1982 Annual Report

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

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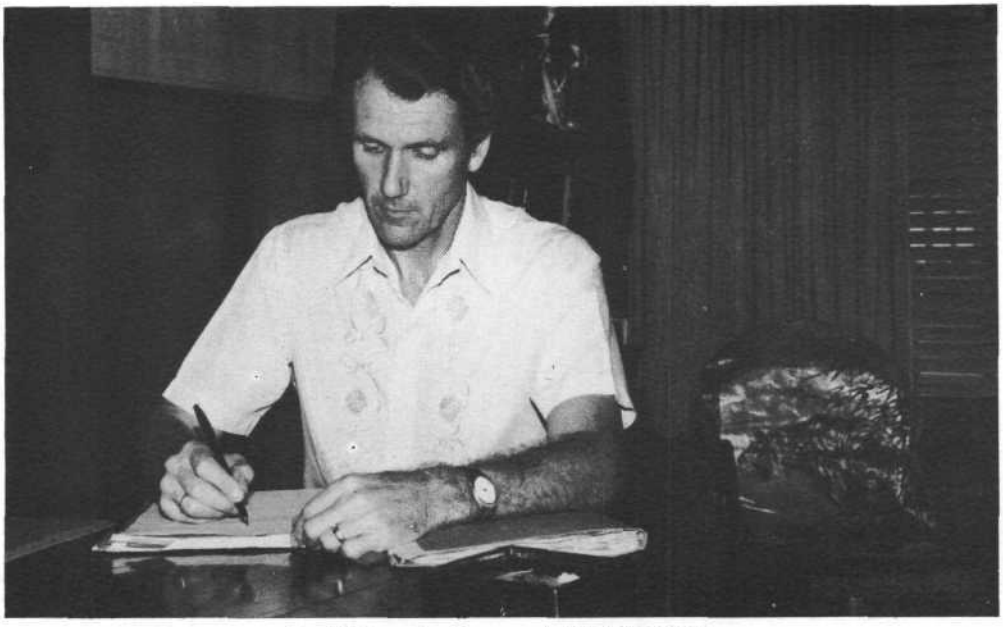


Dr. William B. Greenough III, DIRECTOR

Building on a growing body of knowledge and past successes, ICDDR,B researchers in 1982 significantly broadened the world's scientific understanding of diarrhoeal disease realities – in a series of discoveries and insights that already are influencing the diagnosis, treatment and prevention of diarrhoeal diseases, and that have set the stage for future Centre research.

Maintaining the rigorous standards and hard work that have placed the Centre at the forefront of diarrhoeal disease research, the ICDDR,B's five research working groups made several important and/or intriguing findings in 1982. The highlights:

**A promising, new oral rehydration solution (ORS) has been developed and is being field-tested. The new therapy substitutes rice or other cereals for sugar or glucose – thereby not only replacing crucial body fluids and salts lost during severe diarrhoea, but maintaining and improving nutrition. Moreover, the new ORS leads to less vomiting and lower fluid requirements in severe cholera patients.*

**A large-scale field trial has shown that home use of ORS brought some reduction in diarrhoea-caused hospitalization – and that use of a simple, homemade salt/sugar/water solution leads to significantly better-nourished children, than does use of pre-packaged ORS or no ORS.*

**Mother's milk has been shown to prevent cholera in nursing babies, due to its antibody content against cholera toxin and perhaps against components of other disease-causing organisms as well.*

**In a fascinating, important discovery, Centre scientists detected a unique phenomenon during a severe cholera outbreak. Nearly a decade after it had been replaced by another strain and had disappeared*

from Bangladesh, a virulent cholera bacteria, named "classical," resurfaced with a vengeance – replacing its predecessor, "El Tor," at least temporarily. The event raises critical questions about the cholera bacteria's ability to change and what this may mean to the worldwide struggle to control cholera.

** Two groups of previously known bacteria — Aeromonas hydrophilia and Plesiomonas shigelloides — were found to be important pathogens in Bangladesh, apparently accounting for about two percent of previously undiagnosable diarrhoeal incidents.*

** Yersinia intermedia, a bacteria not known to cause diarrhoea in other countries, was detected for the first time in Bangladesh, in autopsied diarrhoeal patients. This bacteria may be dangerous. For other yersinia are "invasive" bacteria that burrow into, and perhaps through, the intestinal walls – sometimes getting into the lymph nodes and hence into the bloodstream, where they may cause infection and death.*

** Vitamin A-caused blindness is a serious health problem in developing countries – and experience suggests that most such blindness is associated with diarrhoea. Seeking to learn whether vitamin A absorption is impaired during acute diarrhoea, the researchers found that oral vitamin A supplements do reach the bloodstream. The conclusion: prompt vitamin A administration during diarrhoea would prevent nutrition-caused blindness.*

** Advances were made in attempts to develop a successful cholera vaccine. Significant work is continuing that may lead to immunity provided by a "live" bacterial vaccine or by antibodies "manufactured" by a human mother or a cow and made available in "colostrum," the milk produced the first few days after giving birth.*

** Thanks to the tremendous research value of its unique Matlab Demographic Surveillance System – the most comprehensive developing country profile of its kind – the Centre's DSS has been chosen as one of five areas of the world where extensive mortality studies will be done. The selection was made by the U.N. Population Division and the WHO Global Epidemiological Surveillance and Health Situation Assessment section.*

Among other things, such findings dictate the quality of research articles that can be offered for publication in refereed scientific journals worldwide. And while numbers do not attest to quality and are only one index of productivity, I am happy to report a steady improvement in successful presentation of our scientists' work. Thus, in 1982, 60 articles, editorials and related papers were published in refereed journals and 16 book chapters and conference papers came out, compared to 42 and 22 in 1981.

** Moreover, we improved our internal publication process, targeting on significant work and upgrading the quality of our reports to the level of full publications. Also, in a major innovation supported by IDRC of Canada, we established DISC – The International Diarrhoeal Disease Information Service and Documentation Centre. The aim : to help diarrhoeal disease researchers, expecially in Asia, have ready access to all available pertinent material. As part of DISC, the Centre began publishing in May 1983 a quarterly "Journal of Diarrhoeal Diseases Research," containing original papers, and a comprehensive bibliography of available research papers.*

At the same time, research founded on sound technology resulted from physical improvements in our facilities and equipment that, in turn, will enhance our research efforts in 1983 and beyond. We believe that the most common causes of death and disability deserve the best efforts, both technological and intellectual.

The new North Wing of our hospital was completed, and on November 29, patients were moved from the temporary tin shed to a modern, proper treatment facility. This event occurred exactly 20 years to the day from the time the first patient was admitted to the old Cholera Research Laboratory. The space vacated will allow expansion of the Library, Publication and Computer facilities, and will provide breathing space for other overcrowded activities.

The Computer now operates round-the-clock. Still, so extensive and intensive have our research and administrative activities become, that our computation needs no longer are being met. We urgently need a more flexible, powerful computer system – so that we can truly take advantage of the wealth of information increasingly becoming available from such areas as the Matlab and Teknaf DSS, as well as from clinical research and epidemiology.

Likewise, our microbiology laboratories must be thoroughly renovated and reequipped, if we are to maintain our ability to discover causative diarrhoeal agents, and to develop field-adapted methods to learn how such agents spread.

We believe the reason we have made useful contributions is that the ICDDR,B's most important priority has been to make certain all work strives for the highest quality, while addressing critical issues. This often is difficult in the setting of epidemic illness in a developing country, but, at the same time, the opportunities for discovery are far greater.

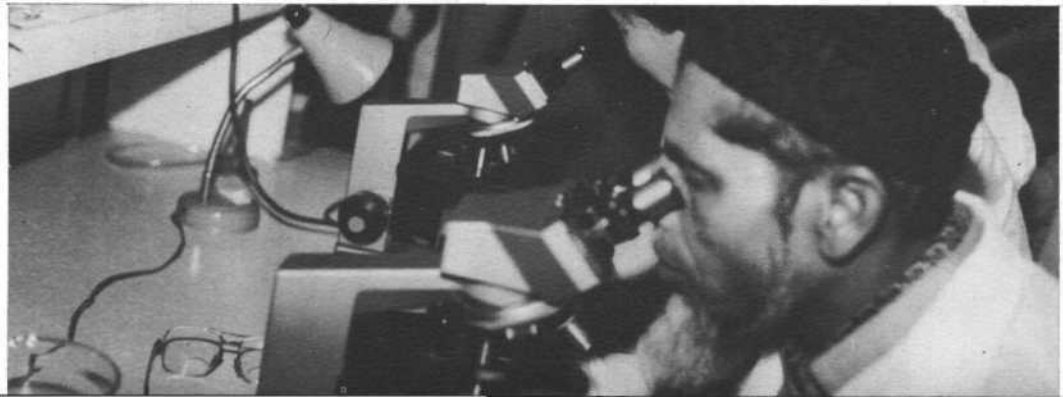
Beyond this, the single most important influence on what we choose to study relates to whether the answers will help solve the diarrhoeal disease and related problems that plague the people of our host country. For not only do we have a special commitment to Bangladesh, but the critical health issues we face here and many of the solutions we can provide are directly applicable throughout the developing world.

Moreover, we think we can be proud of the fact that ICDDR,B personnel strive to use the best available expertise and current technology to solve diarrhoea-related problems. To do so, we follow the simple dictum of Dr. John Rohde, one of our alumni, to "Take science where the diarrhoea is."

By so doing our research is strengthened. For not only must our scientists keep up with current research in their own disciplines, but they are prevented from falling into the too-easy trap of doing only isolated, bio-medical, disease-oriented studies. Given our approach, all our scientists study diarrhoea in its overall economic, health and socio-cultural matrix.

Such broad-based studies would be difficult at best without our Matlab and Teknaf field areas. For, as we learn time and again, some of the most effective diarrhoeal disease cycle interventions require far more than doctors, medicines and hospitals. Thus, we have tried to design the Centre so that as many

PRECISE, PATIENT, highly skilled microscopy lies at the heart of ICDDR,B research efforts, led by Mafizuddin Ahmed, senior research officer, clincal pathology.



disciplines cooperate on as many problems as possible. As part of a major effort to do so we have broadened the scope of our Matlab data base and updated our crucial census and demographic data.

At the same time, at the request of the Bangladesh Government, we are preparing to transfer to four other areas of the country some of the more successful aspects of the Matlab maternal-child health/family planning project. This is perhaps one of our proudest accomplishments, for it means we are fulfilling what has been a major goal of both the ICDDR,B and its predecessor Cholera Research Laboratory: that of providing the best possible health services to the people who make our research possible.

In 1982 the ICDDR,B expanded the year-old Urban Volunteers Program, wherein poor, illiterate and semi-literate slum women are taught to work as diarrhoeal disease volunteers in ther own communities. Working in 11 Dhaka slums in 1982, 158 volunteers treated about 1,500 patients a month, by administering ORS to mild and moderately dehydrated patients. Severe cases were referred to the hospital. It is believed that, partly due to these women's efforts, patient visits to the Centre's Dhaka Treatment facility went from 78,822 in 1981 to 73,924 in 1982. Also, thanks to improved patient care, deaths at the hospital dropped from 401 the previous year to 323 in 1982.

In a related attempt in 1982 to better serve the people of Bangladesh, the Centre sought to more effectively fulfill one of its mandates: that of strengthening the abilities and facilities of Bangladeshi national research and health institutions; and making sure ICDDR,B activities never detract from or weaken local research and service. Accordingly, the Centre established a Project Coordinating Committee, to encourage the types of cooperation with Bangladesh institutions that will improve national research efforts for the people of Bangladesh.

Partly with such a goal in mind, we vigorously expanded and improved our training efforts, which had been almost nil in 1979. Thus, we trained more than 1,000 public health officials and medical personnel – mostly from Bangladesh and other developing countries – in technical and research aspects of diarrhoeal disease prevention, diagnosis, treatment and cure. Furthermore, as a collaborating centre in the WHO Control Programme for Diarrhoeal Diseases, the ICDDR,B conducted three, 12-14 day inter-regional training courses attended by a total of 51 doctors and microbiologists from 12 Asian nations, as well as from Sudan and Turkey.

Among its other training activities, the Centre ran 33 weekly lectures by eminent scientists from the ICDDR,B and abroad and collaborated in short-term consultancies with several countries.

Finally, in its first major international outreach effort, the Centre began getting involved in major projects in other developing countries. First, an ICDDR,B team spent two months in Aceh, Indonesia, helping government health workers establish a system for identifying and controlling cholera epidemics. Second, the Centre and the Kingdom of Saudi Arabia finalized a technical collaboration agreement, whereby the ICDDR,B will help set up a centre for clinical, laboratory and field activities aimed at diagnosing and treating diarrhoeal diseases. Finally, cooperating with Kenya, an ICDDR,B team compared the types of rotavirus existing there with those in Dhaka; and, at the request of the Chinese Government, another team visited there to define possible areas of cooperation.

Turning our eyes to the future as we enter year four of our five-year plan, we are carefully examining the findings and suggestions of a 7– member External Scientific Review Committee that performed in 1982 the first of what will be bi-annual critiques of the Centre, and the subsequent suggestions of the ICDDR,B Board of Trustees, who conducted their own in-depth review using the external reviewers' comments. Their invaluable recommendations provide a platform for formulation of a new Five-Year Plan.

Finally, while extensive planning for the future lies ahead, the broad outlines of what the ICDDR,B needs to better fulfill its mandate already are in view. Thus, adhering to some of our more crucial requirements, we must:

**Continue upgrading our microbiology, immunology and epidemiology, to ensure our capacity to test the effectiveness of a new generation of oral vaccines and other interventions against diarrhoeal diseases.*

**Improve our capacity for operational health services research, to permit valid judgments of effectiveness when technically proven interventions enter the health care systems of developing countries.*

**Pursue the path opened by observations on cereal-based ORS, to assure early and wide application of this least costly, most effective home-based therapy*

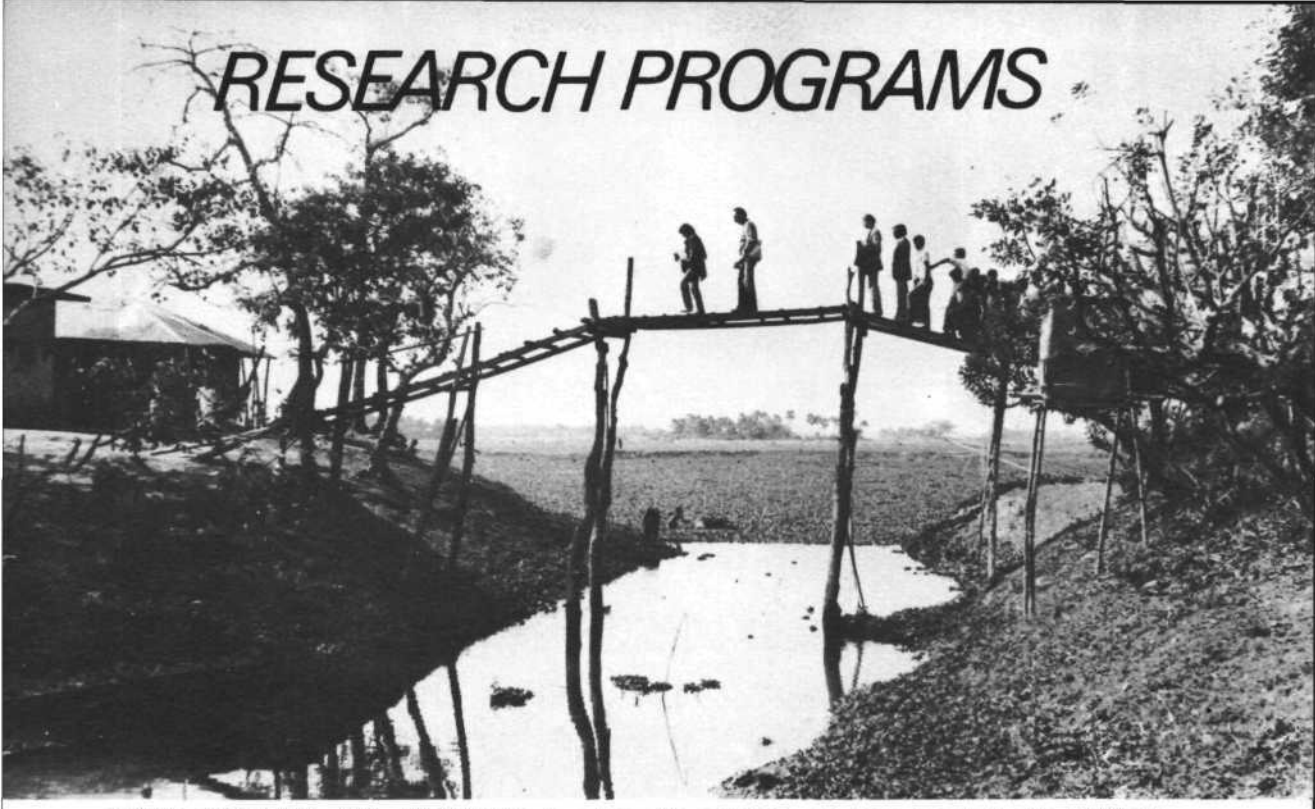
**Further explore sampling and surveillance methodology applicable to developing country settings.*

**Focus our training efforts on improving the research capacity of participant countries as they seek solutions to their problems with diarrhoeal diseases.*

**Give attention to the complications of diarrhoea, especially respiratory infections which now cause the majority of deaths in treated diarrhoea patients.*

**Seek further ways to improve nutrition in those attacked by diarrhoea, by learning more about the basic interaction between diarrhoea-causing organisms and digestive system functions.*

RESEARCH PROGRAMS



TAKING RESEARCH AND TREATMENT to where the problems are most prevalent, the ICDDR,B maintains four sub-centres strategically located throughout its approximately 25 square-mile Matlab Demographic Surveillance Area. At the bridge crossing leading to a sub-centre is an example of the realities that help perpetuate the spread of diarrhoeal diseases : a latrine emptying into water used for bathing, drinking, etc.

