1984 Annual Report

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH

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Dear Friends,

A quarter century ago, in what was considered by many a remote backwater of the world called Dacca, East Pakistan, a unique initiative by Pakistan, the U.S., the U.K. and Australia planted the seed of what has become a unique institution: an international health research center aimed at combating diarrhoeal diseases – one of the world's oldest, most deadly problems – in the context of the overall health of the people affected. Each year, worldwide, diarrhoea kills an estimated 4-6 million people, mostly young children.

As one of its first major undertakings, the Pakistan-SEATO Cholera Research Laboratory (CRL) tested the standard injected cholera vaccines, which had been required for decades for international travel, though their effectiveness was unknown.

To do the tests, four things were necessary: an area where cholera was common each year; a well-defined populace whose members could be followed-up for years, if necessary; a treatment facility for those who might become very ill; and a way of helping such people reach the facility, in a desperately poor area, criss-crossed by rivers, canals and inlets.

Dr. William B. Greenough, III, Director

Chosen was an area called Matlab, about 45 miles from what now is Dhaka, Bangladesh. In 23 villages with about 28,000 people, a small-scale Demographic Surveillance System (DSS) was established in 1963 – that combined periodic censuses of the study population, with continuous registration of such "vital events" as births, deaths, marriages, migrations and divorces.

Over the ensuing decade, six landmark cholera vaccine trials were done in the Matlab DSS area, the last involving 93,000 people. The critical basic finding was that the injected vaccines did not prevent cholera in most people, though some who had had prior exposure were those most likely to be partially protected for a short time. It was concluded that, for an exposed population, the vaccine was of minimal use, did not prevent the spread of infection, and that, given the extensive side-effects and danger of hepatitis transmission via poorly-sterilized needles, the vaccine no longer should be used. (Until today there is no evidence that in those not previously exposed to infection the injected vaccine protects at all).

As a result of these and similar, subsequent trials done elsewhere, almost all nations now have abandoned the cholera vaccine requirements, with cost savings for all.

This year, building on its two decades of cholera vaccine studies, the CRL's successor, the ICDDR.B. once again is engaged in a major trial of a new cholera vaccine an oral one which has great promise. While the details of the current effort appear elsewhere in this report, I have chosen to open with this subject, because the centerpiece of the original cholera vaccine

trials, the Matlab DSS, over time gained a life and purpose of its own; and has become pivotal to the ICDDR,B's search to insure that methods of proven efficacy are provided in health programs throughout the developing world. where resources must not be wasted.

Essentially, it quickly became evident that the original Matlab DSS was an enormously valuable research tool. By using it, it is possible to obtain reliable information about changes occurring in people, households, villages and entire communities over time. Such data provide a unique foundation for monitoring the constantly-changing balance of health and illness, especially the interactions among such variables as socio-economic status, rates of various major infectious diseases, health care, and causes of death, malnutrition and fertility. In no other setting in a least developed country have such precise observations over nearly 20 years been possible.

Recognizing its potential, the CRL by 1968 expanded the DSS to encompass about 250,000 people in 243 villages. However, to make the system less costly, the ICDDR,B reduced the DSS by 1982 to 160,000 people in 149 villages, equally divided into "treatment" and "comparison" sectors.

In the original "treatment" area, the CRL had built a very rudimentary treatment facility in a tin shed, and had provided "ambulance" speedboats to facilitate patient travel. Today, in addition to a more modern treatment center and ambulance boats, four subcenters and two community-operated centers provide health care for a much larger number of people in the same area. This set-up now forms the backbone of the ICDDR,B's Matlab DSS experimental area – which has been greatly improved, to provide the most effective components of primary maternal-child health care services, diarrhoea treatment, and family planning programs. So important is this DSS/treatment facility complex that it has been selected as the site for extensive joint UN/WHO mortality studies.

Since the CRL's internationalization in 1979, the DSS's broader emphasis has been mandated by the ICDDR,B's charter which, in turn, was designed to reflect newly-appreciated health realities. Thus, while the CRL had a single, limited goal, its successor focuses on specific problems, but always in the overall context of the patterns of health and illness in communities.

It is important to understand that the ICDDR,B, although in Bangladesh, is an international research center – currently the only such health research initiative in the developing world. It is supported financially by 26 countries and agencies, with the additional participation of many other nations. Its primary mandate is to undertake and promote study, research and dissemination of knowledge in diarrhoeal diseases and directly related subjects of nutrition and fertility, with special relevance to developing countries.

As an integral part of this effort, Centre scientists from many countries seek to determine how the diarrhoeas are related to health practices, nutrition and fertility. For, as scientists and health planners increasingly have come to comprehend, the diarrhoeas and other major diseases which annually devastate millions of the earth's people do not take their tolls in a vacuum, and the spread of microbes is determined by human behaviour.

Finally, as ICDDR,B studies at the Matlab DSS are indicating with ever-increasing force, impinging on the overall health situation among large, poor populations are the debilitating effects of swiftly-growing populations – effects which drain the strength of babies and compromise Third World mothers' abilities to provide for them, while encouraging disease spread in

crowded households, thereby dramatically depleting health, as well as food, water and other scarce essential resources.

While the detrimental health-related effects of swift population growth on large groups of very poor people long have been recognized, the CRL/ICDDR,B did not become involved in this problem until a decade ago – as a result of one of the great sociological debates of the century.

Thus, beginning in the early 1970s, health and policy planners around the world became embroiled in a controversy over how to alleviate or solve one of mankind's biggest quandrys: whether it was possible, in the absence of concomitant social and demographic change, to dramatically reduce birth and death rates among rural, improverished people. One specific question which cried for an answer was whether family planning programs truly could be successful by themselves, isolated from other health concerns.

In 1975, with access to the world's largest, longest-sustained "population laboratory," the Matlab DSS, located in one of the world's poorer health-and mortality-devastated areas, the CRL began to collect data, in order to inject facts into the great debate. A carefully-optimized contraceptive distribution program was begun. It was widely believed that so great was the demand for smaller families, that if contraceptives simply were given free to all households, a dramatic population decline would ensue.

Unfortunately, this did not prove so. Despite an initial dramatic rise in contraceptive use, levels quickly fell back to the previous low rates, even though a long-established health facility was present and providing care for diarrhoea. The CRL studies concluded that provision of family planning devices as an independent intervention to a large, poor rural people was unsuccessful.

In 1978, following the failure of this attempt, the CRL decided to incorporate family planning with other health care, and to ensure careful follow-up and treatment of all contraceptive-related complications. Thus, comprehensive family planning services, home delivery of oral rehydration therapy (ORT) to treat diarrhoea, immunization against tetanus and measles, nutrition information, and care of pregnant women and new-borns were provided by young mothers chosen from the communities served. This carefully-designed, sustained community services maternal-child health/family planning approach has resulted in large decreases in both deaths and births – with a positive impact on overall health.

Encouraging though this result has been, Matlab is but a small oasis in Bangladesh. Very often, model projects which receive special attention tend to produce striking results. The big question was : could the Matlab successes be replicated ?

Three years ago, the Bangladesh Government challenged the Centre to a working partnership, to determine how to achieve similar results elsewhere, using the existing government health system. As a result, a joint project, supported by USAID, was begun in 1984, in two widely-separated parts of the country.

Early results at Sirajganj and Noapara are encouraging. Using a process known as "operations research," many crucial impediments to success have been identified by ICDDR,B researchers, and the Government has initiated corrective actions. At the same time, a very accurate sample registration system (SRS) was established in both places, at less cost than Matlab's comprehensive DSS.

The two SRSs already are providing a running tally of what is being achieved in the vital terms of life and death. And while it is too early to know if this approach will yield dramatic changes, definite improvements already are visible. More important, the partnership has had an immediate, vital impact on Government policy, as some of the suggested changes have been incorporated in Bangladesh's new Five-Year Plan.

Speaking of 5-year plans, in 1985 the Centre itself will develop one, taking it through 1989. The broad outlines will follow the guidelines emanating from the charter-mandated external review process and the now-active Program Committee of the ICDDR,B's Board of Trustees. Accordingly, the priority research areas will be: 1) Focused maternal-child health and family planning (MCH/FP); 2) Vaccine development and field testing; 3) Studies on shigellosis and invasive diarrhoeal illness; 4) Water, environment and sanitation research; 5) Development of ORT; and 6) Cholera studies, with an emphasis on the basic disease mechanisms, and development of practical anti-secretory drugs.

Of these six areas, this year's Annual Report focuses especially on the first two, which command the Centre's largest investment in terms of funds and efforts.

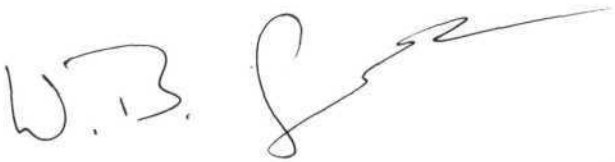
From a research standpoint, these central priorities cooperatively are addressed in diverse ways by members of the Centre's five Working Groups, each of which brings special expertise and technology to bear on the problems within its domain. These groups are: Pathogenesis and Therapy, Host Defense, Disease Transmission, Nutrition, and Community Services Research.

In addition, the Centre has a large Training, Extension and Communications division, which addresses the issue of transferring what has been learned in the research process, and applying these things appropriately in Bangladesh and other countries. This effort is conceived of as a lateral transter of methods already adapted to least developed country conditions. In 1984, demand for these services increased greatly; and people with health responsibilities from 51 countries participated in our training programs.

The Centre's research priorities are set by interaction among these Groups, based on field realities and intensive discussion and review by the ICDDR,B Scientific Council. Finally, presentation to our Trustees and donors determines specific activities, as resource realities are linked to research priorities.

A recent problem has been a sharp decline in flexible support, although there has been a concomitant growth in overall resources. This "core" support decrease has made it very difficult for us to respond, in a timely fashion, to new needs arising in our field stations, hospital and laboratories. Both our Trustees and research staff are worried about this, since one of the principal reasons for being in Bangladesh is to have the realities of this country directly influence our research priorities.

In the last analysis, however, 1984 overall was the most productive year since the Centre's inception; and I am sure we can anticipate an even greater harvest in 1985, under the leadership of a new Director, Dr. Roger Eeckels, who takes over in July.



THE MATLAB

The land is fertile. Rice paddies, jute acreage, buttercup-yellow mustard plants, mango, papaya, jackfruit, banana and coconut trees and lentil/vegetable patches thrive in a verdant setting, intersected by a panoply of sun-spangled, life-giving waterways. Nestled amidst nature's finery, in clusters large and small throughout the 25-square-mile Matlab area, are the thatched huts, made of dried mud, bamboo and, occasionally, cracked, fading wood.

Devoid of litter and graced by bright, sunny skies most of the year, the area has a deceptive, semi-tropical paradise look to it – a patina quickly belied by a closer look at the thin women, some undernourished, in faded saris, and the babies and older children, beset by endless bouts of diarrhoea, running noses, coughs, scabies-infected heads and bodies, swollen bellies and other, less obvious, ailments.

This is the ICDDR,B's Matlab field station, home to about 180,000 people in the 20-year-old Demographic Surveillance System (DSS) area (Page 2). These people represent a microcosm of the nation s estimated 100 million-odd inhabitants, most desperately poor and disease-ridden, many landless, with little hope of significant improvement in their lifetimes.

But Matlab is different, for here there is more than hope; here there has been change, palpable, tangible change which, especially over the past five years, has dramatically improved lives and reduced deaths – change precipitated by a carefully-prioritized, researched and planned program, which an attempt now is being made to transfer, at the Bangladesh Government's request, to two other areas of the country, Sirajganj in the north and Jessore in the southwest.

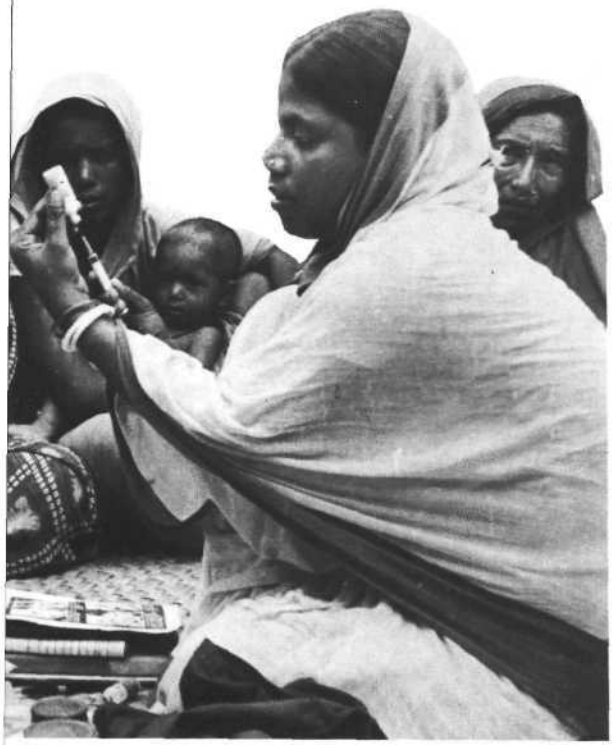
What is this program and what changes has it wrought ?

