahman, Associate Scientist, Acute Respiratory Infection Laboratory, was elected for the Fellowship of Royal College of Physicians (FRCP), Edinburgh, UK, for his outstanding contribution to the understanding of pathogenesis of infectious diarrhoea. Mr. Ramesh Chandra Halder of Virology Laboratory was awarded PhD in Pathology from the Niigata University, Japan. During the year, 20 senior scientific staff attended international meetings, conferences, and workshops in different areas, and seven personnel were abroad for higher studies and training in different fields.

The Division completed 12 protocols. Of the ongoing 22 protocols, 3 were cross-divisional research activities—one with Clinical Sciences Division and 2 with Public Health Sciences Division. Three new protocols were initiated during the year. Eminent scientists from different institutions collaborating with the scientists of LSD visited the Division for discussion on collaborative research projects and/or providing consultancy on different research projects.

In 2001, the Division inaugurated a modern air-flow-controlled Tuberculosis Laboratory with funding from UNOCAL. Major renovation work was carried out in the Nutritional Biochemistry Laboratory with financial support from the World Bank. The Division installed a Fluorescent Activated Cell Sorter (FACS) partially supported by AusAID fund. An Atomic Absorption Spectrophotometer donated by JICWELS, Japan, was installed to estimate arsenic in water. The FACS is the first of such specialized equipment installed in Bangladesh, which, among others, will be helpful for studies on HIV/AIDS and other immunologic investigations. The Division is also in the process of expansion, and renovation of modern Virology and Reproductive Tract Infection laboratories is nearing completion.

Safe blood transfusion in Dhaka and Matlab hospitals of ICDDR,B

Exposure to blood-borne pathogens poses a serious risk to blood recipients. To prevent transmission of hepatitis, STDs, HIV, and malaria and to determine their prevalence among commercial blood donors, a strategy of safe blood transfusion was initiated in August 1996. Blood bags from commercial sources were screened for infectious agents, blood samples positive for any of the diseases were discarded. Of 183 blood bags purchased during 2001 from commercial sources, 45 (24.59%) were positive either for HBsAg or syphilis. None of the 45 blood bags was positive either for
HIV or malaria. Although blood transfusions were done in a few cases, the recipients were assured of blood free from pathogens that could cause serious life-threatening conditions.

Technical Cooperation for Surveillance on Antimicrobial Resistance in Nepal

Antimicrobial resistance and rational use of antibiotics are now important public-health issues in developing countries. Treatment failures are more frequent in places where diagnostic microbiology laboratory capacity is limited due to lack of technical manpower and inadequate laboratory support services. To help improve the capacity of the Ministry of Health, His Majesty’s Government of Nepal, to fight infectious diseases, the USAID’s Nepal Mission funded a project with ICDDR,B to conduct a laboratory-based surveillance on some selected infectious diseases. The surveillance included nine laboratories—five in Kathmandu valley, three in Western region, and one in Eastern region. The scientists of the LSD have been providing technical support to: (a) strengthen the capacity of surveillance for antimicrobial resistance on selected pathogens, such as *Vibrio cholerae*, *Shigella*, *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Neisseria gonorrhoeae*, (b) help develop an external quality control network involving the nine laboratories, and (c) train technical personnel as part of transfer of technologies. Initially, the members of the staff were trained in Dhaka, critical laboratory supplies were provided, quarterly follow-up technical visits were made, problems and suggested remedies discussed, and hands-on-training on the bench provided. Yearly workshops were organized as part of manpower development and continuing education using the previously-trained technical staff under the expert guidance of laboratory scientists of ICDDR,B. Isolates were obtained from the participating laboratories for validation of bacterial identification and antimicrobial susceptibility testing. During 2001, in total, 87 isolates of *V. cholerae* (04), *Shigella* (28), *S. pneumoniae* (25), *H. influenzae* (22), and *N. gonorrhoeae* (8) were obtained.

The Laboratory Sciences Division maintains several state-of-the-art laboratories. Activities of these laboratories during 2001 are reported below:

**Environmental Microbiology Laboratory**
*Head: Md. Sirajul Islam*

The Environmental Microbiology Laboratory has been conducting various studies on aquatic microbiology with special reference to the aquatic reservoir of *V. cholerae*. Attempts have been made to test a model to clarify the role of various bio-physicochemical parameters in maintaining endemicity and seasonality of cholera in Bangladesh. Extensive studies are being carried out to detect the virulence genes of *V. cholerae* isolated from various environmental samples, e.g., water, zooplankton, phytoplankton, sediment, and various aquatic plants. The temporal dynamics of expression and regulation of these virulence genes are also being investigated under different environmental conditions regardless of culturable and non-cultur able state of *V. cholerae* using microarray assay.

**Enteric Bacteriology Laboratory**
*Head: G.B. Nair*

The Enteric Bacteriology Laboratory conducts research in the development and application of phenotypic and molecular techniques to identify and
characterize diarrhoeagenic organisms from clinical sources and the environment. Facilities are available to conduct research in the field of diagnostic and basic bacteriology. The techniques used in this laboratory include gel electrophoresis (conventional gel electrophoresis, pulsed-field 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, DNA probe, and PCR assays for rapid identification of diarrhoeal pathogens, and genetic fingerprinting of pathogenic bacteria as an aid to epidemiological studies. Experiments with animal model for pathogenicity are performed, and specific antisera for bacterial identification are raised in this laboratory. Extensive studies are being carried out by the investigators of this laboratory on the phenotypic and molecular epidemiology of *V. cholerae*, *V. parahaemolyticus*, *Campylobacter*, *Escherichia coli* (specially on Shiga toxin-producing *E. coli*), *Shigella*, *Salmonella*, *Aeromonas*, and *Helicobacter pylori*. Extensive studies on a variety of areas are conducted to understand the basic mechanisms involved in the emergence of new epidemic strains. Antibiotic resistance and mechanisms of obtaining resistance are also being addressed in this laboratory.

**Immunology Laboratory**

*Head: F. Qadri*

The Immunology Laboratory is involved in studies focusing on immune and immunopathogenic responses in patients with cholera, enterotoxigenic *E. coli* (ETEC)-associated diarrhoea and shigellosis. The Laboratory is conducting phase I and phase II studies on live and killed cholera and ETEC vaccines in children and adults. A birth-cohort study is being carried out to understand natural immunity to ETEC by studying the incidence of ETEC infections in the first two years of life. The Laboratory is attempting to develop alternative methods in combating *Shigella* spp. that are resistant to standard antibiotics and to generate a new treatment strategy that will reduce the risk for future development of antibiotic resistance and will potentially shorten the duration and severity of disease. The Laboratory is also looking into possibilities of pharmacological reconstitution of *Shigella*-specific immunity in animal model of shigellosis.

The Immunology Laboratory conducts research in the production of monoclonal antibodies against specific antigens from *V. cholerae* O1 and O139, ETEC and enterotoxigenic *Bacteriodes fragilis*, and cell culture and stimulation assays. It also provides laboratory support for the *Shigella* vaccine study.

**Molecular Genetics Laboratory**

*Head: S.M. Faruque*

The Molecular Genetics Laboratory conducts research in the development and application of molecular techniques to identify and characterize diarrhoeagenic organisms. The technical facilities available in this laboratory include gel electrophoresis, nucleic acid preparation, hybridizations using both radio-labelled and non-radioactive probes, oligonucleotide synthesis and DNA amplification by PCR. Diagnostic techniques routinely used include DNA probe and PCR assays for rapid identification of diarrhoeal pathogens, and genetic fingerprinting of pathogenic bacteria as an aid to
epidemiological studies. Investigators of this laboratory have been involved in studies on the genetics and epidemiology of *V. cholerae* and mechanism of gene transfer in *V. cholerae*, and have contributed to the understanding of basic mechanisms involved in the emergence of new epidemic strains. Other areas of interest include environmental surveillance of diarrhoeagenic *E. coli*, *Shigella*, *V. cholerae* and their bacteriophages, and the role of bacteriophages in the environmental prevalence of these pathogens.

**Tuberculosis Laboratory**  
*Head: Md. Zeaur Rabim*

Tuberculosis Laboratory is equipped to conduct conventional culture and sensitivity of *Mycobacterium tuberculosis* from sputum samples. Using molecular techniques, it is also possible to do rapid diagnosis of drug resistance and molecular epidemiology in this laboratory.

**Virology Laboratory**  
*Head: Tasnim Azim*

The Virology Laboratory is involved in studies on the viral aetiology of diarrhoea with emphasis on group A rotavirus, HIV, and dengue. Typing is done for rotavirus strains from children with diarrhoea attending the Dhaka and Matlab hospitals of ICDRR, B. A study is being conducted on the immune response of children with natural rotavirus diarrhoea, and the response has been assessed in relation to nutritional status. The Laboratory is also providing support to rotavirus vaccine studies. The Laboratory conducted the serological surveillance for HIV for Bangladesh; it has a Voluntary Counselling and Testing Centre for HIV and is conducting a study on a cohort of injecting drug users in Dhaka in collaboration with CARE Bangladesh to ascertain the incidence of HIV, hepatitis, syphilis, and risk behaviours for HIV in that population group. Also, a Fluorescent Activated Cell Sorter (FACS) has recently been installed and will provide services for determining CD4 counts in people living with HIV. Typing of dengue viruses by PCR and isolation of the virus by cell culture are being done, which support studies on dengue by other divisions.

**Reproductive Tract Infection and Sexually Transmitted Infection Laboratory**  
*Head: Motiur Rabman*

The recently-established Reproductive Tract Infection and Sexually Transmitted Infection (RTI/STI) Laboratory, equipped with advanced facilities for extensive research in RTI/STI, is dedicated to research, training, and intervention studies in reproductive health. The main focus is on epidemiology, pathogenesis, monitoring of antimicrobial resistance, and study of resistance mechanism. The Laboratory provides diagnostic and quality control assistance on RTI/STI to different divisions of the Centre and has started some national and international initiatives in reproductive health. The Laboratory provides hands-on training on diagnosis of RTI/STI to laboratory technicians of different NGOs in Bangladesh and Nepal. The RTI/STI Laboratory is currently working as focal point for Bangladesh in WHO-sponsored Gonococcal Antimicrobial Susceptibility Programme (GASP).
Parasitology Laboratory
Head: Rashidul Haque

The Parasitology Laboratory has been conducting research primarily on amoebiasis, a deadly parasitic disease caused by the protozoa Entamoeba histolytica. Studies are being carried out to determine whether protection from intestinal infection due to this parasite is correlated with mucosal or systemic antibody responses to the E. histolytica GalNAc adherence lectin. Recent studies have shown genetic diversity within E. histolytica isolates from an endemic population as reflected in serine-rich E. histolytica protein gene polymorphism. The roles of human mucosal and systemic immune responses to E. histolytica in protection from E. histolytica infection will be studied in details. Studies on host resistance to amoebiasis are being planned, which will also include other parasitic infections.

