ABSTRACTS BOOK

APGAN

COMMONWEALTH ASSOCIATION Of PAEDIATRIC GASTROENTEROLOGY AND NUTRITION

ICDDR,B

CENTRE FOR HEALTH AND POPULATION RESEARCH

8TH COMMONWEALTH CONGRESS ON DIARRHOEA AND MALNUTRITION

"COMBATING MALNUTRITION AND INTESTINAL DISEASES IN CHILDREN: ARE WE DOING ENOUGH?"

6-8 February 2006
ICDDR,B, Dhaka, Bangladesh

DFID Department for International Development

Australian Government AusAID

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"Combating Malnutrition and Intestinal Diseases in Children: Are We Doing Enough?"

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Preface

On behalf of the Organizing Committee at ICDDR,B and members of the Commonwealth Association of Paediatric Gastroenterology and Nutrition (CAPGAN) Advisory Council, I am pleased to welcome you to the 8th Commonwealth Congress on Diarrhoea and Malnutrition, the theme for which rightly states: Are we doing enough to combat malnutrition and intestinal diseases in children? I am sure the presentations will provide inspiring insights into the problems the Congress is set out to meet. The presentations will also explore new experimental interventions that will help many children, especially the poor who continue to suffer needlessly from ill health. Much can be done to help them. It would be important to develop and test strategies to save lives and improve health, especially those that are practical and can be implemented at low cost.

I am pleased that ICDDR,B has been given the opportunity by CAPGAN to host this very prestigious Commonwealth Congress.

I would like to thank the Scientific Committee for its hard work in screening abstracts and preparing the programme, the Publications Committee for the production of the Programme and Abstracts books, the Fundraising Committee for raising funds to organize this congress, and all the other committees which have helped in organizing the Congress. I especially want to thank those organizations and businesses which have assisted with the financial support for the Congress. Without their contributions, this Congress would not have been possible.

I would especially like to thank the Government of Bangladesh for their support. I hope the Congress will be a memorable experience, both for its health research venue at ICDDR,B and for formal and informal exchange of research results and experience. This congress will give us the opportunity to meet with old friends and make new ones. Often these friendships lead to exchange of ideas, concepts, and innovations, and mutually-beneficial collaborations. Please take time to meet your colleagues from other countries in the region and around the world.

David A. Sack, M.D.
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Invitation for Submission of Manuscripts for Possible Publication in Journal of Health, Population and Nutrition

Theme: Scaling up proven, appropriate technologies

Guest Editor: Prof. Charles P. Larson (clarson@icddrb.org)

As highlighted in the recent Lancet series on child survival, there are multiple, proven preventive or treatment technologies that have not met their potential in terms of reductions in mortality and morbidity in least-developed countries. It can be said we know what to do, but not how. The aim of this special issue of the Journal is to present what we do know about scaling up appropriate, evidence-based interventions. We wish to draw upon the experiences of researchers, programmers, and service providers with programmes that have targeted large populations (districts, countries, regions), what has and has not worked, and the lessons learned. This could relate to a specific technology, for example bednets, or an essential services package combining several interventions. Quantitative and qualitative appraisals of programme success will be considered.

This theme-based issue has been scheduled for publication in March 2007. High-quality relevant manuscripts are invited for submission within 30 June 2006. Manuscripts can be submitted to jhpn@icddrb.org

The other upcoming themes are:

1. Vector-borne Diseases in Asia
2. Community Nutrition Interventions
3. Health Sector Reforms
4. Sexually Transmitted Infections
5. Population/Demography

The Journal has added a new section titled "Water and Sanitation". High-quality manuscripts on water and sanitation that deal with public-health aspects are invited.

David A. Sack, M.D.
Editor-in-Chief
Journal of Health, Population and Nutrition and
Executive Director
ICDDR,B: Centre for Health and Population Research
Email: dsack@icddrb.org

DAY 1: Monday, 6 February 2006

9:00 am - 9:30 am (Venue: Sasakawa Auditorium)
Plenary 1: Combating Zinc Deficiency for Improved Child Health

001* (218†)

Systematic Method for Establishing Research Priorities Concerning the Control of Zinc Deficiency

Kenneth H. Brown[1] (khbrown@ucdavis.edu), Sonja Y. Hess[1], and Erick Boy[2]

[1]Program in International Nutrition, Department of Nutrition, University of California, One Shields Avenue, Davis, CA 95616, USA and [2]The Micronutrient Initiative, 250 Albert St., Ottawa, Ontario K1R 7Z1 Canada

