Report on the Third Annual Scientific Conference (ASCON-III)

Sasakawa International Training Centre

15-16 January 1994

Prepared by

Bilqis Amin Hoque
M Shamsul Islam Khan

International Centre for
Diarrhoeal Disease Research, Bangladesh
Mohakhali, Dhaka 1212
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ICDDR,B publishes a journal, newsletters, scientific reports, monographs, bibliographies, and many other items in the field of diarrhoeal diseases and on related subjects.

PREFACE

Environment and health are inseparably linked and include all aspects of development. It is also recognized that the household environment is the most critical area for intervention. Although there has been considerable progress in safe water supply and sanitation, diarrhoeal disease is still one of the most important causes of mortality and morbidity in Bangladesh. Other water-related diseases also have not diminished in incidence. Disasters, almost annual event, are often followed by diarrhoeal epidemics. Rapid growth and high density of population, poverty, and urbanization are causing the environmental health problems to become more severe.

At the national level, more than 80% of the population have access to tubewell/piped water, but only about 12% of the households use tubewell water for all domestic purposes. Although the tubewell water contains no or a negligible number of bacteria, at consumption point the bacterial population in water is several thousands/100 ml. About 30% of the households in 1993 had some kind of provision for sanitary disposal of faeces, but the use rate of those latrines by children is very low. The personal and food hygiene practices are unsatisfactory. Environmental health situations deteriorate after disasters, and there are doubts about the effective use of water-purifying tablets for water disinfection.

In addition to the continuation of the normal water and sanitation programmes, the government is giving increased emphasis to sanitation. The main challenges remain: How can effective safe water coverage and use be attained? How can effective and adequate sanitation coverage be attained? How can people's behaviour be changed towards appropriate and effective hygiene practices? How can we mount an inter-sectoral and coordinated effort to effectively address these challenges?

The Third Annual Conference, "Environmental Health and Policy Perspectives", was a sincere effort to share ICDDR,B experiences and develop recommendations for future activities with concerned GoB, NGO, UN and donor agencies in the fields of environmental health.

We hope that this report will contribute in planning and implementation of future activities by ICDDR,B as well as all the concerned agencies.

Bilqis Amin Hoque, PhD

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The most credit should go to the speakers and the chairpersons without whose presentations the conference could not have been held so successfully. The participants indeed played the key role in the development of the recommendations and making the conference a success.

The editorial assistance of Josephine Sack is gratefully acknowledged.

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INTRODUCTION

Health and the environment being very closely inter-linked, ensuring a safe environment is now a major concern of the environmental scientists, researchers, and policy-makers all over the world. Emphasis has been given to contain the consequences of degraded environments through various means, aimed at avoiding disasters, reducing mortality, and improving the health of the people. These issues warrant adequate and progressive attention from all concerned. Some important research has been done, the results of which have pointed out important deficiencies which need to be urgently addressed to overcome some of the existing problems on a priority basis. These include delivery of improved health care services, health education, and safe water supply and sanitation.

As a partner of the overall efforts of the international community, the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has been actively involved in generating appropriate information through providing facilities for and undertaking research in three major areas: diarrhoea, nutrition, and maternal and child health with family planning. As preventive strategies for diarrhoea control, it has as well conducted research and provided technical assistance in the field of environmental health. The findings of this research have made a significant impact on world health.

ICDDR,B is an autonomous, non-profit organization funded by institutions and nations which share its concern for the health problems of the developing countries. True to its commitment to share its research results, and to provide a forum for the exchange of ideas, ICDDR,B has organized a scientific conference each year since 1991. The scientific annual conferences are aimed at disseminating the knowledge and information gained from the findings of the research undertaken by the Centre's staff.

This year's scientific conference (the third in the series) was held on 15-16 January 1994 in Dhaka at the Centre's Sasakawa Auditorium. The theme of the conference was "Environmental health and policy perspectives".

This report presents briefly an overview of the conference and documents mainly the recommendations developed in the meeting .

CONFERENCE OBJECTIVES

The organization of annual scientific conferences is a major effort by the Centre to pursue its mandate to disseminate and share knowledge in the fields of diarrhoeal diseases and related subjects. This year's conference focussed on environmental health issues, especially water, sanitation and hygiene practices in the control and prevention of diarrhoeal diseases. The forum provided, as usual, an opportunity to discuss policy-making issues relating to health, population, social and environmental matters, all of which are complementary to each other and are necessary for sustainable development. Considering the multi-dimensional and multi-sectoral nature of the issues, ICDDR,B scientists, administrators, researchers, policy- and decision-makers, the donor community, and other development organizations developed a set of recommendations defining the ICDDR,B's role in the areas of environmental research. This interaction greatly helped bridge the gaps between research and policy which is expected to have national and global programmatic implications.

PARTICIPATION

Some 350 delegates and participants from the Government of Bangladesh, NGOs, UN agencies, universities, research institutions, donor agencies, press and media from 17 countries, including Bangladesh, U.K., and the U.S.A., participated in the conference.

The participating organizations included:

o Ministry of Health & Family Welfare

o Ministry of Local Government, Rural Development and Co-operatives

o Ministry of Forests and Environment

o Ministry of Planning

o Ministry of Relief and Rehabilitation

o Armed Forces Institute of Pathology

o Autonomous national institutions (universities)

o Non-government organizations and allied bodies

o London School of Hygiene and Tropical Medicine, U.K.

o The Johns Hopkins University, School of Hygiene and Public Health, USA.

o Donor agencies

o Press and media

This year the keynote address was delivered by a distinguished scientist, Professor R.G. Feachem, Dean, London School of Hygiene and Tropical Medicine, UK, who is one of the pioneering and front-line scientists in the area of environment and health research.

Three symposia addressed the following three areas: i) Diarrhoea Prevention: Obstacles and Opportunities, ii) Population, Urbanization, and Environmental Health, and iii) Cholera Epidemics and Disaster Management. Each symposium included an overview followed by comments and discussions. Speakers were invited from the government, non-government organizations, UN agencies, and ICDDR,B. These symposia were followed by four free paper and poster sessions.

In the free paper sessions, the findings of recent research at ICDDR,B were organized into two related groups: i) Diarrhoea Prevention: Issues in Water Supply and Sanitation, and ii) Environmental Health in the Context of Primary Health Care.

A total of 44 scientific papers on related aspects were presented at the conference.

A set of recommendations was developed during the conference and finalized in the closing session. The closing session was chaired by Dr. Eimi Watanabe, Resident Representative, UNDP in Bangladesh. The Special Guest was Mr. Syed Alamgir Farrouk Chowdhury, Secretary, Local Government Division, Ministry of Local Government, Rural Development and Cooperatives.

THE CONFERENCE

Mr. Chowdhury Kamal Ibne Yusuf, Honourable Minister for Health & Family Welfare, Government of Bangladesh, inaugurated the conference as the Chief Guest. The Special Guests were Dr. Mohammad Haroonur Rashid, Secretary, Planning Division, Ministry of Planning, Government of Bangladesh, Mr. Christopher R. Willoughby, Chief of Mission, The World Bank, Dhaka, and Dr. Peter Arnold, Counsellor and Head, Swiss Development Cooperation.

Remarks by Chief and Special Guests

Appreciating the work of ICDDR,B, Chowdhury Kamal Ibne Yusuf said that the Centre should develop simple, affordable and acceptable technologies to combat diarrhoeal diseases. He further said that the Government of Bangladesh has been working hand-in-hand with the Centre, including water supply and sanitation areas, and the theme of the conference was rightly chosen. Dr Rashid highlighted the existing problems of the country, which include poverty, high population growth, inadequate food supply, inadequate sanitation, rapid urbanization, and environmental degradation. He expressed the need to ensure more effective use of resources in the health and sanitation sectors through inter-ministerial/inter-sectoral programmes and a central clearing-house of information for sharing updated information and knowledge. He mentioned that the SAARC member countries would prepare a Pro-poor Action Plan to substantially reduce poverty and double the per capita income during the next ten years. Bangladesh has already set up a Task Force to work out a Programme of Action. Improvement in health, water supply, sanitation and hygiene education must be a component of this programme. He hoped that this conference would also discuss measures for a mechanism to address the concerns for health and environments to be effectively integrated into the Pro-Poor Plan.