Nutritional Biochemistry Laboratory
Head: M.A. Wahed

The Nutritional Biochemistry Laboratory provides research support, conducts independent and collaborative research and development, and trains student technicians in methods used in the Laboratory. During 2001, the Laboratory carried out about 6,355 tests and provided service to 17 research projects. A collaborative study with Dr. Dilip Mahalanabis of the Society for Applied Studies, Calcutta, India, was completed. In 2001, Mr. Mayor Michael from Austria and Ms Ulla Holmboe from Denmark were trained in the area of Nutritional Biochemistry, and Ms Katja Kongshak from Denmark, a PhD student of Research Department of the Human Nutrition at the Royal Veterinary and Agricultural University, Copenhagen, worked in a research project titled “Efficacy of vitamin A-rich small fish to improve vitamin A status in children in Bangladesh.” Head of the Laboratory Mr. M.A. Wahed worked as UNICEF Consultant in connection with Nutrition Survey in Pakistan.

Clinical Laboratory Services Programme
Head: Md. Anowar Hossain

The Clinical Laboratory Services Programme includes Clinical Pathology, Clinical Biochemistry, Clinical Microbiology and Out-patient Services project in Dhaka and Matlab clinical laboratories. The programme caters to the needs of laboratory diagnostic support to the patient-care activities of the Clinical Research and Service Centre (CRSC) at Dhaka and Matlab and to the Medical Unit of the British High Commission, JICA Medical Unit, Japan; and US Peace Corps. It provided laboratory support to clinical, community and field studies undertaken by the Centre. In addition to heavy service load, the scientists of the programme are carrying out research, providing training to the national and international fellows, and graduate and postgraduate students in laboratory research and laboratory diagnostic procedures.

Major contribution of the programme is the provision of a safe blood transfusion service for the Dhaka and Matlab hospitals with financial support from the Ford Foundation. Blood bags from commercial sources are screened for HIV, hepatitis B, other sexually transmitted diseases, and malaria to ensure transfusion of safe blood. In 2001, the outpatient service project has earned a cash revenue of Taka 195,26,200, and maintained an increasing trend from 1993.

Major achievements included the development of the community-based study on Shigella disease burden funded by the International Vaccine
Institute through Diseases of the Most Impoverished (DOMI) of WHO. Two ultra-low freezers, three refrigerators, three computers, and two printers were also purchased. One Atomic Absorption Spectrophotometer (AAS) was donated by JICWELS, Japan. The programme supported the scheduled courses of the Training and Education Unit of the Centre and also provided training to individual fellows. In 2001, the Laboratory trained 40 personnel of national and international institutions and NGOs.

Clinical Pathology Laboratory
Head: Md. Anowar Hossain

The Clinical Pathology Laboratory comprises haematology, serology and microscopic units. In 2001, the Laboratory performed 145,957 tests/assays on 67,566 specimens of blood, serum, plasma, stool, urine, cerebrospinal fluid (CSF), etc. producing a total of 1,043,053 work-load units (WLUs) in 18,118 work-hours with a general index of 57.57 WLUs per person per hour.

The distribution of routine haematological test profiles is 64.86%, serological test profiles 10.04%, blood banking 1.03%, and analysis of body fluids is 23.89%. Seropositivity of some infectious diseases, such as hepatitis, showed antibodies to hepatitis A virus 33.33% (42 of 96), HBsAg 15.28% (411 of 2,690), hepatitis C virus 30.58% (89 of 291), and hepatitis E virus 48.99% (73 of 149). Malarial parasites (P. vivax and P. falciparum) were detected from 4.06% (67 of 1652) cases and dengue in 38.23% (164 of 429) cases. The External Quality Assurance Scheme (EQAS) in routine haematology and coagulation, and in parasitology continued to be assessed as ‘excellent’ by the EQAS of the College of American Pathologists.

Clinical Biochemistry Laboratory
Head: Ashish Kumar Chowdhury

In total, 125,145 tests/assays were performed on 33,185 specimens of blood, serum, plasma, stool, urine cerebrospinal fluid (CSF), intravenous fluid (IVF), ORS, etc. The Laboratory worked for 1,110,150 work-load units (WLUs) in 19,736 work-hours with an Index of 56.25 WLUs per person per hour. One Atomic Absorption Spectrophotometer was received as a donation from JICWELS, Japan. Two workshops on arsenic estimation in drinking water were conducted for the engineers and chemists of the Public Health and Engineering Department, Government of Bangladesh, in collaboration with Training and Education Unit of the Centre and JICWELS of Japan on 3-5 and 10-12 May 2001. The External Quality Assurance Scheme (EQAS) sponsored by WHO through Wolfson EQA Laboratory, Birmingham, UK, indicated ‘grade-1’ standard.

Clinical Microbiology Laboratory
Head: Md. Khorshed Alam

The Clinical Microbiology Laboratory processed 33,445 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 common diarrhoeal pathogens isolated from 15,692 faecal samples were: 1,599 Shigella (10.19%), 1,329 V. cholerae O1 (8.46%), 163 V. cholerae O139 (1.03%), 429 Salmonella spp. (2.7%), 803 Aeromonas spp. (5.12%), 262 Plesiomonas (1.67%), while 158 Campylobacter (7.48%) were isolated from 2,112 faecal samples.
samples. The commonest blood isolate was S. typhi (3.38%; 218 of 6,429) and urine isolate was E. coli (10.74%; 823 of 7,656). Among 472 rectal swabs collected by the epidemic control preparedness team of the Centre, 67 were positive for V. cholerae O1 (14.19%), and 18 were positive for V. cholerae O139 (3.81%). To accomplish the activities, 1,309,880 WLUs were produced in 23,560 work-hours with a general index of 55.60 WLUs per person per hour. The External Quality Assurance Scheme (EQAS) of the College of American Pathologists assessed these as being within 95% confidence interval. The Laboratory also has been involved in validating the identification and antimicrobial susceptibility testing of bacterial isolates from the Nepalese project on antimicrobial resistance and in conducting its external quality control scheme from January 2000 and maintaining the microbial quality control of Matlab field laboratory.

Matlab Clinical Laboratory
Head: Md. Anowar Hossain

In total, 19,700 tests were performed on 15,177 specimens on blood, stool, urine, CSF, and other biological fluids submitted by the Matlab diarrhoea treatment centre and from some field-based research protocols. The microbiological tests performed on 5,163 specimens (34%) included dark-field microscopy, culture, and antimicrobial susceptibility. The most common diarrhoeal pathogens were: Vibrio cholerae O1 (9.82%, 274 of 2789), Vibrio cholerae O139 (1.72%), Shigella (7.74%), Salmonella spp. (1.51%), and Campylobacter (4.70%). In total, 14,537 tests were performed on 10,014 specimens (66%) for electrolytes, renal function tests, blood glucose, routine haematological tests, urinalysis, and stool microscopy for parasites. Microscopy of 3,557 faecal specimens detected 0.95% E. histolytica and 5.59% Giardia, while Ankylostoma duodenale, Ascaris lumbricoides, Trichuris trichura, and Strongiloid stercoralis are: 1.77%, 35.11%, 20.63%, and 0.70% respectively. Internal quality control was done through clinical laboratories of Dhaka on a monthly basis.

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-related visits by various institutions. The number of research animals of different species and volume of animal blood issued to different research protocols and collaborative institutions during 2001 are shown in the following table.

<table>
<thead>
<tr>
<th>Species/blood</th>
<th>No. produced</th>
<th>No./Vol. issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabbit</td>
<td>654</td>
<td>490</td>
</tr>
<tr>
<td>Guinea pig</td>
<td>412</td>
<td>324</td>
</tr>
<tr>
<td>Rat</td>
<td>466</td>
<td>393</td>
</tr>
<tr>
<td>Mouse (Swiss albino)</td>
<td>7082</td>
<td>6251</td>
</tr>
<tr>
<td>Mouse (Balb/c)</td>
<td>410</td>
<td>192</td>
</tr>
<tr>
<td>Sheep blood</td>
<td>-</td>
<td>36,743 mL</td>
</tr>
<tr>
<td>Rabbit blood</td>
<td>-</td>
<td>2535 mL</td>
</tr>
<tr>
<td>Guinea pig blood</td>
<td>-</td>
<td>650 mL</td>
</tr>
<tr>
<td>Chicken blood</td>
<td>-</td>
<td>96 mL</td>
</tr>
</tbody>
</table>
Logistics Support Branch
Head: Qazi Shahj Ahmad

The primary responsibilities of the Branch are preparation of media, collection of bacterial stock culture, and decontamination. The media section provided technical support to 46 research projects and clinical laboratories in Dhaka and Matlab by supplying different kinds of culture media required for the identification and growth of microorganisms.

During 2001, the media section prepared 4,972 litres of bacteriological media which included semi-solid media 4,079 litres, culture broth 784 litres, carbohydrate fermentation broth 83 litres, and amino-acid broth 26 litres. The bacterial stock culture collection supported five research projects, lyophilizing 3,395 samples. Quality control of prepared media and lyophilized samples was performed regularly. Strict biosafety rules were followed for the decontamination and proper disposal of various infected and biohazard materials.

Biomedical Engineering Cell
Head: Syed Saiful Huq

The Biomedical Engineering Cell offers repair, maintenance and calibration services on analytical, clinical, diagnostics and other biomedical equipment of the Centre. The Cell offers comprehensive preventive maintenance scheme which meets professional maintenance standard. It always looks for prompt, reliable and cost-effective solutions to problems of the equipment. The Cell also imparts training to users of new equipment, and on request, provides technical assistance to other institutions.
Public Health Sciences Division

Director

Associate Director

Division Office

Office of Head
Child Health
Programme

Office of Head
Reproductive Health
Programme

Office of Head
Population Sciences
Programme

Child Health
Unit

Epidemic
Control
Preparedness
Unit

Health
and
Demographic
Surveillance
Unit

Health Economics
Unit

Matlab Health
Research
Centre

Reproductive
Health
Unit

Social
and
Behavioural
Sciences
Unit
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 of poor communities in the world.

The Division provides a variety of scientific skills and methods but with an emphasis on public health, epidemiology, and social sciences. Research work of the Division contributes to the understanding of how health and diseases are generated in the community, with a focus on vulnerable and disadvantaged groups. It searches for cost-effective approaches that could be widely applied and could increase the absolute level and an equitable distribution of health among population groups. The Division has a strong research infrastructure, including provision of primary healthcare services in rural Matlab and Chakaria.

In Matlab, the Health and Demographic Surveillance Unit (HDSU) is responsible for monthly updating health and demographic information on a population of 220,000. Besides the Matlab Health Research Centre (Head: Md. Yunus) and the HDSU (Head: Kim Streatfield), the Division has research units for Reproductive Health (Head: Japhet Killewo), Child Health (Head: Shams El Arifeen), Social and Behavioural Sciences and Health Economics (Head: Abbas Bhuiya), and Epidemic Control and Preparedness (Head: A.K. Siddique). It also houses the Centrewide research programmes on Child Health, Reproductive Health, Population Sciences as well as an office on poverty and health.