Essentially, the effort aims to provide intensive dissemination of family planning advice, methods and medical follow-up, coupled with focused health care and preventives for major ailments, in order to prevent the main causes of disease and death. As a result, over the past five years :

MAJOR SUCCESS

- Overall deaths dropped more than 20 percent (from 15.9 to 12.5 per 1,000; while infant mortality fell more than 10 percent, from 118.3 to 98.
- The overall birth rate dropped more than 20 percent, meaning that families went from an average of 6.3 to 4.9 children – and that the population doubling time (assuming nothing changed) declined from 27 to 44 years.
- Contraceptive use surged, from 8 percent in 1977 to 45 percent;
- Mortality from such debilitating, often deadly diseases as the diarrhoeas, measles and tetanus dived concomitantly; and the number of diarrhoea-caused hospitalizations fell from 12,000 in 1982 and 1983 to 8,000 in 1984.

EXPERIMENT



THE UNDERLYING EFFORT

The principal influences on these vital changes seem to be family planning services, plus vital health coverage, with vaccination against measles and neo-natal tetanus, and use of oral rehydration solution (ORS) (Page 11) to prevent diarrhoea deaths. Nutrition advice and attention to safe birth practices also seems to play a role.

This may be the first time that such a critical demographic transition has been precipitated by a well-planned and –documented service delivery program. This program thus has useful implications for the success of similar efforts elsewhere in Bangladesh and other developing countries.

The above has been achieved not by a big, central hospital with sophisticated medical treatment, but by taking the services to where the problems are : people's homes.

Before describing the program, called the Family Planning Health Services Project (FPHSP), it is important to re-emphasize two points. The first is that the ICDDR,B has two major health-related mandates: to do basic diarrhoeal diseases research, including discovering how the diarrhoeas are related to health practices, nutrition and fertility; and to help improve health care methods and public health programs, especially in developing countries.

THE PROBLEM

The second point is that the diarrhoeas do not maim and kill in a health vacuum, but are part of the overall devastation inflicted by the synergistic, cumulative ravages of the diarrhoeas with such other big killers as malnutrition, neo-natal tetanus, measles, and pneumonia.

Finally, compounding the effects of such a deadly disease environment, is the enormous drain on human strength and vital environmental resources caused by spiraling population growth.

POSSIBLE SOLUTIONS

Over the past decade, international health specialists increasingly have become aware of the failures of most developing nation efforts to meet the basic health needs of the rural poor. While opinions differ on the problems' causes and effective solutions, it is widely agreed that the impact of rural health services could be improved dramatically, if existing resources were focused on a few priority health problems of mothers and children, and were delivered to their homes.

At the same time, many health planners believe that the key to vastly improved health for the world's impoverished rural millions is a drastically reduced population growth rate.

BY WEIGHING children it is possible to determine malnutrition and growth-related factors critical to good health.

THE FPHSP

It is in this overall context that the FPHSP was launched in 1977 in the Matlab area, supported first by UNFPA and later by USAID. It was decided to link provision of carefully-chosen health services with an intensive family planning (FP) program, aimed at about 90,000 residents of the Matlab DSS's "treatment" area. (An equal number of people live in the "comparison" area. For a brief explanation of the Matlab DSS, see Pages 2-4). Success or failure was to be measured by the program's impact on death and fertility.

Over the next few years, critical health care components were added incrementally (to give each time to work and to be assessed) to the Matlab treatment area's diarrhoea care and family planning services. Today's overall program is a three-tier operation involving home-based services, rural community clinics run by trained paramedics, and a rural, medically-supervised treatment center at Matlab, which cares for more serious MCH and FP referral problems, in conjunction with the Government's local health center.

PROGRAM OPERATIONS

The program provides well-integrated, smoothly-functioning services: an intensive FP program, with home delivery of all methods except sterilization; diarrhoeal disease treatment, and intensive education in preparation and use of ORS; immunization of women of child-bearing age, to prevent neo-natal tetanus, the major child killer in the first month of life; immunization of children to prevent another big killer, measles; provision of pre-natal and birth services care, by training traditional birth attendants; screening of pregnant women for birth-associated risks; and information about basic MCH measures, including nutrition.

Except for emergency or complex cases, these MCH/FP services are taken to the homes of rural villagers who, due to poverty, cultural and religious taboos, and the prohibitive cost, in time and money of traveling even a couple of miles, otherwise would virtually live outside the pale of even the simplest modern health care.

Providing these doorstep services are about 80 "community health workers" (CHWs), carefully-chosen from their own conservative, predominantly Muslim (some Hindu) communities, where each serves about 250 families or 1,100 people.

These are women to whom people listen. They are married, from respected families, relatively educated (at least 7 years' schooling) and practice family planning. They report to the female paramedic who staffs one of the ICDDR,B's four Matlab treatment area health facilities. (The paramedics, in turn, report to a female doctor at the Matlab hospital, who cares for MCH/FP referral patients.)

As noted earlier, this integrated MCH/FP program has achieved a dramatic and cumulative impact — suggesting that when critical primary MCH services are linked with a well-planned and executed FP effort, a quantum leap in success for both can result.

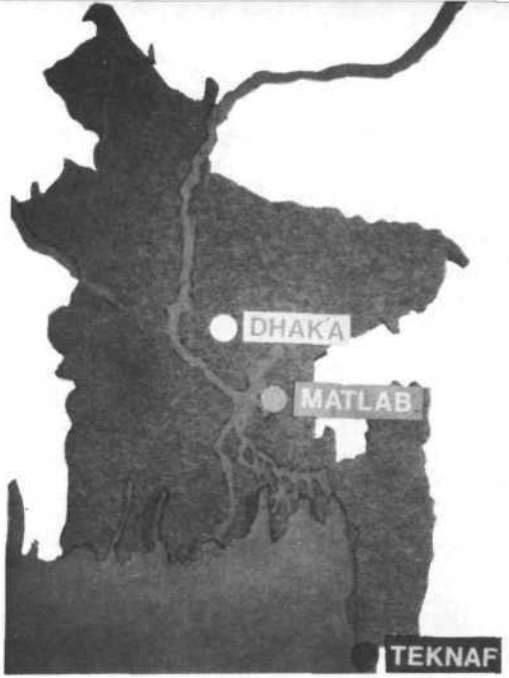
TANTALIZING POSSIBILITY

Furthermore, these studies suggest another tantalizing possibility: that family planning, when integrated with a targeted MCH program, may itself be a powerful primary health tool in the battle to slash disease and death rates in poor, rural Third World societies. This hypothesis arises from two findings :

ICDDR,B-Trained Community Health Workers are playing a crucial role in improving the general well-being of the Matlab Treatment Area populace.

The Matlab hospital, which annually cares for about 8,000 diarrhoea in-patients, also provides training, logistics, supplies and medical back-up to four Matlab area community volunteer-run centers, which annually treat about 6,000 diarrhoea victims. Finally, as part of the Matlab MCH/FP outreach effort, ICDDR,B-trained village volunteers distribute ORS packets in their communities.

* When MCH and FP are combined, it appears that the resulting health benefits are disproportionately greater than what could be expected from such limited MCH interventions; and
* Preliminary evidence suggests that fertility declines can be achieved *before* similar declines in mortality.



Overall, it is vital to recognize that the Matlab experiment remains an experiment — one where critical health technology and family planning policy issues can be researched. Among these are :

How effective are the individual MCH interventions ? How much morbidity and mortality reduction can be achieved by a package of MCH programs, what should be the components and what will this cost ? Does the health of mothers and children truly benefit from low fertility and, *if so, how, why, and how much* ?

And, finally, can the MCH/FP-type program so successfully run by experts at the well-defined, well-serviced Matlab experimental area dramatically reduce disease, death and fertility rates in other circumstances — both within the health and family planning system of Bangladesh and elsewhere – and at a reasonable cost ?

TRANSFER ATTEMPT

At the request of the Bangladesh Government, the ICDDR,B now is trying to answer this vital unknown – by attempting to identify the critical success elements in the Matlab setting, and to integrate them into the existing Government primary health services and family planning system, in two areas far from Matlab.

To do so, two issues are at stake : Can Matlab approaches be transferred without major Government policy changes or added resources ? And if not, what are the barriers to transfer, and how can these best be overcome ?

Such research requires still another dimension, using what is called "operations research methodology" — a research tool which examines the constraints to successful replicability. Since this will be the subject of a subsequent annual report, suffice it to say that the study at Sirajganj and Jessore, *each with more than 120,000 people, is underway.*

Two first steps have been taken. Readily-solvable obstacles within the existing Government service delivery system were identified by ICDDR,B researchers, and practical solutions were introduced by the Bangladesh Government into the draft 1985-90 Five-Year Development Plan; and a Sample Registration System, much like the Matlab DSS, was established to monitor "vital events" (Page 5).

For, as was learned at Matlab and at the ICDDR,B's subsequent and smaller DSS field station at Teknaf, the true effects of any health/FP interventions only can be assessed with any degree of accuracy when certain crucial elements are understood about the people under study.

Finally, after such critical determinations have *been made and tested rigorously under* Matlab-type field conditions, the next step is to attempt to adapt and introduce them into the service systems of interested developing countries.

It is in this context that the ICDDR,B's most enduring contribution to Bangladesh, to other developing nations and to its own overall program has been the development, refinement and ongoing functioning, for more than two decades, of the Matlab experimental area with its invaluable DSS.

For underlying the Matlab experiment itself, the current attempt to transfer its MCH/FP program elsewhere in Bangladesh, and the functioning of many other ICDDR,B efforts, is the need for accurate documentation of interventions.

NEW ORAL REHYDRATION SOLUTION

Perhaps no other success story is as entwined with the Centre's history as that of oral rehydration solution (ORS) – the "miracle" treatment for diarrhoea that the prestigious British medical journal "Lancet" lauded as "potentially the most important medical advance of this century".

For it was the laborious basic research efforts of CRL researchers in the 1960s that resulted in the development of a simple solution – which was proven to be a resounding success in 1971, when it slashed cholera death rates from about 50 to one percent, among thousands of refugees fleeing the Pakistan civil war which resulted in an independent Bangladesh.

That original ORS formulation, which is the one now recommended by the World Health Organization for pre-packaged ORS, consists of a simple, complete formula of electrolytes (sodium chloride, potassium chloride and sodium bicarbonate), plus glucose or sugar, all to be dissolved in water. For patients with all degrees of dehydration, this ORS both rehydrates effectively and prevents further dehydration. It is dehydration which kills in diarrhoea.

However, pre-packaged ORS is available at best to only a small percentage of the millions of developing world people annually stricken by diarrhoea. For this reason, in recent years, much of the ORS emphasis has shifted to a more simple formula, consisting of common salt and sugar (usually available in even the poorest homes) plus water. In Bangladesh and other developing countries, massive campaigns have been underway for some time, to teach people how to prepare this ORS at home and feed it to diarrhoea victims.

CEREAL-ORS

While this ORS, and ORT, the therapy which bears its name, became crucial to health programs of developing nations worldwide, scientists at the CRL/ICDDR,B continued efforts to improve ORS. The results, which began to be definitively published in 1984, although reported earlier, describe a new, cereal-based ORS, in which raw sugar has been replaced by rice or other cereal starches. The comparative advantages :

ORS has been proclaimed a miracle" treatment for the diarrhoea-caused dehydration which can result in death.

* Starch-based ORS is as effective as sugar-ORS in rehydrating diarrhoea patients. Moreover, it better-maintains and even improves nutrition – a critical consideration for most developing nation diarrhoea victims, whose strengths are being sapped and lives are being threatened by frequently-recurring bouts of malnutrition-aggravated diarrhoea. For example, ICDDR,B studies have shown that, compared to glucose-ORS, rice-ORS enables children to gain 20-30 grams per month. Thus, rice-ORS optimizes diarrhoea therapy by adding a nutritional bonus.

* In victims of prolonged diarrhoea, rice-ORS cuts the disease time in half. In diarrhoea victims overall, rice-ORS reduces vomiting by 80 percent – especially in acute cholera, the most deadly of the diarrhoeas, because it kills by ever so swiftly draining the body of essential fluids and salts. Hence, rice-ORS's fluid reducing attribute can be critical. Also, when less fluid is lost, less ORS fluid replacement is needed.

* Starch-based ORS is cheaper and often more readily available to households in Third World countries, many of which must import glucose or sugar. Thus, cereal-ORS reduces these countries' dependence on imports.

* Thanks to its nutritional contents and low osmotic qualities, more rice can be used than sugar in the same amount of ORS, thus improving nutrition at equal or lower cost.

* Rice or other cereal-based ORS often is more readily-accepted by traditional societies, which don't find such preparations "foreign," and often use them as part of their folk medicine tradition.