PATHOGENESIS & THERAPY

The overriding concern of this group is to gain a better understanding of the mechanisms (pathogenesis) whereby diverse organisms produce infections leading to diarrhoea; and to use such knowledge to devise effective preventives and treatments.

To comprehend the implications of these efforts three things must be clear: the relative importance of various disease-causing bacteria, viruses and parasites; the fact that there are two classes of diarrhoea – dysentery and watery diarrhoea; and the fact that diarrhoeal agents cause one of three types of disease : invasive, non-invasive or secretory, and something in-between.

While dozens of diarrhoeal disease agents exist in all countries, some are especially prevalent and damaging, particularly in poor, developing nations.

In Bangladesh and most Third World countries, four of the major diarrhoeal agents include three bacteria: *Vibrio cholerae, E. coli* and *Shigella*, and a virus called rotavirus. Also important are another bacterium, *Campylobacter*, and two protozoa that cause the diarrhoea

illnesses amebiasis and giardiasis. Moreover, a virus called the Norwalk agent is becoming increasingly recognized as an important diarrhoeal agent; as is *Salmonella,* an important diarrhoea-causing bacterium in developed countries that gains significance in developing countries as they get richer.

Finally, other, rarer infectious agents increasingly are being detected, such as *Vibrio parahaemolyticus*, the NAG group, *Aeromonas* and *Plesiomonas*.

Some of these diarrhoea agents, most notably a group belonging to the dysentery variety, are "invasive" organisms: they penetrate the intestinal lining, where they do considerable damage, which leads to blood and mucous in the stool – or dysentery diarrhoea.

Other diarrhoeal agents, such as various strains of cholera and *E. coli*, are "non-invasive": they produce toxins or poisons. These do not destroy the intestinal lining, but cause fluid production which, in turn, leads to the second type of diarrhoea: a watery one with no blood or mucous.

One more point is crucial. No matter which agent causes it, diarrhoea's first threat to humans is that it dehydrates the body, depriving cells of essential fluids and minerals. Severe dehydration ultimately causes death from shock. This is easily prevented by ORS, except in the most severe cholera patients.

With this background, we now can turn to the research of the Pathogenesis and Therapy Working Group, comprised of seven scientists with doctorates in medicine, who are engaged in clinical research into diarrhoeal diseases. Their sub-specialty interests include infectious diseases, gastroenterology, pediatrics and community medicine.

Pathogenesis

The main emphasis in 1982 was to learn more about the disease mechanisms of such 'invasive' diarrhoeal diseases as shigellosis, amebiasis and other forms of dysentery – for the bacteria that cause these diseases are among the most dangerous of the "enteric" (intestinal) pathogens.

For example, in one autopsy study of 50 diarrhoeal disease victims ICDDR,B researchers found in 1982 that *Shigella* and *E. histolytica* were the most common pathogens related to the fatalities, followed by *Campylobacter* and *V. cholerae*.

Additionally, the autopsies showed two other important things. First, a bacteria, *Yersinia intermedia,* not known to cause diarrhoea but possibly dangerous, was detected for the first time in Bangladesh. And second, most of the fatal diarrhoea-related cases were complicated by non-intestinal diseases, including pneumonia, septicemia, hypoglycemia, Reye's syndrome, and necrotic enteritis following circulatory failure. More about these two findings later.

Shigellosis

Turning to one of their major research projects, PTWG scientists focused on invasive shigellosis. For while extensive research has been done and much is known about the disease mechanism of non-invasive *V. cholerae,* little is known about such an important invasive intestinal agent as *Shigella*.

What is known is that *Shigella* primarily affects the colon. And while it's suspected that the bacteria interfere with the colon's ability to absorb water, this remains to be proven.

In work continuing in 1983 PTWG scientists began the first major study of colonic dysfunction in shigellosis. Their work has been greatly enhanced by fiberoptic endoscopes donated by the Japanese Government. The instrument is a very sophisticated medical periscope. It consists of a long, flexible tube which bends back and forth, allowing a powerful light beam to illuminate a major part of the intestines, and transmit images back to the operator's eye.

Researchers thus can visualize the approximately three feet of the small intestines up to the appendix – thereby seeing the precise location of ulcerations. One finding: the extent and severity of ulcerations depend on the duration of shigellosis.

Simultaneously, the scientists have been studying the colon's function, by using dyes and sampling colonic fluids. By understanding colonic function and the nature and extent of the disease, the scientists ultimately hope to learn how to better treat shigellosis.

Shigellosis Complications

In related work, the PTWG researchers studied an often fatal shigellosis complication, "hemolytic-uremic syndrome". The disease affects many children under age four, who have a severe form of shigellosis and who are malnourished. The complication occurs late in the disease, as the dysentery seems to be improving. Red blood cells in the kidney are destroyed, fibrous clots form in kidney blood vessels – leading to acute anemia and kidney failure.

Seeking to learn what host factors contribute to development of the disease, the researchers produced the kidney syndrome in rabbits injected with a *Shigella* bacteria extract. This work is continuing.

Yersinsia's Importance

As for the newly discovered *Yersinia intermedia*, PTWG researchers, collaborating with their colleagues in the Disease Transmission Group, began studies in 1982 that were continuing in 1983. For while *Yersinia intermedia* is not a known diarrhoeal agent, another type of *Yersinia* does cause diarrhoea in other countries. Any *yersinia* may be dangerous, for one of two reasons.

First, *Yersinia* is an "invasive" bacteria that sometimes gets into lymph nodes and hence into the bloodstream, where it can cause severe abdominal pain and fever, mimicking appendicitis. This may lead to unnecessary appendectomies, particularly dangerous in developing countries, where surgical facilities often are inadequate.

The second concern about *Yersinia* is that in the two cases from which it was isolated in Bangladesh, *Yersinia* was found along with fatal pneumonia and fatal sepsis, or blood poisoning. One of the things now being looked at is what possible connection is there between *Yersinia* and other disease killers. This is an important question...directly related to another PTWG research effort, and the other interesting finding in the 50 autopsies mentioned earlier.

DIARRHOEAL DISEASES MECHANISMS must be understood before successful vaccines and other treatments can be developed. Animal tests are crucial; and the ICDDR,B's Animal Laboratory has been cited as one of the world's finest.

Parenteral Diarrhoea

For diarrhoeal illnesses often co-exist with other diseases; and which came first is unknown. The answer may be important. For there's a possibility that when a severe disease exists outside the intestine a spill-over effect occurs. This would be "parenteral diarrhoea" – occurring outside the intestine and somehow causing a problem in the intestine, leading to diarrhoea.

This relates back to the fact that, for as many as one-third of severe diarrhoea patients, no intestinal pathogen can be detected in the stool. PTWG scientists speculate that, while a majority of such cases are caused by intestinal agents, some of those cases in which another major disease is seen may be examples of parenteral diarrhoea.

But that's not the end of the story. For a related disease mechanism may be involved in some serious diarrhoea cases where a pathogen has been found...which leads us to a related area of PTWG research.

Relation to Other Diseases

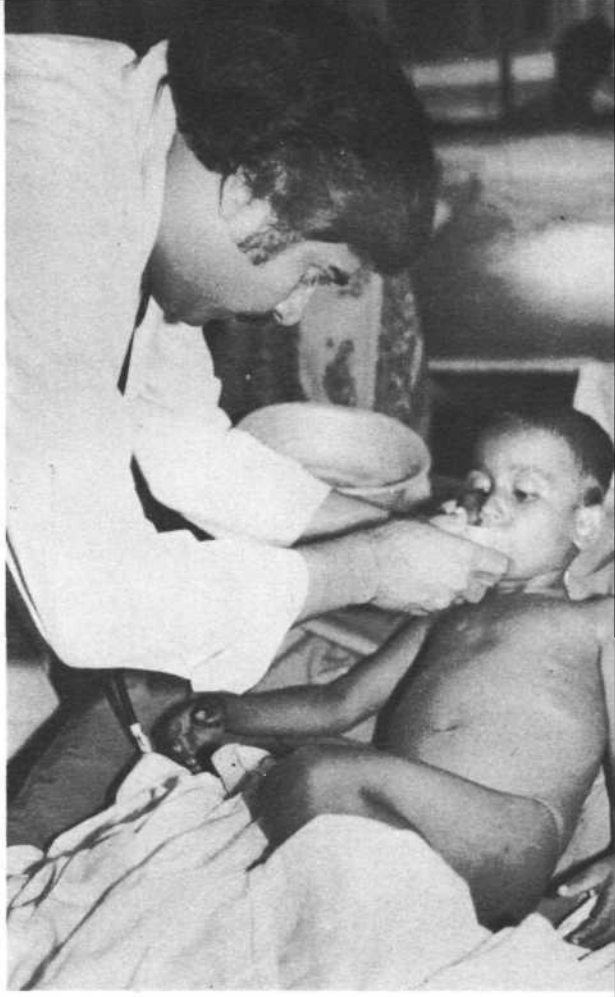
In 1983 PTWG researchers will continue studying possible relationships between such dangerous intestinal pathogens as *Shigella*, and such often fatal diseases as pneumonia, a liver disorder,and necrotic enteritis. For in previous autopsies of victims of *Shigella* and some other invasive diarrhoeas, the researchers found severe lung and liver damage.

Because severe diarrhoeal and other types of diseases often co-exist, it's quite possible, the scientists say, that a severe invasive diarrhoeal infection predisposes patients to pneumonia – or the other way around.

Typhoid Connection

In another study continuing in 1983 PTWG scientists are doing the first systematic research into the diarrhoeal complications of typhoid fever. While as many as one-third of typhoid patients have diarrhoeal complications, tvphoid has not been widely considered a diarrhoeal disease. However, experience in many developing countries shows that, especially in childhood typhoid, diarrhoea can be dangerous.

Thus far, the scientists have learned that for most typhoid patients with diarrhoea, the stool shows a type of diarrhoea somewhere between invasive and non-invasive–thus having some blood and mucous, as well as being watery.



ORAL REHYDRATION THERAPY (ORT) has been cited by the WHO and UNICEF as a major advance in Third World health treatments.

Therapy

Improved ORS

Also in 1983, researchers will study the possibility of further improving ORT solutions by substituting citrate salts for bicarbonates. The reason: in some developing countries citrate salts, which are alkaline, are more available than bicarbonates; and citrates may be more stable when placed in ORS packets.

Antibiotic Resistance

To deal with the problem of fluid losses in diarrhoea, especially cholera, that exceed the rate at which ORS can be taken, PTWG scientists continued their pioneering efforts to perfect an adjunctive therapy: the use of anti-secretory drugs. Having shown in 1979 that an anti-secretory medicine, "chlorpromazine," is effective in cholera, the most severe of the secretory or non-invasive diarrhoeas, the researchers began testing in 1982 three similar drugs.

One of these they found effective: nicotinic acid, a B vitamin.

However, more evaluation is needed of such drugs, as well as of other strategies, before use of anti-secretory drugs can be recommended. For the anti-secretory drugs thus far tested have significant side effects, including drowziness or flushing of the skin. The researchers would like to find similar, side effect-free drugs.

The Hospital

Most likely thanks to improvements in patient care early in the year, significant changes were seen at the Dhaka Station Hospital in 1982.

Compared to 1981, numbers of hospital patient deaths dropped considerably, from 401 to 323, for a diarrhoeal case fatality rate of 0·44 per cent. The rate was 0.51 per cent the year before. Also down was the total number of patient visits: 73,924 in 1982, compared to 78,822 in 1981.

However, 1,291 clinical research patients were admitted to the study ward, more than twice the number studied in 1981.

One patient care advance instituted last year was the new Dietary Care Unit. There, undernourished children are identified and given intensive feeding regimens that emphasize frequent feedings of milk and diets rich in protein and calories.

Another change was the provision of an Intensive Care Unit. There, critically ill patients are segregated into one area for more frequent monitoring of vital signs; and resusitative equipment is readily available.

Finally, some benefit to patient care may have been derived from a new post-mortem service, which brings knowledge about fatal illnesses to practicing physicians.

DISEASE TRANSMISSION

Despite intensive investigations by scientists from many disciplines, in about 30 per cent or more of diarrhoea cases seen by the Center no infectious disease-causing organism can be found.

Moreover, even for the recognized diarrhoea-causing pathogens, much more needs to be learned about how they are transmitted; how these disease agents interact with human hosts and the environment in which they survive and thrive; and about what can be done to combat them.

With these goals, the 5 scientists of the Disease Transmission Working Group are doing intensive studies in many related areas.

Causes

Given the fact that in about 30 per cent or more of diarrhoea cases seen by the Centre no infectious organism can be found, the Disease Transmission Program (DTP) made some important findings in 1982.

New Pathogens

For the first time it was shown that a new bacterium, *Vibrio mimicus*, is responsible for diarrhoea in Bangladesh.

Moreover, DT researchers found that two groups of previously known bacteria, *Aeromonas hydrophilia* and *Plesiomonas shigelloides,* are important pathogens in Bangladesh – apparently accounting for about two per cent of previously undiagnosed diarrhoeal incidents. Another microorganism, *Yersinia intermedia,* also was detected in patients.

Important Pathogen

Scientists in this group also continued studying *Campylobacter,* a bacterium known to be an important diarrhoeal agent in many countries. For in 1982 this pathogen was found in the stools of 14 percent of the diarrhoeal patients treated at the Centre – as well as in the stools of 7 per cent of healthy people examined.

While it is unknown how many of the diarrhoea cases seen were caused by *Campylobacter* (some stools also contained other pathogens) an important scientific question is being asked: "Through what mechanism does *Campylobacter* produce diarrhoea in some people, but not in others ?"

Seeking this answer, DT researchers fed infant chicks with *Campylobacter* taken from patients who had diarrhoea. It was found that 81 per cent of the chicks developed diarrhoea. The bacteria multiplied in the gut, causing fluid outpourings, as well as local intestinal and systemic invasion. Moreover, a negligible percentage of chicks fed with bacteria taken as controls from healthy *Campylobacter* carriers and from domestic animals developed diarrhoea.

Examining the blood of the recovered diarrhoea victims and healthy *Campylobacter* carriers, the scientists found a high rise in antibodies to *Campylobacter* only in the first group. In the second group antibodies were less frequently detected and did not show significant rise, thus supporting the disease-causing role of *Campylobacter* in diarrhoea.

Disease, Host & Environment

New Phenomenon

In a fascinating discovery with important worldwide inplications, ICDDR,B scientists in the autumn of 1982 detected a unique phenomenon during a three-month-long cholera outbreak. Nearly 10 years after it had been replaced by another strain and had totally disappeared from Bangladesh, a virulent type of cholera bacteria suddenly resurfaced here with a vengeance.

Within three months the emergent "classical" strain caused a major epidemic in five separate areas of Bangladesh. Moreover, "classical" replaced its predecessor strain "El Tor" as the main cause of cholera — at least momentarily.

The phenomenon caused a stir in scientific circles. For while El Tor had replaced classical cholera in many countries, the reverse had never happened. Thus, once replaced by El Tor, classical never had reappeared anywhere, except for a few isolated cases in a part of India near Bangladesh.

While both cholera types are dangerous, the newly-emergent classical strain causes more severe illness. For this and other reasons the unique occurrence raises vital questions about how and why it happened. Of utmost interest is whether classical cholera bacteria have changed, acquiring new, crucial biological characteristics that give it advantages over the El Tor variety that once pushed it into oblivion.

This issue is critical. For if classical could adapt and change in one place it might do so elsewhere. Furthermore, an understanding of the mechanism of such a change may provide a key in the struggle to control the global spread of cholera.

In 1983, ICDDR,B scientists began investigaing the implications of this vital discovery.