The scientific staff comprises public-health professionals, epidemiologists, social scientists, population specialists, and health economists. Eleven personnel at international level, 59 national officers, and 674 personnel of other categories, including more than one hundred community health research workers, worked for the Division in 2001. The number of personnel has increased considerably, reflecting the initiation of some larger, long-term research projects during the last two years.

The division has continued to expand, with almost a doubling of its annual budget during the last three years and an increasing number of research protocols. Some of these are large-scale umbrella protocols that run over a number of years and involve scientists from different divisions. Examples are the intervention studies against intrauterine growth retardation and maternal depletion (mainly supported by UNICEF), the arsenic and health studies in Matlab (with main support from SIDA and WHO), and the new extensive research programme on poverty and health (funded by DFID).

The studies are increasingly designed in the form of interventions, mainly community trials. Further, the studies are larger than before, combining quantitative and qualitative approaches and adding health economics as an analytical tool for effective measurements. This is in accordance with the Centre’s mission statement to develop and disseminate cost-effective approaches for major health problems.

The relative difficulty of communication between Dhaka and Matlab was improved by a microwave link that enables voice, email and Internet communication. With assistance from the European Community and in collaboration with the Government of Bangladesh, obstetric care facilities in Matlab were upgraded to provide improved services and to enable further strengthening of research and development work for safer motherhood. Twenty-nine personnel of the Division participated in 38 international
Antenatal check-up is a regular activity in the ICDDR,B sub-centres in Matlab

conferences, seminars, and symposia held in different countries and presented 20 papers. At the end of 2001, the Division had 38 ongoing research protocols.

**Child Health Unit**

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; 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.

**Epidemic Control Preparedness Unit**

The objectives of the Epidemic Control Preparedness Unit (ECPU) are to: (a) improve understanding of the epidemiology of cholera; (b) understand the factors that determine the seasonality of cholera in endemic areas; (c) develop models for the prediction of outbreaks; and (d) improve methods of intervention to slash epidemics. To achieve these objectives, the ECPU conducts (1) surveillance to study epidemiology and ecology of cholera at sentinel sites in Bangladesh in collaboration with environmental microbiologists; (2) epidemiological investigations of cholera outbreaks in collaboration with GoB health services to monitor occurrence, distribution of epidemic strains of *V. cholerae* O1 and O139 and related drug-sensitivity patterns.

**Health and Demographic Surveillance System**

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 Demographic Surveillance Unit (HDSU) 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 (MCH-FP or treatment 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 treatment and comparison areas. 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 all health-related data in addition to all 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 supervising Field Research Assistants (FRAs) 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.

Documentation of the entire HDSS database is now complete. The data are being installed online and are available in hard copy. 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 the quality 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

The Health Economics Unit (HEU) aimed at establishing a resource unit at the Centre for conducting policy-oriented research and training on the application of appropriate technical tools and methodology. In addition to costing of different health interventions, the Unit carries out economic evaluation of child health, nutrition and reproductive health interventions in collaboration with other units of the Centre. It also looks at poverty and health issues in relation to access to healthcare services and analyzing fairness in healthcare financing.

During 2001, the HEU either led or participated in seven studies on various topics. The studies were mostly in the area of child health, maternal health, and nutrition. During the year, the members of the staff also published
several articles in journals. Currently, three personnel are pursuing their PhD work at overseas institutions.

Matlab Health Research Centre

The Matlab Health Research Centre (MHRC) consists of a clinical research branch, a community health research branch, and an administrative services branch, including a training centre of international standard. The Matlab station of ICDDR,B maintains a research infrastructure, including a team of well-trained village-based Community Health Research Workers (CHRWs), four sub-centre clinics (each covering a population of 27,000) run by paramedics, and a primary care hospital at Matlab. The MHRC conducts clinical and epidemiological research and provides health services for diarrhoea, child health and reproductive health problems, including basic maternity care. In addition, the MHRC implements research projects of all other units of PHSD and other divisions of the Centre. During the reporting year, 11500 diarrhoea patients and another 35000 patients comprising women of childbearing age and children aged less than 5 years with various health problems received care at Matlab hospital and the sub-centre clinics. In total, 788 (31%) deliveries were conducted at Matlab hospital (364) and the sub-centre clinics (424). Forty international participants in various courses, fellows, and students spent time in Matlab learning about practical aspects of research methods, process of implementation of projects, and longitudinal data collection system. The Matlab research infrastructure offers an excellent facility for conducting research and training on diverse issues concerning public health in developing countries. The lessons learnt in Matlab have the potential of being formulated into policy and action not only in Bangladesh but also in other developing countries.

Reproductive Health Unit

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) 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

The Social and Behavioural Sciences Unit (SBSU) continued to fulfil its mandate to institutionalize social and behavioural science research by way of carrying out relevant research, providing support to other studies, developing staff-capacity, and participating in national and international activities. There were 10 ongoing studies in the year, which were either led or participated in by the SBSU researchers. Research activities include diverse topics ranging from community development, poverty alleviation, nutrition, health and equity, HIV/AIDS, violence against women, arsenic contamination in ground water, and the like.

New Initiative
Arsenic in tubewell water and health consequences: studies in Matlab

It is estimated that almost 30 million people in Bangladesh are exposed to dangerous levels of arsenic in their drinking water, and ICDDR,B’s field site in Matlab is situated in one of the most affected areas. The surveillance systems in Matlab offer comparative advantages in studying the health effects, the burden of diseases generated by arsenic in tubewell water, and effect of interventions.

The ICDDR,B scientists have started to screen for skin lesions in a 220,000 population to assess arsenic concentration in water samples from 15,000 tubewells of the Matlab surveillance area and to establish a database for epidemiological studies of the levels of arsenic exposure and manifestations of arsenicosis in the population.

The Global Positioning System coordinates will also be linked for spatial analysis, mapping of tubewells, and arsenic concentrations. Immediate analyses of the findings will be performed to determine:

- if individuals exposed to a certain dose of arsenic in drinking water for a certain duration are at a higher risk of developing skin lesions when exposure starts early in life
- if boys and men exposed to a certain dose of arsenic in drinking water for a certain duration are at a higher risk of developing skin lesions than are girls and women
- if individuals with anthropometric signs of chronic protein-energy deficiency and/or micronutrient deficiencies, especially selenium, zinc and antioxidants, exposed to a certain dose of arsenic in drinking water for a certain duration are at a higher risk of developing skin lesions than are individuals with normal anthropometry and micronutrient status
- if women who have higher arsenic concentrations in their drinking water have a higher rate of negative pregnancy outcome, i.e. miscarriage, stillbirth, and early neonatal death
- if individuals with higher levels of dose and duration of arsenic exposure have a higher mortality due to malignant neoplasms and/or cardiovascular diseases compared to those with low arsenic concentrations in drinking water.

A village-based arsenic mitigation activity of ICDDR,B, in collaboration with BRAC, is an integrated part of the project, and priority will be given to
areas with the highest exposure to arsenic. Reversibility of skin changes will be 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.
Information Sciences Division

Director

Associate Director

Training and Education Unit
Dissemination and Information Services Centre
Computer Information Services Unit
Information Sciences Division

The new Information Sciences Division (ISD), created in 2001, includes the Training and Education Unit (TEU), the Computer Information Services Unit (CISU), and the Dissemination and Information Services Centre (DISC) with its three components: Information Services Branch, Publications Services Branch, and Audiovisuals Unit that were previously under the Director’s Division. The Information Sciences Division was initiated with the joining of Mr. Peter Thorpe as its Head on 1 August 2001.

Research findings and strategies developed by the Centre have always been instrumental in the implementation of various programmes undertaken by the national health systems of the developing world and several national and international NGOs. The Information Sciences Division is the major channel through which the Centre disseminates its research findings and technical information.

TEU is mandated to arrange national and international training courses, workshops, seminars, and symposia. These are developed in close collaboration with the other divisions in the Centre, and at times, with national and international organizations. The training courses offered by the Centre aim at:

- increasing manpower development for conducting health-related research in developing countries
- increasing capacity to manage and control diarrhoeal diseases and family-planning programmes
- improving the skills of health professionals through hands-on training on specific aspects of diarrhoeal diseases and malnutrition
- improving the response to emerging and re-emerging issues in health and population problems.

DISC is the Centre’s gateway for the storage and retrieval of global health literature and for the dissemination of information through publications and electronic files. DISC comprises Information Services Branch, Publications Services Branch, and Audiovisuals Unit. The Information Services Branch of DISC, equipped with tools such as online systems and CD-ROM databases, maintains a library that now has a collection of over 35,000 books and bound journals, 326 current journals, and over 13,000 reprints and other documents. Literature search facilities, referral services, bibliographic services, and photocopying services have been strengthened in recent years. Many of the Centre’s publications, including the Annual Report, Journal of Health, Population and Nutrition (JHPN), the quarterly newsletter Glimpse, Bangla newsletter ‘Shasthya Sanglap’, working papers, scientific reports, monographs, and special publications, are edited and produced by the Publications Services Branch of DISC. The Branch also provides Editorial Advisory Service for the production of several divisional and project documents each year. The Audiovisuals Unit of DISC is responsible for producing graphics material (including microphotography) for presentation of papers by scientists, production of slides, taking photographs of important events and regular programmes, audio- and video-recording of important meetings, workshops, conferences, seminars, and symposia, and providing technical support for the design and desktop processing of the Annual Report, Glimpse, and at times, other illustrative publications.
CIS is a communications gateway for input, output and throughput information. Its mission is the provision of modern IT services to all scientific and support divisions in the Centre. It is equipped with a VSAT satellite communications system and is responsible for the management of the Centre’s website at http://www.icddrb.org and an intranet site.

Mr. Peter Thorpe, Associate Director of the newly-created Information Sciences Division, frequently interacts with the key personnel of his division in formal meetings and informal discussions with the aim of forming it into a coherent unit in the minimum possible time.

Research findings and strategies developed by the Centre have always been instrumental in the implementation of various programmes undertaken by the national health systems of the developing world and several national and international NGOs. The Information Sciences Division is the major channel through which the Centre disseminates its research findings and technical information.
Director's Division

Director

Director's Office

Policy and Planning

Human Resources

Administrative Services

Staff Development

External Relations and Institutional Development

Finance

Procurement

Travels and Estate
Human Resources Department

Head, Human Resources: Diann M Hill  
Chief Personnel Officer: Wababuzzaman Ahmed

Human Resources Department of the Centre deals with matters relating to recruitment, promotion, transfer, separation, and retirement of staff. The Department also looks after the well-being of employees of the Centre and their dependants by providing free medical treatment through its Staff Clinic.