BASIC RESEARCH

As with the perfection of what is now standard sugar-based ORS, extensive and intensive research lies at the heart of what may appear, at first, to be a simple, if not simplistic, therapy.

Thus, development of the original ORS, based first on glucose and then on refined sugar, is a tale of both triumph and tragedy. For example, a pinnacle was reached when, in related cholera research, it was discovered that, due to an impaired gut mechanism, cholera victims can absorb critical water and salt only in the presence of sugar molecules; and a couple of years were lost, in the wake of several deaths in pioneering studies in the Philippines, before CRL scientists developed an optimum and safe ORS formula – one which did not overload the body with a deadly level of salt.

IT IS CRUCIAL that mothers learn how to properly prepare and use ORS.

While salt concentrations now are clearly defined, the ICDDR,B's ongoing cereal-based ORS work has been equally exacting – a carefully planned and executed balance of studies at the Centre's Dhaka laboratories and hospital, followed by field trials at Chandpur. These hospital-based studies have included:

* Comparison of the efficacy of intravenous rehydration versus sugar-ORS and rice-ORS of three concentrations (30, 50 and 80 grams/liter) in cholera;

* Assessment of the nutrient value and digestibility of the increased calories present in 80 grams per liter ORS in children with acute diarrhoea;

* Comparison of diverse ORS "cereals" (rice, maize, millet, sorghum, wheat and potato) in adult cholera patients and in children with acute diarrhoea.

At Chandpur, two of the studies are :

* The feasibility of home-preparation, acceptance and impact of rice-ORS (now completed and reported); and

* A three-year field comparison of rice-ORS versus WHO-recommended sugar-ORS, for efficacy, cost and nutritional impact (study continuing).

As a prelude to the cereal-based ORS studies already completed, some important basic scientific discoveries have been made :

* Carbohydrate absorption remains virtually unimpaired in acute diarrhoea of most causes;

* In acute cholera patients, digestive enzymes were normal or above normal; and rice-based ORS did not change the character of the classic cholera stools – suggesting that in most acute diarrhoea, gut functions are not seriously impaired.

* Even one month-old infants have been able to digest and utilize from rice-ORS adequate starch for their needs.

Thanks to these original studies at the ICDDR,B and subsequent work elsewhere, interest in and use of cereal-ORS is spiraling. For instance, the ICDDR,B Dhaka hospital has completely switched to rice-ORS. Moreover, the ICDDR,B research continues, sponsored by UNICEF, and the Aga Khan Foundation.

SHIGELLOSIS : A GROWING THREAT

From the grand vista of the ICDDR,B's Matlab research and the latest details of the "miracle" diarrhoea treatment ORT, we focus now on a critical area of the Centre's basic scientific studies : the diarrhoeal diseases caused by *Shigellae* bacteria and termed collectively "shigellosis."

While cholera is the most feared and deadly of the diarrhoeas, by no means is it the only devastating one. In fact, competing closely for this dubious distinction and now exceeding it in gravity is shigellosis.

Cholera bacteria often are deadly because they produce toxins or poisons which trigger swift, enormous fluid/salt losses through the intestinal lining. While the intestine is not itself damaged, these losses cause dangerous dehydration. The reason cholera is so deadly is that about half those not quickly rehydrated will die. On the other hand, when rehydration fluids are used soon enough, the death rate plunges to under half a percent.

Shigellae are much more dangerous. Among the diarrhoeal organisms they are by far the biggest cause of malnutrition and death. There are two reasons. First, the *Shigellae* are "invasive" organisms, which penetrate and destroy the intestinal lining, causing dysentery-type diarrhoea with blood and mucous in the stool. When this occurs, it is a signal that precious body proteins are being lost. This is so critical that even a healthy child can become dangerously malnourished in a mere 15 days.

The second reason shigellosis is far more dangerous than cholera is that cholera can be treated swiftly, effectively and simply with ORS. ORS does not work in shigellosis, where dehydration is not the deadly factor. Only some antibiotics are effective. However, these cannot be made widely available for indiscriminate use, especially since resistance to them among the *Shigellae* keeps growing and already is an alarming problem.

In developing countries, the *Shigellae* are a major cause of deadly epidemics. For instance, in 1984, shigellosis killed thousands in India's West Bengal State. Among hospitalized shigellosis patients mortality is very high — including about 10 percent of such patients hospitalized in recent years at the ICDDR,B. And this is only the obvious toll, as complications and malnutrition continue to reap a grim harvest weeks to months after the patients are discharged.

Furthermore, the current prognosis for controlling shigellosis in the near future is not bright. For unlike the cholera situation, there is for shigellosis neither an equivalent to ORS treatment nor a potentially effective vaccine (see Page 11).

For these reasons, shigellosis studies are an ICDDR,B research priority. Compared to *Vibrio cholerae*, bacteria, relatively little is understood about the *Shigellae* which have been neglected by most scientists. There are four species, each with dozens of serotypes. The most dangerous serotype is *Shigella dysenteriae* type 1, soon to be described.

In the past five years or so, ICDDR,B scientists have described many new features of shigellosis. The highlights:

VIEWING COLONIC DAMAGE

The diverse diarrhoeal disease pathogens wreak their havoc in diverse ways and different places within the 24-foot long tangle consisting of the large and small intestines. While shigellosis was known to primarily affect the colon, the precise disease mechanisms only recently have been determined by ICDDR,B studies.

Basically, this research showed that, by causing ulcerations or lesions in the colon, shigellosis precipitates loss of potassium and sodium chloride from and prevents water absorption by the colon; and that fluid loss simultaneously is triggered mainly from the large intestine.

Equally important, the researchers were able literally to view the disease process within the colon — apparently the first time this has been done in a living patient.

Making this possible was a 5-foot long flexible medical periscope, called a "fiberoptic endoscope" (or colonoscope), donated by the Japanese Government. Employed previously as a diagnostic tool for cancer and other diseases, this apparently was the first use of the highly sophisticated colonoscope for research on shigellosis in a developing country.

Inserted via the rectum, the device gently bends back and forth around the curves of the colon, while a powerful light beam illuminates the colon and transmits images back to the operator's eye.

THE CHIEF VICTIMS of often-deadly Shigella sepsis and the hemolytic-uremic syndrome are children, especially those malnourished.

From this perspective, a crucial fact about shigellosis became evident: judging by the location of lesions, the disease begins near the rectum and travels upward with time. The tentative conclusion: early treatment could help limit the disease's spread and, hence, its frequently lethal outcome. This finding is important, because a related recent Centre autopsy study showed that the most common cause of death in shigellosis patients was severe and extensive colonic ulceration. Such ulceration is like an "internal burn" with great loss of precious body proteins.

SHIGELLOSIS AND SEPSIS

Shigellosis most often becomes deadly by causing one of two complications: sepsis, when bacteria grow in the blood circulating to the vital organs; and the hemolytic-uremic syndrome. Let's look first at sepsis, about which a Centre study has provided important new insights.

Shigella sepsis occurs predominantly in children, with as high as 20 percent of those hospitalized with the disease dying. And of those whose shigellosis is caused by the epidemic-prone *Shigella dysenteriae* type 1, the most virulent of the *Shigellae* bacteria, about five percent develop sepsis.

ICDDR,B research determined that young children at the greatest risk of developing *Shigella*-sepsis were both infected with *S. dysenteriae* type 1 and were malnourished — another link in the complicated diarrhoea-malnutrition relationship.

Also discovered was that children with *Shigella* sepsis had a defect in their blood's ability to kill *Shigellae* bacteria. This defect is due to the lack of or inactivity of a group of blood proteins called "complement". Whether the defect caused or precipitated the sepsis is one of the questions now being examined.

THE HEMOLYTIC-UREMIC SYNDROME

Like sepsis, this dangerous disease occurs predominantly in malnourished children under four, and is due to *S. dysenteriae* type 1. The syndrome begins late in the disease, as the dysentery seems to be improving. Within only one or two days, red blood cells are destroyed and fibrous clots form in kidney blood vessels — triggering acute anemia and rapid kidney failure.

About half the children with this *Shigella* complication die. In 1984, there were 31 such patients at the ICDDR,B Dhaka hospital, victims of the *S. dysenteriae* 1 epidemic.

Centre researchers developed an animal (rabbit) model of this syndrome, by injecting endotoxin (poison) from *S. dysenteriae* 1, thus confirming other studies that the *Shigella* bacteria's chemical component appears to cause the syndrome.

They also discovered an intriguing phenomenon: in 1984, all hospitalized hemolytic-uremic patients developed the complication *after* antibiotic treatment. Currently, they are trying to learn whether the antibiotics may have precipitated the release of toxin from dying *S. dysenteriae* 1 – thereby causing the disease.

ENVIRONMENTAL

While the worldwide battle against diarrhoeal diseases is being fought on many fronts, especially in developing countries, the largest current efforts by far aim to *treat* diarrhoea victims with oral rehydration therapy (ORT), in order to minimize debility and death. However, relatively little is being done to *prevent* and *control* the spread of these highly contagious diseases among the countless millions living in hyper-endemic diarrhoeal disease areas.

Depending on the cause of specific diarrhoeas, they spread in one of two related ways: from person-to-person in poor, crowded, unsanitary environments; and via fecal contamination of food and water.

Environmental contamination lies at the heart of both processes, with each responsible for spreading one or more of the most devastating of the diarrhoeas. For example, shigellosis (Page 3) spreads directly, while cholera (Page 22) is waterborne.

It widely is believed that diarrhoeal diseases can be controlled effectively when three essential things occur : people practice good hygiene; have access to both good quality water for domestic purposes, and a sanitary facility to isolate feces instead of allowing them to contaminate the household environment; and are motivated to use all these.

This is the theory, still unconfirmed due to major roadblocks :

NO EDUCATION and few tools are needed to repair a new PVC deep tube-well pump, being experimented with under ICDDR,B supervision. (Page 18).

THE PROBLEMS :

* The vast majority of diarrhoea victims globally have no access to clean, safe water or sanitary latrines.

* Moreover, because they are uneducated and live in traditional societies with customs inherited over generations, they do not understand the importance of good hygiene, or why they should worry about their water or feces disposal.

* While access to expensive piped water and sewerage systems is out of the question for most

EXPERIMENT

such areas for a long time to come, no one yet has been able to determine how effective low-cost water/sanitation substitutes may be, which are likely to produce the best results in different circumstances, which will best control the diverse diarrhoeal disease organisms, and how to most effectively motivate people to practice good hygiene and use safe water and latrines.

POSSIBLE ANSWERS

Seeking solutions, ICDDR,B researchers were engaged in 1984 in three related major environmental studies: in two urban Dhaka area slums; in a very conservative rural area at the Centre's Teknaf field station, about 315 miles south-east of Dhaka; and in a rural community at Mirzapur, about 35 miles north of the nation's capital.

These studies seek to measure the impact, on specific diarrhoeal diseases and/or directly-related malnutrition, of providing:

1. Good quality, uncontaminated, readily-accesible water;
2. Relatively inexpensive latrines; and
3. Health information to optimize use of these facilities.

TEKNAF

In this on-going study, which began in 1982, a major effort is being made to determine the effects on diarrhoea of diverse causes, of providing hand-pumps, sanitary latrines and hygiene education.

The study community is comprised of 365 families (about 2,200 people), each of which, by the end of 1984, had bought and installed its own latrine, having become convinced of its value by an intensive ICDDR,B campaign. In addition, groups of five families (about 30 people) share a hand-pump (donated by UNICEF), which provides safe water for all household purposes.

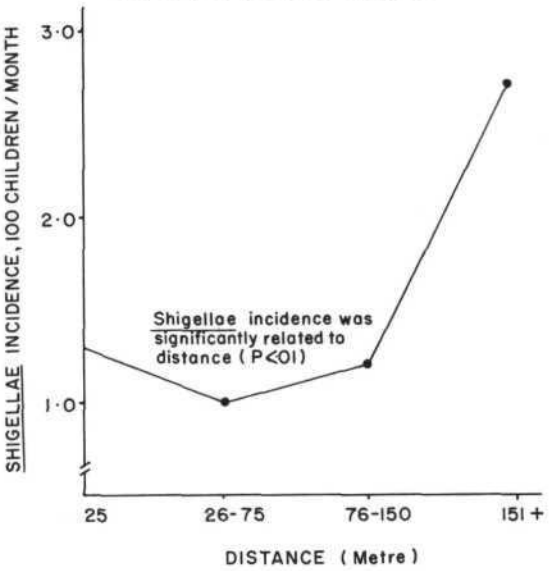
Finally, these families have been the target of an intensive hygiene education effort, which includes explanation of the importance of using the pumps and using and maintaining the latrines.

Some of the more important findings to date are that, compared to a neighboring community with limited access to or understanding of improved hygiene/water/sanitation, in the study community there was:

1. A significantly lower amount of *Shigellae* bacteria isolated; and the nearer people lived to a hand-pump, the lower was this rate. In other words, availability and use of water appears to be an important factor in controlling shigellosis, one of the most deadly types of diarrhoeal disease (Page 13).