Mr. Willoughby said that, over the years, the World Bank and IDA have lent over $14 billion for water supply and sanitation projects and almost $8 billion for population, health and nutrition projects. He expressed concerns about to whether improving water supply and sanitation (along with necessary health education) would be enough in all areas in the future to prevent cholera. Measures may also be needed to preserve and protect the natural water and environmental systems. Dr. Arnold emphasized that the theme of the conference was of central importance for health policy, planning and sustainable programmes. He echoed the challenges faced by the country as stated earlier. The effective participation of NGOs and

private sectors and inter-sectoral coordination were emphasized too. He hoped that ICDDR,B in defining its role in the field of environment and subsequent undertaking of the activities will be associated as a partner in the national as well as global attempt to face the challenges.

Keynote address by Professor R.G. Feachem

In the annual lecture, Prof. Feachem attempted to set the context for discussion in the following 2 days. He outlined the State of World Health drawing attention to dramatic progress made in the past few decades, and the challenges it faces now as well as in the immediate future (heavily drawing on the 1993 World Development Report, World Bank). He commented on the relationship between environment and health suggesting that one aspect of the environment should have overriding priority in research and in policy formulation, and importance of research and of building strong institutes engaged in such research. There has been a dramatic increase in life expectancy in all regions of the world, and Bangladesh has made a contribution in this effort. Challenges faced today are closing the gaps within countries and between countries.

Highly cost-effective interventions are available for respiratory infections, perinatal care and diarrhoeal diseases. The confusion related to the influence of the environment on health could be viewed under two categories: i) the one emphasizing problems in industrialized countries, which include deforestation, ambient air pollution, ambient water pollution, global warming, ozone layer depletion, and declining biodiversity and, ii) the other emphasizing problems in developing countries which include those aspects of the environment having a large immediate negative impact on human welfare and productivity: such as water supply, sanitation, indoor air pollution, and housing. The areas of intervention in major environmental health issues in the world today include household environment, occupational environment, ambient environment, and road transportation. He suggested that as domestic environmental issues dominate the list of priorities, it should also dominate the environmental health research agenda. The issues in household environment include water supply, sanitation, crowding, indoor air pollution and drainage. He appreciated that ICDDR,B, UN agencies and the donor agencies in Bangladesh acted appropriately. He emphasized that researches need to step beyond the epidemiology into questions of service-delivery and policies around how to deliver these services to poor families throughout the country. He also emphasized the continued need for basic research and pointed out the existing challenges in tuberculosis.

RECOMMENDATIONS

The recommendations of the Third Annual Scientific Conference were developed based on issues presented and discussed at the conference with participants from ICDDR,B, GoB, NGOs, UN and donor agencies. The major presentations from which the recommendations were drawn are summarized in the accompanying Appendix. Overall, the need for development of improved environmental health through applied and action-oriented research was emphasized. The recommendations have been divided into three broad categories: A) Research activities at ICDDR,B, B) Coordinating and collaborating activities between ICDDR,B and concerned agencies and C) General policy perspectives.

A. **Research activities which could be undertaken by ICDDR,B scientists (Research)**

A.1. Develop short-term and long-term appropriate comprehensive intervention packages for safe household environments, consisting of context-specific issues, such as: i) appropriate water and sanitation provisions, ii) food hygiene, iii) personal and household hygiene, and iv) domestic (solid) waste disposal.

A.2. Develop and promote appropriate methods for safe water use, storage and handling.

A.3. Develop and promote appropriate ways to preserve and protect surface water for domestic water use when tubewell water is inadequate/unavailable.

A.4. Develop methods on how to involve and train community, specially women, involvement in sustainable water and sanitation activities during normal and disaster periods.

A.5. Study long-term health and water quality impacts of Meghna-Dhonagoda Embankment and interventions to address the negative impacts.

A.6. Develop a programme on adequate, effective and sustainable sanitation coverage through widely replicable strategies.

A.7. Conduct health system research on how to improve and promote integrated MCH-FP and WSS activities for long-term and short-term programmes through GoB, NGOs, and ICDDR,B.

A.8. Develop an appropriate environmental and health emergency preparedness programme taking into account immediate, medium and long-term developmental issues.

A.9. Develop and promote appropriate disposal of waste materials of family planning programmes.

B. **Coordinating and/or collaborating activities which could be undertaken by ICDDR,B with concerned agencies (Coordination and Collaboration)**

B.1. The existing health programmes should be reviewed and revised as a feasible comprehensive health package of MCH-FP and water and sanitation-related issues, giving adequate programmatic considerations to every included component.

B.2. Study long-term health and water quality issues of flood control and drainage projects.

B.3. Establish appropriate environmental health activities during disaster situations, including household water treatment, sanitation and training of relief personnel.

B.4. Develop health and environmental strategies in slums and poor communities.

B.5. Inter-ministerial/inter-sectoral programmes in Health, Environment, LGRD, Planning and Relief sectors should have a central clearing-house of information, so that various agencies undertaking programmes in this sector can share the updated information and knowledge about the programmes and techniques and can shape their own programmes which may complement and reinforce each other, rather than competing and duplicating efforts.

C. General Policy Perspectives

C.1. Discretionary health care may increasingly be left to the private sector emphasizing general and private health care and sanitation in the public sector.

C.2. Long-term health and water quality studies should be conducted on the impact of the Meghna-Dhonagoda embankment.

C.3. Make appropriate linkage and coordination at policy and programme levels of the concerned agencies, such as ICDDR,B, various sectors of the GoB, NGOs, UN and donor agencies.

C.4. Train relief personnel on water sanitation and diarrhoea management issues.

C.5. The attempts for exploring multi-sectoral and multi-disciplinary approach to achieve feasible integrated MCH-FP and WSS programme should include all concerned agencies (e.g. GoB, NGOs, ICDDR,B and other research institutions, UN and donor agencies).

C.6. Where feasible, try to achieve exclusive coverage of tubewell/piped water with appropriate education on its effective use.

C.7. Surface water should be viewed as a complementary source.

C.8. Involve and train community people appropriately in projects at all stages, such as planning, maintenance, and monitoring.

C.9. Emphasize on effective sanitation coverage.

APPENDIX

ABSTRACTS

1 DIARRHOEA PREVENTION: WATER AND SANITATION.

Bilqis Amin Hoque. International Centre for Diarrhoeal Disease Research, Bangladesh

The interest of the Government of Bangladesh (GoB) in controlling and preventing diarrhoea has been encouraging, but the morbidity has not reduced significantly.

Diarrhoea transmission models show parallel multiple transmission modes. When faecal matter is disposed of inappropriately, surviving infective organisms simultaneously or individually contaminate water, food, hands and other objects, and are ultimately ingested. The faecally contaminated environmental and disease-causal variables mainly react to produce diarrhoea. To prevent diarrhoea, water supply and sanitation (WSS) intervention should interrupt the transmission modes -- at the point of disposal of faeces and at the various contact points between faecally contaminated material and humans. The social factors and resource availability influence the process significantly. We will review the opportunities and obstacles experienced by scientists at ICDDR,B in WSS studies for the control of diarrhoea.

Studies in Matlab have shown that safe drinking water alone was not enough to control cholera, and even water use for other domestic purposes was important. The Teknaf study suggested that installation of latrines was more effective to reduce diarrhoea mortality than provision of handpumps. In the Mirzapur project, diarrhoea morbidity in children in the intervention area was reduced by 25% compared to the children in control area. In both studies, handpumps and latrines were given free or at a highly subsidized cost with hygiene education, and the compliance rate was high. An educational intervention in Dhaka slums resulted in 26% fewer diarrhoeal episodes in children. Hand washing with soap is reported to reduce *Shigella*-associated dysentery by 35%.

These studies provided information related to the prevention of diarrhoea under optimum service conditions, but such services are not feasible at

wider scale. We observed that, in Barisal, the GoB-UNICEF achieved about 78% sanitation coverage through integrated social mobilization. There, the law and legal framework supported the programme, and its effectiveness and sustainability are yet to be seen. Sustained community involvement was found in Mirzapur, where the majority of the project-given handpumps (80%) and latrines (67%) were functioning and being used after about 5 years of project completion. There, local women were involved during the project period, and illiteracy and social factors were no barrier to their efficient performance when trained appropriately.

Hand washing is promoted for the control of diarrhoea, but the practice includes factors which need research and development. Soap is unaffordable by about 80% of the rural people. Ash is unavailable in slums, but to clean hands a washing agent has to be used. A controlled study showed that washing hands with soap, soil, or ash provides similar efficient results.

Among other ongoing studies are: contamination of tube-well water between collection and ingestion, impacts of flood control and irrigation drainage projects, rehabilitation of surface water sources for safe water as tube-well water cannot be made available for all domestic purposes, management of water-sanitation in emergency periods, and appropriate intervention in urban slums. Inter-agency efforts are being made to bridge the gap between research and real situations.