Background: Individual scientists may promote future research priorities based on their personal scientific interests rather than more broadly-defined needs of multiple stakeholders. Donor agencies and research institutions need better methods to establish overarching priorities that reflect the interests of these larger constituencies. Zinc deficiency is a major public-health problem contributing to increased child morbidity and impaired growth. More research is needed on the best ways to diagnose and control zinc deficiency. **Objective:** The objective of the study is to apply a new research priority-setting method to determine the most urgent research needs for controlling zinc deficiency and to describe preliminary conclusions resulting from this process. **Methodology:** The Child Health and Nutrition Research Initiative (CHNRI) sponsored a systematic research priority-setting exercise that builds on existing techniques for identifying research needs concerning child health and nutrition. Priorities are established by using a scoring system that addresses each of the following items: (a) the potential for the proposed research to achieve the stated endpoints; (b) the likelihood of these research endpoints to contribute to reducing disease burden; (c) the expected magnitude of the resulting disease reduction; (d) the predicted effect of the resulting interventions on equitable distribution of health resources; and (e) the cost of the research and the ultimate affordability, deliverability, and sustainability of the resulting interventions. To apply this method, a technical working group (TWG) was assembled, consisting of 7 experts in zinc nutrition and/or public health, who represent different fields of expertise and areas of geographic experience. Each TWG member prepared a list of high-priority, zinc-related research options. The TWG members then scored each of the research options included in a consolidated list, using previously-defined weights and thresholds established by an external advisory group. These results will then be critiqued by a broader range of stakeholders before the list is finalized. **Results:** Preliminary results of this exercise are currently being scored, and updated tabulations are being made available for presentation. **Conclusion:** When disseminated to policy-makers and implementing agencies, this process will help guide research investments and ensure greater fairness and equity in optimizing resources to reduce disease burden in low-income countries. **Acknowledgements:** The financial support provided by the CHNRI and International Zinc Nutrition Consultative Group is acknowledged.

*Indicates the sequential number of abstract/title of presentation in this book
†Indicates the number originally assigned to the abstract

9:35 am - 10:35 am (Venue: Sasakawa Auditorium)
Scientific Session 1: Micronutrients in Child Health

002 (018)

Food Systems Approaches to Improving Micronutrient Nutrition: The Example of Zinc in Bangladesh

A.B. Mayer[1] (abm17@cornell.edu), M.C. Latham[1], J.M. Duxbury[2], N. Hassan[3], and E.A. Frongillo[1]

[1]Division of Nutritional Sciences, Cornell University, Ithaca, NY 14850, USA, [2]Department of Crop and Soil Sciences, Cornell University, and [3]Institute of Nutrition and Food Science, University of Dhaka, Dhaka 1000, Bangladesh

Background: Common approaches to address micronutrient deficiencies include supplementation, fortification, nutrition education, and dietary diversification. However, there is potential to integrate agriculture and human nutrition using sustainable food systems approaches. **Objective:** The sutdy was carried out to demonstrate the potential to improve zinc nutrition of children through a series of improvements to agricultural production, rice varieties, processing and cooking of rice, and improvements to water sources. **Methodology:** In a study conducted in Bangladesh in 2000, soil zinc levels were monitored and its uptake in rice was then tracked through human consumption and assimilation. The design was a cross-sectional observational study of zinc content of rice, dietary intake, and nutritional status of children. Samples of raw, parboiled, milled and cooked rice and soil were collected from 4 villages and surrounding areas in different regions. In total, 156 households were enrolled in a diet and nutrition survey. Using household rice samples, dietary zinc intake was individualized for each household. Hair samples were used for zinc nutritional status. Stool samples were collected from children to determine level of intestinal infection. Ethical approval was obtained from Cornell University, USA and University of Dhaka, Bangladesh. **Results:** Rice grown in 2 seasons on high-zinc soil (>0.8 ppm available zinc) were 6% and 13% higher in zinc than on soils having <0.8 ppm. The zinc content of local varieties differed by 31% and 41% in 2 seasons. In 2 villages with mills, milling losses were 24% and 39%. Cooking losses averaged 2% or 16% depending on the practice of discarding cooking-water. Rice supplied 64% of children's dietary zinc. Total dietary zinc would increase from 6.4 mg/d to 9.0 mg/d if children aged 5-11years consumed rice from the 'high-zinc' village compared to the 'low-zinc' village. Hair zinc was positively associated with polished rice zinc ($r=0.24$ $p=0.001$) suggesting that improvements to the nutrient content of rice could result in nutritional benefit. Children from households using pond water for cooking had higher levels of intestinal infection than those using tubewell water. **Conclusion:** Improvement to local systems, including choice of crop varieties, soil and crop management, food processing, and household water sources can enhance children's zinc status through optimizing the zinc content of rice and preventing intestinal infections. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) is acknowledged.