2. A major decrease in incidence of shigellosis and other diarrhoeal diseases when families were made aware of the importance of hygiene and using safe water and latrines.

SHIGELLAE INCIDENCE BY DISTANCE OF HAND PUMPS FROM HOMES



MIRZAPUR

The value of a new type of plastic hand-pump is being assessed here, thanks to funding from the World Bank. Thus far, compared to the type of hand-pump now used throughout the Third World, this one has been seen at Mirzapur to enjoy high acceptability, because it :

1. Provides water of high quality and large volume, with less manual effort, from 200-foot-deep wells (as opposed to 60-70-foot wells ubiquitous in developing nations);
2. Is made of polyvinylchloride (PVC), instead of cast-iron and metal, Thus, at relatively low cost, it can be manufactured (and repaired) from materials readily-available in poor countries;
3. Can withstand the use and abuse of large groups; and has a very low breakdown rate; and
4. Can be maintained by village women, using almost no tools.

In 1984, the ICDDR,B installed 128 pumps free. These are being used by approximately 5,000 people. In this on-going study, Centre researchers are assessing the functioning of the pumps, the number of users, the total water demand for drinking and other household purposes, as well as incidence of diarrhoeal disease and malnutrition. A nearby village is being used for comparison.

Moreover, the researchers are simultaneously examining the effects on diarrhoea and malnutrition of a new type of sanitary latrine. It has a double, instead of single, disposal pit – permitting a rotation of pits about once a year. This gives the contents of a "full" pit time to safely decompose, before it is used again. Though slightly more costly initially than traditional pit latrines, such a facility is more or less permanent, as new pits do not have to be dug.

In 1984, thanks to an ICDDR,B educational effort, 80 such latrines are in use by Mirzapur study families. It is expected that another 620 will be installed in 1985.

URBAN SLUM

Finally, two Dhaka-area slums, A and B, were chosen, to assess environmental influences (hand-pumps and latrines) on diarrhoea rates and malnutrition.

Slum A was poorer and more heavily populated , but had relatively good environmental facilities: one latrine and hand-pump for well water for each 10-15 families (60-100 people). Slum B had a far less favorable ratio of water/sanitation facilities to population, but was less crowded and the community was richer; people owned their own homes.

Preliminary data from this study show that in slum A the diarrhoea attack rate was much lower, but the malnutrition rate was much higher than in Slum B, and vice-versa.

It seems that, though Slum A was poorer and more crowded, readily-available safe water and sanitary latrines resulted in a singnificant diarrhoeal disease decrease. On the other hand, since Slum B was richer, there was far less malnutrition, even though diarrhoea rates were high. This study is continuing.

CHOLERA VACCINE TRIAL

TAKING THE ORAL CHOLERA VACCINE to where the people are is a massive effort in itself – but a critical part of the major vaccine trial which began in late 1984.

Under coconut and jackfruit trees, signalling the presence of village clusters among fields of undulating bright green rice shoots, in and around thatched-roofed bamboo huts with earthen floors, about 1,300 people participated in the successful beginning of a scientific experiment during the last quarter of the year — an experiment which, hopefully, will make medical history: a large-scale field trial of a newly-developed oral vaccine against cholera.

The setting was three contiguous villages in the ICDDR,B's Matlab DSS; and the field trial represents a logical, fitting continuation of the Centre's 20-year-old involvement in cholera vaccine research. For it was at Matlab, from 1964-1974 that the injected cholera vaccines long required for international travel were proven virtually useless (Pages 2 and 3); and it is at Matlab today that the world awaits word of whether a means truly has been found of preventing one of mankind's most ancient, deadly afflictions.

After more than five years of careful basic work on the local immune system of the gut, the vaccine was developed in collaboration with Sweden. The Centre began the vaccine pre-trials in October, with World Health Organization and Bangladesh Government sponsorship. Financing the trial, scheduled to run through April 1985 and to involve about 90,000 Matlab residents, is Sweden, and the U.S.

The vaccine being tested was developed largely by a husband-wife team of Swedish immunologists from the University of Göteborg, Jan Holmgren and Ann-Marie Svennerholm, and their collaboration with scientists at the ICDDR,B and others in France and the United States.

Oral Vaccines

They focused on potential *oral* vaccines, because immunity (antibodies) to naturally-acquired cholera is produced in the intestine, not in the bloodstream. Apparently, this is the reason injected cholera vaccines, which produce blood-based immunity, cannot work: blood does not pass into the lumen of the intestine. Since people who had cholera were found to be resistant for years, it was believed that the most plausible way to establish immunity would be to develop a *local,* rather than a *systemic* immunity.

The vaccine now being tested at Matlab is the kind considered safest: **a dead** oral vaccine consisting of two parts: the entire, but **killed,** whole cholera bacteria cell; plus a portion of the cholera toxin (poison) molecule called B-subunit, which has three critical biological properties: a) it attaches itself to small intestine epithelial cells; b) it is *immunogenic* or capable of inducing the body to produce antibodies against cholera toxin; and c) it does not cause cholera or harmful side-effects.

Tested previously by ICDDR,B researchers, this B-subunit vaccine candidate, injected or oral, was found to spark antibody formation. The oral dose protected longer.

Further work showed that when B-subunit was combined with the conventional whole killed bacterial cell cholera vaccine previously injected, and when given orally, the immune response was in the right place. Thanks to synergism, volunteers' intestines produced antibodies against *both* vaccine parts—at a level equal to that seen in patients newly-recovered from cholera. Since such patients have a high resistance for more than three years, the oral B-subunit/whole cell vaccine was considered a prime candidate for success.

Follow-up studies in U.S. volunteers who swallowed a cholera dose far larger than that normally needed to infect, showed that the new oral vaccine prevented **any** diarrhoea in 63 percent, and that it was 100 percent effective against life-threatening cholera.

Preliminary Trial

Though extremely encouraging, these results in small numbers of volunteers did not mean such an oral vaccine would be applicable and capable of effective long-term protection in large numbers of people in developing countries... hence the importance of the current Matlab experimental field trial.

While the main trial began in January 1985, pre-trials were done in 1984 on about 1,300 people in the same area, for two reasons: to determine whether the vaccine really looked promising in a field setting; and to make sure the vaccine lot

to be used would not cause unexpected side-effects. The pre-trial results confirmed that the vaccine lot was fully immunogenic and devoid of side-effects.

The Main Trial

As for the main trial, the 90,000 population was randomized equally into three groups. One is to receive the experimental oral B-subunit/ plus killed whole cholera cell vaccine; another will get a vaccine containing only the killed whole cell without B-subunit; and the third group will be given a placebo.

The participants are those most at risk of cholera: children aged 2-15 and women of child-bearing age from 15 up. Under-two children are not very vulnerable, perhaps because, as studies have shown, breast milk antibodies prevent symptoms from occurring after infection with cholera bacteria.

During the trial, 70 ICDDR,B health teams are to go house-to-house, to administer the vaccine, after obtaining consent from the 90,000 participants living in 140 Matlab villages. The vaccine is to be given in three doses: January, February and March.

Then the waiting is to begin. For in Bangladesh there are two annual cholera peaks: a small one in late spring, about May, and the epidemic period in October through December, the start of winter.

During those periods, ICDDR,B scientists will be watching those vaccinated. If one or both vaccines appear to work, the vigil will continue for one to several years. For no one can predict the length of such immunity

If effective, such an oral vaccine would have two major advantages over the currently-injected, basically ineffective cholera vaccines. First and foremost, it would afford real protection. Second, it could be given easily by a non-medical person.

The Future

And what if the vaccine is truly effective? What is the prognosis for preventing cholera in the near future?

The answer, say ICDDR,B scientists, is that no vaccine can be a panacea against cholera for some time. For given the time it takes to inoculate masses of people and the initial high cost of such a vaccine, at least for the next few years cholera cannot be prevented on a large scale in developing countries, where it is both endemic and prone to frequent epidemics.

Nevertheless, they conclude, the existence of a highly effective cholera vaccine would mean that the possibility exists to truly control cholera, given the resources and political will to carry out an immunizing campaign.

THOUGH CHOLERA once held the world in its grip.....

CHOLERA : THE BA

DISEASE

What cholera did occur, in these areas and elsewhere in Bangladesh, remained balanced, as it had in 1983, between the El Tor biotype and the slightly more dangerous classical strain. Thus reported Centre scientists who, in 1982, had detected a unique and fascinating scientific phenomenon : the re-emergence, for the first time any-

SURVEILLANCE & CONTROL

From October-December 1984, as an ICDDR,B research team began the oral cholera vaccine trial at Matlab (Page 19), another Centre-directed cholera effort began paying dividends.

Though it was the height of Bangladesh's annual epidemic season for cholera and the related diarrhoeas, deaths due to all these diseases, except shigellosis (Page 13), were far lower than for any comparable period in the Centre's 20-year history – in all areas covered by a new, cooperative ICDDR,B/Government endeavor.

Called the Epidemic Control Preparedness Project, and financed for an initial 2 years by the Ford Foundation, the program provides swift response to reported diarrhoeal disease outbreaks.

Specifically, in 1984, 39 emergency teams, consisting of a doctor, an epidemiologist, a microbiologist and a trainer, were dispatched quickly to a total of 114 Upazillas (counties) to help contain diarrhoeal disease outbreaks and treat patients (Page 29).

Thanks to them and to local volunteers, diarrhoeal disease deaths, mainly from cholera, plunged. So did numbers of cases, since epidemics were prevented from spreading.

SUCCESSFUL EFFORTS to combat its scourge.....

PREVENTING THE SPREAD

Other ICDDR,B scientists in 1984 concentrated on finding simple, inexpensive means of preventing cholera's spread within households. Studied were hand washing with soap and water, and the use in household-stored water of a potassium-alum-sulfate compound, called "fitkari" in Bangladesh.

TTLE CONTINUES

CULPRITS

where, of a virulent cholera strain (classical) which virtually had disappeared for a decade. (See the 1982 Annual Report). In 1984 and 1985, ICDDR,B researchers continued their efforts to explain how and why this event occurred, and what it may mean to global efforts to curtail cholera.

The results : Not unexpectedly, hand washing barely curtailed cholera contagion, because to become infected, an individual must swallow, in food or water, a fairly large dose of cholera bacteria. Contaminated hands do not have enough bacteria.

Fitkari, however, was found to kill cholera germs and decontaminate stored water. Moreover, households using fitkari were found to have substantially lower cholera rates. In Bangladesh and other developing countries, fitkari traditionally has been widely used as a water clarifying agent.

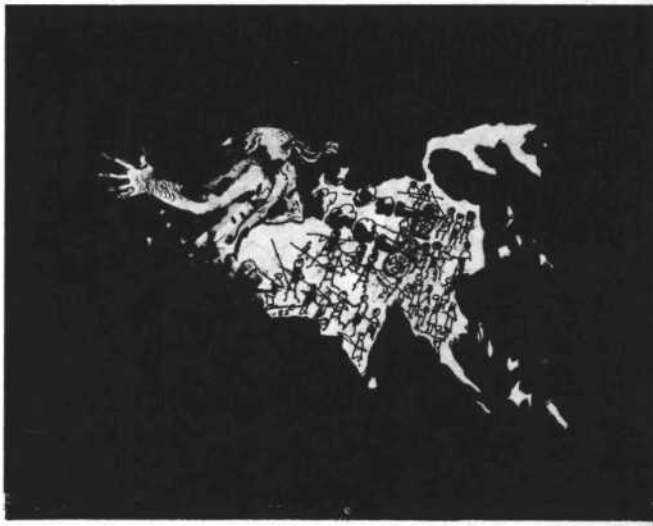
MINIMIZING THE DAMAGE

In other cholera research, Centre scientists continued the search for inexpensive, effective "anti-secretory" drugs, which would shorten the illness, by decreasing the swift loss of bodily fluids and salts--the dehydration process which makes cholera so deadly.

A drug called "berberine," derived from ancient herbal medicines used in antiquity to treat diarrhoea, was found to be moderately effective and to have few side-effects, when taken orally during acute cholera.

Another drug, nicotinic acid, also was found to be useful; while aspirin and a drug named "indomethacin" did not reduce fluid loss or shorten illness duration.

NOW HAVE GOT cholera on the run. . .



THE URBAN VOLUNTEERS

Alarmed about the magnitude of the diarrhoeal diseases problem in Dhaka, the ICDDR,B created in 1981 an effort aimed at identifying and treating diarrhoeal patients in their homes. Called the Urban Volunteers Program, it was based on two facts: that, thanks to ORT, diarrhoea could be treated effectively at home; and that such an effort was unlikely to succeed unless the targeted communities were actively involved.

By broaching the idea to leaders of several very poor, overcrowded and disease-ridden communities, the ICDDR,B was able to recruit a cadre of women – to be trained at the Centre in prevention, care and treatment of diarrhoea.