At the end of 2001, the Centre had a total staff of 1,113 personnel—172 were national officers, and 941 were in the general services category, in addition to 18 Community Health Workers and 63 Health Workers. The Centre also had 22 international staff members, 7 of whom were on secondment.

Appointment, Promotion, and Secondment of Staff at the International Level

Mr. Peter Thorpe, a British national, joined the Centre as Associate Director and Head of the newly-created Information Sciences Division on 01 August 2001 and Mr. Stephen E. Sage, a US national, joined as Chief Finance Officer on 21 August 2001.

Dr. G.B. Nair, an Indian national, who had been working as Research Microbiologist in the Laboratory Sciences Division, was appointed Associate Director and Head of the Division on 13 December 2001. Dr. Md. Sirajul Islam, a Bangladeshi scientist in the field of environmental microbiology, was promoted from a national- to an international-level position of Research Microbiologist under the Laboratory Sciences Division on 1 July 2001.

Dr. W. Abdullah Brooks who had been working previously in the Public Health Sciences Division (PHSD) shifted to the newly-created Health Systems and Infectious Diseases Division (HSID).

Departure

Mr. John F. Winkelmann, Chief Finance Officer, left the Centre on 31 May 2001, and Dr. George J. Fuchs, Associate Director of CSD on 30 June 2001.

Retirement

Four personnel retired from the Centre during the year. They are: Mr. Ali Miah, Animal Attendant, ARB, LSD; Mr. Sohrabuddin Ahmed, Secretary GR II, PHSD; Mr. A.K.M. Nurul Islam, Supervisor, Technical Support, Media & Wash-up, LSD, and Mr. Bernard Gomes, Senior Staff Nurse, CRSC. Mr. Islam had been working at the Centre since its opening in 1960.

Long-service Award

Twenty personnel completed 25 years of service in the Centre by 2001 and were awarded special increase in pay for their meritorious services.

Obituary

With deep sorrow, we record the death of Md. Abu Taher (43), Xerox Operator, FHRP, HSID and of Md. Mustafa (49), Senior Statistical Officer, CCHP, PHSD., who served the Centre for many years.

Staff Clinic

The Staff Clinic provided curative and preventive healthcare services throughout 2001 to the staff and their entitled dependants. Most medicines were made available in the Staff Clinic Pharmacy. In 2001, a total of 19,440 patient-visits took place in the Clinic. Of them, 18,898 patients were treated successfully in the Clinic; 542 required referral to outside clinics, hospitals, and consultants; 459 were vaccinated; 111
were hospitalized; 101 were emergency cases; 326 required minor surgeries; 89 had ECG, and 12 had pap smears. Pre-employment medical examinations were done for 108 employees. Periodical medical examinations were carried out for 91 employees. Another 400 personnel were provided family-planning services. Three health education seminars were arranged to orient the staff on serious health problems, such as hypertension, viral hepatitis, and peptic ulcer disease.

**Finance Department**

Chief Finance Officer: Stephen E. Sage

The Finance Department, with a staff of 32 personnel, has the overall responsibility for financial operations and management of the central stores and fixed assets. The financial operations include: cash management and custodianship of all funds, preparation of the annual budget, recording of all financial transactions and commitments, and preparation of accurate and timely financial reports for the Board of Trustees, management, and donors. The Department is responsible for facilitating the annual audit and assuring that audits for all donors’ contributions are timely completed.

During 2001, the financial management system underwent a review of its operating procedures and internal controls by an international consulting firm. The findings of the review will be used in enhancing the current system and in setting parameters for a new system.

Financial highlights for 2001 are given below:

- The Centre received the first-ever Gates Award for Global Health of US$1,000,000 in recognition of its major and lasting contribution to the field of global health.
- The Government of Bangladesh contributed a matching grant of US$885,000, honouring the Centre’s recognition through receiving the Gates Award.
- Total contribution from donors was US$13,992,000. This was US$162,000 or 1.2% greater than in the previous year.
- Contributions from donors to project decreased by US$547,000, while contributions for central activities increased by US$709,000 compared to that in the previous year.
- Total expenditure was US$14,582,000. This was US$18,000 or 0.1% less than that in the previous year.
- Personnel costs for national and international staff were 60.6% of total revenue compared to 60.7% last year.
- Operating surplus for the year was US$191,000 or 1.3% of total revenue compared to US$63,000 or 0.4% last year.
- Cumulative deficit of operating account decreased to $2,926,000. The total reduction of US$996,000 over the past three years arose from small-annual surpluses in the operating fund along with transfers of earnings from the Reserve Account.
- Cash-flow improved as cumulative deficit declined. Interest charges were US$2,000, while short-term investment of operating cash earned interest of US$36,000.
- Market value of endowment funds before transfers declined by 5.9% over the previous year; this decline was less than that of global performance of equity instruments generally.
Contributors to Hospital Endowment Fund and Circle-Around-the-Centre Fund 2001

**Individuals**

Mr. A.S. Monjurul Hai  
Dr. Abdullah Brooks and Mrs. Vanessa Brooks  
Mr. Abdu Sattar  
Mr. Abdu Shakoor  
Mr. Abu Taher  
Mr. Abul Barq Alvi  
Ms Adaline P. Satterthwaite  
Mr. Ahmed Nazir  
Ms Akhtar Jahan Ivy  
Mr. Alakesh Ghosh  
Mr. Aminul Islam  
Mr. Andrew L. Dannenberg  
Mr. Asem Ansari  
Prof. Barkat-e-Khuda  
Mr. Bashirullah  
Mr. Benjamin Loevinsohn  
Mr. Bill Bennett  
Mr. Biren Shome  
Mr. Bob Archibald and Mrs. Jane Archibald  
Dr. C. Finney  
Mr. and Mrs. Carl E. Miller  
Prof. Cesar Victora  
Dr. David A. Sachar  
Prof. David A. Sack and Mrs. Jean Sack  
Mr. Dirk Frans  
Mr. Elshem Kabir  
Dr. Golam Rahbani  
Mr. Graham A.N. Wright  
Mr. Greg Griiters and Mrs. Cathy Griiters  
Mr. Hamiduzzaman Khan  
Mr. Hashem Khan  
Dr. Henry Mosley  
Mr. Ian Lockwood  
Mr. Ifikhar Uddin Ahmed  
Dr. J.R. Hamilton  
Mr. Jamal Ahmed  
Mr. Joel Underwood  
Ms Joy Charfton  
Ms Kanak Champa Chakma  
Ms Kathryn S. Reimann  
Mr. Kazi Salahuddin Ahmed  
Dr. Kenneth H. Brown  
Mr. Emarat Hossain and Mrs Khairun Nessa  
Mr. Khaled Mahmoud Mithu  
Ms Kaly  
Dr. Leytham  
Ms Loretta Saldanha  
Mr. Mahbubur Rahman  
Mr. Mahmudul Haque  
Prof. Marcel Tanner

Ambassador of the Netherlands H.E. Mr. J.L. IJzermans and prominent artist Prof. Aminul Islam are visiting the galleries in the Silent Art Auction, together with Director Prof. David Sack, Acting Head of CSD Dr. M.A. Salam, and Resident Artist Mr. Asem Ansari who was the organizer of the Auction.

Centre Director Prof. David Sack speaking at the Charity Ball 2001 held at Pan Pacific Sonargoron Hotel, Dhaka.
Mrs. Margaret Wirth
Dr. Mathuram Santosham
Mr. Md. Anisuzzaman (Anis)
Mr. Md. Jalal Uddin
Mr. Md. Muniruzzaman
Mr. Md. Rafiqul Islam
Mr. Moharak A. Sikder and Mrs. Sahanara Sikder
Mr. Mohammad Eunus
Mr. Mohammed Hussain Sattar
Mr. Mostafizul Haque
Mr. Mukul Maqsuddin
Mr. Munirul Islam
Mr. N. Sufian
Ms Nasreen Begum
Ms Nazneen
Mr. Nitun Kundu
Mr. Nurul Alam
Ms Nusrat Taj
Ms Nuzhat Sharmin
Dr. Pierre Claquin
Mr. Rafique Ahmed
Mr. Rafiqun Nabi
Mr. Ramzan Ali
Mr. Ranjit Das
Mr. Rejaul Karim
Dr. Rita Colwell
Mr. Robert C. Terry
Dr. Roger I. Glass
Ms Rokeya Sultana
Mr. Rolf C. Carriere
Mr. Samarjit Roy Choudhury
Ms Sara Bennett
Mr. Sayed Alamgir Parrouk Chowdhury
Mr. Sayeed Talukder
Ms Sayeeda Talukder
Mr. Shamsul Islam Nizami
Mr. Sheikh Afzal
Dr. Sirajul Islam
Mr. Swapan Chowdhury
Mr. Syed Jahangir
Mr. Tajuddin Ahmed
Ms Tayeba Begum-Lipi

Companies and Organizations

Aarong
Acme
AKTEL
American Club
American Express Bank
Aranya
Areac Limited
Arirang House
Aventis Pharma
Bangladesh Scn. & Surgical Instruments Ltd.
Bangladesh Traders
Bangladesh International Community News
Bengal Ceramics
Berger Paints Bangladesh Ltd.
Boi Bichitra
BRAC INN
British Airways
Bukhara
Centre for the Rehabilitation of the Paralyzed
Computer Imart Inc.
Daffodil Computers Ltd.
Dali Store
Delonix International Limited
DeltaSoft
Dohatec New Media
Duncan Brothers (Bangladesh) Ltd.
Eastland Insurance Company Ltd.
Embassy of Switzerland
Emirates
EnergyPac
Farhad Fruit
Ferdous Tailors
Fisons (Bangladesh) Ltd.
Folk Bangladesh
Ganges Travel Services
Global Knitting
Globex Marketing Company Ltd.
GMG Airlines
Golden Bird Guest House
Good Luck Electronics
Government of Japan
Grameen Cybernet
Gulf Environmental Technologies Ltd.
Haque Gallery
Hassan Hardware
Hossain Antiques
Heed Bangladesh
Heed Language Center
Hoechst Marion Roussel
Homebound Packers & Shippers Ltd.
Hot Breads
Hong Kong Shanghai Banking Corporation (HSBC)
ICDDR,B Employees Multi-purpose Coop. Society Ltd.
International Office Equipment
Jane Trading Corporation Ltd.
Kasa Center
Kings Kitchen
Kumudini
Leather Boutique
Leather Emporium
Lemon Grass
Mitra & Associates
Mohna Upashahar
National Warehouse
Nelo’s
New Pearls Museum
Ninfas
Nitol Motors
Northwest Airlines
Opsonin Chemical Industries Ltd.
Organon (Bangladesh) Ltd.
Orient Bread
Pan - Pacific Sonargaon Hotel
Panda Garden
Partex
Pollywog
Premier Bank
Prime Bank Ltd.
Qatar Airways
Quassem Drycells
Radda MCH-FP Center
RC Cola
Reliance Insurance Limited
Rhone Poulenc Rorer Bangladesh
Rockefeller Foundation
Rukshana Pearls
Sajna
Saju Arts and Crafts
Sally Ann Shop
Samarkand
Santoor
Sadia Enterprises
Sarban International Ltd.
Sausages & Meat Products
Scobie & Claire Mackinnon Trust
Shaw Wallace Bangladesh Ltd.
Shetuli/ Heed Handicrafts
Shoukhin Emporium
Siemens Bangladesh
Singapore Airlines
Sky Room
Sports World
Sri Lankan Airlines
Strawberry Street
Super Fresh
Textile Traditions/ DevTek
Thai Airways
Thai House
The Guide Tours
Tivoli Art Gallery
Tradeworths Ltd.
United Insurance Company Ltd.
UNOCAL Bangladesh Ltd.
Westecs Ltd.
Yeart
YMCA Chandpur
Z.H. Sikder Hospital
Zonta Club International

Mr. K.A. Mazid, Managing Director, Prime Bank Ltd. contributing to HEF
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, 2001, 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, 2001 of US$10,317,620 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 21, 2002

Administrative Services
Consultant, Security & Logistics: Colonel Tajul Islam Ghani (retired)

The Department with 207 fixed and contractual staff provided
administrative, logistics, and engineering support for the maintenance and
construction of the physical facilities. It coordinated security and cleaning
services, management of logistics for conferences, training, and transport
operations.