Rotavirus

Studying the transmission of "rotavirus," one of the most important infectious diarrhoea agents of children in both developed and developing countries, DT scientists discovered a possible clue that might help explain how rotavirus outbreaks may occur in children's hospitals. It has been known that rotavirus is transmitted by the faecal-oral route. Centre researchers collected the water used to wash the hands of hospital attendants who cared for children with diarrhoea caused by rotavirus and other infectious agents.

The finding: rotavirus was detected more frequently in the hand washings of the attendants of rotavirus patients than in the hand washings of attendants of children with diarrhoea caused by other pathogens (78.6% versus 19.5%). This may implicate the role of hands in transmission of rotavirus.

Transmission (DT) scientists are working on a "live oral vaccine"—one which would be taken by mouth, and would contain a non-disease-causing, genetically engineered variety of cholera bacteria.

If it worked in humans, this engineered strain of cholera would not cause diarrhoea, but would

HYGIENE EDUCATION, conducted by Centre field workers, is a crucial factor in the campaign against diarrhoeal diseases.

Disease Intervention

Vaccine Studies

In one of the most exciting areas of research at the Centre, scientists will continue in 1983 their attempts to develop an effective cholera vaccine — since other ICDDR,B scientists previously have shown that a widely-used existing cholera vaccine works with only limited effectiveness.

Cooperating with Scientists at Harvard University and the University of Maryland, Disease stimulate the production of protective antibodies against cholera.

With this aim, a collaborative study with Harvard University in 1982 sought to produce a non-toxic cholera strain, which could be a candidate for a live oral vaccine. The method used a cholera-specific virus (a phage) to infect live cholera bacteria. The phage alters in a specific way the gene that produces cholera toxin, leaving live bacteria that are incapable of causing disease but produce the immunizing, non-toxic 'B-Subunit" of cholera toxin.

Taking this immunizing, non-toxic "B-Subunit." DT researchers continued in 1982 to study the possibility of using it to prevent or minimize the spread of cholera within families having very close contact with cholera patients.

Working with families where at least one cholera case had been detected, the researchers' preliminary findings showed that: 1) people receiving B-Subunit develop a favourable" cholera antibody reaction (of still undetermined proportions); 2) still, about 30 per cent of family contacts who received B-Subunit became infected with cholera, either as patients or carriers; and 3) half of those thus infected developed cholera. This was lower than a comparison group, but the significance is yet to be determined.

Other preliminary conclusions were that: 1) people having blood group O are at increased risk of developing cholera; 2) severely malnourished children show no increased risk of getting cholera; and 3) breast milk antibodies to cholera seem to protect breast-fed babies against getting ill from cholera – but not against becoming cholera carriers.

Environment

Disease Transmission researchers also continued studying the seasonal occurrence in different aquatic environments of a bacteria related to cholera, called *Vibrio parahaemolyticus*. They discovered a good correlation between *Vibrio parahaemolyticus* bacteria, and a certain combination of water temperature and amount of salt, dissolved oxygen and aquatic plants.

Their findings may have useful implications for future studies of the ecology and survival of cholera in Bangladesh. The work is a collaborative effort with Dr. Rita Colwell, University of Maryland.

Latrines

Finally, the researchers looked at how effective community latrines are in preventing the spread of intestinal pathogens. They studied two communities where the inhabitants were of similar socio-economic backgrounds. In one, people used community latrines. In the other they used the landscape.

DIARRHOEAL DISEASES are spread by failure to wash hands after "answering nature's call" before eating, drinking, etc.

The finding: The communities had about equal rates of diarrhoeal incidences. The conclusion: latrines alone are not enough to prevent the spread of infectious diarrhoeal diseases. Much broader hygienic measures are necessary, including education about personal hygiene, etc.

HOST DEFENSE

In addition to identifying diarrhoeal disease agents, and studying their nature, disease mechanism, means of transmission and how they may be combatted, scientists must ask, "How does the human body respond to the onslaught of such disease agents? and, "What human factors predispose some people more than others to contracting such serious illness?"

Mice and Men

In basic work on animals to learn more about how the immune response works, one researcher studied the cellular immune response in mice that were injected with live cholera bacteria taken from humans.

Unlike humans, mice do not become ill with cholera. However, challenged by cholera bacteria, a mouse's immune system develops antibodies. Since the immune systems of mice and men are very similar, much can thus be learned about the immune mechanism.

Cholera Immune Studies

In related work, HDWG scientists learned that, during the course of their disease, cholera patients develop antibodies against both cholera toxin and LPS (lipopolysaccharide, structural substance of the bacterial wall). Patients given adequate fluids to replace what they lose usually recover in less than a week. These survivors have developed in their intestinal tracts high levels of antibodies, that protect against future cholera infections.

The objective of vaccine development is to find living bacteria or products of bacteria that elicit an immune response mimicking the immunity acquired during a disease. Therefore, in 1983, HDWG scientists are measuring, after various infection intervals, antibodies against cholera toxin and LPS antigen to cholera bacteria found in the stool and intestine.

Cow-Based Immunity ?

HDWG researchers in 1982 tested whether cholera patients can be effectively treated with antibodies "manufactured" by a cow. For although antibodies in human mothers' milk would be best, the cow would be a possible important proxy, should this form of protection turn out to be viable.

Pregnant cows injected with cholera toxin do not get the disease, but produce very high levels of cholera anti-toxin. These antibodies are found in large quantity in the cows' "colostrum" – the milk produced in the first few days after giving birth.

The researchers are testing whether this colostrum will inactivate cholera toxin in patients who drink the milk. Furthermore, if the colostrum works in the treatment of cholera, the scientists believe it may be possible to develop similar treatments – or possibly preventives — for other diarrhoeal diseases.

Shigella & Blood Poisoning

Also studied was "Shigella sepsis," a disease that occurs mostly in malnourished children, and has a high fatality rate. Because different people react very differently to *Shigella* infection, this study sought to determine why one individual can die from the disease and another not even show symptoms.

Role of CFAs.

Collaborating with Swedish investigators, HDWG scientists studied *E. coli* bacteria and something called "colonizing factor antigens" (CFAs). For with *E. coli,* as with cholera, the first step in infection involves the bacteria attaching themselves to the intestinal lining. CFAs are surface molecules found on some bacteria that allow the organisms to gain a foothold in the host.

In this work, the researchers detected CFAs on certain strains of *E. coli* taken from the stools of diarrhoea patients. The study is continuing to determine the extent of CFA existence, whether CFAs occur together with toxins produced by the bacteria, whether CFAs play a role in producing the disease, and whether the body manufactures antibodies against CFAs.

The ultimate goal might be to produce a CFA – containing vaccine that would trick the body into making antibodies against CFAs.

NUTRITION

Diarrhoea and malnutrition seem inextricably intertwined. The Nutrition Program's broad goals are to unravel the ways in which diarrhoea leads to malnutrition, and to discover how malnutrition modifies the course and outcome of diarrhoea.

To achieve these aims, Nutrition Working Group (NWG) scientists undertook three types of research programs.

*Hospital-based projects, aimed at understanding the pathophysiology of digestion and absorption in diarrhoea that is accompanied by malnutrition. The ultimate goal is to be able to more effectively treat diarrhoea in severely malnourished children.

*Community-based studies of culture and food beliefs and practices, designed to comprehend the complex set of factors affecting the nutritional status of mothers, infants and children.

*Intervention studies, focusing on how to: 1) prevent nutrient loss caused by repeated diarrhoea attacks; 2) increase food intake during and after diarrhoea; 3) rapidly rehabilitate malnourished children in the wake of diarrhoea; and 4) reduce high infant mortality, by improving maternal and child health services, during pregnancy, lactation and infancy.

Cereal-Based ORS

In important continuing work aimed at improving the make-up of the already highly successful Oral Rehydration Solution, NWG scientists have been comparing the currently-used glucose or sucrose-based ORS to a rice-based, calorie-dense one.

Extremely encouraging initial findings show that 1) the rice-based ORS is more effective than its predecessor, by providing significantly higher calories, while simultaneously reducing stool output during severe cholera. 2) Field tests show people more readily accept the new ORS preparation than the old one.

Seeking to determine villagers' beliefs, knowledge about and attitude towards use of rice in general and as a diarrhoea therapy, the researchers learned that certain traditional beliefs about rice will enhance rapid acceptance, if taken into account. For example, many different rice preparations are believed to have a therapeutic "cooling" effect on the "hot" diarrhoeal stomach. The traditional local varieties of the post-monsoon rice called "aman" are considered most suitable for diarrhoeal patients, whereas high yielding variety IRRI rice is believed to be injurious in diarrhoea cases.

These findings are now being used to devise a training manual for promoting rice-based ORT. Other cereals now are being investigated for use in wheat, maize or potato-eating countries.

Gut Transit Time

NWG researchers also sought to test the widely-held hypothesis that one of the main reasons fewer nutrients are absorbed by the intestine during diarrhoea is that food passes through too swiftly.

To determine food transit time, the scientists fed charcoal marker tablets to 68 patients, during and after acute diarrhoea episodes due to cholera, *Shigella*, rotavirus and *E.coli*. Using charcoal presence in stools to pinpoint food transit time,

they then looked for a relationship between transit time and absorption of carbohydrates, fats, nitrogen and calories. While total transit time was considerably shorter than when a person does not have diarrhoea, they found no statistically significant relationship between transit time and absorption of any nutrients.

Their conclusion: as substantial nutrient absorption does occur, continued feeding should be part of diarrhoea therapy, even during the acute stage when transit time is short.

Protein Malabsorption

In related work, protein malabsorption during and after acute diarrhoea of different causes was studied. One finding was that, for infections caused by *E.coli* and *Shigella*, the absorption status of nitrogen did not improve, even two weeks after recovery from diarrhoea.

Further studies are underway to estimate the extent, duration and significance of such protein loss during diarrhoea caused by these two important infectious agents.

BREAST MILK has been shown to contain antibodies which reduce the severity and frequency of certain diarrhoeal diseases in breast-fed babies.

Diarrhoea, Vitamin A and Blindness

In many developing countries, blindness caused by vitamin A deficiency is a serious public health problem. Experience suggests that most blindness due to vitamin A deficiency is associated with or preceded by diarrhoeal illness.

With this in mind, NWG scientists examined the prevalence of visual defects – especially those associated with nutritional deficiencies and diarrhoea. They found an extremely high correlation among diarrhoea, vitamin A deficiency and blindness.

Every household in 149 villages (population 186,200) was visited and residents were asked to bring in all people with eye problems.

Nearly 548 people per 100,000 were found blind or going blind – due to a sequence of events that is caused by vitamin A deficiency, and starts with night blindness, leading to dryness of the cornea (xerophthalmia), corneal ulcer (or opacity) and, finally, to a corneal scar (keratomalacia).

Moreover, the two early stages of this type of blindness also were prevalent: another 166 persons per 100,000 had night blindness; and still another 171 persons per 100,000 had corneal dryness – 90 percent of them also had diarrhoea.

Nearly half of all corneal scarring victims (near total or total blindness) were aged 1-to-4; and about 12 per cent of corneal scarring was associated with diarrhoea.

Finally, females had lower rates of both night-blindness and corneal dryness than did males – meaning they had less severe vitamin A deficiency. Work is continuing to learn why males were more vitamin A deficient; and why night blindness is prevalent among young adults in Bangladesh and other developing countries.

CAN CHILDREN'S nutritional and disease status be improved by providing clean tube well water and education about sanitation and health ? This question is under study at the Centre's Teknaf field station.

Vitamin A Absorption

In related work, NWG scientists sought to learn whether vitamin A absorption is impaired during acute diarrhoeal episodes due to diverse causes. Thirteen children with acute diarrhoea were fed a specific amount of vitamin A both during acute episodes and after recovery. Vitamin A levels in their blood were compared for the two test stages.

The finding: during both acute and recovery stages of diarrhoea, blood levels of vitamin A were significantly up after children took oral vitamin A.

This discovery is very important to national health leaders in developing countries, where malnutrition and diarrhoea are so prevalent. For prompt vitamin A administration during diarrhoeal episodes would prevent nutrition-caused blindness.

Studies are continuing, aimed at fortifying ORS with vitamin A, to be given to children suffering from acute diarrhoea.

Diarrhoea and Malnutrition

In this study, 551 children, aged 3 months to 3 years, were followed up for 12 months after being treated for diarrhoea at a rural ICDDR,B center.

The children had significantly more illnesses and deaths than the populace as a whole. The first three months appeared to be very crucial, for 70 per cent of total deaths among these children occurred then. Moreover, the more malnourished the children, the more likely they were to get ill or die. The highest death rates were in the second year of life – with deaths claiming one-third of severely malnourished children and one-tenth of the moderately malnourished.

The conclusion: nutritional rehabilitation is vital for malnourished children who get diarrhoea.

Breast Milk Protection

It's long been known that breast feeding protects infants from many illnesses. Examining children in an area where prolonged breast feeding is common, NWG scientists sought to learn two facts: whether breast feeding alone or with supplements maintains normal growth levels; and whether diarrhoeal incidences differ for children fed only by breast and for those who get breast milk plus supplements.

Two hundred rural children, from birth to age three, were studied over three years. Height and

weight measurements were made every month for the first year, and quarterly thereafter. Feeding patterns were recorded monthly and diarrhoeal incidences semi-monthly.

The findings: up to age 18 months, children fed only breast milk had a slightly larger monthly weight gain. Also, the average weight of the two groups together paralleled the international standard up to age four months. Thereafter, growth velocity for both groups fell compared to the standard.

During the first two years of life children fed only by breast had slightly fewer diarrhoeal attacks. The average was four episodes a year, lasting 16 to 20 days.

Culturally-Based Nutrition Education

Aiming to improve young children's diets by more effectively educating mothers in nutrition, NWG scientists began a two-year research-cum-action project. The goal: to learn what cultural factors limit the food intake of 5-to-24-month-old children; and then to devise effective nutrition messages to be used in the study community.

Cooperating with the Bangladesh Government, the scientists have begun studying about 400 children and their mothers, in the first part of a four-stage effort. A questionnaire is being used to collect data on illnesses, incomes, food availability and a host of other factors influencing what children are fed. In addition, for the 400 children measurements are being taken of their height, weight and arm circumference.

Next, an in-depth study will be done in the households of 100 of the children, to learn about food beliefs, as well as maternal tasks and child feeding habits. Third, using the data obtained, an attempt will be made to develop effective, practical messages to convince mothers to provide better nutrition.

Finally, the nutrition messages will be evaluated, by comparing the growth curves between the 100 subjects and 300 controls, and by comparing child feeding behaviour. If the program proves effective, plans will be made to implement it throughout Bangladesh.

Teknaf

Under the direction of the Nutrition Group, the ICDDR,B maintains a nine-year-old research station-cum-diarrhoeal treatment center at Teknaf, at the southeastern tip of Bangladesh. Initially funded by UNICEF, the facility now is partly supported by the International Development Research Centre (IDRC), Canada.

The ICDDR,B became interested in Teknaf when its researchers were called in to help control in 1973 a widespread epidemic of a virulent and often drug-resistant type of dysentery. Even today, dysentery is a major infectious disease in the Teknaf area – as opposed to cholera, the critical diarrhoeal disease causing epidemics in the Matlab area.

Moreover, Teknaf area birth and infant mortality rates are among the highest in Bangladesh, among a populace that is very religious and conservative. The ICDDR,B believes there is potential to improve the health of Teknaf residents – by monitoring disease and death rates; providing diarrhoea diagnosis and treatment; introducing education about nutrition, water use and hygiene; providing some sanitation facilities; and encouraging family planning.

To implement these aims, the researchers are using invaluable data collected for nine years, and are studying the effects of tubewells and latrines.

Continuing their studies in 1982, trained Community Health Workers (CHWs) every week or two visited each household in a 50,000 population area. They collected demographic information, as well as data on the prevalence of diarrhoea and other infectious diseases.

Moreover, two clinics, at Teknaf and an outstation, provided free treatment for diarrhoea; and, backed by a small microbiology laboratory, diagnosed diarrhoea causes.

COMMUNITY SERVICES RESEARCH

The backbone of the Community Service Research Working Group (CSRWG) is its Demographic Surveillance System (DSS) – a unique demographic resource in Asia, and the most comprehensive developing country profile of its kind.

The on-going goal of the DSS is to obtain reliable information about diverse changes in a community over time. Such data provides a unique foundation for monitoring many things – such as the inter-relations among such variables as infectious diseases, health care, death and disease rates and causes, nutrition and family planning.

The CSRWG has two main goals. The first is to do basic research on the bio-social determinants of health, disease and fertility. Such studies attempt to assess how disease, death and fertility are affected by complex factors, including socio-economic status; nutrition; hygiene and general education levels; and religious and other beliefs and taboos.

The second aim is to attempt to improve the health of big populations by instituting large-scale community projects – while taking into account such important factors as effectiveness, hazards, community acceptance and applicability; to monitor any problems; and, finally, to determine the ultimate value of such efforts by results.

