

**THIRD
ANNUAL
SCIENTIFIC
CONFERENCE
(ASCON-III)**

**of the
INTERNATIONAL CENTRE FOR
DIARRHOEAL DISEASE RESEARCH,
BANGLADESH**

**" ENVIRONMENTAL HEALTH
AND POLICY PERSPECTIVES "**

15 - 16 JANUARY 1994

**PROGRAMME
&
ABSTRACTS**



**INTERNATIONAL CENTRE FOR DIARRHOEAL
DISEASE RESEARCH, BANGLADESH
Mohakhali, Dhaka 1212**



The **INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH (ICDDR,B)** is an autonomous, non-profit organisation for research, education, training and clinical service. It was established in December 1978 as the successor to the Cholera Research Laboratory, which began in 1960 in response to the cholera pandemic in southeast Asia.

The mandate of the ICDDR,B is to undertake and promote research on diarrhoeal diseases and the related subjects of acute respiratory infections, nutrition and fertility, with the aim of preventing and controlling diarrhoeal diseases and improving health care. The ICDDR,B has also been given the mandate to disseminate knowledge in these fields of research, to provide training to people of all nationalities, and to collaborate with other institutions in its fields of research.

The Centre, as it is known, has its headquarters in Dhaka, the capital of Bangladesh, and operates a field station in and around Matlab *thana* of Chandpur District which has a large rural area under regular surveillance. A smaller rural and a large surveyed urban population also provide targets for research activities. The Centre is organised into four scientific divisions: Population Science and Extension, Clinical Sciences, Community Health, and Laboratory Sciences. At the head of each Division is an Associate Director; the Associate Directors are responsible to the Director who in turn answers to an international Board of Trustees consisting of eminent scientists and physicians and representatives of the Government of Bangladesh.

THIRD ANNUAL SCIENTIFIC CONFERENCE

**of the
International Centre for
Diarrhoeal Disease Research,
Bangladesh**

15 – 16 January 1994

***"ENVIRONMENTAL
HEALTH AND POLICY
PERSPECTIVES"***

Programme and Abstracts



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- 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)
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INTRODUCTION

The 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. It has, through the years, conducted 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 these researches have made a significant impact on world health.

As the research activities of the Centre have expanded and progressed, they have been followed by special efforts towards dissemination of the important research findings. Through the Diarrhoeal Diseases Information Services Centre (DISC), our publications, particularly the *Journal of Diarrhoeal Diseases Research*, *Glimpse*, *Shasthya Sanglap*, and other scientific reports, keep the national and international community informed of all important discoveries and activities of the ICDDR,B. True to its commitment to share these research results, and to provide a forum for the exchange of ideas, the ICDDR,B presents the Third Annual Scientific Conference. The scientific annual conferences, organized by the ICDDR,B, are aimed at disseminating the knowledge and information gained from the findings of the researches undertaken by the Centre's staff.

Conference Objectives

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, the Third Annual Scientific Conference, will focus on environmental health issues, especially water, sanitation and hygiene practices in the control and prevention of diarrhoeal diseases. The forum is expected to provide 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, the ICDDR,B scientists, administrators, researchers, policy- and decision-makers, the donor community, and other development organizations will develop a set of recommendations defining the ICDDR,B's role in the areas of environmental research. This interaction will help bridge the gaps between research and policy which will have national and global programmatic implications.

Programme Highlights

This year's Annual Lecture, a keynote address by a distinguished scientist, will be delivered by Professor RG Feachem, Dean, London School of Hygiene and Tropical Medicine, UK. Dr Feachem is one of the pioneering and front-line scientists in the area of environment and health research.

There will be three symposia addressing three areas: i) Diarrhoea Prevention: Obstacles and Opportunities, ii) Population, Urbanization, and Environmental Health, and iii)

Cholera Epidemics and Disaster Management. Each symposium will include an overview followed by comments and discussions. Speakers have been invited from the ICDDR,B and from the government and non-government organizations of Bangladesh. These symposia will be followed by four free paper and poster sessions participated by the ICDDR,B scientists. The closing session will develop a set of recommendations defining mainly the ICDDR,B's role.

In free paper sessions, the findings of recent research at the ICDDR,B have been 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.

The Chairpersons of all the symposia and scientific sessions will also present their views relating to the themes of their respective sessions. Floor discussion will be invited after every scientific presentation.

In the closing session, the recommendations of the conference will be finalized through interactions with the participants based on a set of draft recommendations.

PROGRAMME

Third Annual Scientific Conference of ICDDR,B

15 – 16 January 1994

Sasakawa International Training Centre
 International Centre for Diarrhoeal Disease Research, Bangladesh
 Mohakhali, Dhaka 1212

DAY 1: January 15, 1994

<u>Time</u>	<u>Event</u>	<u>Venue*</u>
8:00 a.m.	Registration of Delegates	Lobby, Ground Floor
9:00	Opening Ceremony	Auditorium
	– Address of welcome by the Director, ICDDR,B	
	– Address by the representatives of donor and international agencies	
	– Address by representative of international agencies	
	– Address by the Chief Guest	
	– Vote of thanks by the Organising Secretary	
10:30	Tea	2nd floor area
11:00	Annual Lecture – 1994	Auditorium
	World Health: The Role of the Environment Professor RG Feachem, Dean, London School of Hygiene and Tropical Medicine, UK	
12:00	Lunch	2nd floor area
1:00 – 2:15	Symposium I:	Auditorium
	Diarrhoea Prevention: Obstacles and Opportunities	
	Chairperson: ANA Abeyesundere; WHO Representative	

*All venues are in the Sasakawa International Training Centre

Lecture I: 15 minutes

Topic: Diarrhoea Prevention: Water and Sanitation [Abs. # 1]

Speaker: Bilqis Amin Hoque, Scientist, ICDDR,B

Lecture II: 15 minutes

Topic: Combating Diarrhoea Through Rural Water Supply & Sanitation: What Can We Do? [Abs. # 2]

Speaker: Philip Wan
Chief, Water & Environmental
Sanitation Division, UNICEF, Dhaka

Lecture III: 15 minutes

Topic: The Role of Primary Health Care in the Prevention of Childhood Diarrhoeal Disease [Abs. # 3]

Speaker: Peter Miller
Associate, The Population Council, Dhaka

Discussion: 15 minutes

Chairperson's Presentation: 15 minutes

2:15 – 5:00 **Concurrent Free Papers: *Session I***

Diarrhoea Prevention: Issues in Water
Supply and Sanitation

Chairperson: Brigadier ASM Matiur Rahman
Commandant, Armed Forces Institute of Pathology, Dhaka

Co – Chairperson: Eugene Weiss
OR Advisor, UHEP, ICDDR,B

2:15 p.m.	Sanitation, Where Are We Now? Findings of a Survey in Matlab [Abs. # 11]	J Chakraborty BA Hoque A de Francisco
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2:30 p.m.	Long – term Follow – up on Water Supply and Sanitation Intervention Study [Abs. # 12]	BA Hoque T Juncker, RB Sack A Hall, <u>KMA Aziz</u>
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2:45 p.m.	Promotion of Safe Water Supply and Sanitation Practices Through Schools in Rural Bangladesh [Abs. # 13]	BA Hoque <u>Jacques A Myaux</u> MJ Alam J Chakraborty RB Sack
3:00 p.m.	The Application of Rapid and Applied Qualitative and Quantitative Data Collection Techniques in Improving Hygiene Education Programmes [Abs. # 14]	<u>Raquiba A Jahan</u> S Zeitlyn OM Bateman S Brahman
3:15 p.m.	Tea	2nd floor area
3:45 p.m.	Development of an Appropriate Hand – washing Technique [Abs. # 15]	BA Hoque MJ Alam <u>D Mahalanabis</u>
4:00 p.m.	Public Water Distribution System: A Potential Source of Enteric Infection and the Need for Constant Monitoring [Abs. # 16]	<u>SA Alabi</u> OU Arua
4:15 p.m.	Latrine Coverage Statistics: What the Numbers Mean for Health [Abs. # 17]	<u>OM Bateman</u> S Zeitlyn Raquiba A Jahan S Brahman
4:30 p.m.	Fertility and Women’s Health in Bangladesh [Abs. # 18]	<u>M Rahman</u>
4:45 p.m.	Chairperson’s presentation	
	Related Posters:	
	Environmental Health and Training [Abs. # 41]	<u>FA Ara</u>
	Water and Sanitation Activities by NGO Bangladesh Perspective [Abs. # 42]	<u>Nigar S Shahid</u> BA Hoque
2:15 – 5:00	Concurrent Free Papers: <i>Session II</i>	Seminar room
	Environmental Health in the Context of Primary Health Care	
	Chairperson: Prof Sadiqa Tahera Khanam Professor of MCH, NIPSOM, Dhaka	
	Co – Chairperson: Mizanur Rahman Associate Scientist, ICDDR,B	