Priority actions would include: development of appropriate WSS technologies, appropriate education packages, a legal framework, methods for effective community participation and operations research programme in normal, disaster, rural and urban set-ups. Coordinated multi-disciplinary and multi-sectoral efforts at policy levels of all concerned agencies are recommended.

2 COMBATING DIARRHOEA THROUGH RURAL WATER SUPPLY AND SANITATION: WHAT CAN WE DO?.

Philip Wan. UNICEF, Dhaka

Bangladesh has one of the most impressive records on access to rural water supply amongst developing countries. Yet, diarrhoeal incidence has declined only marginally. It is certainly not that people drink polluted water. A recent national survey (Mitra, 1992) showed that 96% of the population drink tube-well water. Hence, are our expectations of the impact of safe drinking water on diarrhoeal reduction misplaced, or too optimistic?

It is true that drinking tube-well water has become a way of life. Unfortunately, it is equally true that polluted water is ingested ... or DRUNK ... everyday, as people take their baths, clean their mouths, etc., in unprotected ponds and streams. If people, and particularly children who are more vulnerable, are not motivated to use tube-well water for other personal needs, the investment made in water supply will not contribute effectively to health impact.

As policy-makers, planners and implementors, we should, therefore, advocate for changes in people's behaviour, rather than merely advocate for more and more tube-wells, except in certain underserved areas.

In the last few years, UNICEF has been moving in this direction, particularly to promote sanitation and hygiene, to complement the multi-purpose use of tube-well water. UNICEF is supporting the Department of Public Health Engineering and other allies in launching a social mobilization for sanitation.

It is significant that politicians and policy-makers have given more emphasis to sanitation and hygiene in the last few years. A major environmental health hazard is the high pathogenic load in the public domain, due to indiscriminate defaecation practices. It contributes to a quarter million of under-five diarrhoeal deaths. An obvious answer is the use of sanitary latrines by all household members. An equally obvious question is: can the rural poor afford to construct a sanitary latrine?

In a recent presentation, the Honourable Deputy Leader of the House of Parliament, Dr. A.Q.M. Badrudduza Chowdhury, proposed the extensive use of the 'do-it-yourself' (home-made) sanitary pit latrine. This can be constructed using building materials available in many backyards. The Department of Public Health Engineering and many NGOs are promoting a range of low-cost options, from the do-it-yourself pit latrine to the water-seal latrine. The recent trend in sanitary latrine usage, rising from 16% at the end of 1990 to 33% at mid-1993 is encouraging. About two-thirds were of the home-made type. A recent study (DPHE-WHO-UNICEF, 1993) revealed that about 43% of the home-made latrines were installed at a cost not exceeding Tk. 100.

In the sanitation sector, we should, therefore, promote the do-able. The construction and use of a home-made latrine is a landmark in rural life; for many households, this will also be the first step to a more sophisticated latrine.

The intervention package is not complete and fully effective without the practice of good personal hygiene, and home sanitation, including food hygiene.

We can think of many ways to reach out to the community for promoting water, sanitation and hygiene, such as the NGO network and religious leaders. Instead, we should start with our own colleagues and people directly or closely associated with our departments or ministries. I mean the school headmasters, teachers, students under the Education Sector, the health and family planning workers, the large number of cooperative members, and others. Can we ensure that all these people be the trend setters and models in using more tube-well water, improving hygiene practices and using sanitary latrines? These are do-able things that can make a difference to Bangladesh.

3 THE ROLE OF PRIMARY HEALTH CARE IN THE PREVENTION OF CHILDHOOD DIARRHOEAL DISEASE.

P.C. Miller. The Population Council

Most efforts to prevent childhood diarrhoeal diseases can be divided into two classes: environment-based prevention and primary health care-based prevention. Environment-based protection, which includes both the physical and the socio-cultural environment, seeks in general to reduce the exposure of children to diarrhoea-causing microbes. PHC-based protection seeks in general to strengthen the ability of children to resist diarrhoeal diseases, given exposure. At the boundary are health education efforts which can be delivered as part of primary health care (PHC) or through other media, and address both reduction of exposure and strengthening of host resistance.

The most important PHC-based interventions are immunization, rehydration, nutrition, and family planning. Immunization may prevent diarrhoeal disease directly (e.g. cholera) or by preventing diseases for which diarrhoea may be an important sequela (e.g. measles). Rehydration, which is primarily a curative approach, also prevents existing cases from worsening, and reduces the degree of weakening of the child, thereby preventing future cases. Nutritional programmes prevent diarrhoea by strengthening the child generally, thereby reducing his/her vulnerability to diarrhoea and other infections to which diarrhoea may be secondary. Family planning can increase the time between children and reduce the total number of children, thereby increasing the access of children to nutrition and other health care, and strengthening the mother to provide care. Other PHC measures

may prevent diarrhoeal diseases by strengthening children generally. Health education encourages immunization, rehydration, nutrition, and family planning, as well as breast feeding, which also strengthens the child's resistance to diarrhoea. The nature and importance of these interventions, in preventing diarrhoeal diseases, and their interactions, are discussed in detail.

4 POPULATION AND URBANIZATION ISSUES OF BANGLADESH. **Abdullah Hel Baqui.** International Centre for Diarrhoeal Disease Research, Bangladesh

Rapid population growth is considered to be the most important problem of Bangladesh. In 1972, the country's total population was 73 million and the population density was 489 per sq.km. -- the highest population density in the world. The total fertility rate (TFR) was 6.4; at this growth rate, the population would have doubled in only 28 years. To keep the country's population within its carrying capacity by stabilizing the population at the earliest time and at the lowest level possible, the Government of Bangladesh (GoB) and non-governmental organizations (NGOs) launched a family planning programme in the early 1970s. Despite a very poor socioeconomic setting characterized by high illiteracy, women's low status, and poor health and economic conditions, the success of the family planning programme in Bangladesh is unprecedented. The 1991 Bangladesh Contraceptive Prevalence Survey reported a national average contraceptive prevalence rate (CPR) of 40%; the CPR was only 8% in 1975. The increase in CPR has reduced the TFR from 6.4 in 1972 to 4.2 in 1991.

Though the success of family planning programme in Bangladesh is notable, a TFR of 4.2 is still too high; at this growth rate, the population would double in 35 years. The GoB has set a goal of reaching replacement level fertility by the year 2005. Even if this goal is achieved, the country's population will continue to grow for the next 50 years and will stabilize at 211 million by the year 2056. With a ten-year delay, the population size will stabilize at 250 million in the year 2081 -- about 40 million more people. Rapid population growth is increasingly threatening our environment and health; more people means more demand on finite natural resources and increasing environmental pollution by chemicals, machines, and wastes.

Urbanization is an emerging problem in Bangladesh. To escape rural poverty, thousands of people are moving from the rural to the urban areas. In 1961, only slightly more than 5% of the population lived in urban areas.

According to the 1991 census estimate, about 21% of the country's population is urban; this population is increasing at a rate of 6%-7% per year. The largest metropolis in Bangladesh is Dhaka, the capital. Between 1961 and 1991, Dhaka's population has increased from about 0.5 million to over 6 million. The rapid growth of Dhaka's population has made the public sector unable to adequately provide the basic services. About a third of Dhaka's population live in slums and squatters, in extremely poor environmental and living conditions. The health burdens due to urban poverty and environmental problems in terms of morbidity and mortality are enormous. Using selected data from ICDDR,B, this paper attempts to illustrate some of these points.

To achieve replacement level fertility by 2005, we would need to increase the country's CPR from 40% to 70% - on an average, a 2% increase per year in the next 15 years. This is a formidable task. Four major programmatic challenges have been identified which need immediate action. They are: 1) to create an enabling environment in which more and more couples will be motivated to adopt contraception, 2) to improve the quality of family planning services to meet the needs of increasing number of users, 3) to strengthen the management of the family planning programme, and 4) to improve programme sustainability -- both financial and institutional.