To understand how the CSRWG pursues these objectives some background about the DSS is necessary.

DSS History

In 1963 the Centre (then the Cholera Research Laboratory) started a small-scale DSS in 23 villages (total population 28,000) near Matlab Thana, Comilla District, about 45 kilometers southeast of Dhaka.

The system combined periodic censuses of the study population with continuous registration of such "vital events" as births, deaths, marriages, divorces and migrations.

In 1966 a census was conducted in what had been named the Matlab Demographic Surveillance Area, encompassing 110,000 people in 132 villages. In 1968, 101 adjacent villages were added to the system, approximately doubling the census area population. Subsequently, the study area was reduced so that, by the 1982 census, it encompassed about 180,000 people in 149 villages.

Before describing the Matlab experiment one point is noteworthy: In view of its unique data base, Matlab has been selected by the U.N. Population Division and WHO Global Epidemiological Surveillance and Health Situation Assessment section as one of five areas in the world where extensive mortality studies will be done.

The Matlab Experiment

To achieve the extensive research goals that lie at the heart of the DSS system, the Matlab DSS area has been divided into two major sectors: "treatment" and "comparison" areas, each with about 90,000 inhabitants. In both areas extensive and intensive collection of vital registration data is done on a continuing basis. In the treatment area trained "community health workers" (CHWs) dispense a wide range of contraceptive devices and give advice about family planning; and the CHWs carry ORT packets to help diarrhoeal victims. The comparison area receives the services of both the government health system and of indigenous practitioners; and acts as a scientific control for the impact of community health workers.

A 50-BED TREATMENT-CUM-RESEARCH CENTRE lies at the heart of the ICDDR,B's Matlab experiment.

In the treatment area, the ICDDR,B operates a 50-bed research center-cum-hospital, mainly designed to monitor the incidences and pinpoint the causes of diverse diarrhoeal diseases. The hospital also treats the diarrhoeal diseases of all patients – those coming from all areas, including "the comparison" area and neighbouring communities.

Treatment Area

At the heart of the treatment area lies the hospital/research center, staffed by five full-time doctors, five nurses and a few aides.

While the hospital mainly treats diarrhoeal disease patients, it also has a female doctor responsible for the ICDDR,B's Maternal-Child Health Family Planning (MCH/FP) program. This program is designed not to treat all major diseases, but to concentrate on the major child killers that can be effectively treated or prevented: diarrhoea, measles, neo-natal tetanus and prevention of maternal death in childbirth.

Before 1982 services provided in the treatment area were oral rehydration therapy; tetanus toxoid immunization; iron supplements and nutritional advice for all pregnant women; and instruction in and devices for all forms of family planning.

In 1982, the treatment area itself was divided into two parts, in order to test the effectiveness of expanded treatment efforts. In one half, treatment was extended to include tetanus immunization for *all* women of reproductive age; measles immunization for children under age five; high risk pregnancy screening; distribution of safe birth kits; and training of traditional midwives to enhance their skills.

Sub-Centers

Also important is the fact that within the treatment area the Matlab center operates four sub-centers. Each is run by a government-accredited woman paramedic, who has 18 months training in MCH/FP activities. The four paramedics, who report to the woman doctor at Matlab, provide the basic health care treatment to patients coming to their sub-centers.

Working under the paramedics at each sub-center are 20 women community health workers" (CHWs). Initially trained for three weeks to collect demographic information about births, deaths, pregnancies, illnesses etc., to treat diarrhoea with ORT and to dispense iron tablets and give nutritional advice to pregnant women, the CHWs are constantly re-trained every two weeks – until they have a repertoire of health and family planning-related activities: mainly the ability to treat scabies, to give tetanus and measles immunizations, to provide dewormers, to treat diarrhoeal episodes with ORT, and to provide advice about and devices for family planning.

Attendance at these sub-centers is good. For example, from March to December 1982 the four sub-centers treated a total of 1,363 children under

age five, as well as 243 pregnant or lactating women. Moreover, during that period, 2,026 women came for contraceptive-related reasons. In addition, the CHWs made 3,000 household visits every two weeks.

AMBULANCE BOATS, operating round-the-clock in the DSS treatment area, bring critically ill diarrhoeal patients to the Matlab Hospital or one of its sub-centres.

Comparison Area

In this area, 30 CHWs, who have at least an eighth grade education, each visit 500 households weekly. While their main duty is to collect vital registration data and to handle family planning, they also carry ORT packets. However, unlike their treatment area counterparts, these CHWs are not trained in primary health care. If they find someone very ill, they often refer the person to the Matlab hospital.

Finally, in both treatment and comparison areas, the ICDDR,B employs a group of "health assistants" and "senior health assistants." They are responsible for supervising the CHWs in collection of demographic data and surveillance of diseases, as well as for providing logistical and administrative support to the overall research effort.

Other Activities

In 1982, the Community Services Research Working Group significantly updated its DSS data covering both the treatment and comparison areas, and computerized the information – broadening the data base that is invaluable for current and future efforts.

Completed was a socio-economic survey of such important health-related variables as use of water and latrines; educational levels; housing types; and numbers of possessions, including land. Using similar previous surveys of the same large groups of people, efforts now are being made to determine how diverse changes – including health intervention efforts – have affected illnesses and deaths over time.

In related work, crucial data on "vital" events and illnesses was compiled, thanks to the "lay reporting" efforts of CHWs. This data is important for monitoring the impact of primary health care, since it is unlikely that medical certification of disease or cause of death in rural areas will be available for developing countries, for a long time to come.

In another effort, the CSRWG began an in-depth study of variations by area in contraceptive practices, as well as beliefs and practices related to the care and feeding of pregnant women and newborn babies. The study will use field workers, not questionnaires, to assess what socio-economic and other factors affect health and mortality. The ultimate aim is to determine what factors work for and against a community's willingness to accept MCH-FP components.

On another front, examining DSS data from 1966 to 1981, the researchers pinpointed some of the Matlab treatment area's successes. Clearly seen are a significant drop in newborn and infant deaths after 1978; as well as drops in birth and death rates for the Matlab area as a whole. Thus, the crude birth rate per 1,000 inhabitants for the entire area declined over the 15 years, from 47 to just below 40 (being 35.3 and 43.8 for the treatment and comparison areas, respectively); the corresponding death rates for 1981 were 11.9 and 14.4, compared to 12.1 and 15.6 in 1979.

Finally, during 1981 and 1982 census books for the Matlab areas were updated. And, between April and June, 1982 a complete re-census of the study population was undertaken, including a socio-economic survey of individual households.

Matlab Treatment-Research Center

In 1982 the Matlab Diarrhoea Treatment Centre cared for 11,054 patients with diarrhoea. Of these, 3,755 (34 percent) came from within the DSS area, while 7,299 (66 percent) came from outside the area. The Matlab microbiology laboratory did routine stool cultures for all DSS area patients, looking for cholera, NAG, *Shigella* and *Salmonella*. They found that 26.5 per cent of the cases were due to cholera, 5.1 to NAG, 8.2 to *Shigella* and 0.4 to *Salmonella*.

As to its maternal-child health program, the Treatment Center in 1982 expanded its tetanus immunization effort, to cover all women of childbearing age. During the year, 7,092 women were immunized against tetanus.

Upgrading its measles immunization efforts, Matlab vaccinated 5,765 children. Moreover, extensive worker training was done to make sure measles vaccine is kept cold throughout the entire time from its receipt to its use.

In other efforts, 550 safe birth kits, prepared at the sub-centers, were distributed to pregnant women. And, intensifying high risk pregnancy screening, Matlab CHWs detected 65 serious cases. Five were referred to bigger hospitals, while the rest were treated at Matlab or one of the sub-centers.

As to ORS packets, most production was decentralized to the sub-centers, under the supervision of the paramedics. During the year, 170,000 one-liter and 4,940, ten-litre packets were produced, and almost all were distributed.

Finally, looking at the overall picture, during 1982 the Matlab central MCH/FP effort and that of its four sub-centers treated a total of 4,556 women and children for various ailments, including medical back-up services for contraceptive side-effects. And, crucially, during two major cholera outbreaks, thousands of lives were saved throughout the Matlab area.

TEACHING MOTHERS to prepare ORT at home is an important Centre strategy.

Community-Based Treatment Centers

In a related effort aimed at improving health care, the Matlab Center helped two communities in its area establish small, community-run simple diarrhoea treatment facilities, and continued to support and assist another one started in 1980 at Shataki. The establishment of such centers is an ICDDR,B goal, since experience shows that it is more effective to have simple, easy access treatment centers dispersed over a large area, than a sophisticated hospital in a single place.

The first center is located in a community called Kalirbazar, about 20 km north of Matlab station. It was opened in June, on land donated by the community, in an ICDDR,B building constructed with financial assistance from the Australian Government. The new center is locally administered, and run by six community volunteers trained at Matlab, which also provided hospital and other supplies.

Between June and December, the Center treated 1,285 diarrhoea patients – and, during a cholera outbreak in the fall, saved hundreds of lives.

The second new center, at Nayergaon, was opened in November. Also on community-donated land, the center is in an ICDDR,B building, constructed with financial assistance from the Federal Republic of Germany.

Finally, in another health-related effort, the ICDDR,B, responding to a Bangladesh Government request, prepared to extend part of the MCH-FP program so successful at Matlab to two other areas of Bangladesh.

OTHER CSRWG RESPONSIBILITIES

Besides the Matlab field station, the CSRWG supervises two scientific support branches: those of Data Management and Computer Information.

During 1982 the computer facilities expanded, and the IBM System/34 now is being used round-the-clock. On-the-job assistance and staff development was provided by the U.S. Statistical Office and the University of Namur, Belgium. Also, important software, including statistical packages, was installed, and others were developed for future use.

Apart from the Matlab DSS, the Center's financial and administrative record keeping system also was computerized. From complete dependency on external computer facilities and expertise, the Computer Branch now has reached the point of needing a new, more sophisticated computer. For the current one is inadequate for the volume and type of analysis required. The Computer Branch also assists many Bangladeshi agencies in developing the computer capabilities of their staffs.

IMMUNIZATIONS AGAINST measles, diphtheria, tetanus and whooping cough are a backbone of the maternal-child health/family planning (MCH/FP) effort.

TRAINING, EXTENSION & COMMUNICATION

Vigorously pursuing one of its major goals —to help improve health care methods and public health programs, especially in developing countries – the Centre provided in 1982 a wide range of training courses, lectures seminars, conferences and workshops. These were taught by diverse health experts and scientists of international stature, from around the world.

On its Dhaka campus the ICDDR,B trained more than 1,000 public health officials and medical personnel – most from Bangladesh and other developing countries – in many technical and research aspects of diarrhoeal disease prevention, diagnosis, treatment and cure. The "students" were being prepared to return to their own communities, where they would be able to offer similar training, resulting in a multiplier effect, leading to widespread effective services.

They were taught such vital aspects of the diarrhoeal disease picture as how cholera and other diarrhoeal diseases are spread; and how they can be diagnosed, treated and controlled; the role of nutrition, hygiene, fertility and traditional medicines; the often tragic realities of chronic diarrhoea; the search for as yet unidentified infectious agents; attempts to understand the varying mechanisms and effects of different bacteria and viruses that cause diarrhoea; and the search for vaccines and medicines that can dramatically reduce the ravages of diarrhoeal diseases.

International Training and Collaboration

Looking first at its wide-ranging international training efforts,the Centre conducted in 1982 three, 12-14 day inter-regional training courses. In this training effort there was close cooperation with the Diarrhoeal Disease Control Programme (CDD) of WHO. WHO regional offices selected trainees and suggested faculty. Attended by a total of 51 physicians and microbiologists, the courses were taught by scientists from many related fields, who came from the ICDDR,B and around the world. The students were from Turkey, Sudan and 12 Asian nations: Bangladesh, China, India, Malaysia, Nepal, Sri Lanka, Thailand, Afghanistan, Pakistan, the Philippines, Burma and Indonesia.

The courses covered up-to-date laboratory procedures for identifying diarrhoeal disease causes, and described how to assure lab quality control; the training of doctors in the treatment of and management of diarrhoeal diseases, and of other health personnel in the use of ORT; and recent advances in monitoring diarrhoeal diseases, studying their transmission, and evaluating prevention and control.

In two other programs, six post-doctoral trainees (from India, Thailand, the Philippines, Indonesia and Malaysia) spent one-to-four weeks at the Centre, studying the clinical and diagnostic aspects of diarrhoeal diseases; and, in training of two weeks-to-four months, 10 pre-doctoral candidates – sponsored by WHO and coming from the United States, Great Britain, India and the Philippines – were trained in diarrhoeal disease control.

There also were 33 weekly lectures, during which eminent scientists, from the ICDDR,B or visiting from abroad, shared their expertise on many subjects.

Turning to other international collaborative efforts, ICDDR,B scientists provided aid in the form of short-term consultancies in several countries; and in other programs either supplied bacterial cultures for classwork diagnosis or tested bacterial strains for disease diagnosis.

National Training and Collaboration

Working with Bangladesh health officials in 1982 the Center conducted four short-courses,

in which 51 government health workers were trained in diarrhoeal disease prevention and treatment. Attended mainly by individuals from the Government's Family Welfare Visitor Training Institutes, these courses prepared "trainers" who, in turn, teach government health workers to provide service to rural areas.

In a related effort, the ICDDR,B ran a week-long course, in cooperation with the Bangladesh Government and the Netherlands Advisory Team. The students were "trainers" from the Government's program that teaches Medical Assistant Trainers. The latter teach primary health care to government health personnel and volunteers working at the local level. The course upgraded the skills and knowledge of MAT personnel, especially relating to the use of modern techniques to teach primary health care methods.

In another program, 90 people from Bangladeshi health-related institutions attended one of 23 two-to-eight-week sessions. Taught were management and control of diarrhoea, including oral rehydration and related nutrition.

On a larger scale, 329 Bangladesh health workers and 483 medical students studied diarrhoea management and control, including use of ORT, at one of 37 training sessions lasting less than a week.

Moreover, ICDDR,B scientists cooperated with Dhaka, Mymensingh and Jahangirnagar Universities in directing the masters thesis research of eight students. Also, Centre scientists helped eight young Bangladeshi doctors and microbiologists, from four local medical centers, develop proposals for diarrhoeal disease research, with an eye toward getting outside funding. During a two-week session they also gained practical experience in how to identify the causes and how to treat diarrhoeal diseases.

Staff Development

As for ICDDR,B scientists themselves, significant efforts were made in 1982 to broaden their skills and outlooks – which, in turn, enhances Centre training programs. With this aim, six Centre scientists continued their studies abroad: in the U.S., U.K., Australia, Thailand and Belgium. Moreover, three other researchers were sent for further study to the U.S., U.K., and Australia. In the meantime, four researchers returned to the Centre after completing their overseas studies.

In addition, 33 ICDDR,B staffers studied in Bangladeshi training institutes. They took courses in public health education, pediatric nursing, epidemiological methods, store keeping and stock control, data management, electronics use, office and accounting management, and orientation courses for the prevention and control of diarrhoeal diseases.

Extension

In one of its most significant extension efforts, the ICDDR,B offered on-the-spot emergency training in different areas of Bangladesh, during sudden cholera outbreaks in the spring and fall of 1982. Responding to government requests for aid, Centre scientists sought to determine the extent and severity of the epidemics; and provided ORS packets to cholera victims, as well as training manuals on diarrhoeal disease treatment, and a crash training program for local paramedics and volunteers.

In another important collaborative extension effort, the Training Program helped a large, private, free hospital about 40 miles north of Dhaka establish a Diarrhoea Treatment Center. Administrative oversight for the center at the Kumudini Hospital, Mirzapur, Tangail, now is the responsibility of the ICDDR,B's Project Development Committee.

Communications

In continuing efforts to further enhance the sharing of its expertise as widely as possible, the ICDDR,B established in 1982 the world's first clearing house solely devoted to disseminating information on diarrhoeal diseases; and strengthened its library and publication divisions – most notably by laying the groundwork for the quarterly publication, starting in March 1983, of the first international journal devoted completely to diarrhoeal disease research.

TRAINING SCIENTISTS from many developing countries is a major ICDDR,B activity.

The first major innovation was the establishment of DISC – the International Diarrhoeal Disease Information Service and Documentation Centre. Financed for three years by the IDRC (International Development Research Centre, Canada), DISC is aimed at bridging the diarrhoeal disease information gap, especially in Asia. The program already is collecting, organizing, analyzing and disseminating literature, is helping avoid research duplication, and is speeding the use of new practices – so that researchers and health practitioners can more readily achieve the ultimate goal: prevention and control of diarrhoeal disease.

Included in DISC are a question-and-answer service; publication of specialized annotated bibliographies, as well as of a directory of Asian Scientists; provision of reprints or microfiches; and the publication of the "Journal of Diarrhoeal Diseases Research." The new journal contains original scientific papers; and an annotated bibliography of diarrhoeal disease-related research papers, both published and unpublished throughout Asia.