- 2:15 p.m. Impact of Health Intervention on Socioeconomic Differentials of Child Malnutrition in Matlab [Abs. # 19] Nikhil Ch Roy
M Rahman
- 2:30 p.m. Infant Feeding Practices in the Slums of Dhaka City and Determinants of Exclusive and Predominant Breast feeding in the First 6 Months of Life [Abs. # 20] Shams - El - Arifeen
AH Baqui
Sarah Salway
Quamrun Nahar
- 2:45 p.m. Demographic Change in Field Sites of the MCH - FP Extension Project, 1982 - 1992 [Abs. # 21] ABMKA Mojumder
JG Haaga, A Hossain
DMM Rahman
- 3:00 p.m. Dynamics of Discrimination Against Female Children in Rural Bangladesh [Abs. # 22] Nurul Alam
Md Shuaib
R Bairagi
- 3:15 p.m. **Tea** 2nd floor area
- 3:45 p.m. Epidemiology of Acute Respiratory Infections in Rural Bangladeshi Children [Abs. # 23] K Zaman
AH Baqui
Md Yunus
SR Chowdhury
RB Sack
- 4:00 p.m. Serotyping of *S. Pneumococcal* Strains in Bangladesh [Abs. # 24] Nigar S Shahid
SS Hoque
MJ Albert
MC Steinhoff
RB Sack
- 4:15 p.m. How Diarrhoea Contributes to Poor Sero - response to Oral Polio Vaccination [Abs. # 25] Jacques A Myaux
L Unicomb
A Uzma, MA Islam
M Santosham
- 4:30 p.m. The IUD Sterilization: A New Way to Carry Sterile Multiple Sets of IUDs to Satellite Clinics [Abs. # 26] Fazilatun Nessa
L Andrews
R Maru, AJ Faisal
- 4:45 p.m. **Chairperson's presentation**
- Related Poster:**
- Testing Doorstep Delivery of Injectable Contraceptive in the National Family Planning programme [Abs. # 43] Tanzina Mirza
A Ashraf
H Kabir
- Longitudinal Demographic Surveillance in Matlab [Abs. # 44] K Alam Khan

DAY 2: January 16, 1994

8:30 – 9:45 **Symposium II:**

Auditorium

Population, Urbanization and Environmental Health

Chairperson: Prof M Shahjahan, Vice – Chancellor
Bangladesh University of Engineering &
Technology, Dhaka

Lecture I: 15 minutes

Topic: Population and Urbanization Issues of Bangladesh
Health: The Case of Bangladesh [Abs. # 4]

Speaker: Abdullah Hel Baqui, Scientist, ICDDR,B

Lecture II: 15 minutes

Topic: Water Supply and Sanitation in Urban Slum
and Fringes [Abs. # 5]

Speaker: Shamsul Hoque, Director
Bangladesh Sanitation Project, Department of
Public Health Engineering, Dhaka, Bangladesh

Lecture III: 15 minutes

Topic: Urbanization and Health Status [Abs. # 6]

Speaker: Ashraf Uddin Ahmed
Chief Health Officer, Dhaka City Corporation

Discussion: 15 Minutes

Chairperson's Presentation: 15 minutes

9:45 **Tea**

2nd floor area

10:15 – 12:15 **Concurrent Free Papers: *Session III***

Seminar Room

**Diarrhoea Prevention: Issues in Water
Supply and Sanitation**

Chairperson: Mehtabunisa Currey
Health & Population Adviser (AMOD)
British High Commission

Co – chairperson: MA Wahed
Head, Biochemistry & Nutrition
ICDDR,B

- | | | |
|------------|---|---|
| 10:15 a.m. | Sanitation in the Urban Slums of Dhaka:
Community Perspectives [Abs. # 27] | <u>Nancy Fronczak</u>
<u>Sandra Laston</u> |
| 10:30 a.m. | Environmental Risk Factors for Shigella – associated
Dysentery in Dhaka City [Abs. # 28] | <u>BA Hoque</u>
<u>D Mahalanabis</u>
<u>MJ Alam</u> |
| 10:45 a.m. | Evaluation of Diarrhoea Epidemic
Activities in Dhaka Slums
[Abs. # 29] | <u>Sandra Laston</u>
<u>AH Baqui</u>
<u>BA Hoque</u> |
| 11:00 a.m. | Effect of Salinity on Toxigenicity of
Enterotoxigenic <i>E. coli</i> During Survival
in Artificial Aquatic Environment
[Abs. # 30] | <u>MS Islam</u>
<u>S Parveen</u>
<u>SI Khan</u>
<u>PKB Neogi</u>
<u>RB Sack</u> |
| 11:15 a.m. | Seasonality of Vital Events and Nutritional
Status [Abs. # 31] | <u>A Francisco</u>
<u>J Chakraborty</u> |
| 11:30 a.m. | The Demographic, Health and Nutritional Impact of
the Meghna – Dhonagoda Embankment [Abs. # 32] | <u>M Strong</u>
<u>S Minkin</u> |
| 11:45 a.m. | Comparison of Quality of Water Samples
Collected from Inside and Outside
Meghna – Dhonagoda Embankment
[Abs. # 33] | <u>BA Hoque</u>
<u>MA Wahed</u>
<u>A Felsenstein</u>
<u>MJ Alam, RB Sack</u> |

12:00 noon **Chairperson's presentation**12:15 p.m. **Lunch:**

2nd floor area

10:15 – 12:15	Concurrent Free Papers: <i>Session IV</i>	Auditorium
	Environmental Health in the Context of Primary Health Care	
	Chairperson: Mufaweza Khan Executive Director Concerned Women for Family Planning	
	Co – chairperson: Anne Maria Vanneste Visiting Scientist, ICDDR,B	
10:15 a.m.	Environmental Issues in Family Planning Programme [Abs. # 34]	<u>Tanzina Mirza</u> <u>JG Haaga, A Wazed</u> <u>Jasimuddin</u>
10:30 a.m.	Factors Associated with the Use of Satellite Clinics and Family Welfare Centres in Rural Bangladesh [Abs. # 35]	<u>Mizanur Rahman</u> <u>Yousuf Hasan</u>
10:45 a.m.	Prevalence and Continuation of Injectable Contraceptives: Evidence from Extension Project Areas [Abs. # 36]	<u>Mafizur Rahman</u> <u>Afzal Hossain</u> <u>Subhas Ch. Das</u>
11:00 a.m.	Birth Attendants in Rural Bangladesh: When Are Trained Attendants Used? [Abs. # 37]	<u>Afzal Hossain</u>
11:15 a.m.	Determinants of Contraceptive Method Choice in Rural Bangladesh [Abs. # 38]	<u>M Mehrab Ali Khan</u> <u>Mizanur Rahman</u>
11:30 a.m.	The Impact of Field Worker’s Visits on Contraceptive Discontinuation in Two Rural Areas of Bangladesh [Abs. # 39]	<u>Mian Bazle Hossain</u> <u>John G Haaga</u> <u>James F Phillips</u>
11:45 a.m.	Use of Trained Traditional Birth Attendants in Bangladesh [Abs. # 40]	<u>Tanzina Mirza</u> <u>Parveen A Khanum</u> <u>T Juncker</u>
12:00 noon	Chairperson’s presentation	
12:15 p.m.	Lunch:	2nd floor area
1:15 – 2:45	Symposium III:	Auditorium
	Cholera Epidemics & Disaster Management	
	Chairperson: Prof Robert E Black, Chairman Department of International Health The Johns Hopkins University	

Lecture I: 15 minutes

Topic: Disaster Epidemic and Environmental Health
in Bangladesh [Abs. # 7]

Speaker: R Bradley Sack, Associate Director,
Community Health & Laboratory Sciences Divisions
ICDDR,B

Lecture II: 15 minutes

Topic: Reservoirs: Seasonality and Endemicity of Cholera
in Bangladesh: Role of Environments [Abs. # 8]

Speaker: Md Sirajul Islam, Associate Scientist, ICDDR,B

Lecture III: 15 minutes

Topic: Health Sector Disaster Preparedness and Response
Programme in Bangladesh [Abs. # 9]

Speaker: M Aftabuddin Khan
Chief, Disaster Preparedness & Response Cell
Director General of Health Services

Lecture IV: 15 minutes

Topic: Linking Relief Programmes to Development: Examples
from the Sanitation and Family Education (SAFE)
Project of CARE Bangladesh [Abs. # 10]

Speaker: Sumana Brahman, Health Sector Coordinator
CARE, Bangladesh

Discussion: 15 minutes

Chairperson's presentation: 15 minutes

2:45 p.m. **Tea**

2nd floor area

3:15 – 5:00 **Concluding Session**

- Opening Remarks by the Chairperson
- Presentation of Recommendations
- Discussion and Finalization of Recommendation
- Concluding Remarks by the Director

THIRD ANNUAL SCIENTIFIC CONFERENCE

15 – 16 January 1994

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) to control and prevent 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, survived infective organisms simultaneously or individually contaminate water, food, hand and other objects, and are ultimately ingested. The faecally contaminated environmental and disease causal variables mainly react to produce diarrhoea. To prevent diarrhoea, 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 human. The social factors and resource availability influence the process significantly. We will review the opportunities and obstacles experienced by scientists at the ICDDR,B in water and sanitation (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 installations of latrines were more effective to reduce diarrhoea mortality than provision of handpumps. In Mirzapur project, diarrhoea morbidity in children in intervention area was reduced by 25% compared to the children in comparison. In both the 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 diarrhoea episodes in children. Hand-washing with soap reported to reduce *Shigella*-associated dysentery by 35%.

These studies provided information related to the prevention of diarrhoea under optimum service condition and such service is feasible at wider scale is questionable and at wider scale with community participation only. 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 is 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 barriers 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 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 polity 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% 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 bath, clean their mouth, 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 mobilisation 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 DOABLE. 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 NGO network, 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 DOABLE things that can make a difference to Bangladesh.