By the end of 1984, the Program had grown tremendously in both size and scope, thanks to the incredible success and acceptance it has enjoyed. Thus, 1,100 women have been trained, in what is now a two-week initial course; and more than 800 of them currently are active in their own slum communities, in 16 of Dhaka's 18 wards.

Currently run by a pediatrician and a social worker, the Urban Volunteers Program also has two nurses, two teachers (former Volunteers), and a driver-social worker.

Each week, the Volunteers are visited in their homes by one of eight pairs of paid field supervisors (all former Volunteers), who discuss problems, replenish supplies and tabulate data. The supervisors meet weekly with the Program's central staff at the ICDDR,B hospital, to designate future areas for training and identify new health problems.

TRAINEE SELECTION

As the Program seeks to deliver health services to Dhaka's poorer areas, community leaders from these slums are asked to recommend 15-20 women aged 14-40, who are intelligent, willing to serve their community, and have permission from their guardians or families. They need not be literate (about half the Volunteers have less than two years' schooling.)

In the initial 60-hour training course, the prospective Volunteers study nutrition, hygiene, and diarrhoea prevention and treatment. They also watch diarrhoea treatment in the Centre's hospital, and teach patients and/or their attendants about ORS preparation and use. Trainees who pass an exam return to their communities as Urban Volunteer health workers. Every 3-4 months, they receive a refresher course.

Back home, a Volunteer identifies diarrhoea patients, determines the illness severity and provides necessary ORS packets. In 1984, 137,000 ORS packets thus were distributed to 61,000 patients. From time-to-time the Program's field supervisors and central staff visit Volunteer-treated patients as a check.

URBAN VOLUNTEERS are trained and retrained about the causes, preventives and treatment for diarrhoea, at the ICDDR,B's central Dhaka hospital.

BACK IN THEIR COMMUNITIES, the Volunteers teach others what they have learned, and treat diarrhoea victims in their homes.

MEETING MORE NEEDS

With the basic program having operated successfully for two years, the Centre evaluated its goals and approach in 1983, and reached an important conclusion : while ORS is a very effective diarrhoea treatment, it is not enough; and should not be the sole health tool offered.

Accordingly, guided by international recommendations and requests from Volunteers and their communities, the ICDDR,B expanded the Program's approach in 1984. At all times, where possible, care has been taken to work with and through government health-related agencies. Within this framework, then, the Urban Volunteers Program did the following in 1984 :

* Vitamin A capsules, obtained from the Bangladesh Blindness Preventive Program (BBPP), were used to treat 1,002 children suffering from xerophthalmia, a dryness of the cornea which often is an early warning of imminent blindness. Additionally, efforts are being made to work with the BBPP, to provide vitamin A prophylactially to targeted children.

* More than 8,000 bars of soap were distributed, in communities where this vital disease preventive is either unavailable or too expensive. Using low-cost soap, manufactured in Dhaka by a local self-help organization, the bars were provided at cost, or, occasionally, free. The soap was very popular, and the effort was limited only by supplies.

* All Volunteers and their children were immunized against measles, polio, diphtheria, pertussis and tetanus, working with the Government's Expanded Program for Immunization centers. Then, an attempt was begun, again with Government co-ordination, for Volunteers to identify all local children and mothers at risk for these serious diseases; and to escort entire communities to vaccination centers on pre-arranged days.

* All 800 active Volunteers became involved in the "green revolution," by planting vegetable patches, and teaching friends and neighbors to do likewise. Seeds were provided by the Ministry of Agriculture.

* Working with local authorities, the Program helped one community establish a joint diarrhoea prevention and treatment clinic; and another community start a nutrition rehabilitation center.

* Through in-service training, interest-free loans and stipends for other projects, the Program was able to provide a minimal income to a small percentage of the Volunteers.

* The Volunteers became involved in various field research projects. The major ones entail efforts to improve local water/sanitation facilities. The initiative came from the Volunteers themselves. As they grew to recognize the consequences of poor hygiene, they asked for help.

Her job is to visit all study homes every two days for two years, encouraging mothers to record, on a home health record, episodes of water-associated disease, including diarrhoea, in all children under age six. Each fortnight, a trained interviewer accompanies the Volunteer on these visits, to obtain detailed health recall records for the period.

Of these homes, 15 percent were chosen randomly, for prolonged observation of hygienic practices. Based on age-specific diarrhoea rates, families were divided into high and low diarrhoea groups. When this information was correlated with health-related practices, the two outstanding factors were seen to be maternal hand washing before food is served and disposal of feces from the compound adjacent to the house.

BROADENING THEIR EFFORTS, the Volunteers now help mothers keep track of episodes of water-associated disease in children under age six.

Before it could be given, it was necessary to determine several crucial facts: the status of existing hygienic practices and beliefs; local diarrhoea rates; and which hygienic measures might have a positive impact on these rates.

To find these answers, the Program chose 51 slum communities, each with 38 contiguous families. Each cluster of houses is adjacent to the home of a Volunteer, who acts as a liaison.

The 51 communities then were ranked in pairs according to diarrhoea rates; and one community in each pair was chosen randomly for intervention or as a "control." In the intervention communities, skilled ICDDR,B trainers, aided by Volunteers, have begun an intensive hygiene education campaign, focusing on the practices which differentiate the two groups. If such education is found to alter behavior, resulting in lower diarrhoea rates, it will be introduced throughout Dhaka.

HEALTH FIELD specialists from around the world receive intensive training at a myriad of ICDDR,B courses, lectures and seminars throughout the year.

TRAINING, EXTENSION & COMMUNICATION

Drawing on the ICDDR,B's scientific resources and expertise, the Training, Extension and Communication (TEC) branch seeks to fulfill one of the Centre's mandated goals : to help strengthen and develop national and international diarrhoeal disease related research capabilities, and to help improve health service delivery in developing countries.

Toward these ends, the TEC operates a three-pronged effort:

* A carefully-designed, extensive series of training courses, workshops and conferences, taught by the Centre's national and international experts, to scientific and technical personnel from Bangladesh and many other developing countries;
* A comprehensive outreach program within Bangladesh, aimed at transferring the ICDDR,B's expertise into the existing Government health system; (see Programme Coordination Committee, page 31).
* A major diarrhoeal diseases information dissemination effort.

TRAINING

In groups of 20 or less, the "students" study diverse diarrhoeal disease topics — including clinical management of diarrhoea and its complications, laboratory techniques to identify disease pathogens, epidemiology, epidemic prevention and control techniques, and use of ORS. For each course, a series of technical manuals, in the form of modules, was prepared in 1984, to facilitate the learning process for trainees from many nations with varying levels of English comprehension (Page 29).

From lectures, hands-on practical experience in the Centre's hospital and field visits, trainees learn invaluable skills — which they can use to teach others in their home countries and institutions, thereby greatly multiplying the effect of the TEC effort.

In 1984, 1,467 researchers, doctors, nurses and other health personnel, from Bangladesh and 31 other countries, mostly developing ones, were trained at the ICDDR,B Moreover, the Centre provided 27 fellowships to young scientists, four from Bangladesh, and the rest from Canada, Sri Lanka, Japan, Jordan, India, Kampuchea, Kenya, the United States and the United Kingdom.

INTERNATIONAL TRAINING

Included were 99 health officials and scientists from 13 nations, who participated in seven international level courses. As training requests far outnumbered spaces available in scheduled courses, additional courses have been added to the TEC's 1985 calendar. Moreover, two tailor-made courses were designed to meet the specific needs of two developing nations; and this option has become available as a regular feature of the TEC program.

In a different sort of international endeavor, the ICDDR,B arranged and co-sponsored in 1984 the First African Conference on Diarrhoeal Diseases. Held in Arusha, Tanzania in November, the event gave nearly 100 African scientists from 18 countries a chance to discuss their latest research and diarrhoeal diseases problems peculiar to Africa, to learn of up-to-date developments, and to seek advice and aid.

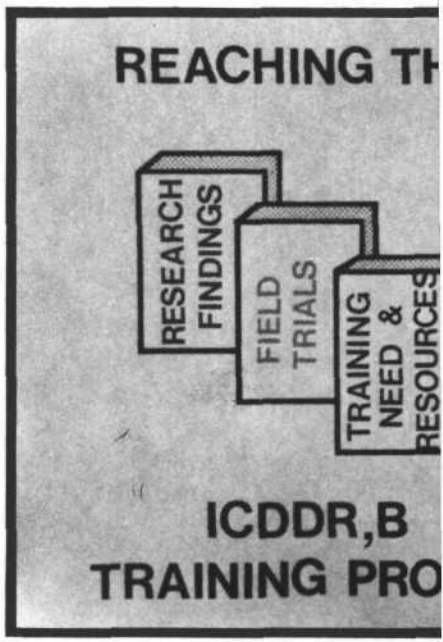
Following the three-day conference, a two-day workshop gave Tanzanian health personnel an opportunity to interact with one another and with the other conference participants, in order to develop a national control of diarrhoeal diseases (CDD) program. The five-day event was sponsored by the Tanzanian Government, the Canadian International Development Agency (CIDA), UNICEF and the Aga Khan Foundation.

INTERNATIONAL OUTREACH

Finally, the Centre also continued its international outreach program, by directly helping several nations on their home territories. Thus, ICDDR,B personnel continued the cooperative effort they had begun in 1982 in Indonesia — by helping implement diarrhoeal disease control recommendations, via a combination of training courses in Dhaka and follow-up technical assistance.

Similarly, in Dammam, Saudi Arabia, ICDDR,B-Saudi cooperation continued, as a diarrhoeal diseases control center was opened and began operating, with the aid of Centre personnel.

In Tanzania and Colombia, at the request of UNICEF, the ICDDR,B studied the feasibility of the Centre training national health personnel, as part of UNICEF's broad GOBI program. Also, the Centre began coordinating with the Governments of six nations, to develop training/technical assistance efforts. The request came from the South-East Asian Health Ministers, through the Bangladesh Government.



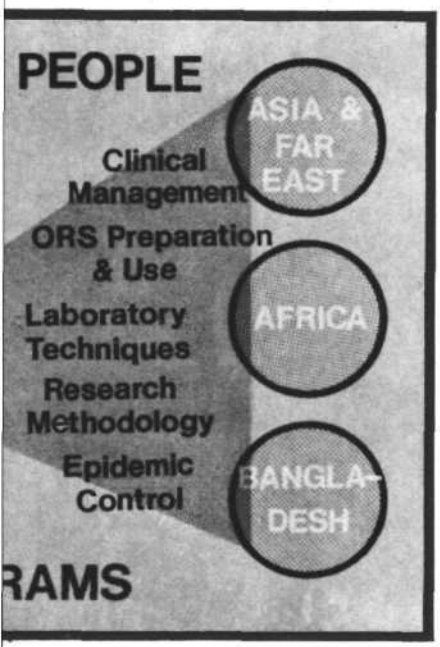
In related efforts, the Centre signed a five-year collaborative agreement with China. Areas of assistance are to include teaching of trainers, in Dhaka; development of China's diarrhoeal diseases research capabilities; exchange of scientists; and technical assistance to help establish in China a national institute, to promote the use of ORT.

Finally, a team of health professionals from the Indian State of Gujerat visited the ICDDR,B and other sites in Bangladesh, to learn about ORT, community-based diarrhoea treatment and other aspects of diarrhoea management.

NATIONAL EFFORTS

On the national front, the Centre's major 1984 focus was to assist the Bangladesh Government strengthen its core health staff, in a comprehensive technical effort aimed at implementing a national CDD program.

In July, the Centre and The Government, aided by the Ford Foundation, initiated a two-year integrated Epidemic Control Preparedness Pro-



gram (ECPP). The purpose: to develop trained manpower and management for diarrhoeal diseases.

The ICDDR,B is helping manage the program; and is assisting senior government health officials involved in CDD activities. Others to be trained include doctors and senior laboratory personnel from Bangladesh's eight medical schools, health officials from all the country's 468 subdivisions, and faculty from the nation's medical assistant training schools and from the National Institute for Population Research and Training.

Back in their jobs, the rural area government health staff will teach local community workers diarrhoeal disease detection, treatment, prevention and control. The ICDDR,B will provide annual follow-up training.

As part of this effort, in 1984,16 doctors from the country's medical schools were deputed to the Centre for a year – to study, to help train the rural health officials, and to be part of diarrhoeal disease epidemic response teams. These teams are a vital part of the ECPP; and 48 were to be trained over the two years.

Consisting of a doctor, an epidemiologist, a microbiologist and an ICDDR,B trainer, the teams respond instantly to reports of cholera and other diarrhoeal disease epidemics, and help rural health personnel both treat the stricken and coordinate treatment and disease containment efforts.

In other national endeavors, the ICDDR,B:

* Conducted 10 collaborative research projects with national scientists; and
* Developed technical course materials for three national and six international courses, to supplement basic available texts. Included in this initial materials development effort were simplified texts on eight diarrhoea-related topics, to be used by medical students; and three slide-tape presentations, on ORT for home management of diarrhoea, cereal-based ORT, and the Centre's scientific activities.