Engineering and Maintenance Branch
Senior Assistant Engineer: Rabindra Das (Civil)
Assistant Engineer: N. Sayem Uddin Abammed (Electrical)

The Branch routinely maintained utility services and all electrical and
telecommunication equipment and facilities of the Centre. The construction
of a four-storied building to house the PSKP Clinic and some project offices
of the Centre was completed in 2001. The construction of the Maternity

Japanese Ambassador visiting the PSKP Clinic in the Outpatient Building, constructed with
partial financial assistance from the Government of Japan
INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH
Statement of Financial Position as at December 31, 2001 (US$ 000) - Abridged

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Assets</strong></td>
<td>20,279</td>
<td>20,122</td>
</tr>
<tr>
<td>Cash and deposits</td>
<td>4,026</td>
<td>3,815</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>2,282</td>
<td>1,786</td>
</tr>
<tr>
<td>Hospital Endowment Fund Investments</td>
<td>5,160</td>
<td>5,246</td>
</tr>
<tr>
<td>Centre Endowment Fund Investments</td>
<td>3,418</td>
<td>3,927</td>
</tr>
<tr>
<td>Inventories</td>
<td>476</td>
<td>460</td>
</tr>
<tr>
<td>Property, plant and equipment</td>
<td>4,917</td>
<td>4,888</td>
</tr>
<tr>
<td><strong>Total Liabilities and Fund Balances</strong></td>
<td>20,279</td>
<td>20,122</td>
</tr>
<tr>
<td><strong>Current Liabilities</strong></td>
<td>7,703</td>
<td>7,177</td>
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<tr>
<td><strong>Fund Balances</strong></td>
<td>12,576</td>
<td>12,945</td>
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<tr>
<td>Fixed Assets Fund</td>
<td>4,917</td>
<td>4,888</td>
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<tr>
<td>Fixed Assets Acquisition and Replacement Fund</td>
<td>-</td>
<td>78</td>
</tr>
<tr>
<td>Hospital Endowment Fund</td>
<td>5,160</td>
<td>5,246</td>
</tr>
<tr>
<td>Centre Endowment Fund</td>
<td>3,418</td>
<td>3,927</td>
</tr>
<tr>
<td>Reserve Fund</td>
<td>2,007</td>
<td>2,162</td>
</tr>
<tr>
<td>Operating Fund</td>
<td>(2,926)</td>
<td>(3,356)</td>
</tr>
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**Statement of Activities (US$ 000) - Abridged**

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2000</th>
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</thead>
<tbody>
<tr>
<td><strong>Income</strong></td>
<td>14,773</td>
<td>14,663</td>
</tr>
<tr>
<td>Contributions</td>
<td>13,992</td>
<td>13,830</td>
</tr>
<tr>
<td>Other items</td>
<td>781</td>
<td>833</td>
</tr>
<tr>
<td><strong>Expenditure</strong></td>
<td>14,582</td>
<td>14,600</td>
</tr>
<tr>
<td>Personnel</td>
<td>8,953</td>
<td>8,617</td>
</tr>
<tr>
<td>Voluntary severance package</td>
<td>-</td>
<td>288</td>
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<tr>
<td>Capital expenditure</td>
<td>914</td>
<td>659</td>
</tr>
<tr>
<td>Other items</td>
<td>4,715</td>
<td>5,036</td>
</tr>
<tr>
<td><strong>Surplus for the year before depreciation</strong></td>
<td>191</td>
<td>63</td>
</tr>
<tr>
<td><strong>Depreciation (without effect on Operating Fund)</strong></td>
<td>964</td>
<td>920</td>
</tr>
<tr>
<td><strong>Deficit for the year after depreciation</strong></td>
<td>773</td>
<td>857</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flows from operating activities</td>
<td>205</td>
<td>136</td>
</tr>
<tr>
<td>Cash flows used in investment activities</td>
<td>(907)</td>
<td>(562)</td>
</tr>
<tr>
<td>Cash flows from financing activities</td>
<td>914</td>
<td>659</td>
</tr>
<tr>
<td><strong>Net Increase in Cash and Equivalents</strong></td>
<td>212</td>
<td>233</td>
</tr>
<tr>
<td>Cash and Equivalents beginning of year</td>
<td>3,815</td>
<td>3,582</td>
</tr>
<tr>
<td>Cash and Equivalents end of year</td>
<td>4,027</td>
<td>3,815</td>
</tr>
</tbody>
</table>

This is the abridged form of the Financial Statements referred to in our report of same date.

Dhaka, March 21, 2002
INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

DONORS CONTRIBUTIONS (US$ 000)

<table>
<thead>
<tr>
<th>Contributions</th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia-AusAID</td>
<td>259</td>
<td>357</td>
</tr>
<tr>
<td>Bangladesh-GoB/WB</td>
<td>654</td>
<td>497</td>
</tr>
<tr>
<td>Belgium–BADC/BTC</td>
<td>241</td>
<td>158</td>
</tr>
<tr>
<td>Canada-CIDA</td>
<td>192</td>
<td>204</td>
</tr>
<tr>
<td>European Union</td>
<td>758</td>
<td>910</td>
</tr>
<tr>
<td>Ford Foundation</td>
<td>284</td>
<td>309</td>
</tr>
<tr>
<td>Howard Hughes Medical Institute</td>
<td>48</td>
<td>3</td>
</tr>
<tr>
<td>International Vaccine Institute (IVI)</td>
<td>118</td>
<td>-</td>
</tr>
<tr>
<td>Japan</td>
<td>1,002</td>
<td>614</td>
</tr>
<tr>
<td>Japan-JICWELS</td>
<td>80</td>
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</tr>
<tr>
<td>MGH and Harvard Medical School (a)</td>
<td>144</td>
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<tr>
<td>Netherlands</td>
<td>1,011</td>
<td>238</td>
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<tr>
<td>New England Medical Center (NEMC)</td>
<td>126</td>
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<td>Saudi Arabia</td>
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<tr>
<td>Sri Lanka</td>
<td>4</td>
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</tr>
<tr>
<td>Sweden-SIDA/SAREC</td>
<td>508</td>
<td>444</td>
</tr>
<tr>
<td>Switzerland-SDC</td>
<td>761</td>
<td>837</td>
</tr>
<tr>
<td>Swiss Red Cross</td>
<td>174</td>
<td>243</td>
</tr>
<tr>
<td>The Johns Hopkins University (a)</td>
<td>87</td>
<td>139</td>
</tr>
<tr>
<td>The Rockefeller Foundation</td>
<td>49</td>
<td>6</td>
</tr>
<tr>
<td>Thrasher Research Fund</td>
<td>52</td>
<td>(51)</td>
</tr>
<tr>
<td>United Kingdom-DFID</td>
<td>879</td>
<td>809</td>
</tr>
<tr>
<td>United States-AID etc.</td>
<td>4,977</td>
<td>5,806</td>
</tr>
<tr>
<td>UNICEF</td>
<td>218</td>
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<tr>
<td>University of Newcastle-DFID</td>
<td>68</td>
<td>63</td>
</tr>
<tr>
<td>University of Virginia (a)</td>
<td>76</td>
<td>78</td>
</tr>
<tr>
<td>UNOCAL Foundation</td>
<td>70</td>
<td>34</td>
</tr>
<tr>
<td>WHO</td>
<td>176</td>
<td>242</td>
</tr>
<tr>
<td>World Bank</td>
<td>758</td>
<td>973</td>
</tr>
<tr>
<td>Disaster Fund (UNOCAL, Shell, Cairn, Others)</td>
<td>20</td>
<td>92</td>
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<tr>
<td>Centre Endowment Fund</td>
<td>69</td>
<td>66</td>
</tr>
<tr>
<td>Hospital Endowment Fund</td>
<td>-</td>
<td>200</td>
</tr>
<tr>
<td>Others (b)</td>
<td>79</td>
<td>376</td>
</tr>
</tbody>
</table>

a) Includes subcontracts from the National Institute of Health (NIH), USA.

b) Contributions in 2001 from ‘Others’ for project funds were received from American Express Foundation, Canadian HC-LFMO, CDC - Atlanta, Cytos Pharmaceuticals Inc., Dartmouth College, The Indepth Network, International Atomic Energy Agency, Nestle Foundation, Novartis-Nutrition Research AG, Quintiles East Asia Pte. Ltd., Self Sustaining Units, UNAIDS, UNOPS, University of Alabama, University of Pennsylvania and University of Basel-SDC.

Director

Member, Board of Trustees

Hoda Vasi Chowdhury & Co
Chartered Accountants

Dhaka, March 21, 2002
Care Unit at Matlab started early in the year and is expected to be completed in early 2002. The Branch also initiated numerous renovation work to accommodate different departments in new settings to facilitate their smooth functioning.

**Transport Management Branch**  
*Senior Transport Officer: M. Hamidullah*

The Branch directed and coordinated the transport operations, using the Centre’s vehicles and those hired from contractors. It provided pick-up and drop services for approximately 350 personnel every day. The vehicle maintenance workshop provided minor and major repair facilities for all vehicles of the Centre.

**General Services Branch**  
*General Services Officer: M. Mujibur Rahman*

The Branch controlled the security services for the grounds and the property by coordinating the Centre’s guards and those contracted from outside. The Branch also provided services for cleaning, mail receipt and dispatch, and logistics management of conferences, seminars, and training activities of the Centre.