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 seekers 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.

POPULATION AND URBANIZATION ISSUES OF BANGLADESH

Abdullah Hcl 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 family planning programme in 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 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 an 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 the 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 actions. 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.

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WATER SUPPLY AND SANITATION IN URBAN SLUMS AND FRINGES

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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 piped water supply and 20% to sanitary latrine, but in the fringe areas, the facilities provided are much less. The condition in slums and fringes will worsen very much due to 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 out 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 different 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 International Water Supply and Sanitation Decade.

URBANIZATION AND HEALTH STATUS

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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 condition, and low standards of personal hygiene are the major causes of diarrhoeal deaths.

The health picture in slums is a bleak one. While 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 water 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.

DISASTER EPIDEMICS AND ENVIRONMENTAL HEALTH IN BANGLADESH

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Natural disasters mostly include floods, cyclones, tornadoes, hurricanes, earthquakes, landslides, and volcanic eruptions. The man-nature interactions also often bring about disaster situations like epidemics, drought, 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 those 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* 0139.

After 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 put in for repair of existing tube-wells and installation of new tube-wells, but the load on tube-wells was unacceptably high. All people, including the majority who use surface water for domestic purposes and tube-well water for drinking only, wanted to use these tube-wells and had resulted into acute shortage of water. The quality of transported water was questionable. The effectiveness of distributing water purifying tablets (WPT) was doubtful as majority of those tablets had lost potency and inefficient management was observed. Disposal of faecal and other water was unacceptable at households, temporary clinics, and shelters. There was no special arrangements to help women, the most vulnerable group. The relief personnel lacked basic environmental health knowledge. Field treatment of diarrhoea cases lacked with disappointing use of oral rehydration therapy and inappropriate use of I.V. fluid or other drugs.

Our experience with man-nature interaction disaster of *V. cholerae* 0139 epidemic was noticed 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 congregation held in Tongi. During this congregation, thousands of people were exposed to unacceptable environmental health conditions and probably that provided favourable transmission modes for spread of the new strain *V. cholerae* 0139 among adults. This cholera can be prevented following similar WSS strategies as for other diarrhoeal diseases.

Like most developing countries, Bangladesh has limited resources, and often development funds are directed around for emergency mitigation activities and it would create long-term implications. On the other side, following disasters international communities usually extend help which alongwith country's support, if planned adequately, could have immediate and long-term implications. We recommend emergency preparedness plan with 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 WPT, promotion of other appropriate water treatment and sanitation techniques, legal framework for managing sanitation in public places (at least), community (including women) preparedness and development programmes.

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RESERVOIRS, SEASONALITY AND ENDEMICITY OF CHOLERA IN BANGLADESH: ROLE OF ENVIRONMENT

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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 the previous pandemics started from the Ganges delta of Bengal, but the seventh pandemic started from the island of Sulawesi (Celebes) in Indonesia. During this period of the seventh pandemic, there was cholera in Bengal [erstwhile East Pakistan (now Bangladesh) and West Bengal], 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 responsible for providing a suitable habitat for cholera in Bengal? Sometimes climatic factors have been considered to be responsible for maintaining endemicity. The climatic features may indirectly affect the causative agent or the human hosts and their interrelationships. It may be that under certain environmental conditions vibrios may be able to persist in the environment or be able to colonize a plant or animal that lives in certain environmental conditions in the aquatic systems in Bangladesh. Different kinds of aquatic fauna, such as oysters, zooplankton, crabs, prawns, have been considered as the potential habitat of *V. cholerae* in the aquatic environment from time to time, but as yet nothing has come out as unequivocal epidemiological importance as the reservoir of pathogenic *V. cholerae* O1.

In late 1970s, scientists started searching vibrios in association of freshwater macrophytes in cholera endemic areas on Bangladesh. The association of vibrios was found with four macrophytes, e.g. *Eichhornia crassipes* (water hyacinth), *Monochoria hastata*, *Marsilea quadrifolia*, and *Ludwigia repens*. Vibrios were isolated from the roots

of these plants. Laboratory-based studies also showed that *V. cholerae* 01 could survive longer in association with a common duckweed, *Lemna minor* than water on which the duckweed was floating. Similar observation was also made when experiments were carried out with four marine algae, e.g. *Ulva lactuca*, *Enteromorpha intestinalis*, *Ceramium rubrum*, and *Polysiphonia lanosa*. However, among the four plants, *V. cholerae* 01 survived longest in association with *U. lactuca*. A laboratory-based study also showed that toxigenic *V. cholerae* 01 gain survival advantages in association with a filamentous green alga, *Rhizoclonium fontanum*, in artificial aquatic environment. *V. cholerae* survived longer with *R. fontanum* than in water on which *R. fontanum* was floating or in control water (without *R. fontanum*). The differences in length of survival of *V. cholerae* between *R. fontanum* and in water on which *R. fontanum* was floating as well as in control water was statistically significant ($p < 0.05$).

Blue-green algal bacterial association is very common in 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 by bacterial respiration. The carbon dioxide which is produced by bacteria during respiration being used by algae. It was found that toxigenic *V. cholerae* 01 can persist in 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* 01. 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 answer to a long-waiting question 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.

HEALTH SECTOR DISASTER PREPAREDNESS AND RESPONSE PROGRAMME IN BANGLADESH

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Bangladesh is one of the disaster-prone countries of this region. During 1960-1991, the country experienced about 145 disasters of varying intensity. Although floods, cyclones with tidal bore, and tornado are the major natural disasters in Bangladesh, drought and salinity, in recent time, have also started to pose a threat to some of the

south and western parts of the country. The effects of these natural disasters on lives and physical and social infrastructures of the country are very significant. Loss of life, family disintegration, population displacement and deterioration of environment condition lead to hardships and sufferings of the affected populations which are further compounded by total or partial destruction of health facilities and other infrastructures. Major epidemics of diarrhoea/communicable diseases have been reported after the five severe natural disasters recorded during 1987–1991.

In view of frequent natural disasters in the country and subsequent health implications, Bangladesh is currently in the process of formulating a detailed plan of action on disaster preparedness and response for the health sector, which will be within the National Plan for Disaster Management in the country. The plan of action for the health sector, which is being formulated, will involve multi-sectoral agencies in disaster management programme and has identified primary health care as the key approach towards disaster preparedness and response. Some of the salient features of the health sector plan are:

- * Shifting of focus of disaster management practices towards preparedness for organizing timely disaster response.
- * Involvement of vulnerable community in disaster preparedness and response.
- * Training of the grassroots level health workers as well as the community volunteers involved in health sector disaster management.
- * Establishment of a peripheral multi-sectoral coordination committee at different levels of administration to review the disaster management practices in every quarter throughout the year.
- * Necessary orientation and training for officials of different levels involved in disaster management, policy-makers, planners, managers and field-level officials.
- * Establishment of disaster-resistant communication facilities at the disaster-prone areas.
- * Establishment of appropriate logistic management practices at all levels of operation.
- * Development of technique for rapid health need assessment to be practised in the health sector during emergency.

To support the activities aimed in the plan, required structural and institutional development is going on. Specific pilot projects have also been undertaken. One of such disaster preparedness programmes is in progress in Banshkhali, the second most affected thana of the country in the cyclone of 1991. The objective is to prevent the health hazards of disasters and their impact on health-care services through:

- a) intensified primary health care system with active participation from staff and local community;

- b) development of local human resources through community development and income-generating activities;
- c) construction of multi-purpose cyclone shelters;
- d) improvement in supply of safe water and hygiene practices; and
- e) repair/reconstruction of coastal embankments and drainage canals.

Usual Disaster Preparedness and Response activities aim to:

- * disseminate cyclone warning signals;
- * search and rescue marooned and stranded people in the event of disasters;
- * provide large-scale first-aid to the injured persons;
- * organize emergency medical relief operations;
- * establish sanitary facilities and safe water supply;
- * establish gruel kitchen;
- * organize medical teams with drugs and logistics for the affected areas;
- * train vulnerable community to stimulate public awareness and people's participation;
- * feed vulnerable groups and to initiate nutritional interventions; and
- * re-construct damaged or destroyed houses of the affected community.

NGOs have played important roles and their activities range from deployment of medical teams with drugs and logistics to the affected areas, training of vulnerable community to stimulate public awareness and people's participation, feeding the vulnerable groups and nutritional interventions to re-construction of damaged or destroyed houses of the affected community. The donor and international agencies have provided financial and technical assistance. The WHO, UNDP, and other UN agencies have been supporting the formulation and implementation of national policies and plans for disaster preparedness and response.

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

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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. WASH began in August 1991 and ended 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 on 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 different 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 is 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 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 individuals 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.

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SANITATION, WHERE ARE WE NOW? FINDINGS OF A SURVEY IN MATLAB

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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 on 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 condition remains poor as it was not promoted. It is suggested that environmental intervention action is to be undertaken to complement the ongoing Primary Health Care efforts.

LONG - TERM FOLLOW - UP ON WATER SUPPLY AND SANITATION INTERVENTION STUDY

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An integrated water supply and sanitation (WSS) and hygiene education intervention project was launched by the 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 households) 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.

PROMOTION OF SAFE WATER SUPPLY AND SANITATION PRACTICES THROUGH SCHOOLS IN RURAL BANGLADESH

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The objectives of this pilot test were 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.