Planned for 1985, were a series of technical modular materials, more slide tapes and video tapes. These will comprise a specially-designed package for each of several courses which ICDDR,B-trained health personnel will be able to replicate and/or tailor to the needs of their home institutions, in Bangladesh and other developing countries. UNICEF provided major support for this activity.

COMMUNICATIONS

DISC

Enhancing its efforts to share its expertise as widely as possible, the Centre further broadened the activities of DISC – the International Diarrhoeal Disease Information Service and Documentation Centre – the world's first clearing house solely devoted to disseminating information on diarrhoeal diseases.

As a major part of this effort, the Centre published issues 3 through 6 of the quarterly "Journal of Diarrhoeal Diseases Research". Edited and contributed to by research experts worldwide, the JDDR contains original scientific papers, opinion pieces, letters, and an annotated bibliography of published and unpublished diarrhoeal disease-related research from Asia.

With more than 160 individual and institutional subscribers in 41 countries, the JDDR has been praised unanimously by readers whose opinions were sought. It also has been chosen for citation in *Index Medicus, Medline, Excerpta Medica, Tropical Diseases Bulletin, Population Index, Indian Science Abstracts, Current Awareness in Biological Sciences,* and *Data Base BIRD* (International Children's Centre, Paris.)

The JDDR is part of DISC, begun in 1982 and financed for three years by Canada's IDRC (International Development Research Centre). DISC collects, organizes, analyzes and disseminates pertinent diarrhoeal diseases literature, to help avoid unnecessary research duplication. It also helps speed use of new practices, helping researchers and health practitioners achieve the ultimate goal: diarrhoeal diseases prevention and control.

DISC also provides a question-answer service; publishes specialized annotated bibliographies (one on "Nutrient Absorption and the Diarrhoea-Malnutrition Cycle" in 1984); and provides reprints and photocopies. By year's end, DISC had 78 individual and organization members from 29 countries.

Finally, at the request of the Centre's Board of Trustees, DISC continued to prepare in 1984 an inventory of diarrhoeal disease-related research, completed or in progress in Bangladesh, for use by the ICDDR,B's Programme Coordination Committee (Page 31).

OTHER EFFORTS

Moreover, nearly 30,000 copies of "Glimpse" the Centre's bimonthly research newsletter were sent free to scientists and organizations in 156 countries; and the Centre published three important documents : Volume 12 in a series of reports on the Matlab DSS (Page 2-5), and Volumes 1 & 2 in a series on Teknaf (Page 17).

Most of these publications were given free to most Bangladesh health-related institutions and libraries, either as donations or under exchange programs.

Finally, more than 7,900 outside researchers, teachers and students used the Centre's library. The facility provides 514 current journals, 16,653 books and bound journals, and 8,475 reprints and other documents, as well as a national and international inter-library cooperation and loan service.

MANDATORY COMMITTEES

Programme Coordination Committee (PCC)

Attempts to transfer a complex or advanced health technology quickly into a developing country setting frequently fail, even when all the necessary equipment and techniques are made available.

The reason is that the recipients who must implement the specific effort, even if experienced, all too often are effectively hampered by a lack of supplies, as well as back-up expertise, to both service complex technology and handle unanticipated problems.

In this context, the ICDDR,B represents a new strategy in the health field for technological transfer – which is accomplished thanks to the skills of first-rate international and national scientists and technicians, recruited for long time periods.

These experts are capable of adapting the latest modern health technology to developing nation realities; and their work is butressed by an institution which both has ready access, via efficient channels, to state-of-the-art technology and supplies, and has itself developed a high degree of expertise.

Add the fact that the Centre's charter mandates it to help strengthen research efforts of institutions in the host country, and the raison d'être of the ICDDR,B Programme Coordination Committee (PCC) becomes clear.

Established by the Centre's Board of Trustees in 1982, the PCC has 40 members : 7 from the ICDDR,B, and the rest from leading Government and private science, health, rural development, education, nutrition and population-related Bangladeshi institutions. The ICDDR,B long has been cooperating with most of these organizations in research and training.

In 1984, the PCC met twice and recommended :

* Production of a book on herbal medicine; and examination of techniques used to develop herbal medicine in China.

* Approval of a protocol entitled "Study of Respiratory Infection at the ICDDR,B." This research will entail collaboration among the ICDDR,B, the Institute of Public Health and the Dhaka Medical College.

* A simplification of research funding approval procedures : At the end of 1984, at the request of the PCC, the Government of Bangladesh did simplify such procedures for national institutions seeking research grants. This should further facilitate collaborative activities.

Thus, it is expected that national organizations now will more readily attract the interest of international donors, who wish to help national research institutions tackle their most common and devastating health problems, including diarrhoeal diseases.

At the same time, however, even earlier in the year, non-ICDDR,B Bangladeshi scientists competed successfully for funding research, from the WHO Control Programme for Diarrhoeal Diseases (WHO-CDD), and from the U.S. National Academy of Sciences.

PCC MEMBERS

*1. Prof. M.A. Matin,
President
Bangladesh College Physicians and Surgeons

*2. Dr. Kamaluddin Ahmad
Director
Institute Nutrition and Food Science,
Dhaka University

*3. Dr. A.K.M. Aminul Haque
Vice-Chancellor
Bangladesh Agricultural University,
Mymensingh

*4. Brig. M.R. Chowdhury
Commandant,
Armed Forces Institute Pathology and Transfusion

*5. Dr. A.K. Khan
353, Elephant Road, Dhaka

*6. Mrs, Gole Afroz Mahbub
Senior Programme Officer,
The Pathfinder Fund

*7. Project Director, National Oral
Rehydration Project (GOB)

*8. Director General
Health Services (GOB)

*9. Joint Chief-in-Charge
Health Section,
Planning Commission
Ministry Planning (GOB)

*10. Director (Admin. & Finance)
Director General's Office
Health Services (GOB)

*11. Chairman
Bangladesh Medical Research Council &
Director, Institute Post-Graduate
Medicine & Research

12. President, Bangladesh Institute
Research & Rehabilitation in Diabetes,
Endocrine & Metabolic Disorders

13. Chairman,
Bangladesh Agricultural Research
Council (GOB)

14. Director, National Institute Preventive
and Social Medicine (GOB)

15. Director, Bangladesh Fertility Research
Programme (GOB)

16. Executive Director, Bangladesh Rural
Advancement Committee

17 Chairman, Bangladesh Council
Scientific & Industrial Research (GOB)

18. Director, Institute Public
Health

19. Vice-Chancellor, Dhaka University

20. Director General, National Institute
Population Research & Training (GOB)

21. Director, Management Information
System, Directorate Population
Control (GOB)

22. Consultant Pediatrician, Shishu Hospital

23. Medical Director, Children's Nutrition
Unit, Save the Children (UK)

24. Director, Institute Public Health &
Nutrition (GOB)

25. Principal
Para-Medical Institute (GOB)

26. Research Director
Bangladesh Institute Development
Studies

27. Director, Institute Bangladesh Studies,
Rajshahi University

28. Director
Bangladesh Medical Research Council

29. Minister Health & Population
Control (GOB)

30. Secretary, Health Division, Ministry
Health & Population Control (GOB)

31. Dr. Hajera Mahtab
Medical Director, Bangladesh Institute
Research & Rehabilitation in Diabetes,
Endocrine & Metabolic Disorders

32. Dr. Farida Huq
Health, Microbiological Laboratory, Institute Public Health (GOB)

33. Dr. Ghyasuddin Ahmed
Associate Professor Population Dynamics, National Institute Preventive and Social Medicine (GOB)

34. Director, ICDDR,B

35. Associate Director, Nutrition Program, ICDDR,B

*36 Associate Director, Training, Extension & Communications, ICDDR,B

37. Associate Director Pathogenesis/Therapy, ICDDR,B

38. Associate Director Host Defense, ICDDR,B

39. Associate Director Disease Transmission, ICDDR,B

40. Associate Director Community Services Research, ICDDR,B

(GOB = Government of Bangladesh)

*Members of the Standing Committee, of which Prof. M.A. Matin is President, Dr. Kamaluddin Ahmad is Vice-President, and Dr. K.M.S. Aziz is Member-Secretary.

Ethical Review Committee

Meeting monthly, the ERC examines and monitors the ethical aspects of research involving human subjects. It has 13 members : three from the ICDDR,B; one from the PCC's Standing Committee; 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 principles, audits informed consent procedures that make certain 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 followed strictly. In 1984 the ERC met 14 times; and considered 52 research protocols, approving 50. The ERC members were :

Dr. K.M.S. Aziz* — Basic Scientist and Chairman
Dr. M.M. Rahaman* — Clinician and Relieving Chairman
Dr. P. Speelman*/Dr. A. Briend* — Laboratory Scientist
Dr. Humayun K.M.A. Hye — Pharmacologist
Dr. Khaleda Banu — Pediatrician
Dr. Sufia Ahmed — Woman and Non-Scientific Member
Mr. Md. Mofazzal Hossain Khan — Religious Representative
Mr. K.Z. Alam — Legal Profession Representative
Mrs. Husnara Kamal — Behavioral Scientist
Mrs. Taherunnessa Abdullah — Behavioral Scientist
Dr. T.A. Chowdhury — Gynecologist, Rep. Bangladesh Medical Research Council
Dr Z. Sestak — WHO Acting Resident Representative
Dr. Kamaluddin Ahmad — Biochemist/nutritionist, Rep. PCC's Standing Committee

*ICDDR,B Members

Research Review Committee

The RRC is made up of ICDDR,B researchers, except for one representative from the PCC's Standing Committee. The RRC reviews research protocols – examining their scientific value, significance, feasibility and researchers' capabilities, as well as their relationship to the Centre's objectives and financial means. During 1984, the RRC met 13 times; and considered 32 protocols, approving 27.

RESOURCES DEVELOPMENT

Summary

In 1984, the ICDDR,B completed its first five years as an international organization. This period was characterized by a series of sustained efforts and exercises designed to obtain international recognition and support for the ICDDR,B's programs and mandate. The tasks set forth for Resources Development were to broaden the Centre's donor base, increase the number of participating countries and agencies, assist expansion activities among developing countries, gain international media attention, and develop a strong relationship with the host country. In 1984, Resources Development continued these efforts.

Although 1984 was a period of global financial and political instability, when major donors realigned aid-giving priorities and major international agencies reduced budgets, Resources Development secured firm donor commitments of $ 7.4 million. More than 50 countries and agencies now participate in ICDDR,B activities (from 18 in 1979), and the Centre has established collaboration with several developing countries in Asia, Africa and Latin America.

DONORS

In 1984, Resources Development successfully renegotiated funding renewals and fresh commitments from several major donors.

***The United States Agency for International Development (USAID),** one of the ICDDR,B's first and most important donors, completed its first five-year support cycle, and committed itself to a second multi-year funding cycle. Additional USAID-supported activities included continuation and expansion of the Centre's Maternal-Child Health/Family Planning (MCH/FP) extension program (Page 6-9) and diarrhoeal disease management training for Indonesia and the Philippines. The latter activities were supported by their respective USAID missions.

***The Canadian International Development Agency (CIDA)** began five years' funding for the ICDDR,B Demographic Surveillance System and its related activities (Page 2-5). Included was installation of a new main frame computer for scientific use. Also, through its International Non-Government Organization Division, CIDA also financed the First African Conference on Diarrhoeal Diseases, in Tanzania in November. Co-sponsors were the ICDDR,B, the Tanzanian Government and UNICEF (Page 28).

***UNICEF** also supported the ICDDR,B, with both a core funding commitment as well as continued financing of cereal ORS studies (Page 11-13) and training activities (Page 27).

***The Arab Gulf Program** renewed its support with an enhanced contribution, to be used to upgrade laboratory facilities and to further the Urban Community Volunteer Program (Page 24).

***The World Bank** supported a water/sanitation effort: a three-year rural area study of an integrated handpump, latrine, sanitation motivation and training program (Page 18).

A major 1984 ICDDR,B priority was completion of preparatory work for an oral cholera vaccine trial at Matlab (Page 19). **SAREC** (Sweden) and **WHO** provided partial support. The aid of other donors, including USAID, is being sought for this important activity.

The ICDDR,B initiated and continued several projects in cooperation with the **Bangladesh** Government. These included year three of the MCH/FP extension project funded by USAID, and the Epidemic Control Preparedness Project, and a study of the National Oral Rehydration Programme funded by the Ford Foundation.

Other donors with continuing 1984 commitments included the **Aga Khan Foundation, Australia, Bangladesh, Belgium, France, IDRC** (Canada), **Japan** (which increased its support level), the **Population Council, Saudi Arabia, Sweden, Switzerland,** the **United Nations Development Programme,** the **United Kingdom** and **UNFPA.** The **World University Service of Canada** provided, for two years, six mid-level technical experts in the areas of health economics, computer science techniques, training, and health care; while Belgium sent and supported three scientific personnel.