5 WATER SUPPLY AND SANITATION IN URBAN SLUMS AND FRINGES. A.M.S. Hoque. Department of Public Health Engineering, Government of Bangladesh, Dhaka

Bangladesh has a total population of 116 million living in an area of 143,998 sq.km. About 20% of its population live in the 111 urban areas. The government also has decided to declare 460 *thana* headquarters as urban areas. The population growth in urban areas is 4.9%. A World Bank report forecasts a Bangladesh population of 144.1 million by the year 2001, of which 39.1 million will be in the urban areas. The rate of population growth in urban slums and fringes is much more than that in the normal urban areas. About 30% of the people in the urban slums have access to a piped water supply and 20% to sanitary latrines, but in the fringe areas, the facilities provided are much less. The condition in slums and fringes will worsen very much due to the influx of people from rural areas, and will create a gigantic problem of water supply and sanitation. Considering all these factors, the Department of Public Health Engineering, Government of the People's Republic of Bangladesh, felt the need to improve the condition of water supply and sanitation in urban slums and fringes of the 111 municipalities. Accordingly, the Department undertook

a project for the water supply and sanitation of those areas in the name and style of "Water Supply and Sanitation Project for Urban Slums and Fringes" at a cost of about Tk. 140 million, and this is being partially assisted by two donors, viz. SDC and DANIDA through UNICEF. The project is progressing smoothly and in the meantime, 3,581 tube-wells and 5,768 sanitary latrine sets have been installed. Some problems encountered in the implementation are being taken care of effectively. The government is also trying to find suitable donors to finance a similar gigantic project of water supply and sanitation under preparation for the 460 *thana* headquarters. On the other hand, the Local Government Engineering Department (LGED) is also trying to improve the water supply and sanitation conditions of the urban slum areas of several municipalities by installing tube-wells and supplying sanitary latrine sets in their Slum Improvement Project (SIP) and other projects. It is expected that the water supply and sanitation will improve and hopefully reach the target of the International Water Supply and Sanitation Decade.

6 URBANIZATION AND HEALTH STATUS. **Mohammed Ashraf Uddin**. Dhaka City Corporation

Bangladesh has experienced a rapid growth in urban population during the last few decades. The urban population growth rate (5-8%) ranks among the highest in Asia. It is estimated that the country's urban population (currently more than 22 million) will be doubled by the year 2000.

High infant and child mortality rates prevail due to the incidence of diarrhoea, acute respiratory infection, and vaccine preventable diseases. Sixty per cent of children are chronically malnourished and about 10% are acutely malnourished among the urban poor.

About 300,000 children aged less than 5 years die of diarrhoeal disease every year, of which one-third die in the city slums and squatter settlements. Over-crowding, contaminated water, poor housing and environmental conditions, and low standards of personal hygiene are the major causes of diarrhoeal deaths.

The health picture in the slums is a bleak one. Although the urban population as a whole tends to have higher birth, death and infant mortality rates than that of the national average, health services for the urban poor are minimal. City corporations and municipalities are mainly responsible for providing primary health care services as well as curative services to some extent. In many municipalities, health staff members are limited to sanitary

inspectors and health assistants, and they have very minimal training or no training at all in primary maternal and child care. Family planning services are supported by the government but mostly provided by NGOs.

Adequate supply of pure drinking water and facilities for proper sanitation are very important in a situation where diseases are linked to the deteriorated environmental conditions.

Short-term and long-term measures should be taken into consideration to improve the health, nutrition, water, sanitation and environmental and as well as educational status of the slum dwellers.

Involvement of the concerned ministries, i.e. Health, Education, Local Govt., City Corporations, Pourashavas, WASA, City Improvement Organizations, and NGOs and above all community participation will be sought for attaining the pollution-free environment and Health for All By the Year 2000.

7 DISASTERS, EPIDEMICS AND ENVIRONMENTAL HEALTH IN BANGLADESH. R. Bradley Sack. International Centre for Diarrhoeal Disease Research, Bangladesh

Natural disasters include floods, cyclones, tornadoes, hurricanes, earthquakes, landslides, and volcanic eruptions. Man-nature interactions may also bring about disaster situations, such as epidemics, droughts, and famines. Floods, cyclones, tornadoes and hurricanes, and diarrhoea epidemics are almost annual events in Bangladesh. The association between water, sanitation and diarrhoea transmission is well-known, and these relationships gain extra importance after disaster events when many of the normal sanitary provisions have been destroyed or disrupted. We present our (ICDDR,B) experiences gained during specific natural disasters and the recent man-nature-interactions-related disaster of *Vibrio cholerae* O139.

During and following the 1988 floods, diarrhoea was the most common illness (34.7%) followed by respiratory tract infections (17.4%). After the cyclone of 1991, extensive efforts were made to repair existing tube-wells and install new ones, but the load on tube-wells was unacceptably high. All people, including the majority who used surface water for domestic purposes and tube-well water for drinking only, wanted to use only tube-wells; that resulted in an acute shortage of water. The quality of transported water was also questionable. The effectiveness of distributing water-purifying tablets was doubtful, because the majority of them had

lost their potency, and inefficient distribution and management was observed. Disposal of faecal and other waste water was unacceptable in households, temporary clinics, and shelters. There were no special arrangements to help women, the most vulnerable group. The relief personnel generally lacked basic environmental health knowledge. Field treatment of diarrhoea cases was not optimal with too little use of oral rehydration therapy and inappropriate use of I.V. fluids or other drugs.

Our experience with the *V. cholerae* O139 epidemic began in February 1993. Although the epidemic began in December 1992 in southern Bangladesh, it was identified in our Dhaka hospital following "*Ijtema*", one of the biggest Islamic congregations, held in Tongi. During this congregation, thousands of people were exposed to unacceptable environmental health conditions and that may have provided favourable transmission modes for spread of the new cholera strain among adults. This new type of cholera can be prevented following the same WSS strategies used for other diarrhoeal diseases.

Like most developing countries, Bangladesh has limited resources, and often development funds are redirected to emergency mitigation activities, thereby preventing implementation of long-term solutions. On the other hand, following disasters, international communities usually extend additional help along with the country's support, and if planned adequately, this could have immediate and long-term implications. We recommend an emergency preparedness plan with an immediate and long-term developmental approach for effective use of available funds. Recommendations include: appropriate training courses for relief personnel, rehabilitation and restoration of normal water systems, standardization of quality control of water purification tablet, promotion of appropriate water treatment and sanitation techniques, establishment of a legal framework for managing sanitation in public places (at least), promotion of community (including women) preparedness and development programmes.

8 **RESERVOIRS, SEASONALITY AND ENDEMICITY OF CHOLERA IN BANGLADESH: ROLE OF THE ENVIRONMENT.** **Md. Sirajul Islam**. International Centre for Diarrhoeal Disease Research, Bangladesh

In endemic areas of Bangladesh, cholera epidemics occur twice a year and maintain a regular seasonal pattern. During epidemics, *Vibrio cholerae* O1 are isolated from patients as well as from surface water, but disappear from the environment during inter-epidemic seasons. The reservoirs or sites of

survival and multiplication of pathogenic vibrios between epidemics are not known.

Seven pandemics have been recorded so far. The seventh pandemic started in 1961 and is still continuing. One important aspect of the present pandemic is its place of origin. All previous pandemics started from the Ganges delta of Bengal, but the seventh started from the island of Sulawesi (Celebes) in Indonesia. During the seventh pandemic, there was cholera in Bengal [erstwhile East Pakistan (now Bangladesh) and West Bengal, India], and it is still there. However, until now it is not clear why Bengal is the homeland of cholera. Why should it be endemic there? What are the factors in Bengal responsible for providing a suitable habitat for cholera? Some feel that climatic features may indirectly affect the causative agent or the human hosts and their interrelationships and, therefore, maintain endemicity. It may be that under certain environmental conditions, vibrios persist in the environment or are able to colonize a plant or animal that lives in certain environmental conditions in the aquatic systems. Various kinds of aquatic fauna, such as oysters, zooplankton, crabs, prawns, have been considered potential habitats of *V. cholerae* in the aquatic environment from time to time, but nothing of unequivocal epidemiological importance has yet been found to be the reservoir of pathogenic *V. cholerae* O1.

In the late 1970s, scientists started searching for vibrios in association with freshwater macrophytes in cholera endemic areas in Bangladesh. Four macrophytes were found to associate with vibrios: *Eichhornia crassipes* (water hyacinth), *Monochoria hastata, Marsilea guadrifolia*, and *Ludwigia repens*. Vibrios were isolated from the roots of these plants. Laboratory-based studies also showed that *V. cholerae* O1 could survive longer in association with a common duckweed, *Lemna minor* than in water on which the duckweed was floating. Similar observation was also made when experiments were carried out with four marine algae: *Ulva lactuca, Enteromorpha intestinalis, Ceraminum rubrum,* and *Polysiphonia lanosa*. However, among the four plants, *V. cholerae* O1 survived longest in association with *U. lactuca*. A laboratory-based study also showed that toxigenic *V. cholerae* O1 gain survival advantages in association with a filamentous green alga, *Rhizoclonium fontanum*, in artificial aquatic environment, surviving longer with *R. fontanum* than in water on which the *R. fontanum* was floating or in control water (without *R. fontanum*). The differences in length of survival were statistically significant ($p<0.05$).