In related communications efforts, the Centre produced 11 internal publications; and a sophisticated 50-page booklet, requested by the Bangladesh Government in conjunction with the September 1982 combined WHO South-East Asia Regional and Health Ministers Meeting. The booklet provides an in-depth description of health services offered in Bangladesh by the Government, as well as by private and international agencies.

Moreover, nearly 38,500 copies of "Glimpse," the ICDDR,B's bi-monthly newsletter, were distributed free to scientists and scientific organizations in 143 countries. Contained in "Glimpse" are descriptions of ICDDR,B research and other activities, as well as summaries of all ICDDR,B papers and other publications.

Also, ICDDR,B publications were distributed free to most Bangladeshi health-related institutions and libraries, either as donations or under exchange programs.

Finally, a new pricing system for ICDDR,B publications was begun, and proceeds are coming in, so that, by year's end, the Centre was recovering part of its printing and mailing costs.

As for the ICDDR,B's library, 1,200 outside researchers, teachers and students used the facility in 1982. Besides access to 447 current journals, 14,754 books and bound journals, as well as 6,425 reprints and other documents, the library provided, among other things, a national and international interlibrary loan service.

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BOARD OF TRUSTEES

The Budget

In a review process with major implications for the ICDDR,B's future, the Board of Trustees spent considerable time and effort at both its June and December meetings reviewing budgetary considerations. Before acting, they examined in-depth reports from the Centre's Associate Directors for Finance and Administration and for Resources Development.

The presentation highlights were that:

1. Given the difficulties and uncertainties of fund-raising in the current economic climate, the budget was drafted based on conservative revenue estimates.

2. The record of past years shows that the Centre's staff and program have been too big to be adequately supported by available income. The policy has been to make large plans and then attempt to scale them down to meet actual revenue. This cannot be done effectively, because the greater part of the budget is spent on staff salaries and benefits, and these expenditures cannot be cut without almost a year's advance warning.

   In a changed planning policy, the Director should present, more than a year in advance, a basic plan, including detailed staffing levels that can be carried out within a very conservative revenue estimate. To this basic budget should be added plans for new programs or projects, in order of initiation priority, if and when more money is available.

   The fundamental goal is to keep the basic continuing staff and facilities small enough to be adequately supported by the lowest annual revenue that reasonably can be foreseen.

3. Deficiencies in planning, cost control and efficiency of current operations necessitate a full overhaul of administration, stores and maintenance. Program Heads will be asked to review staffing, with a view toward reductions, retaining only the most productive staff.

4. Deficit financing must be overcome as soon as possible. Therefore, the only prudent action is to reduce the Centre's basic size and hence operating costs, eliminate the deficit, establish reserves as quickly as possible, and remain poised to take full advantage of new funds when they appear.

Reacting to these reports, Board members came to a consensus that the Centre cannot tolerate a continuing operating deficit—and that the ICDDR,B must cut its activities and staff to fit available resources.

The Board complimented Mr. Michael F.L. Goon, who was completing in December his first year as head of Administration and Finance, for his remarkable success in reducing costs during 1982—with little constraint to programs thus affected.

Resolutions

The Board then passed a number of resolutions related to finance:

1. In June, the Board instructed the Director to cut the Centre's 1982 expenditures to a total of US $4.5 million by November, unless revenue were to exceed US $6 million.

2. In December, approved a budget ceiling of US $6.5 million for 1983. While this is US $2 million more than the amount spent, after budget cuts, in 1982, the extra money will not permit significant program expansion, the Board noted. For, much of the extra funds will go for the newly-mandated WHO salary scale increases, towards reducing the operating deficit and for a contingency fund.

3. Instructed the Director to set aside US $700,000 to start a "Reserve Fund". This amount comes from an operating budget credit balance of US $914,000 remaining in 1982 after total donor contributions of US $6.48 million.

4. The Director also was told to further pursue the possibility of attracting donor matching funds against this reserve fund account.

5. Recognizing the necessity of temporary cash shortfalls, due to the timing of expenditures ver-

sus receipt of donor funds, the Board authorized the Director to negotiate up to US $1 million in bank overdraft bridging facilities—and, if absolutely necessary, to pledge the Centre's assets as collateral.

6. Seeking to minimize cash shortfalls, the Board said no projects above the set budget ceiling will begin, until pledged funds for the project are received.

Program Review

In another major effort of vital importance to the Centre, the Board of Trustees participated in an intensive review of all ICDDR,B programs. For a week prior to the December meeting small groups of Trustees reviewed each program—aided by a written summary overview for 1982, 1983 and beyond from Program Heads, and in-depth meetings with senior staff. Taken into account before final presentation to the entire Board were the early 1982 findings of an External Review Committee.

The Board members presented their conclusions in a day-long special session. They gave special attention to the importance of gearing the Centre's overall conceptual framework and setting of priorities to best meet the ICDDR,B's mandated goals.

Among other things, they emphasized the importance of accumulating, within programs and across the Centre as a whole, funds not specifically assigned to on-going projects—so the Centre always will be in a position to take advantage of new research opportunities, as they arise. Such contingency planning, the Board said, would prevent the ICDDR,B from stagnating and rapidly losing the leadership it has achieved in many areas of research.

This leadership position, the Board maintained, must be fostered, and should form the basis of research priorities. Some projects will have to be delayed or dropped to achieve this end, the Board said.

WHO Pay Scales

Desiring to bring the salaries and benefits of ICDDR,B staff in line with those of U.N. organizations, the Board of Trustees voted to adopt World Health Organization (WHO) pay-benefit scales for all employees. Under this change, the salaries and benefits will be adjusted as necessary. For all except "international" level staff this will mean a major improvement in both.

Other Actions

1. The Board welcomed four new members, re-elected another, and expressed its gratitude to four out-going members:

   *Dr. David Bradley was re-elected, and was made Board Chairman, replacing Dr. M.A. Matin, whose one-year tenure as Chairman expired.

   *Dr. F. Assaad, Director of WHO's Communicable Diseases Division, Geneva, replaced Dr. A. Zahra;

   *Maj. Gen. Shamsul Haq, Advisor-in-Charge, Ministry of Health and Population Control, Bangladesh Government, replaced Bangladesh's previous member, Dr. A.Q.M. Badruddoza Chowdhury.

   *Dr. Yoshifumi Takeda, of the Research Institute for Microbial Diseases, Osaka, Japan; and Dr. David Bell, Chairman, Department of Population Science, Harvard University's School of Public Health, replaced Drs. C.C.J. Carpenter and Omond Solandt.

2. Reappointed Dr. William B. Greenough III to a two-year term, starting July 1983; and established a Search Committee to find a new Director for when Dr. Greenough's six-year maximum tenure as mandated in the Ordinance ends in 1985.

3. Reappointed, for 3 years, as Associate Director for Resources Development, Mr. M.R. Bashir.

4. Established an international level position of Personnel Officer.

5. Mandated an evaluation of international staff whose contracts expire in June 1983 or earlier.

6. Urged the Centre to continue pursuing income tax exemption for Bangladeshi staff—as such is consistent with Bangladesh's policy vis-a-vis UN agencies' staff.

7. Implemented the Programme Coordination Committee (see details under "Committies") as mandated in the Ordinance.

8. Decided that an External Scientific Review will be done every two years, with the next one in early 1984.

MANDATORY COMMITTEES

To coordinate research and prevent any actions prejudicial to Bangladesh's research interests in similar fields, and to ensure an ethical review process, the ICDDR,B Trustee Board has established several ordinance mandated committees:

THE ETHICAL REVIEW COMMITTEE

Meeting monthly, the ERC examines and monitors the ethical aspects of research involving human subjects. It has 12 members, three from within the ICDDR,B; and nine outsiders representing different professions, including one member from the Bangladesh Medical Research Council. The ERC has a four-member sub-committee that checks the implementation of ethical procedures – makes sure that the informed consents are properly obtained, that patients know that the quality of medical care would be unaffected if they do not agree to participate in a study; and that protocol procedures are strictly followed. ERC members are

Dr. K.M.S. Aziz*	—	Basic Scientist and Chairman
Dr. M. Mujibur Rahaman*	—	Clinician and Relieving Chairman (Alternate Dr. K.A. Monsur)
Dr. Brian Seaton*	—	Laboratory Scientist (Replaced by Dr. P. Speelman, October 1982)
Dr. T.A. Chowdhury	—	Bangladesh Medical Research Council
Dr. Humayun K.M.A. Hye	—	Pharmacologist
Dr. Z. Sestak	—	WHO Representative
Dr. Khaleda Banu	—	Paediatrician
Dr. Sufia Ahmed	—	*Woman and non-scientific member*
Mr. Md. Mofazzal Hossain Khan	—	Religious Representative
Mr. K.Z. Alam	—	Behavioural Scientist
Mrs. Taherunnessa Abdullah	—	Behavioural Scientist

*Members from ICDDR,B

PROJECT COORDINATION COMMITTEE

To coordinate, strengthen and facilitate research efforts with Bangladeshi organizations, a major ICDDR,B objective, an organizing committee was formed to establish a Project Coordination Committee. The PCC will facilitate research by national organizations and will coordinate their joint projects with the ICDDR,B. The organizing committee, headed by Prof. M. Ibrahim, Ex-Health Minister of Bangladesh, had 26 members from leading health, rural development, nutrition and population-related institutions in Bangladesh. The ICDDR,B has long-standing programs with most of these organizations, cooperating with them in research and training.

In December, the ICDDR,B Board of Trustees formally established the PCC, outlined its membership and approved its by-laws. Moreover, the Board set up a Standing Committee of 11 members, two representing the Bangladesh Government. This committee is designed to more efficiently manage the affairs of the parent committee. The Standing Committee, which will meet quarterly, also will prepare and constantly will up-date a list of work being done in diarrhoeal diseases and related subjects.

The PCC will closely coordinate its activities with the Centre's Ethical Review and Research Review Committees.

OTHER COMMITTEES

PROJECT DEVELOPMENT COMMITTEE

To enhance the effectiveness of projects requiring coordination among Center Programs or extensive collaboration with outside institutions or countries, the Project Development Committee (PDC) was established in April 1982, by the ICDDR,B's Management Committee.

The PDC is responsible for all proposals not clearly falling within the responsibility of any one Centre program; and has final say over whether new projects within its jurisdiction will be implemented.

In 1982, the PDC coordinated 14 projects within Bangladesh; and five projects in other countries, four of these in the Middle East and one in China. Brief descriptions follow:

Collaborative Research

While the ICDDR,B itself is intensively trying to promote medical research in Bangladesh, and is involved in many collaborative efforts with Bangladeshi organizations, there had not been a significant collaborative effort between the Centre and the Bangladesh Medical Research Council.

In the long term, both organizations would benefit from this, as well as from an organized program for research-oriented training of Bangladeshi scientists.

With this aim, the ICDDR,B and the BMRC have agreed to establish a Research Cell at the Institute of Public Health (IPH). Currently, the ICDDR,B is partially located within IPH building facilities. There, ICDDR,B researchers will work jointly with Bangladeshi scientists sponsored by the BMRC or other national institutions.

Improving Health and Family Planning

As the Matlab experience has shown for six years, simply distributing contraceptives does not result in sustained usage or significant fertility reduction. The way to achieve this – as well as to markedly improve health and mortality rates – is to *introduce simple health care, with follow-up* treatment for contraceptive side-effects.

This project seeks to learn how best to transfer maternal/child health-family planning elements to Bangladesh's health care system, by working in four places: the ICDDR,B's centers at Matlab and Teknaf, and two areas, Sirajganj and Noapara. This, the Centre's major effort to directly address the problem of transferring knowledge to a true situation, is being funded by U.S. AID.

Meghna-Dhonogoda Embankment

With a $ 44 million grant from the Asian Development Bank, Bangladesh completed about one-third of a huge dyke around half of the Matlab field area. An evaluation of the long-term impact on health and related variables never has been done. The Matlab data base is unique in the developing world – although the scope of the suggested study is far beyond the ICDDR,B's expertise and mandate. Accordingly, discussions are underway with several national and outside institutions and individuals to explore how best to take advantage of this extraordinary research opportunity.

INFANTS often are the innocent victims of deadly diarrhoeal disease dehydration — for which swift intravenous therapy is mandatory.

RUNNING AN URBAN VOLUNTEERS program Australian nurse-volunteer Eva Doherty is helping fulfill a major ICDDR,B goal : helping people help themselves.

Urban Volunteer Program

Aiming to prevent and treat diarrhoea within Dhaka communities, thereby reducing the numbers of patients coming to the ICDDR,B's main treatment center, an Urban Volunteers training program was begun in 1981. Run by an Australian nurse-volunteer, the program teaches illiterate and semi-literate slum women to work as diarrhoeal disease volunteers in their own communities.

Training for a week in batches of 10, the women learn about general hygiene and nutrition,about how to treat most diarrhoeal dehydration with ORS therapy, and about how to spot dehydration severe enough to require hospitalization. Tested and retrained every few months, the volunteers did a magnificent job in 1982.

Working in 11 Dhaka communities, the 158 volunteers who remained active in 1982 treated about 1,500 patients a month, by administering ORS to mild and moderately dehydrated patients. Where ORS failed, patients were referred to the ICDDR,B Treatment Center for intravenous therapy.

Matlab-Munshiganj

This study compares fertility and mortality levels, use of health services, contraceptive knowledge and use, and reproductive motivation, for the ICDDR,B's Matlab operation versus that of a neighbouring area. The baseline survey was completed, and round two is under way.

Self-Sufficient Community Centers

Seeking to rapidly implement effective diarrhoea treatment, but having limited funds, the ICDDR,B helped the Matlab-area community of Shotaki start its own self-sufficient treatment center. A building was donated by the ICDDR,B and the community chose volunteers to be trained at Matlab. Thus far, the center has treated many hundreds of people and saved many lives. With some variations, similar initiatives have begun in another six rural areas.

BRAC Evaluation of ORT

The Bangladesh Rural Advancement Committee has trained teams of field workers to teach mothers how to make ORS from household ingredients. They have taught a hand measurement system, utilizing a three-finger pinch of salt, and two four-finger scoops of crude cane sugar, mixed into one-half litre of water. ICDDR,B researchers were technical advisors for this entirely national initiative. A mortality impact evaluation is in progress on the 17 million people now covered by this effort.

Extending ORS Use

At Chandpur, a community adjacent to the Matlab field area, researchers are studying how best to use ORT in a community, using existing resources. While the new, rice-based ORS is being field-tested, an initial study on mothers' attitudes is being done at Chandpur. A subsequent study there is looking at how best to present the therapy to mothers.

Diarrhoea Growth Monograph

A unique data set from intensive Matlab studies several years ago has resulted in the publication in journals of several important scientific reports. These need to be combined into a monograph, and the original data analysis needs to be transferred into the ICDDR,B's computer. Computer tapes will be an invaluable resource for the future. The initial stages of this project will be funded by a joint Ford-Rockefeller Foundation grant.

Training Materials Evaluation

A researcher from NIPSOM (National Institute of Preventive and Social Medicine) has been contracted to do an independent, external evaluation of a Trainer's Training Manual and instruction book for teaching diarrhoea treatment. The evaluation results will help the Center perfect its training materials, with an eye toward providing them for broader use.

Duckweed

Due to indiscriminate defecation habits, human wastes now spread diarrhoeal and other diseases in Bangladesh. These wastes are a valuable source of scarce organic chemicals for food growth.

A native Bangladeshi plant, duckweed, converts such wastes to protein, which can be fed to ducks, chickens and certain fish. This project proposes to study the collection of human wastes into protected ponds, for the growing of duckweed – which, in turn, would feed animals and humans. If successful, human wastes would be seen as having economic value, thus providing a stimulus for safe handling. The aggregation of wastes also should provide a cleaner environment and should stop the spread of water-borne diarrhoeal diseases.

OVERSEAS EFFORTS

Saudi Arabia

After three years, the ICDDR,B and the Kingdom of Saudi Arabia completed talks in 1982 that led, in Jan. 1983, to the signing of an agreement whereby the Centre would help Saudi Arabia combat a serious diarrhoeal disease problem. Focusing first on the Eastern Province of the country, the effort will begin by establishing basic diagnostic and treatment facilities for diarrhoeal diseases.

Kuwait

Invited by the Government, the ICDDR,B sent a team to prepare a proposal as to how the Centre might help Kuwait combat diarrhoeal diseases. The possible components of such aid were: strengthening of basic microbiologic methods for diarrhoea diagnosis; improving surveillance of such specific pathogens as cholera; and assisting with clinical training of volunteers. These talks are continuing.