003 (082)

Impact of Zinc Supplementation to Children with Cholera Admitted to an Urban Hospital in Bangladesh

S.K. Roy[1] (skroy@icddrb.org), Santhia Ireen[2], M. Jahangir Hossain[1], Gulshan Ara[1], Sonia Ahmed[2], Barnali Chakraborty[1], and Sumaya Islam[1]

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Background: Cholera is characterized by massive rice-watery stool, vomiting, rapid dehydration, acidosis, and sometimes death in absence of treatment. Rehydration and antibiotic use have been the mainstay of treatment, yet deaths are frequent due to dehydration in cholera. Zinc has been proven to reduce volume and duration of diarrhoeal stool in children with acute diarrhoea and water and electrolyte secretion in response to cholera toxin-induced intestinal secretion in animal models. **Objective:** The study was conducted to evaluate whether zinc supplementation to children aged 1-14 year(s), in addition to antibiotic therapy, has any effect on the duration and severity of cholera. **Methodology:** A randomized, double-blind, placebo-controlled clinical trial was conducted in 164 children of either sex aged 3-14 years. In each group, 82 children with watery diarrhoea of less than 24 hours and stool dark-field examination positive for *Vibrio cholerae* were enrolled after initial correction of dehydration by intravenous (IV) fluid (cholera saline) or oral rehydration solution (ORS) based on the WHO guidelines. After enrollment, children were randomly allocated to receive either 30 mg elemental zinc per day or a comparison till recovery from diarrhoea or for a maximum of 7 days. Alternative study children were advised to return to the hospital 10 days from initiation of interventions for serum zinc assay. All study children received erythromycin suspension orally in a dose of 12.5 mg/kg every 6 hours for 3 days. **Results:** The **c**hildren receiving zinc supplementation had 14% shorter mean duration of diarrhoea than the children receiving placebo (64.0 vs 73.0 hours, $p<0.03$), but their total diarrhoeal stool output were not different. When the children were stratified by more malnourished sub-groups (weight/age <75% NCHS median), the children receiving zinc supplementation had 20% shorter duration of diarrhoea ($p<0.02$) and 28% lesser volume of diarrhoeal stool compared to the children in the control group ($p<0.05$). Fifty-five percent of the zinc-supplemented children recovered within 64 hours compared to 35% of the placebo group ($p<0.05$). **Conclusion:** Zinc supplementation significantly reduced the duration of diarrhoea and stool output in children with cholera, an effect that was more pronounced in malnourished children. **Acknowledgements:** The financial support of ICDDR,B: Centre for Health and Population Research and Thrasher Research Fund, USA, is acknowledged.

004 (110)

Effect of Micronutrients on Morbidity and Duration of Hospital Stay in Childhood Pneumonia

M.A. Wahed (mawahed@tistaonline.com)