Blue-green algal bacterial association is very common in the natural aquatic

environment. Studies have revealed that the association of bacteria and heterocysts of a blue-green alga, *Anabaena* sp., is a symbiotic process, because it was observed that during algal photosynthesis the excess oxygen which is accumulated near the heterocysts has been used in bacterial respiration. The carbon dioxide which is produced by bacteria during respiration is used by the algae. It was found that toxigenic *V. cholerae* O1 can persist in the mucilaginous sheath of a blue-green alga, *Anabaena variabilis*, for 15 months. *V. cholerae* were also seen dividing and clustering around the heterocysts of the alga which are sites for atmospheric nitrogen fixation. This study demonstrated the possible symbiotic relationship between blue-green algae and *V. cholerae* O1. The symbiosis might possibly provide a basis for seasonality of cholera in Bangladesh, because the peak incidence of cholera in endemic areas of Bangladesh occurs together with the bloom of blue-green algae in their natural aquatic environment. These findings, therefore, provide answers to long-waiting questions about the inter-epidemic survival of *V. cholerae* and may help to explain how the seasonality and endemicity of cholera in endemic areas of Bangladesh are maintained.

9 LINKING RELIEF PROGRAMMES TO DEVELOPMENT: EXAMPLES FROM THE SANITATION AND FAMILY EDUCATION (SAFE) PROJECT OF CARE BANGLADESH.

Sumana Brahman. CARE Bangladesh

CARE is a large non-sectarian international non-government organization (NGO) with a focus on relief and development programmes worldwide. CARE has had a long history in this part of the world, and CARE Bangladesh was established shortly after the Liberation War in 1971. Since then, CARE has been very active in a number of important disaster response efforts in Bangladesh, the most recent being the devastating cyclone which hit the coastal areas of Chittagong and Cox's Bazaar in April 1991.

One of the relief projects administered by CARE at this time was the Water and Sanitation/Hygiene (WASH) project. WASH responded to the immediate need for potable water after the cyclone and resultant tidal surges, which destroyed many water systems in the area. Thus, WASH focused primarily on water and sanitation hardware rehabilitation and installation, including the repair of damaged tube-well platforms, provision of tube-wells, and latrine construction.

WASH was administered in 14 *thana* in Chittagong and Cox's Bazaar districts, beginning August 1991 and ending in December 1992. During this

period, CARE provided 681 deep tube-wells, 291 shallow tube-wells, 111 ringwells, and 1,080 new tube-well platforms. CARE also reconstructed 1,173 damaged tube-well platforms, installed 11,433 water-sealed latrine sets, and 2,887 pit latrines.

WASH was clearly an important relief effort for CARE, through which some very important contributions were made to those communities most hard-hit by the cyclone. Nonetheless, it is also important to recognize the limitations of this approach. WASH responded to an immediate need created by a disaster. The water and sanitation focus of the project was mainly providing much-needed "hardware" to the communities. There was no real time to plan for a strong hygiene education (or "software") initiative, nor was this possible immediately following the cyclone. Hygiene education is a necessary element of a successful water and sanitation programme. CARE did recognize this to be shortcoming in the project design and later added a limited hygiene education component in selected communities, after the immediate urgency had passed.

However, the WASH experience provided CARE Bangladesh with a valuable entry into communities where there had been little outside (NGO and government) involvement, and where there is a great receptivity among community members due to CARE's quick post-cyclone response. This gave us the opportunity to make the linkages between a quick-response relief effort and a longer term community development project. Thus, CARE designed and is now implementing a pilot project in selected WASH project areas, to address the issue of community-based hygiene education outreach.

The SAFE project is designed to build on the earlier WASH experience and is focused on the "software" aspects of water, sanitation and hygiene in the same areas where WASH previously installed hardware. The SAFE project area covers about 9,100 households in Sitakunda and Anwara *thana* in Chittagong District. The objectives of the SAFE pilot are to develop effective and replicable hygiene education strategies to promote behaviour change, to develop and assess various models for health and hygiene education outreach, and to design and implement a behaviour-based monitoring system for the hygiene education programme.

To achieve this, two hygiene education outreach models are being implemented and assessed. The first, more conventional model, examines outreach efforts through local tube-well care-takers and their spouses, who, in turn, provide hygiene education to village dwellers via group meetings.

The second explores ways to more widely disseminate messages to community members through different extension methods. This is done via school programmes, child-to-child activities, and by reaching men and key persons identified by the community, in addition to tube-well care-takers.

The SAFE approach is innovative in several respects. The hygiene education messages and activities are developed based on data collected in complementary quantitative and qualitative research activities, rather than depending on stock education messages and materials. The hygiene education interventions build on current beliefs and practices, and are, therefore, more appropriate and tailored to the local situation. We believe that this approach will greatly increase the project's ability to influence behaviour change at the community level.

Basing hygiene education activities on current beliefs and practices implies an incremental approach to improving hygiene behaviour. In any conceptual model of perfect hygiene behaviour, there are a large number of behaviours. Thus, SAFE will focus on a few high priority behaviours for intervention, to raise awareness of the transmission and prevention of diarrhoea. This will include those behaviours most closely linked to the transmission of diarrhoea, and which can be changed in the short term. This approach is action-oriented, with a focus on behaviours that can be improved through better information and problem-solving in the community. This will provide a basis for further improvement in behaviour over the long term.

But, perhaps what are most useful about the SAFE approach are the linkages it made possible between a short-term emergency relief project to one which addresses longer term development issues. Many organizations take an active part in responding to disasters in Bangladesh. Unfortunately, the geography and location of this country makes it prone to such tragedies.

Organizations involved in emergency-response efforts should also plan for solutions regarding longer term community development issues. For instance, if a disaster-response programme focuses on the immediate short-term need for water and sanitation hardware (provision of tube-wells and latrines) we should think about ways to complete the job after the disaster has passed, by addressing the software component of hygiene education. Organizations should take advantage of the successful aspects of disaster efforts. Given the nature of a rapid response in times of great calamities, there is often a special rapport and relationship built with the afflicted communities. The next step could be to capitalize on this, to prepare indi-

viduals for the next disaster by better understanding their beliefs and practices, and making them aware of the important relationships between water, sanitation, hygiene, and health.

10 SANITATION, WHERE ARE WE NOW? FINDINGS OF A SURVEY IN MATLAB. J. Chakraborty, Bilqis Amin Hoque and A. de Francisco. International Centre for Diarrhoeal Disease Research, Bangladesh

Indiscriminate practices of defaecation play a major role in the spread of diarrhoeal diseases. It has been widely shown that the promotion of sanitation can reduce the spread of diarrhoeal disease-causing agents. This paper attempts to describe the household latrine density, the system of draining excreta, and the conditions of the latrines available to households in a rural community of Bangladesh.

The survey, carried out in 14,915 households in the Matlab MCH-FP Intervention Area, showed that only 7% of the households had a latrine with a septic system sealed with water, 54% had a latrine of open drainage to any water source or to the open field, and 39% had no latrine at all. Regular use of a latrine was reported by respondents from 54% of the households (most of the latrines used drain directly to the environment), and 46% did not use a latrine at all. Availability of soap on the day of the visit was, in general, high in the area and independent of the type of latrine used.

The findings of the study suggest that, although the MCH-FP intervention programme has been ongoing for over a decade, the sanitary conditions remain poor because it was not promoted. It is suggested that environmental intervention action should be undertaken to complement the ongoing Primary Health Care efforts.