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

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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. While 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 programme. 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. Several 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.

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DEVELOPMENT OF AN APPROPRIATE HAND – WASHING TECHNIQUE

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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.

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PUBLIC WATER DISTRIBUTION SYSTEM: A POTENTIAL SOURCES OF ENTERIC INFECTION AND THE NEED FOR CONSTANT MONITORING

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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 public water supply system are highlighted.

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LATRINE COVERAGE STATISTICS: WHAT THE NUMBERS MEAN FOR HEALTH

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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 a hygienic latrine, the risk of diarrhoea in households with a hanging latrine 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.

FERTILITY AND WOMEN'S HEALTH IN BANGLADESH

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Among numerous beneficial effects of fertility regulation on human life, improvement in women's health is an important one. Family planning programmes are thought to have positive impact on women's health, however, such programmes may also have negative health effects because of diseases and side-effects associated with the use of contraceptive methods. Additionally, in developing countries, family planning programmes may have adverse effects on health because of programmes' relatively poor quality of services.

In this paper, we analyze demographic data over a 10-year period in two areas of Matlab in Bangladesh. Due to a specially designed family planning programme, the treatment area of Matlab experienced a remarkable reduction in fertility from a TFR of about 7 in the early 1970s to a TFR of below 4 in the late 1980s. The comparison area, which is covered by the government programmes, has a TFR of over 5. The treatment area receives limited maternal and child health services, namely immunization of children and mothers. Health services related to delivery of pregnancies that may reduce maternity-related deaths are nearly similar in both the treatment and comparison areas.

We consider two aspects of women's health: a) mortality measured by the probability of dying between 15 and 45 years of age and b) fetal loss measured by the incidence of abortions, miscarriages, and still-births. We argue that there would be an improvement in female mortality and fetal loss in the treatment area due to fertility reduction.

Mortality reduction in the treatment area, where fertility is lower than that of the comparison area, would be due to two main reasons. First, lower life-time exposure of women to pregnancy and, thus, lower maternity-related deaths. Second, due to lower incidences of repeated pregnancies in the treatment area than those of the comparison area; exposure to maternal depletion would be lower in the former than that of the latter area. Fetal loss would be lower in the treatment than that of the comparison area due to similar reasons.

Using life-table methodology, we estimated the probability of dying during 15 to 45 years of age to compare between areas and sexes. We also estimated expected number of life-time fetal losses between areas.

Life-table results showed that the probability of dying of females aged 15-45 was 18 percent lower in the treatment than that of the comparison area. Our estimated indicate that about 46% of the difference in mortality would be explained by the lower number of maternity-related deaths in the treatment area. The other 54% of lives

survived would probably be explained by lower level of maternal depletion in the treatment area.

The probability of dying of females was consistently lower in the treatment area than that of the comparison area. There were no consistent differences of male mortality between areas. The comparison of male mortality by area serves as a control in a sense that these two areas could have similar female mortality if there would not be differences in fertility.

In Bangladesh, adult females experience higher mortality than their male counterparts because of: a) females' exposure to maternal mortality, and b) lower allocation of health care and food to females than to males due to cultural reasons. In the treatment area, we observe that the gap between male and female mortality (ages 15–30) reduced over the last few years. Additionally, in the treatment area, females aged 30–45, on the average, experienced lower mortality than males; this is consistent with females' biological superiority of health over males.

Results of our study showed that fetal loss was substantially lower in the treatment area than in the comparison area.

We also compare the levels of fertility and adult mortality in the two areas of Matlab with those of Teknaf, another rural area of Bangladesh. TFR in Teknaf was nearly 8 during the study period. We found that, while the levels of male mortality (ages 15–45) was quite comparable between areas, female mortality was substantially higher in Teknaf than that in the Matlab comparison area.

We observed that the level of female mortality during reproductive age was positively associated with the level of fertility. Reduction in fertility seems to improve women's survival not only by protecting them from maternity-related deaths, but also from the adverse consequences of maternal depletion associated with repeated pregnancies. Fertility reduction also reduces the burden of fetal loss. Family planning activities in Bangladesh have been making a remarkable positive impact on women's health through a reduction in fertility.

IMPACT OF HEALTH INTERVENTION ON SOCIOECONOMIC DIFFERENTIALS OF CHILD MALNUTRITION IN MATLAB

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It is widely accepted that malnutrition is an important contributor to child mortality in some parts of the world and may be responsible for the death of millions of children

in developing countries. It is the "unfit" individuals who die. Their weakness may not be a genetic quality, but they have been weakened due to unfortunate economic, social or cultural circumstances. A few studies have explored the nutritional status of the children benefited by the services of nutritional intervention of MCH-FP programmes.

It has been already documented that the Matlab MCH-FP programme has played an important role in reducing fertility and mortality in recent years. However, whether similar improvements in nutrition have been achieved has not been investigated. An effective MCH intervention may enhance the defence capacity of the individual; e.g. food supplementation, referral to the sub-center or main hospital, nutritional education to the community, improved nutritional practice, etc. All these interventions have been introduced in the Matlab treatment area since the inception of the programme. The purpose of this study is to see: a) whether the nutritional status changed over time with the introduction of the above interventions and b) whether or not the improvement in nutritional status was accompanied by a reduction in socioeconomic differentials of malnutrition.

We found that nutritional status improved significantly during the study period. In 1987, the average malnutrition rate was about 17% for children aged 6-17 months, which fell to about 7% in 1991.

Severe malnutrition (defined as mid-upper-arm-circumference of <120 mm) was analyzed in a logistic regression model. Differentials of malnutrition varied over this study period. We found that:

- * mother's education, mother's age, religion and dwelling space were significantly associated with the nutritional status of children in 1987; and these effects have changed in 1991.
- * children of higher birth order had a higher risk of malnutrition in both periods, though the differentials was smaller in 1991.

Findings of our study suggest that improved health service delivery may reduce the negative health impact of a poor environment. A carefully designed health and family planning programme can reduce the burden of malnutrition in Bangladesh and similar settings.

INFANT FEEDING PRACTICES IN THE SLUMS OF DHAKA CITY AND DETERMINANTS OF EXCLUSIVE AND PREDOMINANT BREAST FEEDING IN THE FIRST 6 MONTHS OF LIFE

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The objective of the paper is to describe the feeding practices of infants in the slums of Dhaka and to investigate socio-demographic factors that are associated with exclusive and predominant breast feeding, and frequency of breast feeding in this population.

Data from the 1990 baseline survey of the Urban Surveillance System (USS) of the International Centre for Diarrhoeal Disease Research, Bangladesh have been used for this analysis. The USS is a health and demographic surveillance in a probability sample of the slum communities of five *thana* of Dhaka city. Data were collected on current feeding for the youngest child from mothers who had one or more children aged less than 5 years. Descriptive statistics, bivariate and multivariate techniques were used to analyze the data.

A total of 2,030 mother-child pairs were surveyed, of whom 578 were infants aged less than 1 year. About 30% of the children did not receive breast milk within 3 days of birth; that means they did not receive the colostrum. The prevalence of breast feeding was very high, but the prevalence of exclusive and predominant breast feeding was extremely low. Only about 30% of the infants aged less than 2 months were exclusively breast fed. In the third month, the prevalence was less than 10%. The prevalence of predominant breast feeding also fell from 75% in the first month to about 30% in the third month of life. Compared to male infants, female infants were more likely to be exclusively breast fed and less likely to be bottle fed. Prevalence of predominant breast feeding was significantly less if the mothers were using any form of contraception at the time of the survey compared to non-contraceptors.

Supplementation commonly occurred at an early age. More than 20% of the infants aged less than 2 months were receiving animal or powdered milk. The mean number of daily breast feeding among infants aged less than 6 months, who were receiving milk supplements, was significantly lower than those who were not.

The low prevalence of exclusive and predominant breast feeding in this population is alarming. Health planners can and should make efforts to retain the advantages of traditionally prolonged breast feeding in Bangladesh and promote exclusive breast feeding up to 4-6 months of age. The factors identified in this study to be associated with exclusive and predominant breast feeding can be important in the design of appropriate interventions.

**DEMOGRAPHIC CHANGES IN FIELD SITES OF THE
MCH-FP EXTENSION PROJECT, 1982-1992**

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The present rate of population growth is considered to be a detrimental factor to overall environment for socioeconomic development of Bangladesh. The MCH-FP Extension Project, with the collaboration of the Government of Bangladesh, has emphasized on the ways of improvement of the family planning services to curb the population growth rate. These joint efforts are in operation since 1982 in its field sites, Sirajgonj and Abhoynagar. The aim of this paper is to summarize these efforts and interventions and their impact upon the demographic indices and the family planning programmes indicators over the period of 1983-1992 and to provide information for further analytical works. The data sets for these descriptive study come from the Sample Registration System of the MCH-FP Extension Project.