COLLABORATIVE ACTIVITIES

In 1984, the ICDDR,B and **Saudi Arabia** agreed to a second year of technical support and training at Dammam, in the Kingdom's Eastern Province. Training also was provided to **Indonesian** and **Filipino** medical and scientific personnel.

The **Health Ministers of South-East Asia,** through the Bangladesh Government, had asked the Centre in 1983 to provide diarrhoeal disease training and assistance to health professionals under the Technical Assistance among Developing Countries (TCDC) program. The first such course was held in 1984, and funding is being sought for continuation in 1985.

At **UNICEF's** request, the Centre began feasibility studies in **Tanzania** and **Colombia,** to explore how the ICDDR,B might assist those countries' diarrhoeal disease programs. Also, arrangements for long-term training and research collaboration were finalized between the ICDDR,B and **China**.

RESERVE FUND

The ICDDR,B Board of Trustees mandated establishment of a Reserve Fund, principally designed to provide seed money for new scientific work, and to ensure that cash-flow difficulties do not adversely affect projects already underway. The Fund's establishment was announced at the ICDDR,B's Consultative Group meeting in June 1984. **Japan** initially supported the Fund, and the **Ford Foundation** has committed $500,000 for 1985. Other donors are being sought.

CONSULTATIVE GROUPS

In addition to individual donor contacts, there were two meetings in 1984, aimed at acquainting donors and interested agencies and governments with ICDDR,B programs and requirements. One, the fifth international Consultative Group meeting, was held again during the United Nations Governing Council, on June 5th in Geneva. UNDP presided, and representatives of 19 governments and agencies participated. The other meeting was held to permit Dhaka-based donor and agency representatives to keep abreast of ICDDR,B activities. Thus, a local Consultative Group was organized in 1984, sponsored by the UNDP Resident Representative. Attending this Group's first meeting December 4th, 26 representatives were briefed on the Centre's current activities and financial status.

CAPITAL DEVELOPMENT

The ground floor treatment centre of the ICDDR,B's new facility was completed in 1983, with the aid of the **OPEC Fund** and **Saudi Arabia.** Donor support is being sought to complete the project. In 1984, the ICDDR,B also solicited funding for construction of suitable facilities at its Matlab and Teknaf field stations.

THE ICDDR,B's Dhaka-based Consultative Group keeps abreast of the Centre's activities.

BOARD OF TRUSTEES MEMBERS

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Director of Communicable Diseases
World Health Organization
Geneva, Switzerland

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Chairman
Department of Population Sciences,
School of Public Health
Harvard University, USA

Dr. D.J. Bradley
Chairman,
Division of Communicable & Tropical Diseases,
London School of Hygiene and Tropical Medicine
United Kingdom

Dr. Immita Cornaz
Swiss Development Cooperation and
Humanitarian Aid,
Berne, Switzerland
Chairman, Board of Trustees

Dr. W.B. Greenough III
Director, ICDDR,B
Dhaka, Bangladesh

Maj. Gen. M. Shamsul Haq
Minister for Health & Population Control
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Professor Leonardo J. Mata
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Instituto de Investigaciones en Salud (INISA)
Universidad de Costa Rica
San Pedro, Costa Rica

Mr. A.B.M. Golam Mostafa
Secretary
Ministry of Health & Population Control
Government of Bangladesh

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Indian Council of Medical Research
New Delhi, India

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Department of Microbiology & Immunology,
The University of Adelaide
Australia

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Jakarta, Indonesia

Dr. D.B. Sebina
Secretary for Health
Government of Botswana

Dr. Abdul Rahman Al-Swailem
Deputy Minister of Health
Kingdom of Saudi Arabia

Dr. Yoshifumi Takeda
Chairman
Department of Bacterial Infections,
Institute of Medical Science
University of Tokyo
Tokyo, Japan

Mr. M. Munir-uz-Zaman
Secretary, Ministry of Finance,
External Resources Division
Government of Bangladesh

BOARD OF TRUSTEES

At both its June and December meetings, the Board focused on how best to prepare for the Centre's expanding opportunities as an international institution. Among its more significant decisions were the following resolutions :

***The Budget** : Noting that the ICDDR,B's draft budget for 1985 was $ 9.2 million — of which $ 1.4 million was slated for the cholera vaccine trial — the Board said the budget was insufficient to support a number of important research activities relating to high priority subjects, including shigellosis and development of field diagnostic techniques.

Moreover, at its December session, the Board pointed out that firm donor commitments to date totalled only $ 6.2 million, leaving a $ 3 million shortage, which must be raised to support the Centre's crucial 1985 activities.

Thus, while recognizing the generous contributions already committed, the Board made a special request to members of the ICDDR,B's Consultative Group, to extend additional support to meet this budget and, if possible, to permit enlargement of the budget in order to support additional high priority research, which the Centre has the capacity to do, given the funds.

***New Director** : The Trustees appointed a new ICDDR,B Director for a three-year term beginning in July 1985. He is Dr. Roger Eeckels, Professor and Head, Department of Pediatrics, University of Leuven, and Professor of Tropical Child Health, Institute of Tropical Medicine, Antwerp, Belgium. He succeeds Dr. William B. Greenough, III, a professor of medicine, who will return to Johns Hopkins University in the United States.

***Trustee Changes** : The Board expressed its appreciation to out-going Trustees Dr. M.A. Matin and Dr. M.K. Were; and welcomed two new members, Mr Munir-uz-Zaman, Secretary, External Resources Division, Bangladesh Government; and Dr. D. Sebina, Secretary for Health, Botswana.

Dr. Immita Cornaz was elected Board Chairman for one year, replacing Prof. J. Kostrzewski, who was re-elected to a second three-year term. Also re-elected for three years were Dr. L. Mata and Dr. V. Ramalingaswami.

***External Review** : The Board decided that an external management review of the Centre will be done in 1986; and asked the Director to prepare for the Trustees' May 1985 meeting a working paper on the proposed terms of reference and the scope of the review, as well as the profile and possible names of the reviewers, and the estimated cost.

***ICDDR,B Outreach** : The Trustees agreed that the Centre should participate in activities outside Bangladesh; and, thus, encouraged the Centre to proceed with its planned projects in Saudi Arabia, China, Indonesia and Kenya (Page 28). However, the Board asked to be kept informed, as possible new collaborations are explored.

Management & Administration

In 1984 there was a significant increase in senior scientific and administrative staff :

- All scientific programs were headed by an Associate Director;
- A Senior Microbiologist was appointed, to revamp and improve the Centre's microbiological research facilities;
- An Administrative Services Officer was appointed, to head the administrative and logistics support facilities;
- A Budget and Finance Officer was appointed.

To accomodate this staff increase, various physical facilities had to be improved and/or provided :

- A new office wing on the top floor of the old hospital building was added;
- Work began on renovating the microbiology laboratory and upgrading support facilities;
- New laboratory space was created;
- Three small buildings were constructed, to house staffs of the MCH/FP Extension Project, the Urban Volunteers and Administrative Services;
- A new transformer was purchased and installed in a service building, to supply power to the new hospital;
- An IBM 4331 main frame computer was purchased with funds from Canadian CIDA; and field logistics and physical facilities were upgraded to meet vaccine trial requirements.

The above cost $ 600,000, part of which came from the capital replacement account.

FINANCE

Total 1984 operating expenditures were U.S. $7,469,874, up $1,528,480 from 1983. Major cost increases resulted from

- — The addition of scientific and administrative staff, costing $300,000;
- — A local salary increase, retroactive to January 1983, amounting to $130,000;
- — Additional local staff and direct operating expenses for the Vaccine Field Trial and the National Oral Rehydration Project. Total cost $170,000;
- — National salary increases amounting to $200,000;
- — A service interest cost of $159,000, arising from the Centre's heavy reliance on overdraft facilities to meet operating expenses;
- — Depreciation allocations, which increased to $334,000.

The Centre's total 1984 income was $7,633,000. After deducting $781,000 in income restricted to capital development, the 1984 total available operating income, including an exchange gain of $12,000, was $ 6,864,000. Total operating expenditure was $ 7,470,000, leaving an operating deficit of $ 606,000.

During 1984 the trend towards donors providing restricted project support continued, further reducing the Centre's flexibility in allocating funds. The accompanying figure Illustrates this decrease in the relative amount of flexible funds over a five-year period.

RESERVE FUND

To meet this difficulty, the Centre, in its fund-raising effort, has continued to press for flexible support. The Reserve Fund is seen as a partial means of protecting Centre initiatives, based on field realities which, in the early research stages, might not interest donors.

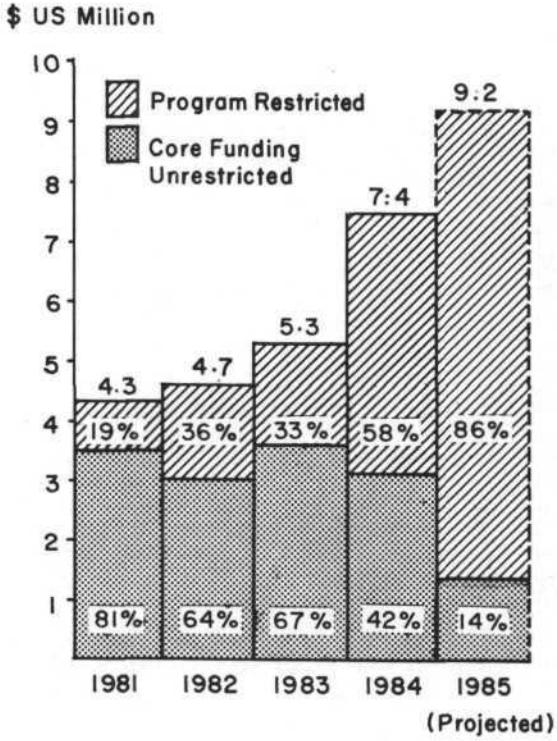
Thus, in 1982 a Reserve Fund was established, to provide temporary bridging funds and to generate income to support the Centre's programs. As of December 31, 1984, the Reserve Fund balance was $ 841,630, up $ 441,630 from 1983.

PENSION/RETIREMENT FUND

The Centre now has two funds held in AIRCO, one each for local, non-international level staff and for international level staff. These are essentially "separation payments" funds, which are given staff members when they leave the ICDDR,B.

These funds are fully vested, and every staff member covered by the WHO pay scale is entitled to this separation payment. The Centre contributes 14 percent of a staff member's yearly salary to the fund, which accumulates interest into the staff member's account. Staff are required to contribute 7 percent.

ICDDR,B DONOR CONTRIBUTIONS, OPERATING FUND
(MILLIONS OF US DOLLARS)



BALANCE SHEET AT DECEMBER 31, 1984

	Notes	1984	1983
Fixed Assets/less depreciation	2	3,875,751	3,614,402
Current Assets			
Stock of stores and spares	3	765,735	655,512
Advances, deposits and prepayments	4	1,943,389	720,518
Cash and bank balances	5	942,062	758,539
		3,651,186	2,134,569
Less :			
Current Liabilities			
Bank overdraft	6	1,612,021	439,433
Current liabilities	7	1,669,164	2,193,188
		3,281,185	2,632,621
Net Current Assets		370,001	(498,052)
		US $ 4,245,752	3,116,350
Represented by			
Capital Development Fund	8	4,669,403	3,899,292
Operating Fund	9	(2,230,184)	(1,182,942)
Reserve Fund	10	841,629	400,000
Employees Retirement Fund		964,904	—
		US $ 4,245,752	3,116,350

NOTES FORM PART OF THE ACCOUNTS

Director
ICDDR,B

Member
Board of Trustees

Deloitte Haskins + Sells
Chartered Accountants

Ahmed Reza & Co.
Chartered Accountants

Dhaka, April 04, 1985

RECEIPTS AND EXPENDITURE ACCOUNT (OPERATING FUND) FOR THE YEAR ENDED DECEMBER 31, 1984

	Notes	1984	1983
RECEIPTS			
Contributions	11	7,398,637	5,276,212
Other receipts		234,104	113,005
		7,632,741	5,389,217
Less : Transferred to Capital Development Fund to the extent of capital contribution		781,003	—
		6,851,738	5,389,217
Exchange gain/(loss)		12,523	(13,896)
		6,864,261	5,375,321
EXPENDITURE			
Personnel Services and Benefits	12	4,930,702	4,027,713
Supplies and Materials		980,347	675,863
Travel Expenses		571,827	524,349
Transportation of Materials		146,703	123,842
Rent, Communication and Utilities		97,353	63,083
Printing & Reproduction		42,287	42,375
Other Contractual Services		366,997	206,745
Depreciation		333,658	277,424
		7,469,874	5,941,394
Surplus/(Deficit)		US $ (605,613)	(566,073)

NOTES FORM PART OF THE ACCOUNTS

SOURCES AND APPLICATION OF FUNDS AT DECEMBER 31, 1984

	1984	1983
Source		
Capital Development Fund Receipt	781,003	589
Decrease in Working Fund	96,851	688,671
Depreciation	329,830	277,424
	US $ 1,207,684	966,684
Application		
Additions to Fixed Assets (net)	591,179	400,611
Loss on sale of assets	10,892	—
Deficit as per Receipts and Expenditure Account	605,613	566,073
	US $ 1,207,684	966,684

NOTES TO THE ACCOUNTS DECEMBER 31, 1984

1. ACCOUNTING POLICIES

(i) Receipts and Expenditure Account and Balance Sheet of the Centre are maintained in the manner as prescribed and approved by the Board of Trustees.