11 LONG-TERM FOLLOW-UP ON WATER SUPPLY AND SANITATION INTERVENTION STUDY. Bilqis Amin Hoque, T. Juncker, R. Bradley Sack, A. Hall and K.M.A. Aziz. International Centre for Diarrhoeal Disease Research, Bangladesh

An integrated water supply and sanitation (WSS) and hygiene education intervention project was launched by ICDDR,B during 1983-1987 in rural areas of Mirzapur *thana* (about 60 km north-east of Dhaka). The project provided in the intervention area handpumps (an average of 1 pump for each 33 people), double pit sanitary latrines (to service almost all house-

holds) and extensive hygiene education to about 800 households. Village women were trained to maintain the pumps. The control population (800 households) did not receive any of these project interventions, but had access to the usual government and private facilities. This study is a follow-up of both populations to compare the present conditions of water and sanitation facilities, their use, and the disease-transmission knowledge in both areas. The data collection, which was a one-time, cross-sectional survey, was completed in mid-1992. About 500 households from each area were randomly selected and studied. Preliminary analyses indicate that, in general, the promoted water and sanitation facilities and practices have been sustained in the intervention area. The people who did not use tube-wells collected water from mainly ponds, ditches, and other surface water bodies. About 80% of the pumps were found in good functional condition; 94% of these were functioning well in 1987. The functioning status of the latrines had deteriorated (64%) from that (93%) at the end of the project period. In the comparison area, however, only 7% used sanitary latrines. The WSS knowledge related to the disease transmission was found to be poor in both the areas. Thus, transfer of knowledge to the maintenance of technologies sustained better than disease-transmission knowledge. There is a need for studies on effective transfer of hygiene knowledge.

12 **PROMOTION OF SAFE WATER SUPPLY AND SANITATION PRACTICES THROUGH SCHOOLS IN RURAL BANGLADESH. Bilqis Amin Hoque, J. Myaux, M.J. Alam, J. Chakraborty and R. Bradley Sack.** International Centre for Diarrhoeal Disease Research, Bangladesh

The objective of this pilot test was to study the constraints of involving primary schools in delivering sanitation messages in rural Bangladesh, so that a comprehensive sanitation programme could be recommended.

The promotion of sanitation was undertaken in 4 rural primary schools (up to 5th grade). Two teachers from each of these schools were trained on specific sanitation and hygiene issues and their relevant messages. It was agreed that the teachers would promote those messages suitably during their normal courses. The content of the training session was earlier determined and tested based on experiences, focus group discussions, and pre-testing.

Two unannounced surveys were conducted to generally assess the acceptance of the messages among the students of these schools (a baseline and a final survey after 4 months, following the teachers' training session). There

was a significant reduction ($p<0.05$) in faecal coliform counts of hands when compared between the baseline and final surveys. Although the knowledge related to hand washing and use of sanitary latrines improved, the level of improvement of knowledge about disease transmission among students was unsatisfactory. The teachers mostly promoted the knowledge during morning assembly. They stated that a formal teaching process would be required for effective transfer of knowledge. The study indicated that sanitation practices could be promoted through primary schools, but an appropriate study should be conducted before undertaking any large-scale programme.

13 THE APPLICATION OF RAPID AND APPLIED QUALITATIVE AND QUANTITATIVE DATA COLLECTION TECHNIQUES IN IMPROVING HYGIENE EDUCATION PROGRAMMES.

Raquiba A. Jahan[1], Sushila Zeitlyn[2], O. Massee Bateman[2] and Sumana Brahman[1]. [1]CARE Bangladesh, and [2]International Centre for Diarrhoeal Disease Research, Bangladesh

Hygiene education programmes can be expected to be more effective if initial programme design and intervention messages are based on local beliefs and customs, and are appropriate to local resources. To achieve this, information must be collected from (or with) the local community. Although this is feasible within research projects or large implementation programmes with many resources, the collection of such information presents special challenges for the small implementation programmes. Such programmes commonly have severe constraints, both in terms of time and human resources, as well as in other resources. The Sanitation and Family Education (SAFE) Project, which is being implemented by CARE/Bangladesh in the coastal area of Chittagong, is a hygiene behaviour-change programme that designed and tailored hygiene interventions to suit local conditions. The SAFE Project has many limitations in resources common to such implementation programmes and here we describe how information was gathered within these constraints and how such information was invaluable to the development of the interventions.

The objectives of the qualitative techniques used were to: a) define the nature of the problems and to devise appropriate interventions and messages; b) answer questions like "Why" and "How" behaviours occur; and 3) promote community participation in the process of finding solutions to problems. Qualitative methods used included: Key Informant Interviews, Focus Group Discussions, Observation, PRA Mapping Techniques, and a small survey collecting both qualitative and quantitative information. Sever-

al examples of how these techniques were used to design the baseline questionnaire, refine potential interventions, and further investigate initial findings will be cited. In one example, an anomalous finding in the baseline questionnaire, where those households furthest from the tube-well experienced the least amount of diarrhoea in children aged less than 5 years, was investigated using these techniques and provided useful information for intervention development and refinement. Techniques used here included unstructured observations of households, observations of water collection and transportation methods, observations of tube-wells and tube-well use, and a small survey to explore the hypotheses generated by these observations. Through this process, the initial explanations of why those living furthest from the tube-well had the least diarrhoea were not supported, but new insight was gained on specific water collection and handling behaviours that appeared to increase the risk of diarrhoea and which had not previously been identified as prevalent problems requiring specific intervention. This enabled us to improve our interventions to address these key issues.

In summary, the SAFE experience with these techniques shows that they are feasible and that they provide useful information for programme design and intervention development. These investigations also had a pervasive effect on the programme staff by giving them closer contact with the community and a better appreciation of how community participation is key to the development of a successful programme.

14 DEVELOPMENT OF AN APPROPRIATE HAND-WASHING TECHNIQUE. Bilqis Amin Hoque, Md. Jahangir Alam and D. Mahalanabis. International Centre for Diarrhoeal Disease Research, Bangladesh

Proper hand washing is almost universally a personal hygiene message for the prevention of diarrhoea. But in a community where the majority of the people are illiterate and poor, the chance is that, willingly or unwillingly, they will not wash their hands adequately. The objective of this study was to develop an appropriate technique for washing hands after defaecation in a rural community in Bangladesh. An observational method was used to investigate the existing practices, and an experimental method was used to develop a technique building on those practices. Socioeconomic status rather than knowledge about germ theory was associated with the use of soap. Soap was, however, unaffordable by about 80% of the people. Hands were found unacceptably contaminated after usual hand washings. Under controlled conditions, relationships were found between the bacterial concentration on hands and the source of water, volume of water, and

the number of rubs. The washing agents (soap, ash, or soil) gave similar results when hands were washed under similar conditions. This finding has programmatic implications for hand-washing interventions.

15 PUBLIC WATER DISTRIBUTION SYSTEM: A POTENTIAL SOURCE OF ENTERIC INFECTION AND THE NEED FOR CONSTANT MONITORING. **S.A. Alabi[1] and O.U. Arua[2].** [1]Microbiology Division, Nigerian Institute of Medical Research, Yaba; and [2]Microbiology Department, University of Lagos, Lagos, Nigeria

Following an increase in the incidence of typhoid fever cases in the Lagos metropolis in early 1991, a bacteriological evaluation of the public water supply system in the city was undertaken to assess its possible role in the transmission of the disease. Treated water samples were collected aseptically both from the waterworks (after treatment as the water was about to enter the distribution line) and from taps located at five different parts of the city. The bacterial load in these samples was estimated by the most probable number (MPN) technique, and isolates were identified using standard microbiological procedures. Bacterial contamination was detected in 3 of the 6 sampled sites, and pathogens recovered included *Salmonella typhi*, *Escherichia coli*, *Staphylococcus aureus*, and *Citrobacter*. It was satisfying to note that water treatment procedures in the waterworks of water meant for home consumption met accepted international standards, since no bacteria were detected in the sample as it entered the distribution system. However, there was contamination at some locations along the distribution network. In particular, *S. typhi* were isolated at one site, strongly suggesting this route of transmission. These findings are of importance to the ICDDR,B's effort at controlling diarrhoea in Bangladesh, since consumption of contaminated water probably still represents a major source of acquiring these infections. Its public health implications and the need for constant monitoring of the public water supply system are highlighted.

16 LATRINE COVERAGE STATISTICS: WHAT THE NUMBERS MEAN FOR HEALTH. **O.M. Bateman[1], Sushila Zeitlyn[1], Raquiba A. Jahan[2] and Sumana Brahman[2].** [1]International Centre for Diarrhoea Disease Research, Bangladesh, and [2]CARE Bangladesh

The association between improved sanitation (i.e. disposal of human faeces) and reduced risk of diarrhoeal disease has been well established. In a recent review of the literature, a median reduction of 36% in diarrhoea morbidity associated with improved sanitation was found. As this subject is getting

increased attention, a closer examination of the relationship between sanitation and health is needed. Specific questions that need to be answered, both for research and implementation programmes, include: What is the best measure of "improved sanitation"? What are the relative health benefits of using hygienic latrines (which effectively isolate faeces from the environment) compared to unhygienic latrines (e.g. hanging latrines)? Are the health benefits of improved sanitation primarily related to improvement in individual/household sanitation or to improvements in collective/community sanitation (or both)?