**Staff Cafeteria**  
*Supervisor: M. Rafiqul Islam*

The Staff Cafeteria provided catering services to the staff by maintaining the main canteen and the Corridor Café (newly-introduced in 2001) for lunch and the morning and evening tea. About 400 members of the staff used the canteen facilities every working day.

**Procurement Branch**  
*Procurement Manager: Md. Mahbubul Alam*

For carrying out the research activities of the Centre smoothly, the Procurement Branch procured hi-tech scientific equipment, reagents, chemicals, consumables, stationeries, spares, medicines, and medical aid products through overseas and local purchases.

In 2001, the Branch spent a total amount of US$2,887 million—US$0.776 million for local purchase, US$1.588 million for overseas purchase, and US$0.523 million for procuring I.V. fluid materials and equipment for the Institute of Public Health, Government of Bangladesh (under an agreement between ICDDR,B and Government of Bangladesh), which resulted in an income of about US$7,500. The Branch cleared 574 shipments, including 177 perishable items. The Branch earned a total revenue of about US$12,000. During the year, 18 scientific samples were exported to different collaborative research institutions. The Branch completed contracts of security service, cleaning service, transport service, selected vendors, and completed periodical rate-running contracts aiming at cost minimization and reduction of lead-time.

**Travel and Estate Office**  
*Manager: Kh. Shafiqul Hossain*

The Travel Services Office provided travel-related services to all expatriate personnel, local staff, members of the Board of Trustees, trainees, and others who visited the Centre during 2001; maintained liaison with
concerned ministries, departments of the Government and different high commissions/embassies for obtaining clearances for long-term Bangladesh visa to facilitate their stay in Bangladesh and to visit abroad; maintained the ICDDR,B Guest House which was thoroughly renovated in 2001. The Office also arranged parties during Board meetings and other occasions.

The Estate Office maintained the operation of the telecommunication system of the Centre; assisted in hiring/leasing offices for various projects of the Centre and houses for international staff, and helped them in matters relating to the payment of utility bills and taxes.

Committees

Board of Trustees
Chairperson: Prof. Marian E. Jacobs

The supreme policy-maker of the Centre is the multinational Board of Trustees comprising 17 members with a Chairperson and Director of the Centre as its Member-Secretary. Other trustees include three persons nominated by the Government of Bangladesh, one representative of the World Health Organization (WHO), one representative of the United Nations Children’s Fund (UNICEF), and 11 members from different countries and organizations; at least half of them must come from developing countries. The Board meets twice a year in June and November.

The Board had its June 2001 meeting in Washington, DC. It coincided with a grand award giving ceremony where Chairperson Prof. Marian Jacobs and Director Prof. David Sack received the first-ever Gates Award for Global Health presented by the Global Health Council of the Bill & Melinda Gates Foundation. The November 2001 meeting was held in Dhaka. In both the meetings, the Board provided guidance to the Centre’s management team on matters relating to scientific programmes, finance, and administration.

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. A member from the PCC sits on the Ethical Review Committee, but there were no PCC meetings during 2001.

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 (RCC) reviews research protocols of the Centre and evaluates their scientific merit, competence of principal investigators, and relevance of protocols to the objectives and priorities of the Centre.
The Committee is composed of clinicians, epidemiologists, nutritionists, social scientists, laboratory scientists, gynaecologists, and demographers/population scientists from both within and outside the Centre. In 2001, the Committee, in its 12 meetings, considered 32 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. Iabnudur 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 from the Programme Coordination Committee, one from the Bangladesh Medical Research Council, one from the WHO-Bangladesh, and eight selected by the Committee on an individual capacity. The Committee has a broad range of experience and expertise to undertake competent review and evaluation of all ethical aspects of research protocols.

The Committee examines and monitors research protocols following the ethical principles laid down in the ERC Guidelines, and makes risk/benefit analysis and scientific merit of protocols. While reviewing research protocols, the Committee keeps in view that, ‘in research on humans’, the interests of science never takes precedence over considerations relating to the well-being and human rights of subjects. Therefore, while the goals of research are considered important, the dignity, rights, safety, and well-being of all research participants are the primary consideration. The Committee, however, effectively reconciled the scientific, clinical and methodological aspects of research protocols with the welfare of research participants and with broader ethical implications. At times, the Committee also looked into scientific soundness of proposals, since it believes that ‘any unsound research is unethical’.

In 2001, the Committee convened one special meeting to consider two research protocols needed for urgent consideration, in addition to monthly meetings. All the scheduled meetings were convened, and businesses 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, 24 research protocols involving human subjects were approved, but many of them had been subjected to modifications 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.

Two sub-committees were formed for overseeing the implementation of approved protocols to ensure scientific and ethical conduct of research to ensure the integrity of studies to achieve valid results.

Two members prematurely retired because of their personal constraint, and four members joined the Committee during the year:

Dr. A.K.M. Iqbal Kabir, an ERC member, attended a training course on “Ethical Issues on International Health,” organized by the Harvard School of Public Health, Boston, USA.
In 2001, the Centre has received Federalwide Assurance (no. FWA 00001468) from the Office for Human Research, U.S. Department of Health and Human Services, USA.

**Animal Experimentation Ethics Committee**  
*Chairperson: Dr. Mirza A. Jalil*

The Animal Experimentation Ethics Committee (AEEC), established by the Board of Trustees to ensure 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 was reconstituted during the year comprising: four members representing national institutions involved in research and rearing of laboratory animals, three members on individual capacity, and two from the Centre.

**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 Centre for the purpose of maintaining good relationship between the staff and management and dialogue with the management and BOT. Several accomplishments were made in 2001. Some of those are: enhancement of staff salary, medical assistance provided to sick staff members, educational stipends provided to children of the low-paid employees of the Centre and condolence meetings for the deceased personnel. During the year, SWA played an important role to improve relationship between the staff and the management.

**External Relations and Institutional Development Office**  
*Acting Head: Ishtiaque Zaman*

As the primary line of communication of ICDDR,B, the External Relations and Institutional Development (ERID) Office interacts with the donor community, government offices, NGOs, business community, and different institutions throughout the world, and is responsible for final reviews of all applications for grants, contracts, and other agreements entered into by the Centre that are directly related to its research, service, and training activities. The Office serves as the secretariat for the Centre’s Donor Support Group (DSG), assists the Director in the preparation of reports to be presented in meetings of the Board of Trustees, develops project proposals for institutional support, works with the Centre’s administrative wings and scientists to address issues concerning implementation of agreements between the donors and the Centre, and coordinates and undertakes all fund-raising activities of the Centre.

The major functions of the Office in 2001 included: (a) writing and submission of project proposals particularly for institutional support, (b) liaising with donors and responding to their queries, (c) entering grant and contract negotiations with donors and collaborators, and (d) organizing appropriate programmes for special visitors to the Centre and arranging tours of the Centre’s facilities and field sites for visitors. The Office assisted the scientists of the Centre to identify sources of funds for new programmatic activities and new donors, worked with four scientific divisions and six theme-based cross-cutting programmes to get funding for their respective major initiatives, and liaised with the Finance Department to ensure financial support for the core activities of the Centre.
Other external relations activities included: coordinating press conferences and press briefings, and publicizing the achievements of the Centre in scientific fora, organizing special events, and developing targeted fund-raising initiatives and sponsorships for programmes and special events. The Office continued to spearhead the efforts for the growth of the Centre Endowment Fund and the ICDDR,B Hospital Endowment Fund.

Major Accomplishments

Gates Award for Global Health

The Bill & Melinda Gates Foundation presented the first-ever Gates Award for Global Health to the ICDDR,B for pioneering the discovery and development of oral rehydration solution (ORS) that saves three million children each year. The Gates Foundation gave this prestigious award to bring much-deserved recognition to this institution dedicated to promoting better health for all citizens of the world. Mrs. Melinda Gates, co-founder of the Foundation, handed over the award that carries a contribution of US$1 million and gold crest to ICDDR,B in a gala ceremony on 31 May in Washington, DC, in presence of about 1,200 dignitaries, including Mr. Kofi Annan, UN Secretary-General. The award ceremony was administered by the Global Health Council. The Bill & Melinda Gates Foundation has established this award to recognize an organization that has made a major contribution to the field of global health.

Matching Fund from the Government of Bangladesh

Reciprocating the international recognition achieved by the Centre, the Government of Bangladesh announced a grant of an equivalent amount to the ICDDR,B to match the Gates Award. The Government of Bangladesh credited an amount of US$885,000 to ICDDR,B’s account. This is the biggest ever one-off contribution from the Government, surpassing the previous highest contribution of two crore taka made a few years ago.

Multi-year Core Grant from the Netherlands Government

The Netherlands Government awarded a multi-year core funding grant of US$1 million per year for three years to the Centre in recognition of its important work for developing countries and of its value as a resource for the rest of the world. Ambassador of the Royal Netherlands Government to Bangladesh His Excellency Mr. J.L. IJzermans presented the agreement letter to Prof. David A. Sack in a simple ceremony. The annual core contribution of US$1 million has made the Netherlands the top core contributor among the 55 current donors to the Centre.

Increased Core Grant from Swiss Agency for Development and Cooperation

The Swiss Agency for Development and Cooperation (SDC) awarded a multi-year core grant of US$500,000 per year for three years to the Centre. The annual core contribution of US$500,000 has made SDC the second largest core contributor.
Major multi-year grant from DFID

The Department for International Development (DFID) of the United Kingdom signed an agreement with the ICDDR,B in mid-November 2001 to provide the Centre with a multi-year grant in aid of UK£5 million sterling.

The goal of the project is to improve health of the poor people around the world and develop an expanded national and global knowledge base influencing policy and practice on attaining equitable health. This grant will help the Centre to conduct research on safe motherhood and neonatal health, reduce the prevalence of tuberculosis, develop a clearer understanding of the disease burden among adults in poor communities, promote poverty-focused health research and build capacity for this in Bangladesh and internationally, develop more effective means of communicating new knowledge and influencing policy and programmes, and enhance its own capacity for poverty-focused health research through development of its human resources, management information, and communication systems.

Japan

The Government of Japan gave US$980,000 to the Centre as its annual allocation to continue to support the same programmes (Clinical Sciences, Laboratory Sciences, Training, Fellowship, and Matlab that were supported for the past few years at the same level of contribution. The Government of Japan has also approved an additional contribution of US$200,000 for the ICDDR,B’s Hospital Endowment Fund and US$200,000 for joint research projects between the ICDDR,B and Japanese scientists.

Swedish International Development Agency

The Centre is negotiating a new multi-year agreement with the Swedish International Development Agency (SIDA) for over 20 million Swedish Kronor (8.5 million as core contribution, and 11.5 million for project activities) for the 2002-2004 period. The project activities will involve collaboration between the scientists of the Laboratory Sciences Division of ICDDR,B and those of Swedish research institutions.