Department of Paediatrics, Rangpur Medical College, Rangpur, Bangladesh

Background: Acute respiratory infection (ARI) is the most common cause of morbidity among children, aged less than 5 years, in Bangladesh and is a great public-health concern. Among all the ARIs, pneumonia is responsible for a significant proportion of childhood mortality. Supplementation of micronutrients reduces risk of pneumonia by 45% and duration of hospital stay by 41%. **Objective:** The study was conducted to compare the effects of supplementation of 5 micronutrients (vitamin A, vitamin C, vitamin E, folic acid, and zinc) on morbidity and duration of hospital stay in childhood pneumonia to know the nutritional status and average serum level of these 5 micronutrients in these children. **Methodology:** This prospective, cross-sectional and case-control study was conducted in the Department of Paediatrics of Rangpur Medical College Hospital from 1 July 2003 to 30 June 2005 among children, aged less than 5 years, suffering from pneumonia. Data were collected from 1,150 children. Of them, 8 died, 100 left the hospital on 'risk bond', 234 were discharged 'on request' of parents before cure, and 8 developed various complications. Finally, data from 800 children were analyzed. The children were divided into 2 groups: 400 in control group and 400 in intervention (case) group. In both the groups, specific treatment was given by one of 4 combinations: ampicillin and gentamycin or ampicillin and cloxacillin or penicillin and cloxacillin, or penicillin and gentamycin, according to nature and severity of pneumonia. In the intervention group, 200 children were given the 5 micronutrients from the day of admission, which were continued up to discharge. Another 200 children were again divided into 5 sub-groups (40 in each sub-group), and a single micronutrient was given in the same way in each sub-group. Blood samples were collected for estimation of serum level of vitamin A (retinol), vitamin C, vitamin E, zinc, and folic acid from all the subjects before starting treatment by standard procedures. **Results:** Of the 800 children, 475 (59%) were male and 325 (41%) were female. Their mean age was 6.5±5.6 months, and 450 (56.25%) were infants. The rate of exclusive breastfeeding was only 15%, and 50% of the children were weaned in time. Among those weaned, intake of mixed food was only in 13% of the children and 85% were weaned by carbohydrate-rich diet. These socioeconomic and health indicators did not differ between the cases and the control group. According to Gomez's classification, 8.0% of the children were nutritionally normal, and 7.2% were suffering from severe protein-energy malnutrition (PEM). By z-scoring, 51.0% of the children were nutritionally normal, and 11.0% were suffering from severe PEM. The individual values of level of micronutrients in the samples were either low or marginally normal but the average level was low. The average duration of hospital stay was 6.75 days in the intervention group and 7.75 days in the control group. Again, in the intervention group, those who were malnourished took longer time (8.5 days) in hospital than those who were well-nourished (5.0 days). The micronutrient level in the serum of the children who were exclusively breastfed was higher than those who were non-breastfed. **Conclusion:** The study results suggest that supplementation of micronutrients decrease morbidity and duration of hospital stay of children suffering from various types of pneumonia. **Acknowledgements:** The support of the Padma Diagnostic Centre, Dhaka, and Appollo Diagnostic Centre, Rangpur, for investigations done at a lower price is acknowledged.

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Ascorbic Acid Counteracts the Inhibitory Effect of Phytic Acid on Iron Bioavailability from a Traditional Complementary Food Consumed by Pakistani Infants

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Background: Although human milk contributed significant quantities of ascorbic acid (mean molar ratio ascorbic acid to iron was 2.3:1), no significant difference in iron bioavailability was found between *khichuri* consumed with water or with human milk in a recent study in Bangladesh. **Objective:** The study was conducted to evaluate the effect of added ascorbic acid on iron bioavailability from *khichuri* at 2:1 and 4:1 molar ratio ascorbic acid to iron. **Methodology:** Erythrocyte incorporation of iron stable isotopes 14 days after administration was used as a proxy for iron bioavailability. On 4 consecutive days, infants, aged 6-10 months, consumed 8 servings of *khichuri*: 4 labelled with 57Fe: test meal A with added ascorbic acid and 4 labelled with 58Fe: test meal B without ascorbic acid), fed in the order AABBAABB or BBAABBAA. **Results:** Geometric mean iron bioavailability increased from 8.1% to 15.1% (n=9; p=0.002 paired Student's *t*-test) and from 10.5% to 35.0% (n=10; p<0.000.1) after addition of ascorbic acid at 2:1 and 4:1 molar ratios relative to iron respectively. **Conclusion:** Ascorbic acid increased iron bioavailability significantly when added at molar ratios in the same range as evaluated in a previous study of human milk as a source of ascorbic acid. These results, thus, indicate indirectly that components of human milk modify the influence of ascorbic acid on iron bioavailability. Data on the enhancing effect of added ascorbic acid on iron bioavailability cannot be extrapolated when human milk is the source of ascorbic acid. **Acknowledgements**: The financial support of the International Atomic Energy Agency (IAEA) is acknowledged.

9:35 am - 10:35 am (Venue: Seminar Room)
Scientific Session 2: Child Nutrition and Growth

006 (004)

Nutritional Status of Working and Non-working Children

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Background: Child labour continues to pose a challenge to public health. Although malnutrition has been associated with child labour, underlying poverty is thought to be the link between the two. **Objective:** This study assessed the nutritional status of working and non-working school children attending primary and secondary schools in Ibadan, Southwest Nigeria. It sought to compare the nutritional status of these children across socioeconomic classes. **Methodology:** Two primary schools and two secondary schools were randomly selected from a list of schools provided by the local government office. Children in classes 4-6 in primary and JS 1-3 in secondary schools were requested to participate in the study after obtaining the permission of the school authorities. Children were selected and categorized as 'working' if they were engaged in economic activities outside the home after school hours. Non-working children were selected from the same class. A structured questionnaire was administered to both the categories of children. The interview was followed by physical examinations, including measurements of height and weight. These measurements were analyzed with the Epi nut package and compared with the National Centre for Health Statistics (NCHS) reference values. **Results:** In total, 453 children, aged 8-15 years, were interviewed: 223 working and 230 non-working. In all, 120 (26.5%) were under-weight, and 135 (30%) were stunted. Eighty-seven children (19%) were stunted and thin. Seventy-four (33%) of working children were under weight compared to 46 (20%) non-working children (p=0.002). Seventy-six (34%) working children were stunted compared to 59 (26%) of non-working children. Fifty-two (23%) working children were both stunted and thin compared to 35 (15%) of non-working children. Two socioeconomic categories were identified by resident type. In both the categories, stunting and thinness were more frequent among working children. **Conclusion:** Child labour may worsen the nutritional status of children. This may be due to unreplenished energy expenditure while carrying out work on the streets.