THE RESEARCH REVIEW COMMITTEE

The RRC reviews all research protocols – examining their scientific value, significance, feasibility, and researchers' capabilities, as well as their relevance to the Centre's objectives and financial capabilities. The RRC was reorganized in 1981 to include the Scientific Program Heads and three other scientists, who rotate yearly.

DUCKWEED, a native Bangladeshi plant, converts human wastes to protein -- which can be fed to ducks, chickens and certain fish. Can duckweed thus be grown, to fulfill a two-fold goal ?

RESOURCES DEVELOPMENT

In its short three-year existence as an international institution, the Centre has developed support and participation in its projects from a wide range of governments and international agencies. The ICDDR,B began in 1979 with 18 signatories to its Memorandum of Understanding and 11 donors. By 1982, there were 18 donors, and 36 governments and agencies had joined the Centre in efforts to combat and ultimately eradicate the worldwide scourge of diarrhoeal diseases.

While the focus remains at the Centre's Dhaka headquarters, technical assistance projects have been undertaken in Kenya, Indonesia and Saudi Arabia; and health professionals from many countries have been trained at the Centre.

In 1982, several new donors and participants provided support in various areas. The Government of France has sent a scientist and has contributed cash.

Negotiations are being finalized to receive a contribution from the Government of Belgium; and an arrangement with the Free University of Belgium will include training exchanges between the two institutions.

The Aga Khan Foundation is helping fund attempts to develop an improved, possibly cheaper cereal-based oral rehydration solution. During the year the Government of Turkey agreed to cooperate with the ICDDR,B.

Donor continuity also is vital. In 1982 Swedish SAREC renewed its scientific collaborative support; the United Kingdom is expected to renew its general support grant; and the International Development Research Centre of Canada (IDRC), which has been supporting sanitation impact studies at the Teknaf Field Station, now is funding the Centre's new DISC project – an international diarrhoeal diseases reference and referral system. The IDRC also supported a study on infant morbidity and mortality.

COLLABORATION

The ICDDR,B continues to expand its collaborative activities, both in Bangladesh and elsewhere. The Bangladesh Government has asked the Centre to work with the Ministry of Health and Population Control in three areas, to do baseline demographic studies and explore the effectiveness of low-cost delivery services. This project now is funded by UNFPA and USAID. Also, the Population Council is funding a related Operations Research project.

The ICDDR,B and the Kingdom of Saudi Arabia have begun a technical collaboration project, involving clinical, laboratory and field activities to detect and control diarrhoeal diseases.

Several Chinese health professionals have been trained at the Centre; and in October an ICDDR,B team went to China to explore further collaboration.

At the request of the Indonesian Government an ICDDR,B team spent two months in Aceh Province helping government health workers identify and control the sources of a cholera outbreak. This collaboration was funded by USAID/Indonesia. The Centre now is helping Indonesia establish a project for future prevention and control.

While the ICDDR,B is offering technical assistance to an increasing number of developing countries, the Centre's financial resources are inadequate to meet such requests. A tri-partite arrangement, such as that with Indonesia, therefore represents an excellent opportunity for Third-World governments to improve their technical capabilities in the control of major diseases.

The Centre has received increasing recognition for the research, training and services it provides. In 1982, the ICDDR,B was honoured with the UNICEF Regional Award for South-East Asia – for "Service to mothers and children," the chief victims of diarrhoeal diseases.

Also in 1982, the ICDDR,B convened the third Consultative Group meeting, chaired by UNDP and held during the UNDP Governing Council in Geneva. Honoured guests included Mr. A.M.A. Muhith, Bangladesh's Minister of Finance and Planning, and Dr. Halfdan Mahler, Director-General of WHO. Delegates from 17 governments and agencies discussed the Centre's activities, plans and financial needs.

Finally, as the first phase of ICDDR,B's capital development drew to a close, the new ground floor clinical centre was completed, with support from the OPEC Fund and UNDP. During the second phase the Centre will seek donors to complete construction of its Dhaka base and facilities in its field stations.

MANAGEMENT & ADMINISTRATION

The key factor dominating Management and Administration activities in 1982 was economic measures that resulted in a reduction in the Centre's total expenditures. These amounted to less than the US $ 4.5 million target set by the Board of Trustees, which was US $ 1.7 million less than the amount that had been budgeted for 1982, and US $ 1.3 million less than the amount spent in 1981. Moreover, the success of the economy drive permitted the Centre to carry over US $ 700,000 to the 1983 budget. This will form the nucleus of a reserve fund for unbudgeted emergency expenditures. It also means that, effective 1983 as approved by the Board of Trustees, WHO salary and benefit scales will be implemented for all employees.

Most of the savings in 1982 resulted from improved systems controls in transport, field logistics, maintenance and supply areas. Moreover, internal control systems were strengthened to reduce expenditures and improve cost-effectiveness.

In other activities:

*The Centre changed auditors, upon completion of a contract with the auditing firm of Price, Waterhouse & Rahman, Huq & Huq. A two-year agreement was signed with the autditing firm Deloitte, Haskins & Sells and S. Ahmed.

*Mr. Michael F.L. Goon was appointed associate director of the ICDDR,B, in charge of Finance and Administration.

*The physical facilities for new community treatment centers, at Sirajgonj, Kalirbazar and Nayergaon, were completed, and began operating. The Federal Republic of Germany financed construction of the Sirajgonj facility, while Australia funded the one at Kalirbazar.

*Phase one of the new ICDDR,B building was completed. This encompasses the ground floor of the new hospital and clinical research unit. The Dhaka Hospital, along with all supporting facilities, as well as the Urban Volunteers training program, now are housed in the new building.

*Some of the space vacated by Dhaka hospital has been turned into storeroom areas, and the warehouse has been moved from its rented facility to this location. This will mean more control, and a considerable saving in rent.

*In Aceh, Indonesia a cholera surveillance and control program was successfully started, in cooperation with the Indonesian Health Ministry and the local US AID program.

STAFF WELFARE ASSOCIATION

The Staff Welfare Association (SWA) is recognized and supported by the ICDDR,B management, and a constitution guides its operations. The SWA aims to safeguard the interests and welfare of Centre employees, regardless of rank or status. It endeavors to foster understanding and cooperation among the members of the staff, and organizes staff members for collective solution of problems.

To create a healthy and congenial atmosphere, the SWA in 1982 organized a play, a picnic widely attended, and interdepartmental tournaments in football, badminton, etc. The SWA also maintains a library, and provides stipends to meritorious and deserving children of ICDDR,B staff.

STAFF CLINIC

The staff clinic was established in 1980 to provide health care to ICDDR,B employees and their families. In addition to medical care, it also provides preventive medicines, vaccines and family planning information and measures. In 1982 a separate staff pharmacy began operations.

The staff clinic newsletter throughout 1982 carried information on good health practices, preventive health care, tips on first aid during emergencies and other information of help to the non-medical staff.

EMPLOYEES COOPERATIVE

An employees cooperative provides low-cost, high-quality food and needed household items to all employees. In addition, the cooperative produces and packages ORS for use by the Centre and any outsider requiring it.

Financial Report

Total donor contributions to the operating funds received during FY 1982 amounted to US $ 4,712,879. After taking into account other receipts, writing off exchange losses and transferring capitalized items to the balance sheet, net receipts for the year totalled US $ 4,574,426. Compared to FY 1981 this reflected an increase in net receipts of US $ 471,702.

A cost reduction program launched in 1982 resulted in limiting the year's operating expenditures to US $ 4,348,784, leaving an operating surplus of US $ 225,642. Operating expenditures for FY 1982 were US $ 1,072,563 less than the amount spent in FY 1981.

This saving made it possible for the Centre to set aside US $ 100,000 in a reserve fund for 1982, thus complying with the resolution passed by the Centre's Board of Trustees in November 1981.

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

We have audited the Balance Sheet of International Centre for Diarrhoeal Disease Research, Bangladesh as of December 31, 1982 and the relative Receipts and Expenditure Account for the year ended on that date, which are in agreement with the books and records maintained by the Centre and produced to us. Our examinations were made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion and to the best of our information and according to the explanations given to us, the Balance Sheet and the Receipts and Expenditure Account, subject to the notes to the accounts attached thereto, give respectively a true and fair view of the state of affairs of the Centre as of December 31, 1982 and the results of its operations for the year then ended.

DELOITTE HASKINS + SELLS
CHARTERED ACCOUNTANTS

AHMED REZA & CO.
CHARTERED ACCOUNTANTS

CONTINUING THE SUPPORT so generously given the Centre, the Japanese Ambassador to Bangladesh, Hirohiko Otsuka, presents a Japanese Government donation to ICDDR,B Director William B. Greenough III.

BALANCE SHEET AT DECEMBER 31, 1982

	Notes		1982	1981
Fixed Assets	2		3,491,215	2,817,802
Current Assets				
Stock of stores and spares	3	630,843		771,243
Advances, deposits & prepayments	4	656,886		374,683
Cash and bank balances	5	117,235		115,659
		1,404,964		1,261,585
Less :				
Current Liabilities				
Bank overdraft		512,507		1,130,719
Current liabilities	6	701,838		579,089
		1,214,345		1,709,808
Net Current Assets			190,619	(448,223)
			$ 3,681,834	$ 2,369,579
Represented By				
Trustees Fund Accounts				
Capital development fund	13		1,817,893	832,675
Operating fund	14		1,763,941	1,536,904
Reserve fund	14		100,000	—
			$ 3,681,834	$ 2,369,579

NOTES FORM PART OF THE ACCOUNTS

Director
ICDDR,B

Member
Board of Trustees

Member
Board of Trustees

Deloitte Haskins + Sells
Chartered Accountants

Ahmed Reza & Co.
Chartered Accountants

Dhaka, April 28, 1983.

RECEIPTS AND EXPENDITURE ACCOUNT (OPERATING FUND) FOR THE YEAR ENDED DECEMBER 31, 1982

	Notes	1982	1981
RECEIPTS			
Contributions	7	4,712,879	4,315,488
Other receipts		72,821	94,589
		4,785,700	4,410,077
Less : Transferred to balance sheet to the extent capitalised		154,623	421,820
		4,631,077	3,988,257
Exchange gain/(loss)		(56,651)	114,467
		4,574,426	4,102,724
EXPENDITURE			
Personnel services	10	2,913,339	3,102,688
Supplies and materials		754,468	909,098
Travel expenses		275,780	610,627
Transportation of materials		149,224	219,653
Rent, communication and utilities		86,369	127,190
Printing and reproduction		40,573	53,716
Other contractual services		129,031	398,375
		4,348,784	5,421,347
SURPLUS/(DEFICIT)		$ 225,642	(1,318,623)

SOURCE AND APPLICATION OF FUNDS AT DECEMBER 31, 1981

Source	
Capital Development Fund Receipt	955,485
Surplus as per Receipt and Expenditure Account	225,642
	1,181,127
Transfer from Receipt and Expenditure Account	154,623
Currency Adjustments (24,814 + 29,733)	54,547
	US $ 1,390,297
Application	
Additions to Fixed Assets	751,455
Increase in Working Capital	638,842
	US $ 1,390,297

NOTES TO THE ACCOUNTS DECEMBER 31, 1982

1. Accounting policies

(i) As no manner of presentation of annual accounts has been prescribed under Clause 18 of the International Centre for Diarrhoeal Disease Research, Bangladesh Ordinance 1978 (Ordinance No. 11 of 1978) promulgated by the Government of Bangladesh, the format of the Balance Sheet and a Receipts and Expenditure Account as prepared have been considered appropriate.

(ii) Receipts and expenditure of the Centre are required to be maintained in the prescribed manner. In the absence of prescribed manner of recording of transactions, the Centre has followed the generally accepted accounting principle for recording of receipts and payments.

(iii) Fixed assets have been accounted for at material cost up to August 1981. Since September 1981 incidental expenses like labour, freight, insurance etc. (excluding clearing charges) have also been considered in arriving at the cost of fixed assets.

(iv) Stock of stores and spares have consistently been accounted for at materials cost only.

(v) "Receipts" and "Expenditure" of the Centre for the year to December 31, 1982 have been, as usual, accounted for on "cash" and "accrual" bases respectively.

2. Fixed Assets

(i) Depreciation on fixed assets has not been provided in the accounts. The accummulated chargeable depreciation as at December 31, 1982 amounts to US $ 327,392.

(ii) 4.10 acres and 0.51 acre of land situated at Mohakhali (Dhaka) and Matlab (Comilla) respectively received as donation have not been accounted for pending determination of their values by competent valuers.

(iii) Buildings include an amount of US $ 52,841 spent on the extension of the Institute of Public Health, owned by the Government of Bangladesh, at present partly accommodating the Centre. The new extension was made for use by the International Centre for Diarrhoeal Disease Research, Bangladesh with permission from the Government of Bangladesh.

(iv) All assets capitalised in the books of $ 50 or below amounting to $ 78,042 have been written off during the year from fixed assets, and the same amount has been reduced from the operating fund.

(v)

	Opening Balance on January 1, 1982 US $	Additions US $	All items under US$50 written off during the year US $	Balance on December 31, 1982 US $
Capital Development Fund				
Land (includes development expenses)	66,207	541	—	66,748
Buildings	55,287	40,519	—	95,806
Equipment	62,000	—	—	62,000
Capital work-in-progress Buildings	630,079	555,772	—	1,185,851
	813,573	596,832	—	1,410,405
Operating Fund				
Vehicles	277,972	2,000	739	279,233
Furniture	342,967	8,193	60,046	291,114
Equipment	1,361,952	86,357	11,133	1,437,176
Books and other assets	21,338	58,073	6,124	73,287
	2,004,229	154,623	78,042	2,080,810
US $	2,817,802	751,455	78,042	3,491,215

3. Stock of Stores and Spares	1982	1981
Building materials	—	77,314
Supply stores	440,444	476,922
Maintenance stores	190,399	217,007
	$ 630,843	$ 771,243

Drugs abandoned by the Government of Bangladesh amounting to $31,731 have not been provided or written off during the year.

4. Advances, Deposits & Prepayments		
Capital Development Fund		
Advance against building construction	387,184	150,614
Operating Fund		
Advance against supply	83,808	105,179
Advance against travelling and other expenses	22,999	32,245
Other advances	160,696	83,859
Deposits	2,199	2,786
	269,702	224,069
	$ 656,886	$ 374,683

5. Cash and Bank Balances		
Cash at Banks		
US$ Account		
American Express International Banking Corporation, New York	1,503	82,224
American Express International Banking Corporation, Switzerland	479	532
American Express International Banking Corporation, Dhaka	18,676	8,804
Janata Bank, Dhaka	3,024	3,025
	23,682	94,585
Taka Account		
Agrani Bank, BAF Branch, Dhaka	67,714	10,107
Janata Bank, Dhaka	516	108
American Express International Banking Corporation, Dhaka	8,961	2,687
Agrani Bank, Matlab	1,327	3,473
Agrani Bank, Teknaf	329	1,683
	78,847	18,058
UK £ Account		
American Express International Banking Corporation, London	14,022	2,199
SFR Account		
American Express International Banking Corporation, Switzerland	14	59
	116,565	114,901
Cash in Hand	670	758
	US $ 117,235	115,659

6. Other Current Liabilities	1982	1981
Capital Development Fund		
For building construction	344,509	240,280
Operating Fund		
For supplies and materials	70,939	52,926
For expenses	256,858	268,336
Security and other deposits	29,532	17,547
	357,329	338,809
US $	701,838	579,089

7. **Contributions**

Grants by way of various services rendered by the donor agencies to the Centre have not been considered in these accounts.

(i) **Capital Development Fund**		
Australian Government	—	4,130
OPEC	950,000	—
West German Government	5,485	—
	955,485	4,130
(ii) **Operating Fund**		
(a) **Unrestricted**		
Australian Government	163,133	343,594
Bangladesh Government	36,120	99,120
Swedish Government	148,800	94,062
Ford Foundation (FF)	—	200,000
Japan Government	200,000	—
Saudi Arabian Government	100,000	100,000
US AID – Washington	1,900,000	1,900,000
Switzerland Government	271,000	378,692
Ohyama Health Foundation	—	3,000
UK Government	197,890	239,030
Private Contributions	14,560	123,862
	3,031,503	3,481,360
(b) **Restricted**		
Aga Khan Foundation	75,000	—
UK Government	—	82,213
UNFPA (United Nation's Fund for Population Activities through Bangladesh Government)	58,925	54,486
UNFPA (United Nation's Fund for Population Activities)	332,990	325,360
International Development Research Centre (IDRC), Canada	142,633	50,139
UNICEF	20,836	—
Bangladesh – German (FRG) Technical Co-operation	—	70,000
WHO (World Health Organization)	325,901	218,500
United Nations University, Japan	—	8,070
Swedish Agency for Research And Co-operation, Sweden (SAREC)	110,722	—
Kuwait Government	—	10,000
Ford Founation (FF)	—	13,000

US AID, Dhaka	438,658	—
US AID, Jakarta	44,298	—
US AID/Pop Council	37,240	—
Helen Keller International	13,036	—
Roche Far East Research Foundation	5,000	—
Miscellaneous Contribution	9,273	2,360
	1,614,512	834,128

(c) **Contribution in Kind**

Japan Government	62,908	—
Miscellaneous	3,956	—
	66,864	—
	US $ 4,712,879	4,315,488

8. **Taxation**

Income taxes payable by its Bangladeshi employees are borne by the Centre. With respect to expatriate employees, no tax is paid or deducted in Bangladesh from their remuneration. In this connection reference may be made to Clause 21(2) of the Bangladesh Ordinance No. 11 of 1978 which provided *inter alia* that remuneration of such expatriate employees will be exempt from income tax in Bangladesh if such remuneration of the person is also exempt from payment of tax in the country of his domicile or permanent residence and evidence in respect of the said exemption is produced to the income tax authority concerned in Bangladesh. Efforts are being made to obtain tax exemption for its employees from the Government of Bangladesh.