In this paper, we report the changes in the fertility and the mortality levels and trends in the Extension areas. We also report the contraceptive rates and their differentials. Mortality of children aged less than 5 years is reported with a brief discussion on the distribution of causes of death. An overall declining trend of fertility level is evident and all areas tend to converge at a range of the level of total fertility rate (TFR) of 6 to 4.5 to a level of 4.5 to 3.0. Contraceptive prevalence rate started at as low as 11 user per 100 women of reproductive age in Sirajgonj in 1982 and has reached to a level of 50 in Abhoynagar in 1992. CPR of 40 in Sirajgonj appears to represent the national figures in 1991. The most contribution for this rise in CPR comes from the increased use of pills and injectables. It also appears that proportion of sterilization in the CPR has declined over the period. Experimental sites of Sirajgonj and Abhoynagar have been able to replace the traditional method effectively compared to the nation as a whole. Sex composition of living children appears to be an important factor in the consideration of contraception differentials. Contraception of women having at least one boy and one girl sustains at a higher level over the period compared with women having only boys or only girls. Sex preference issues in regulating fertility appears to diminish over the time in both project sites.

Although infant mortality rate did not fall much, but there has been a significant change in the distribution among the neonatal and post-neonatal deaths. Fifty per cent of infant deaths come from the post-neonatal deaths. But this proportion comes down to 36% for Sirajgonj and 27% for Abhoynagar during 1989-1991. It tells us that maternity care still deserves a special attention. Immunization programme might have contributed to survive during the post-neonatal period. Prematurity and probable low birth weight appears to be the major cause of neonatal deaths. Neonatal tetanus and other neonatal infections stand next to prematurity and probable low birth weight.

ARI causes the largest proportion of deaths during post-neonatal period, followed by diarrhoea. Over the 10-year period, child mortality has come down significantly to a level of 15 from the level of 40 per 1000 children person years in Sirajgonj. During childhood, diarrhoea becomes the number one cause of death followed by ARI. All these changes imply that a well-tailored family planning programme can bring the population growth rate down and eliminate the threat of over-population responsible in many ways for environmental hazards.

DYNAMICS OF DISCRIMINATION AGAINST FEMALE CHILDREN IN RURAL BANGLADESH

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Discrimination against female children in rural Bangladesh is very strong. This study investigates whether socioeconomic, cultural and familial environments and MCH-FP services have any impact on this discrimination.

Data for the study came from Matlab and Teknaf, two rural areas with some differences in life style and MCH-FP facilities. Mortality figures of 1982-1983 birth cohorts of 8,151 children from the Matlab Comparison area, 6,798 children from the Matlab MCH-FP area, and 6,646 children from Teknaf were observed for the first five years of life. Female to male mortality ratios of children of 1-4 years of age was considered as a measure of discrimination.

This mortality ratio was 1.9 in the Matlab Comparison area, 1.6 in the Matlab MCH-FP area, and 1.4 in Teknaf. The ratio was higher for higher order births, and for those girls who had older sisters than for those girls who had older brothers only. Mortality of an only boy in a family was lower than that of a boy who had older brothers. The mother's education and family wealth were helpful in reducing mortality, but not the discrimination.

It is estimated that 1-4 year mortality in Bangladesh would be reduced by more than 30% if the discrimination against female children could be eliminated. The difference in discrimination between Matlab and Teknaf areas suggests the existence of a cultural difference pertaining to discrimination in the two areas. Strengthening of MCH-FP services and the improvement of the status of women are two of the possible solutions to reduce discrimination against female children in this country.

EPIDEMIOLOGY OF ACUTE RESPIRATORY INFECTIONS IN RURAL BANGLADESHI CHILDREN

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Using data from a community-based longitudinal study conducted at Matlab, the age-specific incidence/prevalence and seasonality of acute respiratory infections (ARI) in children aged less than 5 years were determined. A total of 696 children were followed for a year, yielding 183,865 child-days observation. Trained Community Health Workers (CHWs) visited the study children every fourth day. Data on symptoms suggesting ARI (fever, cough, nasal discharge) were collected for the preceding three days by recall. To determine the type of ARI, the CHWs conducted physical examinations of children reporting fever and cough. The overall incidence of ARI in the study children was 5.5 episodes per child-year observed. The prevalence was 35.4 per hundred days observed. Most of the episodes (96%) were upper respiratory tract infections (incidence 5.3 per child per year). Only 4% of the episodes were lower respiratory tract infections (incidence 0.23 per child per year). The incidence rate was highest in 18-23 months old children followed by infants 6-11 months and 0-5 months old. About 16% of the children did not experience any ARI episode, whereas about 14% suffered 10 or more episodes. Forty-seven per cent of the episodes lasted 15 days or more. About 30% children suffered from ARI for more than 50% of the total days observed. The incidence rates of ARI were higher during July-November (monsoon and pre-winter period) with the highest peak in September.

The study reconfirms ARI as a major cause of morbidity among rural Bangladeshi children.

SEROTYPING OF S. PNEUMONIAE STRAINS IN BANGLADESH

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Pneumococcal diseases are among the most common severe bacterial diseases of infants and children in this region. It is estimated that 20-40% of the 4 million infant and child deaths due to acute lower respiratory tract infection (ALRI) or pneumonia are

due to *S. pneumoniae* (Spn). ALRI mortality is highest in the post-neonatal period and *Spn* is also known to be an important causative agent in this age group. There is considerable variation in the serotype distribution between geographic regions.

As antibiotic resistance to this organism is increasing, it is important to know the current sensitivity patterns of the circulating serotypes which are highly dependent on antibiotic use in the community. Since the immunity to pneumococcal disease is serotype specific, the composition of the new conjugate vaccine for *Spn* should match the distribution of pathogenic serotypes where they are to be used.

The aim of the project is to identify the current pattern of the *Spn* strains in Bangladesh. The study population includes *Spn* isolations from nasopharyngeal aspirates of children 0-5 months of age enrolled in a longitudinal study and from blood isolates of children with pneumonia admitted to the clinical research centre, ICDDR,B. So far 80 *Spn* strains have been serotyped and there has been a predominance of strains belonging to virulent serotypes of groups A and B.

The data generated from this project has important policy implications for future preventive strategies which will complement environmental efforts in the control of ALRI.

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HOW DIARRHOEA CONTRIBUTES TO POOR SERORESPONSE TO ORAL POLIO VACCINATION

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Poliomyelitis continues to be an important cause of morbidity in less developed countries and particularly the Indian subcontinent. Since prevalence of diarrhoea is also high, oral polio vaccine is frequently given to infants during a diarrhoeal episode. Therefore, we evaluated the effect of acute diarrhoea on seroresponse among infants of vaccination age from Bangladesh. Two cohorts of infants aged 6 to 16 weeks were enrolled; 129 infants who presented with acute diarrhoea (DC), and 262 infants with no diarrhoea (NDC). Both cohorts were given three doses of oral polio vaccine at monthly intervals. Serum samples were obtained prior to first and second doses of vaccine and four weeks after the third dose. Rectal swabs were collected before vaccination for rotavirus detection, and one week following the first dose for poliovirus cultivation. After the first vaccine, we observed a significant lower seroconversion rate in the DC on poliovirus type 2 and type 3; respectively 40.8% versus 55.5% and 27.3% versus 41.5% ($p < 0.02$). Similarly, the GMT showed significant differences on serotype

2 and 3, respectively 234.8 (154–359) versus 446.4 (569–350) and 63.9 (45–90) versus 112.4 (88–143). After full immunization, the trends remain unchanged, but less pronounced. Among DC infants with rotavirus, the seroresponse was even lower than that of NDC infants after the first dose. Diarrhoea had no impact on poliovirus multiplication in the intestinal tract.

These results indicate that the administration of oral polio vaccine to infants during a diarrhoea episode leads to a lower seroresponse to the vaccine. Therefore, an additional booster dose should be given to these infants. Alternative immunization programmes should be tested on a national scale. The importance of sanitation interventions is emphasized to reduce transmission of both poliovirus and causative agents of diarrhoea.

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THE IUD STERILIZER: A NEW WAY TO CARRY STERILE MULTIPLE SETS OF IUD TO SATELLITE CLINICS

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The Family Welfare Visitors (FWVs) usually do not use the large autoclave available in the Family Welfare Centres (FWC) for sterilizing the IUD equipment. They may boil the equipment at the FWC than carry to the satellite clinics in an unsterile cloth, plastic bag or in a pan with a loose cover. If they sterilize in the satellite clinics they soak the instruments in savlon solution. For proper sterilization of the IUD instruments and IUD insertion under aseptic condition, the MCH–FP Extension Project of the ICDDR,B conducted an experimental study with a small size of the sterilizer.

The sterilizers used in the programme are now being used in the EPI programme. Three compartments, each for 1 set of IUD equipment, were designed to be put in the sterilizer. The uterine sound and the tenaculum had to be shortened.

Twenty-two sterilizers were field-tested in rural and urban areas. Data were collected from: 1) Focus group discussion with FWVs, Senior FWVs and Medical Officers; 2) Questionnaire filled in by FWVs; and 3) Observation checklist filled in by Senior FWVs and MOs. The purpose of the study was to find out: 1) whether the 3 compartments within the small sterilizer could be used easily; 2) how much time was required to organize the sterilizer with the multiple sets of IUD; 3) how convenient it was to carry this sterilizer with the multiple sets of IUD to the satellite clinic.

The results of the study showed that the sterilizer was easy and convenient to use. The FWVs could carry 3 complete sets of sterile IUD equipment to the satellite clinics

where she can insert IUD under aseptic conditions. It will save a lot of time for the FWVs in the satellite clinics for they will not have to wait for one set of instruments to boil and dry before IUD insertion. It maintains the sterility of the equipment during transport. It will stop the common practice of contaminating the sterile instruments by wrapping them with unsterile towels or unsterile instrument boxes to carry them to the satellite clinics. It will stop the common practice of soaking the instruments in savlon solution.