Data used in this analysis are from the baseline survey of the Sanitation and Family Education (SAFE) Project implemented by CARE/Bangladesh in the coastal region of Chittagong, where 720 households were surveyed in 120 clusters. Information was collected by questionnaires, spot observations, and demonstrations by the mother. Characteristics of the population were tabulated using frequency distributions. Risk factors for diarrhoeal disease were examined using cross tabulations and, to control for confounders, logistic regression analysis. Diarrhoea prevalence within the past 2 weeks in at least one child under 5 years of age in the household was used as the dependent variable. Risk relationships were estimated using odds ratios (OR) and 95% confidence intervals (C.I.).

Eighty per cent of the households surveyed had access to a latrine; however, only 16% had access to a hygienic latrine. The remainder had access to a hanging latrine. Compared to households with access to hygienic latrines, the risk of diarrhoea in households with hanging latrines was similar (OR = .9) and slightly increased for no access to a latrine (OR: 1.6, C.I.: .9-2.7). Reported latrine use was much more strongly associated with reduced risk of diarrhoea; this was true individually for the mother, the man of the house, and children over 5 years of age, usually using any type of latrine. Furthermore, there was a "dose-response" relationship between the number of household members who were reported to usually defaecate in a latrine and the risk of diarrhoea - a greater number of the household members usually using a latrine was associated with reduced risk of diarrhoea in the household. There was an independent association of community latrine coverage with diarrhoea prevalence. Those clusters where 66% of the households or more had access to a hygienic latrine had reduced risk of diarrhoea compared to those clusters with fewer hygienic latrines. In contrast to the associations with individual household access to latrines and use, the reduction in risk of diarrhoea with improved community latrine coverage was seen only for hygienic latrines. However, even in clusters with low coverage with hygienic latrines (and high risk of diarrhoea), the

risk of diarrhoea in households was reduced when any available latrine was used by household members.

These results have several implications for programmes and research projects in water, sanitation, and hygiene behaviour change. First, latrine use is the key measure for examining health benefits; coverage statistics alone may present a distorted picture of sanitary conditions in the community- and related health benefits. Second, individual household access and use of latrines reduce the risk of diarrhoeal disease, but latrine type is not important for this effect. From an individual household point of view, any latrine is better than no latrine. Finally, high community levels of coverage with hygienic latrines are associated with decreased risk of diarrhoea, but in this case latrine type is important; unhygienic latrines have no apparent health benefit from a community coverage point of view. These findings suggest that, where sanitation is concerned, programmes to reduce diarrhoea morbidity should focus first on latrine use and second on building hygienic latrines or upgrading existing unhygienic latrines to hygienic latrines.

17 SANITATION IN THE URBAN SLUMS OF DHAKA: COMMUNITY PERSPECTIVES. N. Fronczak and S. Laston.

International Centre for Diarrhoeal Disease Research, Bangladesh

Information on current water and sanitation conditions, and community perspectives regarding these, was collected through key informant interviews from slum tenants and landlords in three *thana* of Dhaka. The interviews and visits were conducted in September 1992. These interviews provide insight into the attitudes of slum populations and land-owners regarding their participation and responsibility for improving the sanitation of their environment.

Slum areas with different land ownership and water and sanitation facilities were purposely selected. Sixteen sites were visited on government or private land (where the landlord lives in the same compound). Representatives from various organizations and from government offices involved in sanitation activities were also interviewed.

Interviews with tenants and landlords confirmed that many people are willing, and in fact, do pay for improved water facilities. Paying an increased amount for a water source which is more convenient and provides more water was stated to be reasonable.

There was no expressed demand for improved latrine facilities once the basic need (identified as privacy) had been met. Tenants on private land stated that latrines were a responsibility of the landlord, and were not a facility people expected to pay for. This was unlike water, electricity, and cooking gas which were identified as amenities for which payments in keeping with the amount of service were acceptable.

The major constraint to improvement of water and sanitation infrastructure was the lack of land tenure. This was particularly true for people living on government land or disputed land. Tenants as well as government representatives stated a reluctance to upgrade facilities without a guarantee that the slum area would not be demolished, and that the rent (on privately owned land) would not be raised for a number of years after the improvement. Tenants on private land stated that infrastructure development increased the value of the landlord's property, thus, development was the landlord's full responsibility.

Implementation of improvements in water and sanitary facilities was evident in some sites despite the problems mentioned above. Explanations from tenants or landlords indicated that in most cases there was a person or group with a strong leader who initiated the change. The most frequently mentioned reasons for improving latrine facilities were privacy, odour, and prestige. Reasons given for not improving obviously dangerous and foul smelling latrines were that this was not the responsibility of the tenants, as well as lack of funds.

Recommendations for activities which could be taken in the short term by persons or organizations interested in improving the sanitation in slum areas are to: 1) create demand for latrines through marketing techniques to promote convenience and aesthetics as well as health aspects; 2) work with communities to enhance basic problem-solving and organizational skills for addressing water and sanitation problems in communities where facilities are shared; and 3) work with landlords and government bodies for interim answers to the land tenure issue.

18 **ENVIRONMENTAL RISK FACTORS FOR SHIGELLA-ASSOCIATED DYSENTERY IN DHAKA. Bilqis Amin Hoque, D. Mahalanabis and Md. Jahangir Alam.** International Centre for Diarrhoeal Disease Research, Bangladesh

Shigellosis is a major health problem, and since the bacteria are developing resistance to available antimicrobials, the importance of understanding

environmental risk factors amenable to intervention is increasing. A case-control study was conducted to identify the risk factors for *Shigella*-positive dysentery in children (case) attending the diarrhoea treatment centre (DTC) of the ICDDR,B compared to *Shigella*-negative watery diarrhoea in children (control 1) attending the same DTC and randomly selected children (control 2) living in the same community as the cases. The cases were children aged 1-10 years, and controls were matched for sex and age. Data were collected for 542 cases and an equal number of each type of control.

Preliminary analysis indicates that the use of non-piped water, presence of an unprotected surface water source (within 15 meter, approximately), unsanitary disposal of children's faeces, and inadequate hand-washing practices were significantly associated with *Shigella*-associated dysentery. These findings have programme and policy implications for the control of diarrhoea.

19 EVALUATION OF DIARRHOEA EPIDEMIC: ACTIVITIES IN DHAKA SLUMS. S.L. Laston, A.H. Baqui and Bilqis Amin Hoque. International Centre for Diarrhoeal Disease Research, Bangladesh

Beginning in February 1993, there was a dramatic increase in the number of diarrhoea patients admitted to the ICDDR,B Hospital in Mohakhali and diarrhoea patients treated by the Urban Volunteers in the slums of Dhaka. In response to this epidemic, the Urban Health Extension Project (UHEP) intensified its activities and particularly emphasized use of oral rehydration solution (ORS) and water purification practices. Activities included refresher training for supervisors and volunteers, miking of diarrhoea prevention and treatment messages on main roads in the slums, and distribution of bleach solution for water purification in addition to ORS.

A survey was conducted in a sample of households (n=431) in the urban slums to assess the effectiveness of the intervention. Twenty-six per cent of the households surveyed were in the UHEP intervention area (an area with an active urban volunteer). Thirty-two per cent of the 431 households surveyed knew bleach could be used to purify water. Specific reasons they cited for using bleach included: `to prevent diarrhoea or other disease' (34%) `to make water pure' (29%), `bleach replaces organisms' (18%), and `to clean bathroom wastes' (7%).

Of the households interviewed, only 16% heard the miking in the slums, but 47.6% were aware that there was a diarrhoea epidemic at that time. Of the 16% of the households who heard the miked messages, significantly more respondents in the UHEP intervention areas knew that they should add bleach to their drinking water if they were not using tube-well water ($p<.01$).

Of the 26 households who had used the bleaching solution for water purification (6%), only 21% (7 respondents) said that they would continue to use it if it was not supplied to them. This presents a real problem for sustainability of this intervention, if an NGO doesn't provide water purification means or methods.

Reasons that households gave for not wanting to add bleach solution to their drinking water for purification included; 1) `it wasn't important' (39%), 2) `the water already contains bleach' (20%), 3) `bleach is not available' (12%), 4) `bleach is used in dirty places like toilets' (4%), and 5) `Allah will take care of us' (1%).