Resource Mobilization Strategy

The ERID Office developed the Resource Mobilization Strategy to become part of the new Strategic Plan of the Centre aiming at seeking ways to expand the Centre’s efforts to achieve sustainability in the long run.

Preparation of Proposals

The ERID Office prepared and submitted the institutional components of proposals seeking annual contributions for the year 2001 from AusAID, Kingdom of Saudi Arabia, and Sri Lanka. The Office also provided assistance in the preparation and submission of the concept papers and project proposals for research initiatives from scientific divisions and programmes of the Centre.

1. The donors who contributed for various research protocols included International Vaccine Institute (IVI), Korea; Medical Research Council,
UK; Quintiles East Asia Private Limited, India; Thrasher Research Foundation, USA; World Health Organization; Canadian International Development Agency (CIDA); Centers for Disease Control and Prevention (CDC), Atlanta, USA; University of Tokyo, Japan; International Energy Companies (Cairn, Occidental, Shell, and UNOCAL).

**Administration of Grants and Contracts**

The ERID Office reviewed various grants and contracts the Centre was offered to ensure that the agreements are acceptable and do not jeopardize the interests of the Centre. The review was done also to make sure that standards of scientific and ethical review were consistent and the work of the Centre’s scientists protected. The Office liaised with the Finance Department to ensure that the full cost of each research project was realized.

The Office coordinated the implementation of the ongoing multi-year Cooperative Agreement (CA) that the Centre has with USAID/Washington on child health research and the CA with the European Union (EU) on reproductive health. The activities included, among others, ensuring of the adherence by the Centre’s scientists to the respective agreements and compliance with the USAID and EU rules. The ERID Office also initiated the process of putting together the technical and financial reports for these two donors.

**Fundraising Initiatives**

To reach potential donors and supporters, such as corporations, foundations, and collaborating organizations in the western academic community, the ERID Office held profile-raising events where the traditional partners of the Centre participated in the celebration of achievements of the Centre. Potential supporters and partners were invited to learn about the Centre and consult the Centre’s Director and several scientists in varied disciplines on strategies for sustainability of its research agenda, training programmes, and service components.

**Hospital Endowment Fund:** The ERID Office assisted in organizing the Annual Fundraising Dinner at the Pan Pacific Sonargaon Hotel. The Consortium of Pharmaceutical Companies of the Foreign Investors Chambers of Commerce and Industry (FICCI) sponsored the dinner event. About US$50,000 was raised from ticket sales, raffles, art auction, and generous contributions. The Office also initiated discussions with local and international businesses interested in expanding their support to the ICDDR,B’s Dhaka Hospital as an important community caregiver.

**Circle-Around-the-Centre Campaign:** The ERID Office expanded its fundraising efforts through its ‘Circle-Around-the-Centre’ campaign. The initial appeal was directed to recent visitors, collaborators from academic or research institutions, and alumni and former international staff or Trustees of the Centre, many of whom had begun their careers at the Matlab research facility. Resources from the campaign will be directed toward funding new research activities and to supporting the key initiatives of the Centre requiring funds. Such funds will be targeted toward research designed to address those health problems that are most closely associated with developing countries and prevalent in Bangladesh.
Communication

The ERID Office disseminated information materials to the donor community, collaborating institutions, and health and population research and training institutions throughout the world. The Office produced the bi-monthly newsletter Grants News and routinely distributed its copies to the donors, friends, Trustees, and well-wishers to keep them abreast of the activities of the Centre.

The Office organized press conferences and arranged media coverage of major scientific accomplishments of the Centre. It also continued to provide press releases to the media whenever the Centre needed to share its knowledge with the rest of the world.

Visitors in 2001

Reputation and achievements of the Centre attracted a number of visitors and dignitaries in 2001. The ERID Office organized visits of ambassadors/high commissioners, senior civil servants, policy-makers, academicians, and researchers both from home and abroad to the Centre’s Dhaka and Matlab facilities. During their visits, they expressed keen interest in the Centre’s research, service, and training activities. Following is a list of the distinguished visitors to the Centre in 2001:

**Australia:** Mr. Percy Stanley, Director of AusAID, Canberra; H.E. Mr. Robert Flynn, High Commissioner and Mrs. Villaison Campbell, First Secretary, AusAID Dhaka

**Bangladesh:** Mr. Mohd. Moniruzzaman, Secretary-in-charge, Ministry of Health and Family Welfare; Prof. Modasser Ali, Director General, Health Services

**Canada:** Alain Berranger, Director of Partnership and Business Development Division—Program and Partnership Branch, International Development Research Centre (IDRC)

**Denmark:** Ms Marianne Thompson, Danish Management A/S, Brussels, Belgium

**Energy Companies:** Mr. Scott A. Barber, Managing Director and Mr. Naser Ahmed, External Affairs, UNOCAL Bangladesh Ltd.; Mr. Peter Chapman, Gas and Power Development Manager; Dr. Ruba Rahman, Team Leader, External Affairs and Ms Saskia Koning, External Relations, Shell Bangladesh Exploration and Development BV; and Mr. Anwarul Huq Chowdhury, Office and Administration Manager, Cairn Energy PLC

**European Union:** Mr. Hans Rhien, Second Secretary of the European Office in Dhaka; and Dr. Didier Patte, Consultant of global evaluation of the EC cooperation in the domain of health

**France:** Prof. J.F. Desjeux of CNAM, Paris, and Prof. Antoine Andremont, Bichat-Claude Bernard University Hospital, Paris

**Germany:** Ms Hildegard Hinkelmann, Administrative Staff, Embassy of the Federal Republic of Germany

**Haiti:** Dr. Henry Perry, Chief Executive Officer, Hôpital Albert Schweitzer
India: Ms Kavita Chandhok, Programme Manager and Mr. V.R. Sankaran, Secretary and Treasurer, Deep Educational Society for Health, Chennai; Dr. Amit Ghosh, Director, Institute of Microbial Technology, Chandigarh; Prof. Minnie Mathan, Hospital Road, Jangpura A, New Delhi; Dr. T. Ramamurthy, Assistant Director, National Institute of Cholera and Enteric Diseases, Kolkata; Dr Dipankar Chakraborty, Jadavpur University, Kolkata; Dr. Paritosh Keertikar, Ms Jamila Joseph, Mr. Sudip Sinha, Quintiles Spectral (India) Ltd., Mumbai

Japan: Mr. Masataka Tomita, Mr. Hiroshi Takano, and Ms Naoki Okawa, accompanied by Mr. Yutaka Nakamura, First Secretary, Embassy of Japan, Dhaka; Mr. Kayokazu Ota, Charge d’Affaires, Embassy of Japan, Dhaka; Dr. Yasuyo Matsumoto, Gynecologist, Japan Overseas Christian Medical Cooperative Service (JOCS); Mr. Minoru Hiramoto, Representative, JOCS Dhaka Office; and Dr. Yasuo Oyake, Pediatrician, JOCS Japan; Prof. T. Hayashi, Japan International Cooperation Agency (JICA); Ms Noriko Kimura, Instructor, OSICA-International, OSICA IDB (Japan), Dhaka; Ms Keiko Mizuno, JICA Expert, Women in Development, JICA, Dhaka; Ms Meiko Tsumori, Institute of Environmental Studies, University of Tokyo; a 7-member team of the Evaluation Mission for Global Issues Initiative on Population and HIV/AIDS (G II), Japan, headed by Ms Kimiko Abe (Consultant); Prof. Takashi Yokochi of Aichi University; Dr. Shinobu Kudoh, GSK, Japan; Dr Nobukatsu Ishikawa, Vice-Director, Research Institute of Tuberculosis, Tokyo; Dr. Hisao Kurazono, Professor of Department of Medical Technology, School of Health Sciences, Okayama University; Dr. Shinji Yamasaki, Division Chief, Appropriate Technology Division, Research Institute, International Medical Center

Mexico: Dr. Lynnette Neufeld, Head, Department of Child Nutrition and Health, National Institute of Public Health, Cuernavaca, Morelos

Mozambique: Dr. Marcelino de Sales Lucas, Director, Department of Environmental Hygiene, and Dr. Avertno Barreto, Ministry of Health, Maputo

The Netherlands: H.E. Mr. J.L. Ijzermans, Ambassador; Mrs. Renate Pors, First Secretary (DA); Ms Marijke Wijnroks, Health Adviser, Ministry of Foreign Affairs; and Dr. Inge Hutter, University of Gronengen

Planet Earth: Mr. Jeff Gray, Team Leader, Ms Marilyn Weiner, Executive Producer, Mr. Hal Weinder, Director, Mr. Dennis Boni, Cinematographer, and Mr. Tim Fabrezio

South Korea: Dr. Lorenz von Seidlein, Research Coordinator, International Vaccine Institute

Sweden: Ms Bo Holmstrom, Journalist; Dr. Andrej Weintraub, Karolinska Institute, Stockholm; Prof. Bengt Wretlind, Huddinge University Hospital, Stockholm; and Dr. Lars Lindholm, Health Economist, Department of Community Medicine, Umea University

Singapore: Mr. Sebastian Yeoh, Clinical Research Associate from Propharma

Switzerland: Prof. Klaus Gyr, Head, Internal Medicine, University of Basel; and Dr. Lena Davidson, Swiss Institute of Technology, Zurich
**Thailand:** Dr. Sukanya Linpisarn, Chiang Mai University; Dr. Tim Endy, Outgoing Director, Division of Viral Diseases, Dr. Anza Mammen, Incoming Director, Division of Viral Diseases, Dr. Dan Libraty, Research Scientist, and Dr. Jim Jones, Entomologist, Armed Forces Research Institute of Medical Sciences, Bangkok

**UNFPA:** Mrs. Suneeta Mukherjee, UNFPA Representative in Bangladesh

**UNICEF:** A 12-member team from UNICEF-Jordan; and Ms Shizuka Nakamura, UNICEF, Dhaka

**UN Foundation:** Mr. David van Note, Team Leader

**United Kingdom:** Mr. Julian Lob-Levyt, Health and Population Division, Department for International Development; Prof. Sally Grantham McGregor, Institute of Child Health, London; Dr. John Horton, Head, Clinical Strategy, Tropical Medicines, GSK; Ms Sally Coudlen, Senior Clinical Investigational Scientist, GSK; Mr. Damian Walker, Research Fellow in Health Economics, Health Policy Unit, London School of Hygiene & Tropical Medicine (LSHTM); Dr. Tom Curtis, University of Newcastle upon Tyne; Dr. Andrew Collins, Division of Geography and Environmental Management, University of Northumbria; Dr. Carine Ronsmans, Maternal & Child Epidemiology Unit, and Dr. Sophie Moore, LSHTM