Closing and opening the lid of the sterilizer was a problem. Most of the FWVs said that carrying the sterilizer was a problem due to its heavy weight. The FWVs and their supervisors reported that use of the shorter uterine sound was not a problem. But a few of them mentioned that it was hard to hold properly.

The study concludes that the use of the IUD sterilizer will be successful in improving the quality of services. But its use depends also on the availability of transport and money for kerosene, as well as some modifications of instruments and compartment.

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SANITATION IN THE URBAN SLUMS OF DHAKA: COMMUNITY PERSPECTIVES

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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 were evident in some sites despite the problems mentioned above. Explanations from tenants or landlords indicate 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 aesthetic 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.

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ENVIRONMENTAL RISK FACTORS FOR SHIGELLA - ASSOCIATED DYSENTERY IN DHAKA

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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 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.

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EVALUATION OF DIARRHOEA EPIDEMIC: ACTIVITIES IN DHAKA SLUMS

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Beginning 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.

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EFFECT OF SALINITY ON TOXIGENICITY OF ENTEROTOXIGENIC *ESCHERICHIA COLI* DURING SURVIVAL IN ARTIFICIAL AQUATIC ENVIRONMENT

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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 public health point of view.

SEASONALITY OF VITAL EVENTS AND NUTRITIONAL STATUS

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Seasonal changes are environmental factors which have an important effect on the incidence of infectious disease and mortality. Environmental changes, such as deforestation, may affect seasonal duration and this may, in turn, affect the incidence of certain infectious diseases.

We looked into seasonal patterns of births, deaths, nutritional status, and morbidity. All of them present strong seasonality. Even though the season in itself may not be a determinant of morbidity or mortality, there are clear associations between season and these events.

The seasonal pattern of severity of acute lower respiratory infections (ALRI) was investigated in children and infants in the MCH-FP intervention area for the years 1987 to 92. Community Health Workers were distributing antibiotics to children aged less than five years with tachypnoea following the WHO recommendations. ALRI point prevalence and severity show monthly variations, and these seemed to follow the seasonal pattern reported for malnutrition of the same population. That effect was more marked in infants than in children with pneumonia.

We conclude that seasonal changes may affect patterns of morbidity, mortality and severity of ALRI in this community.

THE DEMOGRAPHIC, HEALTH, AND NUTRITIONAL IMPACT OF THE MEGHNA - DHONAGODA EMBANKMENT

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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, the 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 are:

- * 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 of it.

COMPARISON OF QUALITY OF WATER: IMPACT OF MEGHNA - DHONAGODA EMBANKMENT

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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 were 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 μ hos/cm; outside embankment COD=47 mg/l and conductivity=160 μ hos/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.

ENVIRONMENTAL ISSUES IN A FAMILY PLANNING PROGRAMME

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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 being 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 is 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 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.

FACTORS ASSOCIATED WITH THE USE OF SATELLITE CLINICS AND FAMILY WELFARE CENTRES IN RURAL BANGLADESH

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The Ministry of Health and Family Welfare (MOHFW) provides family planning (FP) and health services in the villages through Family Welfare Assistants (FWA), Family Welfare Centres (FWC), and Satellite Clinics (SC). FWAs through their bi-monthly house-to-house visits educate village women on FP-MCH, distribute contraceptive methods, and motivate villagers to attend at the SCs and FWCs for FP-MCH services. The static service centres (FWC and SC) could be more cost-effective and efficient if these are widely used by the villagers. While services offered at these clinics are directed to mothers, causes of their limited use lie in the cultural and social practices that indirectly prohibit village women to avail them.

This paper attempts to identify groups of women who are more likely to use these services than other women. We also identified a mechanism of "selectivity" in that there is a group of innovators who tend to accept a new concept, or an idea, or a service as soon as it is offered. For example, an innovator is more likely to welcome a FWA at her home, accept contraception, listen about available opportunities, and then make a rational decision.

The study uses data of the Sample Registration System (SRS) of the MCH-FP Extension Project of the ICDDR,B in Abhoynagar and Sirajgonj. SRS maintains longitudinal data on the contraceptive use of sample women and FWA visitations. Surveys were conducted on the use of FWCs and SCs in 1989 and 1990 respectively. Use of clinics is measured by the attendance at the clinics. We use logistic regression to examine the association between the visits of FWAs, use of contraception, and the use of these clinics. We also consider the effects of demographic, socioeconomic, and areal variables.

Use of health and family planning services is markedly higher in Abhoynagar than that in Sirajgonj. Factors associated with the use of the clinics generally are similar for both areas, and the association is in the same direction for both FWCs and SCs. However, contraceptive users seem to behave differently in two areas.

Home visits of FWAs is strongly and positively associated ($p < 0.001$) with the attendance of village women in both FWCs and SCs. The likelihood of attendance at clinics increases with maternal age, but declines after 35 years of age. Similarly, attendance at clinics increases with the number of children, but decreases after four living children.

Attendance at clinics is negatively associated with education of both woman and her

husband. This association is stronger in the case of husband's education. Attendance at clinics, as expected, is higher for those women who live in the clinic villages than non-clinic villages.

Contraceptive users and pregnant women have higher attendance at FWCs than non-users of contraception in both areas. Similar relationship is observed for the attendance at SCs in Sirajgonj. But, in Abhoynagar, contraceptive users have lower attendance than non-users.

Lower use of static clinics by women of educated than non-educated households probably reflects the former's perception about the quality of services available at the clinics. Similarly, perception about the services also seems to vary according to the development of health and family formation.

Our analysis also indicates that the positive association between FWAs' visits at households and the use of clinics is explained partly by an effect and partly by a selectivity process.

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PREVALENCE AND CONTINUATION OF INJECTABLE CONTRACEPTIVES: EVIDENCE FROM EXTENSION PROJECT AREAS

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Injectable contraceptives have been used in the national family planning programme as clinical contraceptives since 1976. Injectables are delivered only by the female paramedics (FWV) at FWCs and Satellite Clinics. However, an experimental programme, in which injectables are delivered at the homes of the clients by the female outreach workers (FWAs), has been in operation in the Extension Project *thana* since 1984. This programme, called the Door step Injectable Programme, has demonstrated that injectables can effectively be delivered at the homes of the clients by the FWAs. Having been inspired with the success of this experimental programme, the Ministry of Health and Family Welfare (MOHFW) has recently expanded it in another 8 *thana*. This situation has made it imperative to assess the effectiveness of injectables as a method of family planning in terms of level of prevalence and continuation. This paper is an attempt towards this end and intends to achieve three major objectives: a) to ascertain the level of prevalences; b) to estimate the continuation rate; and c) to investigate the reasons for drop-outs (discontinuation) of injectable contraceptives.

The data for this paper were drawn from two major sources. Data on continuation were collected through the longitudinal surveillance system of the Extension Project, called Sample Registration System (SRS). Data relating to causes of drop-outs were

collected from the service records of the FWAs, called FWA Register.

The longitudinal data show that there has been a significant increase in the Contraceptive Prevalence Rate (CPR), as well as use of injectables after introduction of home delivery. In 1983, the CPRs in Abhoynagar and Sirajgonj were 21% and 11% respectively, with an injectables prevalence rate of 0.1%. In March 1993, the CPR rose to 48.7% and 39% for Abhoynagar and Sirajgonj respectively, with the prevalence of injectables being 12.9% and 11.8%. Injectables accounted for 26.5% and 30.3% of all users in Abhoynagar and Sirajgonj respectively. Nationally, the injectable prevalence rate was 2.6% in 1991, which accounted for 6.5% of the CPR (Mitra, *et al.*, 1991).

The continuation rates for injectables during 1984–1992 were estimated at 73.5% at 6 months, 58.9% at 12 months, 48.2% at 18 months; 39.4% at 24 months and 26.6% at 36 months. The continuation rates for oral pills and condoms for the same period were lower than that for injectables.

The major reasons for drop-outs of injectable contraceptives during 1984–1991 were side-effects, a switch to other methods, and client absent from home. Each of the first two reasons accounted for one-fifth of the drop-out cases, while the last reason accounted for one-sixth. However, failure of method as a reason for drop-outs was reported to be very low (0.29%). The data also show a considerable variation of reasons for drop-outs between Abhoynagar and Sirajgonj. The major reason in Abhoynagar was side-effects, whereas the highest proportion of drop-out cases were attributed to a switch to other methods in Sirajgonj.

The effectiveness of the family planning programme is by and large measured by its ability to prevent births. The continuation rate of a contraceptive method is positively related to birth prevention. Although the continuation rate for injectables is higher than oral pills and condoms, it is not yet satisfactory. It appears that more than half of the injectable users discontinued after 18 months which reduces the effectiveness of the method considerably. This emphasizes the need for programme strategies and/or operations research to improve the continuation rate. The findings relating to the causes of drop-out, also suggest that strategic measures be undertaken to ensure proper management of side-effects, which, in turn, will increase the continuation rate of injectable contraceptives.

BIRTH ATTENDANTS IN RURAL BANGLADESH: WHEN ARE THE SERVICES OF TRAINED BIRTH ATTENDANTS USED?