Tests for faecal coliform counts in water storage containers were conducted in a sub-sample of the slum households. Results demonstrated a significant difference ($p<.005$) in the coliform counts (0-9 faecal coliform/100 ml of water) between intervention households ($n=65$) where bleach solution was added to the water compared to control slum households ($n=16$).

In conclusion, this study demonstrates that with motivation, slum residents will use bleach solution to purify their water (26% in intervention area) and it is effective in significantly reducing the faecal coliform count in their stored water.

Specific recommendations for further activities during epidemic periods include; 1) use hand miking in crowded slum areas instead of megaphones on rickshaws on the main roads to reach more slum people, 2) use of bleach solution for water purification requires more intense motivation for use, and 3) pre-package bleaching solution and distribute through service providers; this should increase its use for water purification during emergency periods.

20 EFFECT OF SALINITY ON TOXIGENICITY OF ENTEROTOXIGENIC *ESCHERICHIA COLI* DURING SURVIVAL IN ARTIFICIAL AQUATIC ENVIRONMENT. M.S. Islam, S. Parveen, S.I. Khan, P.K.B. Neogi, R.B. Sack and M.J. Al-

bert. International Centre for Diarrhoeal Disease Research, Bangladesh

In Bangladesh, enterotoxigenic *Escherichia coli* (ETEC) is an important diarrhoeagenic bacteria. A study was carried out to investigate the effect of salinity on toxigenic properties of ETEC during survival in microcosms. Survival of ETEC was assessed by viable counts on MacConkey agar and enterotoxin production was detected by tissue culture assay using Y1 adrenal cells. Results showed that ETEC could survive longer in water containing 0.5 and 1.0% NaCl than in water without NaCl. The toxin assay showed that ETEC strains retained the capability of toxin production during survival in the microcosms. This study indicates that release of ETEC strains in the form of faecal pollution in the surface water system is hazardous from a public health point of view.

21 THE DEMOGRAPHIC, HEALTH, AND NUTRITIONAL IMPACT OF THE MEGHNA-DHONAGODA EMBANKMENT. M. Strong and S. Minkin. International Centre for Diarrhoeal Disease Research, Bangladesh

The disastrous floods of 1987 and 1988 stimulated the Government of Bangladesh to undertake a comprehensive review of its flood policy. After several international studies were completed, the government asked the World Bank to coordinate a five-year plan.

A major part of these plans involve the construction of embankments and the compartmentalization of protected areas in manageable units for controlled flooding and drainage to meet the needs of integrated land and water use. These embankments will have a significant impact on the lives of the people living inside them and in the neighbourhood. To date, however, there have been few systematic evaluations of the possible impacts of embankment projects in these areas.

The Meghna-Dhonagoda Irrigation Project (MDIP) is a medium-scale flood control, drainage, and irrigation project located in Matlab *thana*, about 50 km south-east of Dhaka. Since 1963, ICDDR,B has been conducting research in this *thana*. Data from various studies, especially the Demographic Surveillance System and the MCH-FP project, are available.

The purpose of this paper is to begin to evaluate the impact of this embankment project, in terms of morbidity, mortality, and nutrition, using these data.

Preliminary findings on the impact of this embankment show that, using the ICDDR,B 1982 census of Matlab as a baseline, there were few pre-embankment differences in the areas:

* Morbidity: using incidence of diarrhoea in the last two weeks as a health indicator, the embankment has had little impact.

* Nutrition: similarly, using arm circumference to measure nutritional status of children, little impact of the embankment has been shown.

* Mortality: infant and child mortality rates are similar inside and outside the embankment.

* Migration: using life-table methods, the embankment has not resulted in large-scale out-migration.

Thus, the overall conclusion of this study is that there has been no major negative impact, to date, on the health or nutritional status of people living in areas inside the embankment. This is the optimistic lesson. On the other hand, perhaps more should be expected from a multi-million dollar project. Especially if agricultural output is rising we would hope to see an improvement in the nutritional status of children living inside the embankment compared to those living outside.

22 **COMPARISON OF QUALITY OF WATER: IMPACT OF MEGHNA-DHONAGODA EMBANKMENT. Bilqis Amin Hoque, M.A. Wahed, A. Felsenstein, M.J. Alam and R. Bradley Sack.** International Centre for Diarrhoeal Disease Research, Bangladesh

In view of the yearly flooding of Bangladesh, many flood control and irrigation projects have been implemented or are envisaged. There have been, however, hardly any environmental impact studies. The Meghna-Dhonagoda flood control and drainage embankment was implemented from 1977 to 1991 to increase agricultural production, create employment opportunities and to improve living conditions of the people in the area.

ICDDR,B conducted a pilot study to determine its impact on water quality. Water samples were collected from 50 water sources, half of those were from inside and half outside the embankment. The samples were analyzed for Chemical Oxygen Demand (COD), iron, faecal coliform contamination, and conductivity. Morbidity information was also collected.

Preliminary analysis indicated that the pond water inside the embankment was significantly more polluted than outside the embankment in the dry season (inside the embankment, COD = 73 mg/l and conductivity = 279 μmhos/cm; outside embankment COD = 47 mg/l and conductivity = 160 μmhos/cm). The study also noted a higher prevalence of diarrhoea among the children inside the embankment. This preliminary study indicated that the surface water inside the embankment was more polluted than the water outside the embankment.

23 ENVIRONMENTAL ISSUES IN A FAMILY PLANNING PROGRAMME. Tanjina Mirza, John G. Haaga, A. Wazed and Jasimuddin. International Centre for Diarrhoeal Disease Research, Bangladesh

The Bangladesh Family Planning programme is regarded as an international success story. The wide availability of family planning services, especially injectable contraceptives (NET-EN, DMPA), sterilization, IUD, menstrual regulation (MR), etc., also causes serious concern regarding the disposal of used needles, syringes, ampoules, cotton swabs, etc. without creating hazards for the providers, clients, communities, and the environment. With the emergence of AIDS and the continuing problem of hepatitis B and more recently hepatitis C and D, this issue is more critical; however, very little attention has so far been given to this aspect of the family planning programme.

To understand the existing situation of the management of clinical waste in the Bangladesh family planning programme from field to *thana* level, exploratory research was conducted in three *thana*: Monohardi, Abhoynagar, and Sirajgonj. Informal interviews were conducted with key personnel involved in provision of clinical contraceptives, and observations were conducted to record the fate of used material. This paper presents the results and also discusses alternative ways to manage clinical waste.

Information collected showed that the existing situation was far from safe. Although there is a government circular regarding the disposal of used syringes and needles following the delivery of doorstep injectable contraceptives it has not been followed. There are no government instructions on management of wastes created at satellite clinics, sterilization camps, the Family Welfare Center (FWC), or the Thana Health Complex (THC).

In the proposed alternative models, the storage and transportation procedures for used material are the same for all models (doorstep, clinics, etc.).

However, the disposal procedures are different based upon available facilities and finances, taking into account that there is a scarcity of land for burial, and floods may remove topsoil from burial sites. In addition, there is a lack of a suitable cheap energy source for constructing incinerators.

One of the models proposes burial of wastes after burning in a hole at THC and FWC. The other two models propose construction of simple incinerators in THC and FWC. In all proposed models, the providers must receive training on the necessity and procedures of waste disposal. Furthermore, items, such as containers for storage and transportation of wastes, have to be provided. Finally, monitoring activities must be designed for the mid-level supervisors to ensure that safe procedures of disposal are implemented.

24 WATER AND SANITATION ACTIVITIES BY NON-GOVERNMENT ORGANIZATIONS: BANGLADESH PERSPECTIVES. **Nigar S. Shahid and Bilqis A. Hoque.** International Centre for Diarrhoeal Disease Research, Bangladesh

Non-government organizations (NGO) have been playing a substantial role in the developmental programmes of Bangladesh. We present here the experience of a group of NGOs currently involved in Water Supply and Sanitation (WSS) Programmes, who participated in a workshop entitled "Mobilization of NGOs in water supply and sanitation" held during 12-13 April 1992 at BRAC Auditorium, Rajendrapur, Bangladesh. Eight of the 20 NGO participants presented case studies. Participants were divided into three small groups to discuss and list programmes and identify possible solutions. Lack of: education and awareness at community and policy-making levels, coordination between NGOs, adequate funding, appropriate technology, training, monitoring and evaluations and involvement of women at all levels were cited as common problems by all the groups. The solutions suggested were mainly strengthening/improving inter-agency collaboration and coordinating, promoting WSS, motivating people and social leaders, making appropriate technology available and encouraging the participation of women. These identified problems and solutions have programme and policy implications for effective WSS activities.