**United States of America:** H.E. Ms Mary Ann Peters, Ambassador; Mr. and Mrs. R. Wilkinson, Defense Attache; and Mrs. Brigit Worrell, US Embassy, Dhaka; Mrs. Vivian Stackpole, wife of General Hank Stackpole (the Commander of the US led Operation Sea Angel); Irit Houvras and Ms Zareen Khair, USAID, Dhaka; Dr. Barry Silverman, Dr. Anne Schuchat, Dr. Dan Vostrejs, and Dr. Chitr Sithi-Amoom, members of the Child Health Evaluation Team, USAID/Washington; Dr. Francisco J. Roasales, Department of Nutrition, University of Pennsylvania; Dr. R. Suskind, Dean, School of Medicine, Finch University of Health Services, Chicago Medical School; Prof. R. Bradley Sack, John Hopkins University (JHU); Dr. Anwarul Huq, University of Maryland Biotechnology Institute; Dr. R. A. Petri, Jr., Professor of Microbiology and Pathology, University of Virginia; Dr. David Jarmul, Deputy Director, Communication, Howard Hughes Medical Institute; Prof. M. Mahmud Khan, Associate Professor, Department of Health Systems Management and Department of International Health and Development, Tulane University; Dr. Jane Menken, Professor of Sociology and Faculty Associate, Population Programme, Institute of Behavioral Sciences, University of Colorado at Boulder; Dr. Daniel W. Isenbarger, Department of Enteric Infections, Water Reed Army Institute of Research, Washington, DC; Professor Mathuram Santosham, Director, Division of Community Health and Health System, JHU; Dr. Mark Steinhoff, Professor of International Health, Epidemiology and Paediatrics, JHU; Dr Robert Pack, Associate Professor, School of Medicine, West Virginia University; Prof. Kathy Rasmussen, Prof. Gretel Pelto, Prof. Jean P. Habicht and Prof. Jere Haas, Division of Nutrition Sciences, and Dr. Edward Frongillo, Associate Professor, Public Health, Cornell University; Dr. Lyle Petersen, Deputy Director, Division of Vector-born Infectious Diseases, Dr. Caryn During her visit to the Centre, H.E. Ms Mary Ann Peters, US Ambassador is shown the nutritious foods that are served to the malnourished children

WHO Representative Dr. Suniti Acharaya speaking during the opening ceremony of the TB Laboratory. Director General of Health Services, Government of Bangladesh Prof. Syed Modasser Ali and UNOCAL Bangladesh President Mr. Scott Barber are also seen

The Global Issues Initiative team comprising USAID representatives and officials of the Japanese Foreign Ministry are discussing issues of mutual cooperation
Bern, Medical Epidemiologist and Dr. Ellen Dotron, Entomologist, CDC, Atlanta; Dr. Andrew Kantner, FOUCS Consultants; Dr. Neil McKee, CGP, Johns Hopkins University; Dr. Christopher Hoffmann, Medical Student, Oregon Health Sciences University, Portland; Dr. Rick Spiegal, Head of Pneumococcal Vaccine Portfolio, PATH

**Vietnam:** Dr. Dinh Phuong Hoa, Department of Social Pediatrics, National Institute of Pediatrics, Hanoi

**World Bank:** Dr. Sundararajan Srinivasa Gopalan, Senior Health, Nutrition & Population Specialist, World Bank, Washington, DC

**World Health Organization:** Dr. Suniti Acharya, Representative and Chief of Mission, World Health Organization (WHO), Dhaka; Dr. Henrica A.F.M. Jansen, Epidemiologist, Department of Gender, Women and Health, WHO, Geneva; Dr. Deoraj Caussy, Regional Epidemiologist, South East Asia Regional Office (SEARO), WHO; Dr. Kersten Gutschmidt, Scientist, Department of Protection of the Human Environment, Occupational and Environmental Health, WHO, Geneva

**Staff Development Office**
Manager: Bejoy R. Saha

Under the staff development programme, the Centre regularly organizes internal workshops and training courses and sends personnel to local and overseas institutions for higher studies and focused training aimed at improving its manpower to sustain ongoing research, training, and clinical services and to develop well-trained staff to meet future needs. Under this programme, 134 personnel benefited in 2001 with financial support from the Gates-Bangladesh grant to the Centre, Circle-Around-the-Centre Fund, and fellowships from several agencies and various projects of the Centre.

**Foreign training:** Of 44 personnel who attended training courses/study programmes in Australia, Belgium, Finland, France, India, New Zealand, the Netherlands, Sweden, Thailand, the UK, and the USA, 14 completed their studies and training. Four of them received PhD degree, three returned after completing the partial requirement of the doctoral studies, three obtained Masters degree, and another four completed non-degree training programmes in various disciplines. During the year, 25 personnel left to begin their higher studies or training abroad. At the end of the year, 30 were studying abroad—16 for PhD degree, one for post-doctoral work, 10 for Masters degree, and three for non-degree focused training.

**In-country and in-house training:** Forty-one personnel received in-country training in various disciplines during 2001. Under the in-house training programme, several members of the staff attended workshops and training courses organized by the Training and Education Unit. Fourteen personnel attended the Introductory Course on Epidemiology and Biostatistics; five participated in the International Workshop on Health and Demographic Surveillance System and Longitudinal Data Analysis; and 30 attended the Course on Feasible Means to Address Moderately Malnourished Children.
Institutional Collaboration in 2001

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. Following is a list of institutions that the Centre collaborated with during 2001:

**International Level**
*(In alphabetical order)*

- Albany Medical College, USA; AMP, France; Applied Science Institute, India; Armed Forces Research Institute of Medical Science (AFRIMS) Thailand; Arysta Life Science Corporation, Japan; Centers for Disease Control and Prevention, USA; Centre for Southeast Asian Studies, Kyoto University, Japan; Chiba University, Japan; Cornell University, USA; Dartmouth Medical School, USA; Department of Immunology & Parasitology, Fuku Medical University, Japan; Department of Infectious and Tropical Diseases, London School of Hygiene & Tropical Medicine, UK; Department of Medical Technology, School of Health Sciences, Japan; Department of Medicine and Immunology, Aichi Medical University, Japan; Department of Medicine, Microbiology and Pathology, University of Virginia, USA; Department of Microbiology and Immunology, Mahidol University, Thailand; Emory University, USA; Faculty of Human Life Sciences, Jyssen Women’s University, Japan; Harvard Medical School, USA; Harvard University, USA; Hasan Sadakin Hospital, Indonesia; Howard Hughes Medical Institute, USA; Indian Institute of Population Sciences, India; INSERM, France; Institut Pasteur, France; International Demographic Institute, The Netherlands; International Vaccine Institute, Korea; Johns Hopkins University School of Hygiene and Public Health, USA; Karolinska Institute, Sweden; Laboratory of International Prevention of Epidemics, Osaka Prefecture University, Japan; Massachusetts General Hospital, USA; McGill University, Canada; Ministry of Health, His Majesty’s Government of Nepal; National Institute of Cholera and Enteric Diseases, India; National Institute of Immunology, India; National Institute of Infectious Diseases, Japan; New England Medical Center, USA; NIDI, Netherlands; Oxford University, UK; Partnership for Health Reform (PHR), USA; Pathfinder International; Population Council, India; Population Studies Centre, University of Pennsylvania, USA; RAND Corporation, USA; School of Medicine, The University of Tokushima, Japan; Southampton University, USA; Stanford University, USA; Tuberculosis Research Centre, India; UNICEF; University of Alabama at Birmingham, USA; University of Edinburgh, UK; University of Goteborg, Sweden; University of Leuven, Belgium; University of Liege, Belgium; University of Maryland Biotechnology Institute, USA; University of Maryland, USA; University of Newcastle upon Tyne, UK; University of Texas at Galveston, USA; University of Umea, Sweden; Wageningen Agricultural University, The Netherlands; Wagner College, USA; Walter Reed Army Institute of Research, USA; World Health Organization; and Wyeth-Lederle-Praxis.

**National Level**

- American International School in Dhaka; APOSH; ARI Control Programme, Ministry of Health and Family Welfare (MoHFW), Government of Bangladesh; Ashar Alo; Bandhu Social Welfare Society; Bangabandhu Sheikh Mujib Medical University; Bangladesh Agricultural University; Bangladesh Bureau of Statistics; Bangladesh Institute of Development Studies; Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine & Metabolic Disorders (BIRDEM); Bangladesh Institute of Research for
Promotion of Essential and Reproductive Health & Tuberculosis (BIRPERHT); Bangladesh Integrated Nutrition Project (BINP); Bangladesh Livestock Research Institute; Bangladesh Mahila Parishad; Bangladesh Rural Advancement Committee (BRAC); Bangladesh Women Health Coalition; CARE Bangladesh; Central Drug Treatment and Rehabilitation Centre; Central Skin and Social Hygiene Centre, Chittagong; Chittagong Medical College Hospital; Concerned Women for Family Planning; Dhaka Medical College Hospital; Dhaka Office of Save the Children Fund (Australia); Dhaka Shishu Hospital; Directorate General of Health Services, MoHFW; Directorate of Family Planning, MoHFW; Durjoy Nari Sangha; EPI Programme, MoHFW; Family Health International; Field Laboratory at Refugee Camp in Chittagong Hill Tracts; Gonoshasthya Kendra; Grameen Bank; Health Department, Dhaka City Corporation; Holy Family Red Crescent Hospital; Institute of Epidemiology and Disease Control Research; Institute of Public Health, Jahangirnagar University; Jatiya Jumbo Sangha; John Snow Inc.; Karmajibi Kallyan Sangha; Kumudini Welfare Trust (Kumudini Hospital); Lamb Hospital, Dinajpur; Marie Stopes Clinic Society; Mukti Lawrence Foundation; Mukti Mahila Samity; Nari Moituree; Nari Mukti Sangha; National Institute of Population Research and Training (NIPORT); National Institute of Preventive & Social Medicine (NIPSOM); Nijera Kori; NOVA Medical Centre; Paricharja; PIACT Bangladesh; Planning Cell, MoHFW; Popular Diagnostics; Prochestra; Progoti Samaj Kallyan Protisthan (PSKP); Radda MCH-FP Centre, Mirpur; Rajshahi Medical College Hospital; Rangpur Medical College Hospital; Shishuk Bangladesh; Sir Salimullah Medical College Hospital; Sylhet M.A.G. Osmani Medical College Hospital; TB/Leprosy Control Programme, MoHFW; The Salvation Army; University of Dhaka; Urban Family Health Partnership; Voluntary Health Services Society; and World Vision Bangladesh.
ICDDR,B PUBLICATIONS 2001

A. Internal Publication Series


Working Papers


Scientific Reports


Special Publications


Journal and Newsletters


3. Shasthya Sanglap. V. 9, no. 3 and V. 10, no. 1-2

4. Electronic DISC Bulletin. No. 1-26 (publication ceased)
B. Original Scientific Papers (Including Short Reports)


C. Review Articles, Book Chapters, Papers in Conference Proceedings, and Monographs


**D. Letters, Editorials, and Abstracts in Journals**


*Not listed in earlier annual reports*