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In rural Bangladesh, most of the pregnancies are delivered at home, attended by traditional birth attendants (TBA), by relatives experienced in attending births, by inexperienced relatives, and by the women themselves. Though there are trained TBAs and medical professionals available for helping pregnancy terminations in the rural areas, they are rarely used. The purpose of the paper is to examine the correlates of the use of services of the trained TBAs and medical personnel in the delivery of pregnancies.

We used data from a longitudinal sample registration system of the MCH-FP Extension Project of the ICDDR,B operated at Abhoynagar and Sirajgonj. The system's birth registration records information on the type of birth attendant. We used multinomial logit regression to identify factors associated with a villager's selection of a particular type of birth attendant available around him. As independent variables in the analysis, we included demographic and socioeconomic factors and a variable that describe the type of pregnancy outcome.

We observed the likelihood that a medical professional attended in the case of a miscarriage or a still-birth was higher than in the case of a live-birth. This indicates that the villagers call for a trained birth attendant in the case of difficult pregnancies. With regard to the use of services of the trained TBAs, we observed that their use was higher in the case of still-births than in the case of live-births. We also observed that, other things being the same, educated mothers were more likely to use the services of the trained TBAs and medical professionals than those of the non-educated mothers. The services of the trained TBAs and medical professionals were also more used in the area where level of health was high and family size was small.

These findings have an important policy implication; as the TBAs are trained, and they are more likely to adopt sanitary practices during delivery, they are regarded by the villagers as medically capable of delivering pregnancies, and, thus, there are potentialities of promoting them in the communities. Agencies working in the areas of MCH-FP in rural communities should undertake measure to promote the use of services of the trained TBAs.

In assessing the impact of trained TBAs on the reduction of neonatal mortality, we faced a particular problem. Since the services of trained TBAs were more used in the case of high risk and difficult pregnancies, we failed to find a significant beneficial impact of using the services of the trained TBAs upon neonatal mortality.

DETERMINANTS OF CONTRACEPTIVE METHOD CHOICE IN RURAL BANGLADESH

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Rapid population growth has a serious and detrimental impact on resources as well as environmental degradation in Bangladesh. The National Health and Family Welfare Directorate and other agencies are trying to reduce population growth by supplying modern and effective methods of contraception. A study of contraceptive method choice, in particular, of factors affecting method choice is important in Bangladesh with its current moderate level of contraceptive use. This paper examines demographic, behavioural, and socio-cultural factors affecting contraceptive method choice. Factors considered in this analysis are: maternal age; number and gender composition of living children in the family; approval of a woman and of her husband of family planning; education of the woman and her husband; and religious affiliation of the family. It uses data from a KAP survey conducted in 1990 among over 10,000 married women of reproductive age in Abhoynagar and Sirajgonj. The logistic regression procedure was employed to identify factors associated with contraceptive use and a multinomial logit regression to identify factors associated with method choice respectively.

Logistic regression analysis showed that contraceptive use was associated with maternal age, the number of living children, and the number of living sons. Contraceptive use increases with age and then decreases after age 35. Contraceptive use increases both with the number of living children and living sons. An addition of a son in the family leads to an increase of contraception by 23%. However, parents who do not have a son also use contraception, e.g. about 20% of couples who do not have a son adopted a method of contraception. Approval of both the woman and her husband are strong determinants of contraceptive use; e.g. contraceptive use is 4 and 5 times higher respectively if a woman and her husband approve of family planning than if they do not approve. Women's education positively and strongly affects contraceptive use, whereas husband's education negatively and weakly affects contraceptive use. Contraceptive use is higher among non-Muslims than Muslims.

Multinomial logit regressions indicate that the effects of these factors considerably vary for different methods of contraceptives. The methods compared in the analysis are pills, injectables, IUDs, sterilizations (mostly tubectomies), and other methods (condoms and other traditional methods). As expected, sterilizations are used by relatively older women with a large number of living children; in contrast, pills and injectables are used by relatively young women.

It is reflected for all methods that husband's approval is an important factor, but the effect of the husband's approval is particularly noticeable for permanent methods. The effect of the wife's approval is weaker for permanent methods than for other methods

indicating that if the husband decides to adopt a method, the wife's approval matters very little.

Both wife's and husband's education positively affects the use of pills and other methods and negatively affects the choice of permanent methods. Use of injectables is not associated with the education of wife and husband. Use of IUDs increases with the wife's education, but does not vary with the husband's education.

Higher use of contraception among non-Muslims than Muslims is explained by their greater use of only permanent, IUDs and other methods. A substantial areal variation of the level of contraceptive use is observed among sample couples. Factors affecting method choice have some variation over areas, but do not seem to follow a particular pattern. Minor fluctuations may be related to small sample size. This indicates that our estimates are quite robust, and the identified factors associated with method choice may be applicable to many areas of rural Bangladesh.

The findings of the present study can help family planning workers to identify potential users and to counsel appropriate and favoured methods for their clients. Improving service-delivery in this way can help rural population limiting their size and having better environmental health.

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THE IMPACT OF FIELD WORKER VISITS ON CONTRACEPTIVE DISCONTINUATION IN TWO RURAL AREAS OF BANGLADESH

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A series of surveys in Bangladesh have shown that contraceptive use prevalence increased dramatically in the past two decades. As adoption and use of contraception has increased, the continuity of use represents an increasingly important determinant of programme effectiveness. This paper examines the role of outreach workers in sustaining contraceptive practice among rural Bangladesh adopters.

The present analysis will test the null hypothesis that worker (FWA) client exchanges have no effect on contraceptive continuation. We hypothesize that the likelihood of discontinuation of a method will be lower in the case where the FWA provides better services to deal with side-effects than in the case where such services are poor or are not provided.

Discontinuation of contraception is used as a dependent variable in the analysis. In all, 4,349 respondents are available for the analysis. Conventional logistic regression

procedures assume that successive observations of a given individual are independent. In the present analysis, however, the contraceptive status at a given observation interval varies with the status of that individual at other points of time. Models are, therefore, time conditional hazard models.

This analysis has examined the findings, observed in numerous studies, that discontinuation dramatically reduces the impact of contraceptive adoption. Our focus has been on the role of outreach and the question of whether female outreach workers meting the tendency of women to discontinue. Overall odds of discontinuation are reduced by 53% if a women is contacted at home, and 87% among contacted women who received services. This estimated role of outreach is independent of client characteristics and, thus, represents a direct contribution of the programme to contraceptive use. This finding is consistent with the view that demand for family planning is fragile in rural Bangladesh and that the support the outreach provides represents a continuing contribution of FWA over time.

Results of the study showed that household exchanges had an impact on the continuity of use among all types of users, including adopters of long-acting methods, such as the IUD. This suggests that outreach not only introduces women to family planning, it also provides critically needed support for continued contraceptive use over time.

USE OF TRAINED TRADITIONAL BIRTH ATTENDANTS IN BANGLADESH

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Deliveries in Bangladesh are mostly attended by relatives and Traditional Birth Attendants (TBA) at home. Therefore, this paper attempts to measure knowledge, performance and quality of care provided by the trained TBAs in two rural areas, viz. Sirajgonj and Rajghat of Jessore.

A descriptive study with emphasis on qualitative research methods was designed. Focus group discussions and in-depth interviews were conducted with the trained TBAs, national family planning field workers (FWA), young women, older women and men of the study area. Data on coverage was obtained from the longitudinal data collection system (SRS) of International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) and from government Management Information System.

Results of the study indicated that coverage of trained TBAs was very low in the study areas in 1991. Of the total 680 deliveries, only 6% were attended by trained TBAs. Similar results were also obtained from the 6 focus group discussions with the community members. The reasons for inviting the birth attendants were similar for

both trained and untrained TBAs, because they live near, are known to them, and have always attended their deliveries in past.

Almost all the TBAs were called at the time of onset of labour pain. Majority (71%) of them assessed the stage of labour by asking about the characteristics of labour pain and 30% assessed by watching vaginal discharge. Only a few of them mentioned abdominal examination, less than half the TBAs talked about washing hands. Almost all used boiled thread and blade to cut the umbilical cord.

Very few TBAs mentioned about birth-related complications, such as eclampsia, prolonged or obstructed labour, and hand prolapse. Majority referred the clients to female paramedics who could not do much and so referred again to Health Complex, thereby delaying emergency care.

The trained TBAs receive sari, food, or may get invitation to the ceremony of the newborn however, they get less remuneration after obtaining training, because they are perceived to be government employees.

None of the community respondents knew that the TBAs have received training. This may be one of the main reasons for low use. The female paramedics also have no contact with the trained TBAs once the training ends.

The study recommends ways of overcoming poor coverage and quality of care offered by trained TBAs, such as communication strategies for informing the community about the use of trained person, ways of increasing linkage with paramedics, so that TBAs can get back-up support, supervision and re-enforcement on technical quality. Recommendations are also made for improvement of referral centres and for introducing the trained TBAs to the health complex staff which would raise the credibility of TBAs.

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ENVIRONMENTAL HEALTH AND TRAINING

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Training plays a key role in disseminating knowledge. Appropriate knowledge is essential to improve the health situation. To improve environment and to reduce morbidity due to communicable and other infectious diseases, training can make a significant contribution.

The Centre's Training Coordination Bureau (TCB) organizes both long-term and short-term training courses for the clinical management, laboratory diagnosis, health education, etc. for the prevention and control of diarrhoeal diseases. Epidemiological

Methods in Public Health and Research Methodology are 2 other important training courses. Role of environment is emphasized routinely in each of these courses. Simple interventions to improve the deteriorating environmental health are feasible for developing countries with limited resources. The ICDDR,B, with its multi-disciplinary scientific staff members, is in an advantageous position to deliver appropriate knowledge regarding environmental health to the members of the community.