9. ***Currency Translation***

Rates of exchange used for the translation of various currencies for the purpose of these accounts as of December 31, 1982 are as follows:

Currency	Average rate used for the conversion of monthly expenditure of Fixed Assets and stock of stores and spares in US $	Bank rates used for other items at December 31, 1982 in US $
Tk. 1.00	0.045	0.041
A $ 1.00	1.025	0.974
UK £ 1.00	1.755	1.607
SFR 1.00	0.499	0.498

10. **Personnel Services**

Expenditure on the above account includes US $ 35,100 paid as honorarium to the members of the Board of Trustees.

11. **Contingent Liabilities** : In respect of—

(i) Prior years' tax on expatriates salary US$ 110,000 and

(ii) Severance pay not provided for US$ 211,000.

12. **Capital Commitment** : In the opinion of the management, this amount is considered to be $ 400,000.

13. **CAPITAL DEVELOPMENT FUND**

	1982	1981
LIABILITIES		
Fund Account		
Balance at 1 January 1982	832,675	828,545
Add: Receipts during the year	955,485	4,130
	1,788,160	832,675
Adjustment for currency translation	29,733	—
	1,817,893	832,675
Current Liabilities	344,509	240,280
	US $ 2,162,402	1,072,955
ASSETS		
Fixed Assets	1,410,405	813,573
Current Assets		
Stock of stores and spares	—	77,314
Advances, deposits and prepayments	387,184	150,614
Balancing figure which represents an amount has been merged with the operatng fund	364,813	31,454
	751,997	259,382
	US $ 2,162,402	1,072,955

14. **Operating Fund**

	1982	1981
Balance at 1 January 1982	1,536,904	2,581,743
Add: . . Adjustment for currency translation	24,814	—
	1,561,718	2,581,743
Transferred from Receipts and Expenditure Account	154,623	421,820
	1,716,341	3,003,563
Less: Adjustment for writing off Fixed Assets under $ 50	(78,042)	(148,036)
	1,638,299	2,855,527
Transfer to Reserve Fund	100,000	—
	1,538,299	2,855,527
Surplus/(Deficit) for the year ended December 31, 1982	225,642	(1,318,623)
	US $ 1,763,941	1,536,904

PUBLICATIONS DURING 1982

Working Paper:

25 Becker S, Mahmud S, Sarder AM. Validation study of pregnancy histories and indirect techniques of fertility and mortality estimation in Matlab, Bangladesh. Apr 1982. 59 p.

26 Horton S, Claquin P. Cost effectiveness study of hospital and of ambulance services at Matlab Treatment Centre. May 1982. 52 p.

27 Chowdhury AMR, D'Souza S. A design and field methods for monitoring impact on mortality of an oral therapy programme. Jul 1982. 23 p.

28 Chowdhury AI, Aziz KMA. Demographic studies in rural Bangladesh : May 1971 – April 1972. Nov 1982. 24 p.

29 Chowdhury AI, Aziz KMA. Demographic studies in rural Bangladesh : May 1972 – April 1973. Nov 1982. 24 p.

30 Chowdhury AI, Aziz KMA. Demographic studies in rural Bangladesh : May 1973 – April 1974. Nov 1982. 22 p.

Scientific Report:

55 Becker S, Razzaque A, Sarder AM. Demographic Surveillance System – Matlab. Volume 8. Census update 1978. Apr 1982. 31 p.

56 Chowdhury MK, Razzaque A, Becker S, Sarder AM, D'Souza S. Demographic Surveillance System – Matlab. Volume 9. Vital events and migration 1979. May 1982. 56 p.

57 Sarker SA, Molla AM, Karim AKMM, Rahaman MM. Calorie intake in childhood diarrhoea. Jul 1982. 12 p.

58 Chowdhury MK, Razzaque A, Mostafa G, Sarder AM, D'Souza S. Demographic Surveillance System – Matlab. Volume 10. Vital events and migration tables 1980. Nov 1982. 61 p.

Special Publication:

17 Rahaman MM, Aziz KMS, Rahman S eds. Proceedings of the 1st Asian Conference on Diarrhoeal Disease, Dacca, 16-20 Feb 1981. Feb 1982. 262 p.

18 Claquin P, Claquin B, Rahman S, Razzaque MA, Shaikh K, Chowdhury TR, Kanawati NH. An evaluation of the Government training programme of traditional birth attendants. May 1982. 78 p.

19 Samadi AR, Islam MR, Aziz KMS. ICDDR,B model for treatment of diarrhoeal diseases. Jul 1982. 12 p.

Newsletter:

Glimpse : ICDDR,B Monthly Newsletter. Volume 4, No. 1-12, Jan-Dec 1982.

B ORIGINAL SCIENTIFIC PAPERS:

Bairagi R, Aziz KMA, Chowdhury MK, Edmonston B. Age misstatement for young children in rural Bangladesh. Demography 1982 Nov;19(4):447-58.

Bairagi R, Chowdhury MK. On error due to graduation of scaling for anthropometry. Am J Phys Anthrop 1982;58(3):331-3.

Bairagi R. Reliability and validity of the anthropometric indices : weight-for-age versus weight quotient and height-for-age versus height quotient. Rur Demogr (Dhaka) 1980;7(1-2):25-32*

Becker S, Sarder AM. Seasonal patterns of vital events in Matlab Thana, Bangladesh. *In :* Chambers R, Longhurst R, Pacey A eds. Seasonal dimensions to rural poverty. London : Pinter, 1981:149-54*

Bhatia S. Contraceptive intentions and subsequent behavior in rural Bangladesh. Stud Fam Plann 1982 Jan;13(1):24-31.

Bhatia S, Becker S, Kim YJ. The effect on fecundity of pill acceptance during postpartum amenorrhea in rural Bangladesh. Stud Fam Plann 1982; 13(6-7): 200-7.

*Not listed in earlier annual report. **Collaborative work.

Bhatia S. Experience with lippes loop and copper-T intrauterine devices in rural Bangladesh. Int J Gynaecol Obstet 1982 Jun;20(3):175-82.

Bhatia S. Training community health workers in rural Bangladesh. World Health Forum 1981;2(4): 491-4*

Black RE, Greenberg HB, Kapikian AZ, Brown KH, Becker S. Acquisition of serum antibody to Norwalk virus and rotavirus and relation to diarrhea in a longitudinal study of young children in rural Bangladesh. J Infect Dis 1982 Apr;145(4): 483-9.

Black R. Aspectos epidemiologicos de la diarrea aguda. Diagnostico 1982;9(4):180-8.

Black RE, Brown KH, Becker S, Alim ARMA, Merson MH. Contamination of weaning foods and transmission of enterotoxigenic *Escherichia coli* diarrhoea in children in rural Bangladesh. Trans R Soc Trop Med Hyg 1982;76(2):259-64.

Black RE, Brown KH, Becker S, Yunus M. Longitudinal studies of infectious diseases and physical growth of children in rural Bangladesh. I. Patterns of morbidity. Am J Epidemiol 1982 Mar; 115(3): 305-14.

Black RE, Brown KH, Becker S, Alim ARMA, Huq I Longitudinal studies of infectious diseases and physical growth of children in rural Bangladesh. II. Incidence of diarrhea and association with known pathogens. Am J Epidemiol 1982 Mar; 115(3):315-24.

Blaser MJ, Huq MI, Glass RI, Zimicki S, Birkness KA. Salmonellosis at rural and urban clinics in Bangladesh: epidemiologic and clinical characteristics. Am J Epidemiol 1982 Aug;116(2):266-75.

Boyce JM, Hughes JM, Alim ARMA, Khan M, Aziz KMA, Wells JG, Curlin GT. Patterns of *Shigella* infection in families in rural Bangladesh. Am J Trop Med Hyg 1982 Sep;31(5):1015-20.

Briscoe J, Chakraborty M, Ahmed S. How Bengali villagers choose sources of domestic water. Wat Suppl Manag 1981;5:165-81*

Brown KH, Black RE, Robertson AD, Akhtar NA, Ahmed MG, Becker S. Clinical and field studies of human lactation: methodological considerations. Am J Clin Nutr 1982 Apr;35(4): 745-56.

Brown KH, Black RE, Becker S, Nahar S, Sawyer J. Consumption of foods and nutrients by weanlings in rural Bangladesh. Am J Clin Nutr 1982 Nov;36(5):878-89.

Brown KH, Black RE, Becker S, Hoque A. Patterns of physical growth in a longitudinal study of young children in rural Bangladesh. Am J Clin Nutr 1982 Aug;36(2):294-302.

Brown KH, Black RE, Becker S. Seasonal changes in nutritional status and the prevalence of malnutrition in a longitudinal study of young children in rural Bangladesh. Am J Clin Nutr 1982 Aug; 36(2):303-13.

Chowdhury AKMA. Education and infant survival in rural Bangladesh. Health Pol Educ 1982;2(3-4): 369-74.

Chowdhury AKMA. Pregnancy prevalence: a direct method of estimating fertility. Sankhya (Ser B) 1982 Dec;44(3):330-42.

D'Souza S. A population laboratory for studying disease processes and mortality – the demographic surveillance system, Matlab, Comilla, Bangladesh. Rur Demogr (Dhaka) 1981;8(1):29-51*

D'Souza S, Bhuiya A. Socio economic mortality differentials in a rural area of Bangladesh. Pop Dev Rev 1982 Dec;8(4):753-69

Gilman RH, Brown KH, Gilman JB, Gaffar A, Alamgir SM, Kibriya AKMG, Sack RB. Colonization of the oropharynx with gram-negative bacilli in children with severe protein-calorie malnutrition. Am J Clin Nutr 1982 Aug;36(2):284-9.

Gilman RH, Mondal G, Maksud M, Alam K, Rutherford E, Gilman JB, Khan MU. Endemic focus of *Fasciolopsis buski* infection in Bangladesh. Am J Trop Med Hyg 1982 Jul;31(4):796-802.

Glass RI, Becker S, Huq MI, Stoll BJ, Khan MU, Merson MH, Lee JV, Black RE. Endemic cholera in rural Bangladesh, 1966-1980. Am J Epidemiol 1982 Dec;116(6):959-70.

Grundy MS. Preliminary observations using a multilayer ELISA method for the detection of *Entamoeba histolytica* trophozoite antigens in stool samples. Trans R Soc Trop Med Hyg 1982;76(3): 396-400**

Hossain MM, Glass RI, Khan MR. Antibiotic use in a rural community in Bangladesh. Int J Epidemiol 1982 Dec;11(4):402-5.

Huber DH, Rahman M, Chakraborty J. The condom in rural Bangladesh. *In:* Zatuchni GI, Sobrero AJ, Speidel JJ, Sciarra JJ eds. Vaginal contraception: new developments; proceedings of an International Workshop on New Developments in Vaginal Contraception, 25-27 Apr 1979, Guatemala City. Hagerstown: Harper & Row, 1979: 317-24*

Hughes JM, Boyce JM, Levine RJ, Khan M, Aziz KMA, Huq MI, Curlin GT. Epidemiology of eltor cholera in rural Bangladesh: importance of surface water in transmission. Bull WHO 1982;60(3):395-404.

Islam MR, Bardhan PK, Rahaman MM. A comparison of oral replacement solutions containing sodium in concentrations of 120 m mols/L and 60 m mols/L in paediatric diarrhoea. Indian J Pediatr 1982 May-Jun;49(398):349-55.

Islam MR, Sack DA, Holmgren J, Bardhan PK, Rabbani GH. Use of chlorpromazine in the treatment of cholera and other severe acute watery diarrheal diseases. Gastroenterology 1982 Jun;82(6): 1335-40.

Islam MS, Rahaman MM, Aziz KMS, Munshi MH, Rahman M, Patwari Y. Birth care practice and neonatal tetanus in a rural area of Bangladesh. J Trop Pediatr 1982 Dec;28(6):299-302.

Islam MS, Rahaman MM, Aziz KMS, Rahman M, Munshi MH, Patwari Y. Infant mortality in rural Bangladesh: an analysis of causes during neonatal and post-neonatal periods. J Trop Pediatr 1982 Dec;28(6):294-8.

Kabir S. Characterization of the lipopolysaccharide from *Vibrio cholerae* 395 (Ogawa). Infect Immun 1982 Dec;38(3):1263-72.

Khan MU. Efficacy of short course antibiotic prophylaxis in controlling cholera in contacts during epidemic. J Trop Med Hyg 1982 Feb;85(1):27-9.

Khan MU, Shahidullah M. Epidemiologic pattern of diarrhoea caused by non-agglutinating vibrios (NAG) and EF-6 organisms in Dhaka. Trop Geogr Med 1982;34(1):19-27.

Khan MU Interruption of shigellosis by hand washing. Trans R Soc Trop Med Hyg 1982;76(2):164-8.

Khan MU, Shahidullah M. Role of water and sanitation in the incidence of cholera in refugee camps. Trans R Soc Trop Med Hyg 1982;76(3):373-7.

Koster FT, Curlin GT, Aziz KMA, Haque A. Synergistic impact of measles and diarrhoea on nutrition and mortality in Bangladesh. Bull WHO 1981;59(6): 901-8*.

Lindenbaum S. Implications for women of changing marriage transactions in Bangladesh. Stud Fam Plann 1981 Nov;12(11):394-401*

Measham AR, Khan AR, Rosenberg MJ, Jabeen S, Akbar J, Banu H, Phillips JF. The demographic impact of tubectomy in Bangladesh. Int Fam Plann Perspect 1982 Mar;8(1):18-21.

Molla A, Molla AM, Rahim A, Sarker SA, Mozaffar Z, Rahaman M. Intake and absorption of nutrients in children with cholera and rotavirus infection during acute diarrhea and after recovery. Nutr Res 1982;2:233-42.

Molla AM, Sarker SA, Hossain M, Molla A, Greenough WB, III. Rice-powder electrolyte solution as oral therapy in diarrhoea due to *Vibrio cholerae* and *Escherichia coli*. Lancet 1982 Jun 12;1(8285): 1317-9.

Phillips JF, Stinson WS, Bhatia S, Rahman M, Chakraborty J. The demographic impact of the Family Planning-Health Services Project in Matlab, Bangladesh. Stud Fam Plann 1982 May;13(5): 131-40.

Rabbani GH, Gilman RH, Islam A, Froelich J. Comparison of string-test and stool examination in the diagnosis of *Strongyloidiasis* and *Giardiasis* in gastroenteritis patients. Asian Med J 1982 Sep; 25(9):695-700.

Rabbani GH, Greenough WB, III, Holmgren J, Kirkwood B. Controlled trial of chlorpromazine as antisecretory agent in patients with cholera hydrated intravenously. Br Med J 1982 May 8;284 (6326):1361-4.

Rahaman MM, Aziz KMS, Munshi MH, Patwari Y, Rahman M. A diarrhea clinic in rural Bangladesh: influence of distance, age, and sex on attendance and diarrheal mortality. Am J Public Health 1982 Oct;72(10):1124-8.

Rahman ASMM, Al-Mahmud KA, Islam KMN. Dental malocclusion in New Zealand white rabbit (Oryctolagus cuniculus). Bangladesh Vet J 1982;16:

Rahman M. Neonatal tetanus in Bangladesh : effect of active immunization of mothers; anti-tetanus active immunization of mothers-field experience in Bangladesh. Pak Pediatr J 1982 Jun-Sep;6 (2-3):144-51.

Rahman M, Chen LC, Chakraborty J, Yunus M, Chowdhury AI, Sarder AM, Bhatia S, Curlin GT. Use of tetanus toxoid for the prevention of neonatal tetanus. I. Reduction of neonatal mortality by immunization of non-pregnant and pregnant women in rural Bangladesh. Bull WHO 1982;60(2): 261-7.

Rahman M, Chen LC, Chakraborty J, Yunus M, Faruque ASG, Chowdhury AI. Use of tetanus toxoid for the prevention of neonatal tetanus. 2. Immunization acceptance among pregnant women in rural Bangladesh. Bull WHO 1982;60(2):269-77.