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

(iii) Stock of stores and spares have been accounted for at material cost only.

(iv) 'Receipts' and 'Expenditure' of the Centre for the year ended December 31, 1984 have been accounted for on 'cash' and 'accrual' bases respectively, as per past practice.

(v) Depreciation on Fixed Assets have been charged during the year at rates varying from 2% to 20% on a straightline method. No provision has been made in the accounts for depreciation up to December 31, 1982.

(vi) Accounts have been prepared on the basis of Historical Cost Convention, except to the extent reflected in item 14 of 'Notes to Accounts'.

2. FIXED ASSETS

(i) The Centre has not maintained itemwise, locationwise and valuewise Fixed Assets Register. It has also not taken any physical inventory of Fixed Assets at any time during the year.

(ii) All assets costing $50 or below have been charged to the Receipts and Expenditure Account. The Centre maintained a separate register for such assets up to December 31, 1983 which has not been updated since then.

(iii) 4.10 acres and 0.51 acre of land situated at Mohakhali (Dhaka) and Matlab (Comilla) received as donation from the Government of Bangladesh and a private party respectively, have not been accounted for.

(iv) **FIXED ASSETS**

	COST				DEPRECIATION					
Capital Development Fund	Opening balance on 1.1.84	Addition this year	Sale/ Adjust-ment	Total	Rate	As on 1.1.84	Charge for the year	Adjust-ment	Total	BALANCE on 31.12.84
Land	66,758	—	—	66,758	—	—	—	—	—	66,758
Building	1,602,352	142,904	—	1,745,256	2%	32,047	34,905	—	66,952	1,678,304
Vehicles	283,079	131,430	15,051	399,458	20%	56,616	79,892	3,010	133,498	265,960
Furniture	297,188	52,529	6,043	343,674	10%	29,719	34,367	600	63,486	280,188
Equipments	1,538,403	250,734	2,182	1,786,955	10%	153,840	178,695	218	332,317	1,454,638
Books & Other Assets	104,046	11,932	—	115,978	5%	5,202	5,799	—	11,001	104,977
Capital Assets under Installation	—	24,926	—	24,926	—	—	—	—	—	24,926
US $	3,891,826	614,455	23,276	4,483,005	—	277,424	333,658	3,828	607,254	3,875,751

(v) Buildings include:

(a) An Amount of US $96,360 spent on the extension of the Institute of Public Health, owned by the Government of Bangladesh and at present partly accommodating the Centre. The new extension was made for use by the ICDDR,B, with permission from the Bangladesh Government.

(b) Capital Work in Progress, the cost of which is not separately ascertainable.

3. STOCK OF STORES AND SPARES

	1984	1983
Capital Development Fund		
Capital Assets	153,804	42,482
Operating Fund		
Supply stores	439,844	449,649
Maintenance stores	172,087	163,381
	611,931	613,030
US $	765,735	655,512

Drugs abandoned by the Government of Bangladesh amounting to US $ 31,731 have not yet been written of.

4. ADVANCES, DEPOSITS AND PREPAYMENTS

Capital Development Fund		
Advance against capital expenditure	308,394	376,049
Operating Fund		
Advance against supplies	307,807	92,745
Advance against travelling and other expenses	317,104	60,527
Other advances	39,005	186,633
Deposits	6,175	4,564
	670,091	344,469
Employees Retirement Fund		
Deposit with American International Re-insurance Co.	964,904	—
US $	1,943,389	720,518

5. CASH AND BANK BALANCES

Cash at Banks		
US $ Account		
American Express International Banking Corporation, New York	—	337,505
American Express International Banking Corporation, Reserve Account	20,820	299,214
American Express International Banking Corporation, Switzerland	4,776	401

		1984	1983
American Express International Banking Corporation, Dhaka		12,031	55,978
American Express International Banking Corporation, Dhaka			
— Reserve Fund Account		16,809	—
— Call Deposit		804,000	—
Janata Bank, Dhaka		1,275	3,138
	US $	859,711	696,236
Taka Account			
Agrani Bank, BAF Branch, Dhaka		43,046	35,990
Agrani Bank, Head Office, Dhaka		32	32
Janata Bank, Dhaka		1,723	3,365
American Express International Banking Corporation, Dhaka		9,077	—
Agrani Bank, Matlab		5,235	419
Agrani Bank, Teknaf		60	329
Agrani Bank, Sirajgonj		557	—
Agrani Bank, Noapara		35	—
Agrani Bank, Chandpur		346	—
Agrani Bank, Mirjapur		476	—
	US $	60,587	40,135
UK £ Account			
American Express International Banking Corporation, London		4,927	8,800
SFR Account			
American Express International Banking Corporation, Switzerland		12,840	12,888
SR Account			
Saudi American Bank		1,565	—
Cash in hand		2,432	480
	US $	942,062	758,539

6. BANK OVERDRAFT

US $ Account			
American Express International Banking Corporation, New York		438,443	—
Taka Account			
American Express International Banking Corporation, Dhaka		1,173,578	439,433
	US $	1,612,021	439,433

7. OTHER CURRENT LIABILITIES

		1984	1983
Capital Development Fund			
For building construction		56,194	397,700
Operating Fund			
For supplies and materials		91,209	117,182
For expenses		325,196	461,178
Security and other deposits		10,485	31,048
Interest free loan (unsecured)		1,186,080	1,186,080
		1,612,970	1,795,488
	US $	1,669,164	2,193,188

8. CAPITAL DEVELOPMENT FUND

Balance at 1 January, 1984		3,899,292	1,817,893
Add : Transferred during the year from Receipts and Expenditure Account		781,003	589
Transferred from Operating Fund		—	2,080,810
		4,680,295	3,899,292
Less : Loss on sale of assets		10,892	—
	US $	4,669,403	3,899,292

9. OPERATING FUND

Balance at 1 January, 1984		(1,182,942)	1,763,941
Surplus/(Deficit) for the year ended December 31, 1984		(605,613)	(566,073)
		(1,788,555)	1,197,868
Less : Transfer of Fixed Assets to Capital Development Fund		—	2,080,810
Transfer to Reserve Fund		441,629	300,000
		441,629	2,380,810
	US $	(2,230,184)	(1,182,942)

10. RESERVE FUND

Balance at 1 January, 1984		400,000	100,000
Add : Transferred from Operating Fund		441,629	300,000
	US $	841,629	400,000

11. CONTRIBUTIONS

	1984	1983
Unrestricted		
Australian Government	161,078	162,589
Bangladesh Government	32,760	34,440
Swedish Government	207,280	—
* Japan Government	240,000	200,000
Kingdom of Saudi Arabia	100,000	100,000
USAID-Washington	1,898,000	2,217,000
Switzerland Government	324,271	576,545
UK Government	168,516	178,308
Belgian Government	—	74,766
Private Contributions	—	14,000
US $	3,131,905	3,557,648
Restricted		
AG Program	280,000	70,000
Aga Khan Foundation	—	39,038
French Government	49,220	44,371
UNFPA (United Nation's Fund for Population Activities through Bangladesh Government)	26,000	88,150
UNFPA (United Nation's Fund for Population Activities) DSS/Matlab.	16,400	394,270
International Development Research Centre (IDRC), Canada	58,610	62,666
Canadian International Development Agency (CIDA)	1,407,016	—
UNICEF	451,244	—
Bangladesh-German (FRG) Technical Cooperation	—	50,000
Belgian Administration for Development Cooperation (BADC)	7,906	—
WHO (World Health Organization)	349,567	286,336
Swedish Agency for Research and Cooperation (SAREC)	36,579	38,733
Ford Foundation	256,900	50,000
USAID/Dhaka	655,672	326,479
USAID/Jakarta	60,817	912
USAID/Manila	14,241	—
USAID/NIROG Project	12,603	11,397
UN University, Japan	5,787	—
The Population Council	27,167	62,067
UNDP/Water Embankment Project	—	35,000
Saudi Arabia	485,614	—
Roche Far East Research Foundation	5,000	—
Netherland Government (MAT)	—	6,300
The Johns Hopkins University	9,224	13,255
IBRD-Handpump Project	41,162	131,218
Princeton University	5,493	1,057
Miscellaneous Contributions	4,510	—
US $	4,266,732	1,711,249

* Erratum: The Japan Government's contribution is "restricted," not "unrestricted."

Contribution in kind		1984	1983
UNFPA		—	6,709
Miscellaneous		—	606
	US $	7,398,637	5,276,212

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

12. PERSONNEL SERVICES AND BENEFITS

Expenditure on the above account include :

(a) An amount of US $ 35,088 (1983 US $ 37,950) paid as honorarium to the members of the Board of Trustees.

(b) Retirement Fund contribution amounting to US $ 37,094 in respect of prior period.

13. RETIREMENT LIABILITY

Retirement liability to the extent of US $ 158,900 (approx.) has not been provided for in the accounts, in respect of :

(i) ICDDR,B Employees not covered by WHO Scale — US $ 26,700.

(ii) Interest on Retirement Fund till 31.3.1984 — US $ 108,900.

(iii) International Level Staff during their services in ICDDR,B local pay scale — US $ 23,300.

14. CURRENCY TRANSLATION

Rates of exchange used for the translation of various currencies for the purpose of accounts as at December 31, 1984 are as follows :

Currency	Rates used for the conversion of quarterly transactions in US $			
	1st. Qtr.	2nd. Qtr.	3rd. Qtr.	4th. Qtr.
Tk. 1.00	0.040	0.040	0.040	0.039
UK 1.00	1.409	1.403	1.359	1.207
SFR 1.00	0.446	0.446	0.431	0.397
SR 1.00	—	0.284	—	—

The effect of year end exchange rates of different currencies in US Dollar has not been ascertained and consequently not accounted for as in previous years.

15. CONTINGENT LIABILITIES

Prior years' tax on expatriates salaries amounting to US $ 110,000.

16. CAPITAL COMMITMENT

In the opinion of the management, the amount is considered to be US $ 200,000 (Approx).

17. Previous year's figures have been rearranged and regrouped wherever found necessary.

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

We have audited the Balance Sheet of the International Centre for Diarrhoeal Disease Research, Bangladesh as of December 31, 1984, 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 item Nos. 3, 13 and 14 of the 'notes to accounts' attached thereto, give respectively, a true and fair view of the state of affairs of the Centre as of December 31, 1984 and the results of its operations for the year then ended.

Deloitte Haskins + Sells

DELOITTE HASKINS + SELLS
CHARTERED ACCOUNTANTS

AHMED REZA & CO.
CHARTERED ACCOUNTANTS

Dhaka, April 04, 1985

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M.A. Jabbar	Bangladesh	Senior Personnel Officer
M. Rahman Khalili, ACA	Bangladesh	Financial Accounting Head
S.A.A. Abdul Matin, B. Com	Bangladesh	Senior Accounts Officer
A.K.M. Abdul Matin, BA	Bangladesh	Logistics & Field Support Branch Head
Noor Mohd. Meermalat	Bangladesh	Technical Officer
Mir Mohiuddin	Bangladesh	Senior Coordination Officer
Shamima Moin, M.Com., MBA	Bangladesh	Budget Accounting Head
*Md. Akram Ali Molla, MA	Bangladesh	Senior Procurement Officer
M. Golam Morshed, MA, LLB	Bangladesh	Supply Branch Head
*Beverley Morris	UK	Assistant to Admn. & Finance Associate Director
Naomi Rock Novak, MS	USA	Consultant, Communications Coordinator and Scientific Editor
Tazia Qamar, MA	Bangladesh	International Staff Officer
Md. Mujibur Rahman	Bangladesh	Senior Estate Officer
Md. Mizanur Rahman, M. Com	Bangladesh	Senior Accounts Officer
Mofzalur Rahman	Bangladesh	Technical Officer
Md. Bozlur Rahman, M. Com	Bangladesh	Budget Officer
Md. Mukhlesur Rahman, BSc. Dip in PM	Bangladesh	Personnel Officer
A. Razzaque	Bangladesh	Senior Technical Officer
Sirajus Salekin, M.Com	Bangladesh	Programer
A.K. Md. Abdus Samad, M.Com	Bangladesh	Senior Accounts Officer
Mohd. Jalil Sarker	Bangladesh	Secretary
Md. Shahabuddin	Bangladesh	Special Assistant to the Director
R.H. Sircar	Bangladesh	Secretary
M. Sobhani	Bangladesh	Bio-Medical Engineering Cell Head
Md. A. Hossain Talukder, Dip in Engg. (Civil)	Bangladesh	Site Supervisor