The Bureau has the capability to develop and organize a variety of dissemination programmes to improve awareness of the health professionals and service-providers, programme managers and policy-makers regarding the role of environmental health in the control and prevention of diarrhoeal diseases.

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WATER AND SANITATION ACTIVITIES BY NON-GOVERNMENTAL ORGANIZATIONS: BANGLADESH PERSPECTIVES

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Non-governmental 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.

TESTING DOORSTEP DELIVERY OF INJECTABLE CONTRACEPTIVES IN THE NATIONAL FAMILY PLANNING PROGRAMME

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Injectable hormonal contraception provides an effective means of fertility regulation. The progesterone only injectables depot medroxyprogesteron acetate (DMPA) and norethisterone oenanthate (NET-EN) are most widely used all over the world. In Bangladesh, small projects have shown that injectable contraceptives are highly acceptable to women, however, its usage in the national programme remains still low. The experiences of the ICDDR,B in Matlab, Abhoynagar and Sirajganj suggest that the use of injectable contraceptives increases if they are offered at the doorstep of the clients. This successful experience has led to the decision by the Directorate of Family Planning, Government of Bangladesh, to expand and test doorstep delivery of injectable contraceptives.

The objective of the expansion is to understand the capacity of government programme to handle this new mode of service-delivery with minimum support from outside agency. It would also help to identify the training, logistics and management needs of this programme. The ultimate objective is to determine whether this mode of service-delivery can be offered all over Bangladesh with the existing capacity.

Doorstep delivery of injectable contraceptive is being tested in 8 *thana* of 4 divisions of Bangladesh. Training manuals have been prepared to train different levels of workers and their supervisors. The government field staff and the *thana*-level officers were trained on various aspects of this new service-delivery. To review the programme and to adopt necessary changes, the project is being monitored very closely with the help of monitoring tools, including performance report on injectables and independent observation reports from field sites. An independent survey has also been completed to gather information on injectable users, side-effects, discontinued users, etc. All these data are currently being analyzed and preparations for report are underway to answer the research questions raised.

LONGITUDINAL DEMOGRAPHIC SURVEILLANCE IN MATLAB**Khayrul Alam Khan***International Centre for Diarrhoeal Disease Research, Bangladesh*

The principal aim of the longitudinal Demographic Surveillance System is to record all vital events for each individual in a well-defined area. The Matlab Demographic Surveillance System (DSS) covers a rural population with a current size of 208,171 in and around Matlab *thana* 50 km south-east of Dhaka. Data from this population provide useful information for comparing Bangladesh and other developing countries. DSS monitors this population using censuses and the longitudinal registration of births, deaths, migrations, marriages, and divorces. The whole population is under continuous surveillance for these events. Using the 1982 census as a starting point, the DSS has constructed a large population database. This database is maintained on the mainframe computer using SQL/DS software.

This poster presents the cyclic procedures of the data collection, editing, correction and the updating of the database. It also shows in detail how the Matlab data capture system and database loading system work. Finally, the poster gives an idea of how a scientist can easily trace people over time in Matlab using the longitudinal surveillance system.

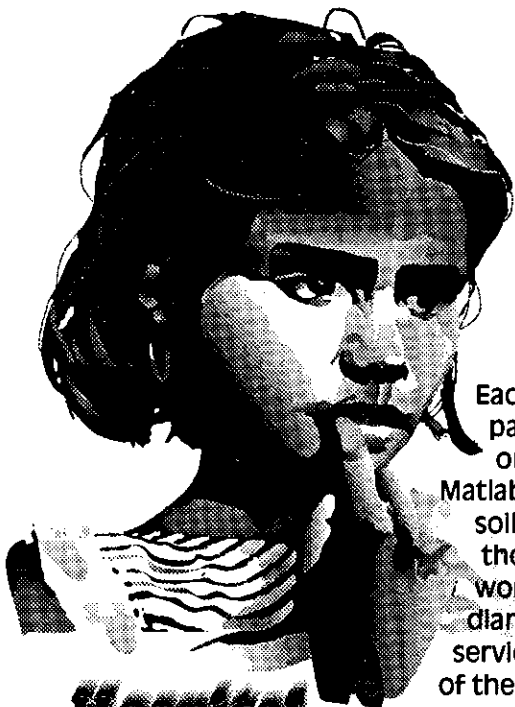
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An Appeal

Each year, ICDDR,B treats over 70,000 patients attending its two hospitals, one in urban Dhaka, the other in rural Matlab. Though they are planted in Bangladeshi soil, they grow because of the dedication of thousands of concerned people throughout the world. The patients are mostly children with diarrhoea and associated illnesses and the services are offered free to the poorer section of the community

Hospital Endowment Fund

Since these services are entirely dependent on financial support from a number of donors, now we at the ICDDR,B are establishing an entirely new endeavour: an ENDOWMENT FUND. We feel that, given securely implanted roots, the future of the hospitals can confidently depend upon the harvest of fruit from perpetually bearing vines.



To generate enough income to cover most of the patient costs of the hospitals, the fund will need about five million dollars. That's a lot of money, but look at it this way:

JUST \$150 IN THE FUND WILL COVER THE COST OF TREATMENT FOR ONE CHILD EVERY YEAR FOREVER!

We hope you will come forward with your contribution so that we can keep this effort growing forever or until the world is free of life-threatening diarrhoea. IT IS NOT AN IMPOSSIBLE GOAL.

Cheques may be made out to: ICDDR,B Hospital Endowment Fund.

For more information please call or write to:
Chairman, Hospital Endowment Fund Committee
GPO Box 128 · Dhaka, 1000, Bangladesh

Telephone: 600-171 through 600-178
Fax: (880-2)-883116

RESEARCH FACILITIES AT THE ICDDR,B

Bangladesh has many major health problems in common with other developing countries, such as diarrhoeal diseases and malnutrition. It too has widespread poverty and illiteracy, an increasing population, and a health system poorly equipped to respond to these challenges. The Centre is in an exceptional position to conduct research in a natural setting on the problems of diarrhoea, nutrition, fertility, and public health relevant to Bangladesh and other developing countries.

Clinical facilities

A large number of patients with diarrhoeal diseases attend the Centre's two hospitals each year, one in urban Dhaka, the other in rural Matlab. The Clinical Research Centre in Dhaka has a 25-bed research ward, a 10-bed metabolic ward, specific wards for persistent and invasive diarrhoea, a nutrition rehabilitation ward for children who have become severely malnourished from diarrhoeal diseases, and a laboratory to provide a wide range of biochemical and microbiological tests. In Matlab, the new two storey hospital complex also provides facilities for medical and maternity care, training, and research. These facilities are extensively used for training in clinical management and in research methods.

Research laboratories

There are well equipped and well staffed laboratories for research in bacteriology, bacterial genetics, histopathology, immunology, molecular biology, environmental microbiology, nutritional biochemistry, parasitology, and virology. The Centre has a walk-in cold room and freezer, facilities for growing and isolating pathogens, a large animal house, and many items of laboratory equipment including an atomic absorption spectrophotometer, a cobas-bio analyser, a gas-liquid chromatograph, a high performance liquid chromatograph, an ultracentrifuge, a bombcalorimeter, and a polymerase chain reaction machine.

Community Health Research

Community health researches are conducted by investigators whose primary interest is in the study of infectious diseases, especially diarrhoeal and related illnesses in children and their mothers; attention is also given to family planning, environmental health, nutritional rehabilitation and maternity care. The research and service work takes place in both rural and urban areas. Technical assistance is provided to governmental and non-governmental agencies. It also maintains two environmental science laboratories.

Demographic surveillance

Information collected on vital events concerning 200,000 people in the Centre's Matlab field area over the last 28 years currently provides an unrivalled opportunity to study demographic trends, to investigate the epidemiology of ill-health, and to examine the effect of providing new health services on morbidity and mortality. These data allow a multidisciplinary approach, integrating insights from the social and behavioural sciences with those gained from biomedical research.

Computing facilities

The Centre operates an IBM 4361 mainframe computer with eight megabytes (MB) of real memory and an on-line storage capacity of 3,000 MB. It is connected to 25 terminals. This system provides a capacity to analyse large data sets and is complemented by over 100 personal computers scattered throughout the Centre.

Diarrhoeal Diseases Information Services Centre (DISC)

DISC provides access to the scientific literature on diarrhoeal diseases, nutrition, population studies, and health in general by means of MEDLINE and POPLINE databases on CD-ROMS, AIDS compact library on CD-ROM, Health and Environment Information Asia Prototype CD-ROM, and Current Contents on diskettes, 25,239 (as of 31 December 1993) books and bound journals, over 11,500 reprints and documents, and 398 current periodicals. DISC publishes the quarterly Journal of Diarrhoeal Diseases Research, a Current Awareness Bulletin (namely DISC Bulletin), a bi-monthly newsletter - Glimpse, and ICDDR,B News, a 4-monthly newsletter - "Shasthya Sanglap" in Bangla, and monographs.

Staff

The Centre currently has over 200 scientific researchers and medical staff from more than nine countries doing research and providing expertise in the many disciplines related to the Centre's areas of research.