Ruzicka LT, Bhatia S. Coital frequency and sexual abstinence in rural Bangladesh. J Biosoc Sci 1982 Oct;14(4):397-420.

Sack DA, Rhoads M, Molla A, Molla AM, Wahed MA. Carbohydrate malabsorption in infants with rotavirus diarrhea. Am J Clin Nutr 1982 Dec;36(6): 1112-8.

Samadi AR, Wachsmuth K, Huq MI, Mahbub M, Agbonlahor DE. An attempt to detect *Yersinia enterocolitica* infection in Dhaka, Bangladesh. Trop Geogr Med 1982 Jun;34(2):151-4.

Sarker SA, Molla AM, Karim AKMM, Rahaman MM. Calorie intake in childhood diarrhoea. Nutr Rep Int 1982 Oct;26(4):581-90.

Shahid NS, Alam AN, Haider K, Henning C, Gothefors L, Greenough WB, III. Rapid technique for detection of pneumococcal pneumonia. Bangladesh Med Res Counc Bull 1982 Dec;8(2) :47-51

Snyder JD, Yunus M, Wahed MA, Chakraborty J. Home-administered oral therapy for diarrhoea : a laboratory study of safety and efficacy. Trans R Soc Trop Med Hyg 1982;76(3):329-33.

Stinson WS, Phillips JF, Rahman M, Chakraborty J. The demographic impact of the Contraceptive Distribution Project in Matlab, Bangladesh. Stud Fam Plann 1982 May;13(5):141-8.

Stoll BJ, Glass RI, Huq MI, Khan MU, Banu H, Holt J. Epidemiologic and clinical features of patients infected with *Shigella* who attended a diarrheal disease hospital in Bangladesh. J Infect Dis 1982 Aug;146(2):177-83.

Stoll BJ, Glass RI, Huq MI, Khan MU, Holt JE, Banu H. Surveillance of patients attending a diarrhoeal disease hospital in Bangladesh. Br Med J 1982 Oct 23;285(6349):1185-8.

Svennerholm A-M, Sack DA, Holmgren J, Bardhan PK. Intestinal antibody responses after immunisation with cholera B subunit. Lancet 1982 Feb 6; 1(8267):305-8.

Swenson I. Relationships between pregnancy spacing, sex of infants, maternal age, and birth order, and neonatal and post-neonatal mortality in Bangladesh. Soc Biol 1981;28(3-4):299-307.

Yunus M, Rahman ASMM, Farooque ASG, Glass RI. Clinical trial of ampicillin v. trimethoprim-sulphamethoxazole in the treatment of *Shigella* dysentery. J Trop Med Hyg 1982 Oct;85(5):195-9

C EDITED BOOKS, PROCEEDINGS, AND REVIEW ARTICLES :

Bairagi R, Chowdhury MK, Phillips JF. A multivariate logistic regression analysis of childhood survival: the interaction of household economic status and nutritional status with sex of child. *In :* Edmonston B, Bairagi R eds. Infant and child mortality in Bangladesh; proceedings of a Conference on Infant and Child Mortality, Dhaka, 9 Jan 1982. Dhaka : Institute of Statistical Research and Training, University of Dhaka, 1982:97-110.

Black RE, Merson MH, Huq I, Alim ARMA. Epidemiological importance of diarrheal agents in rural Bangladesh. *In:* Holme T, Holmgren J, Merson MH, Mollby R eds. Acute enteric infections in children: new prospects for treatment and prevention. Amsterdam: Elsevier, 1981:141-8*

Brown KH, Black RE. The nutritional cost of infections. *In :* Nutrition in health and disease and international development : symposia from the XII International Congress of Nutrition. New York : Liss, 1981: 467-77*

Chen LC, Chowdhury AKMA, Huffman SL. Anthropometric assessment of energy-protein malnutrition and subsequent risk of mortality among preschool aged children. *In :* Sukhatme PV ed. Newer concepts in nutrition and their implications for policy. Pune : Maharashtra Association for the Cultivation of Science Research Institute, 1982: 157-84.

Chen LC, Chakraborty J, Sardar AM, Yunus M. Estimating and partitioning the mortality impact of several modern medical technologies in basic health services. *In :* Proceedings of the International Population Conference, Manila, 1981. Liege : Ordina Editions, 1981;2:113-40*

Chen LC. Malnutrition and mortality. NFI Bull 1982 Oct:1-5.

Chen LC, Huq E, Huffman SL. A prospective study of the risk of diarrhoeal diseases according to the nutritional status of children. *In :* Sukhatme PV ed. Newer concepts in nutrition and their implications for policy. Pune : Maharashtra Association for the Cultivation of Science Research Institute, 1982: 185-94.

Chowdhury AKMA. The concept of intermediate level variables in mortality studies. *In :* Edmonston B, Bairagi R eds. Infant and child mortality in Bangladesh; proceedings of a Conference on Infant and Child Mortality, Dhaka, 9 Jan 1982. Dhaka : Institute of Statistical Research and Training, University of Dhaka, 1982:29-37.

Chowdhury AKMA. Determinants of late fetal, infant and child mortality changes. *In :* Proceedings of the International Population Conference, 1981. Liege: Ordina Editions, 1982;4:

Chowdhury AMR, D'Souza S. A design and field methods for monitoring impact on mortality of an oral therepy programme. *In* Edmonston B, Bairagi R eds. Infant and child mortality in Bangladesh; proceedings of a Conference on Infant and Child Mortality, Dhaka, 9 Jan 1982. Dhaka : Institute of Statistical Research and Training, University of Dhaka, 1982:173-202.

D'Souza S, Bhuiya A. Mortality differentials in a rural area of Bangladesh: results from Matlab thana, Comilla district. *In :* Edmonston B, Bairagi R eds. Infant and child mortality in Bangladesh; proceedings of a Conference on Infant and Child Mortality, Dhaka, 9 Jan 1982. Dhaka : Institute of Statistical Research and Training, University of Dhaka, 1982:69-96.

D'Souza S. Nuptiality patterns and fertility implications in South Asia. *In :* Proceedings of the International Population Conference, Liege : Ordina Editions, 1982;4:305-36.

Glass RI, Huq I, Stoll BJ, Kibriya G, Blaser MJ. Epidemiologic features of Campylobacter enteritis in Bangladesh. *In :* Newell DG ed. Campylobacter : epidemiology, pathogenesis and biochemistry. Lancaster : MTP Press, 1982:28-9

Greenberg HB, Wyatt RG, Kalica AR, Yolken RH, Black R, Kapikian AZ, Chanock RM. New insights in viral gastroenteritis. *In :* Pollard M ed. Perspectives in virology XI. New York: Liss, 1981:163-87*

Greenough WB, III. Bacterial diarrhoeal diseases : current concepts on etiology and pathogenesis. Southeast Asian J Trop Med Public Health 1982 Sep;13(3):319-24.

Greenough WB, III, Merigan TC, series eds. Current topics in infectious disease series no 4. Cytomegalovirus: biology and infection, by Monto Ho. New York: Plenum, 1982:275 p.

Greenough WB, III Joo I. Problems of intestinal immunity. *In :* Holme T Holmgren J, Merson MH, Mollby R eds. Acute enteric infections in children: new prospects for treatment and prevention. Amsterdam : Elsevier, 1981:523-31*

Greenough WB, III. Vaccine development. *In :* Holme T, Holmgren J, Merson MH, Mollby R eds. Acute enteric infections in children : new prospects for treatment and prevention. Amsterdam : Elsevier, 1981:411-12*

Holmgren J, Svennerholm AM. Cholera B subunit : promising immunogen against cholera. *In* ; Rahman S ed. Proceedings of the Conference on Experimental Cholera Vaccines, Dhaka, 6-8 Apr 1981. Dhaka : International Centre for Diarrhoeal Disease Research, Bangladesh, 1981:95-109*

Holmgren J, Greenough WB, III. New perspectives in the treatment and prophylaxis of diarrheal diseases. *In :* Holme T, Holmgren J, Merson MH, Mollby R eds. Acute enteric infections in children : new prospects for treatment and prevention. Amsterdam: Elsevier, 1981:341-54*

Islam MS, Rahaman MM Aziz KMS, Patwary Y. Traditional childbirth practice; implications for neonatal mortality in Bangladesh. *In :* Edmonston B, Bairagi R eds. Infant and child mortality in Bangladesh: proceedings of a Conference on Infant and Child Mortality, Dhaka, 9 Jan 1982. Dhaka: Institute of Statistical Research and Training, University of Dhaka, 1982:203-16

Merson MH, Black RE. Enterotoxigenic *Escherichia coli* diarrhea. *In :* Holme T, Holmgren J, Merson MH, Mollby R eds. Acute enteric infections in children: new prospects for treatment and prevention. Amsterdam: Elsevier, 1981:81-92

Molla A. Acute diarrhoea and dietary menagement. J Bangladesh Assoc Women Scientists 1981; 1(1): 97-101*

Rizvi N. Getting to know a rural community in Bangladesh. *In :* Islam S ed. Exploring the other half : field research with rural women in Bangladesh. Dhaka: Women for Women, 1982:21-39.

Rizvi N. Life cycle, food, behaviour and nutrition of Bangladesh women. J Bangladesh Assoc Women Scientists 1981;1(1):87-96*

Sack DA. Treatment of acute diarrhoea with oral rehydration solution. Drugs 1982; 23:150-7.

Seaton B. Regional priorities in reproductive endocrinology research in Southeast Asia. *In :* Proceedings of the Sixth Contributors' Conference of the Bangladesh Fertility Research Programme. Dacca, 4 Dec 1981:126-30*

Spira WM. Environmental factors in diarrhea transmission: the ecology of *Vibrio cholerae* 01 and cholera. *In :* Holme T, Holmgren J, Merson MH, Mollby R eds. Acute enteric infections in children: new prospects for treatment and prevention. Amsterdam: Elsevier, 1981:273-88*

Svennerholm A-M, Sack DA, Holmgren J. Antibody determinations in intestinal lavage, milk and saliva for studies of immune responses to enteric vaccines: a clinical trial of cholera B subunit. *In:* Holme T, Holmgren J, Merson MH, Mollby R, eds. Acute enteric infections in children: new prospects for treatment and prevention. Amsterdam: Elsevier, 1981:431-42*

D ABSTRACTS, LETTERS, AND TALKS :

Ali MA, Molla A, Chowdhury AK, Rahaman MM. Estimation of zinc status in apparently healthy volunteers and patients with diarrhoeal diseases of different aetiologies. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in: Proceedings (Section VI), 1982:224.

Aziz KMA, Maloney C, Sarker PC. *Parda* and family planning in Bangladesh. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in: Proceedings (Section VI), 1982: 179-80

Bairagi R. On best cutoff point for nutritional monitoring (letter). Am J Clin Nutr 1982 Apr;35(4): 769.

Black RE, Merson M, Sack D. Sucrose or glucose for diarrhea (letter). Pediatrics 1981 Oct;68(4):607-8*

Butler T, Bardhan P, Islam R. The leukemoid reaction in shigellosis. Twenty-second Interscience Conference on Antimicrobial Agents and Chemotherapy, Florida, 4-6 Oct 1982. Abstract in: Program and abstracts, 1982:220.

Glass RI, Stoll BJ, Struelens M, Huq MI, Blaser MJ. Campylobacter associated diarrhoea in Bangladesh: an endemic disease. International Congress of infectious and Parasitic Diseases, Stockholm, 7-12 Jun 1982. Abstract in: Clin Res 1982;30(2): 367A

Glass RI, Huq MI, Lee JV, Threlfall EJ. Outbreak of multiply drug-resistant *Vibrio cholera* 01 El Tor (Vc) in Bangladesh: evidence for a point source. Twenty-second Interscience Conference on Antimicrobial Agents and Chemotherapy, Florida, 4-6 Oct 1982. Abstract in: Program and abstracts, 1982:220.

Greenough WB, III, Molla AM. Cereal-based oral rehydration solutions (letter). Lancet 1982 Oct 9; 2(8302):823.

Huq A, Small EB, Colwell RR. A possible role of copepods in the ecology of *Vibrio cholerae* Electron Mircoscope Central Facility Newslett 1982 Mar; (10): 20-2.

Huq MI, Samadi AR. Chloramphenicol-resistant *Salmonella typhi* Vi phage type A isolated from patient in Bangladesh (letter). Lancet 1982 May 15;1(8281):1125.

Huq MM, Karim MJ, Rahman ASMH, Shaikh H. Helminth parasites of rats, house mice and moles. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section VI), 1982:221.

Islam R. Use of citrate as a substitute of bicarbonate in oral rehydration solution (abstract). Southeast Asian J Trop Med Public Health 1982 Sep; 13(3): 497.

Islam MS, Rahaman MM, Aziz KMS, Rahman M, Munshi MH, Patwari Y. Infant mortality in rural Bangladesh: an analysis of causes during neontal and postneonatal period. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section VI), 1982:180.

Islam MS, Rahim MZ, Aziz KMS, Huq MI, Chowdhury AA. Isolation of coliforms and faecal streptococci from the Buriganga river. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section II), 1982:117.

Islam MS, Rashid MH, Aziz KMS, Huq MI, Chowdhury AA, Rahim MZ. Study of the presence of bacterial flora in water plant, water and soil specimens from Shahbagh pond in Dhaka city. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section II), 1982:117.

Khan MR, Chowdhury MH, Rahmatullah M, Chowdhury SA. An improved method for the determination of citrulline. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section VI), 1982:183.

Khan MU. Role of water and sanitation in the incidence of cholera in refugee camps. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section VI), 1982:196.

Khanam A, Stoll BJ, Huldt G, Ljungstrom I, Nazrul H, Biswas J. Acquisition of *Giardia lamblia* by infants and the protective role of breast milk. 8th International Congress of Infectious and Parasitic Diseases, Stockholm, 1982. Abstract in: Proceedings, 1982:197

Khanam A, Molla A, Molla AM. Changes in serum vitamin A level after an oral loading dose in children with acute diarrhoea (abstract). Southeast Asian J Trop Med Public Health 1982 Sep;13(3):501-2

Molla AM. Feeding during diarrhoea. Bangladesh Paediatr 1982 Mar; 6(1): 5-7.

Molla AM, Molla A, Sarker SA, Khatoon M. Intake and utilization of food in children with diarrhoea due to different aetiology. Annual Conference of the Bangladesh Pediatric Association, Dhaka, 13 Mar 1982. Abstract in : Conference programme, 1982.

Molla AM, Sarker SA, Hossain M, Molla A, Greenough WB, III. New strategy in oral therapy: cereal based, rice powder electrolyte solution as oral therapy in diarrhoea due to *V. cholerae* and *E. coli* (abstract). Southeast Asian J Trop Med Public Health 1982 Sep;13(3):493.

Mozaffar Z, Molla A, Molla AM, Sarkar SA, Rahaman MM. Lactose intolerance in apparently healthy Bangladeshi children under five years of age. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section VI), 1982:206-7.

Rahman ASMH, Al-Mahmud KA, Islam KMN. Dental malocclusion or buck teeth – an inherited ailment of laboratory rabbit (*Oryctolagus cuniculus*). 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section VI), 1982:212.

Rahman ASMH, Al-Mahmud KA, Rahaman MM. Haematological values of clinically healthy New Zealand white rabbit S (*Oryctolagus cuniculus*) raised in Bangladesh. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section VI), 1982: 218-9.

Rahman M, Rahman R, Chowdhury AK, Aziz KMS. Nutritional value of dried fish of Bangladesh. 6th & 7th Bangladesh Science Conference, Joydevpur, Dhaka, 7-11 Feb 1982. Abstract in : Proceedings (Section VI). 1982:205-6.

Speelman P, Kabir I, Islam MM. Contrasting features in amoebic and shigella colitis in Bangladesh: clinical, colonoscopic, and histological findings. 8th International Congress of Infectious and Parasitic Diseases, Stockholm, 1982. Abstract in: Proceedings, 1982:113

Stoll BJ, Glass RI, Huq MI, Khan MU, Banu H. A 2 year study of agents associated with diarrhoea in Bangladesh. 8th International Congress of Infectious and Parasitic Diseases, Stockholm, 1982. Abstract in: Proceedings, 1982:134

Wahed MA, Zimicki S, Rahaman MM. Sodium content in home-made oral rehydration solution collected from different projects in Bangladesh (abstract). Southeast Asian J Trop Med Public Health 1982 Sep; 13(3): 499.

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**K.A. Shaheed	Bangladesh	Senior Property Control Officer
Md. Shahabuddin	Bangladesh	Controller
**Md. Siddique	Bangladesh	Technical Officer
**Mobarak Ali Sikder	Bangladesh	Accounts Officer
R.H. Sircar	Bangladesh	Secretary
M. Sobhani	Bangladesh	Bio-Engineering Cell Head
**Mark P. Tucker	USA	Physical Plant Manager