007 (034)

A Home-made Energy-dense Weaning Formula Decreases Growth Faltering in Infancy: An Intervention Study

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Background: Optimum nutrition and good feeding of infants and young children are among the most important determinants of their health, growth, and development. A common pattern seen in the growth charts of Sri Lankan children is growth faltering after the age of 4 months. This could be because of poor-feeding practices, such as inadequate energy density, avoidance of oil and fat due to cultural beliefs, delay in introducing appropriate solids, frequent milk feeds at the expense of complementary feeds, and use of semi-solid and liquid feeds beyond the

'critical'' period leading to refusal of solids. **Objective:** The efficacy of a home-made energy-dense weaning formula on growth faltering during infancy was evaluated. **Methodology:** Infants attending 4 child health welfare clinics of Medical Officer of Health area, Ragama, Sri Lanka, were recruited in the study at the age of 4 months. Infants attending 3 clinics were included in the intervention group, and the infants from the 4th clinic served as controls. The intervention group received a speciallydesigned hand-blender, recipe, and advice to prepare a weaning food containing approximately 110-130 kcal/100 mL. The control group received weaning foods without any intervention. All of them were followed up monthly by home-visits with regular growth monitoring up to the age of 12 months. **Results:** In total, 142 infants completed the study (83 from intervention group and 69 in control group). The infants in the intervention group gained significantly more weight than the control group (intervention group 2.43±0.72 kg and control group 2.02±0.62 kg, p=0.0002). Both the groups showed growth faltering during the study period but the drop in the z-score for mean weight for age was less marked in the intervention group. **Conclusion:** The study has shown that the home-made complementary feeding preparation with high energy density is more effective in improving the weight gain of infants than conventional weaning foods. **Acknowledgements:** The financial support of the United Nations Children's Fund and Sri Lanka Medical Association is acknowledged.

008 (142)

Impact of Breastfeeding Counselling on Breastmilk Intake by Young Infants as Measured by Test Weighing Method

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Background: Breastfeeding counselling increases both rate and duration of exclusive breastfeeding. However, the impact of breastfeeding counselling on breastmilk intake by young infants remains to be known. Insufficient breastmilk is one of the most important reasons cited by mothers for discontinuing breastfeeding and/or starting other milk or milk substitutes. Therefore, breastfeeding counselling may be an effective mechanism for improving mothers' confidence in producing enough breastmilk. **Objective:** The study was conducted to evaluate if breastfeeding counselling to lactating mothers improves breastmilk intake by their babies. **Methodology:** The study was conducted at the Dhaka Hospital of ICDDR,B from April to October 2001 where trained counsellors routinely provided bareastfeeding counselling to all mothers having infants, aged less than 6 months, who do not exclusively breastfeed their children. Forty mother-infant pairs were randomly selected to receive either breastfeeding counselling or regular health messages provided in the hospital during their stay in the hospital. The babies, aged 0-4 months, were admitted to the hospital for their diarrhoeal illness. After the recovery of the babies from diarrhoea, the mothers were randomized, in equal numbers, to receive breastfeeing counselling or routine health messages. Breastmilk intake was measured by the test weighing method for 3 consecutive days. The amount of exclusive breastfeeding and breastmilk intakes were compared between counselling and no-counselling groups using chi-squared test and Student's *t*-test respectively. **Results:** In the breastfeeing counselling group, 16 (80%) babies were exclusively breastfed at discharge compared to 5 (25%) babies in the control group ($p<0.001$). On day 3, the mean±SD intake of breastmilk was significantly higher than the non-counselled group (555±146 mL vs 391±195 mL; $p<0.005$). **Conclusion:** Breastfeeing counselling to mothers not only improves the rate of exclusive breastfeeding but also improves the amount of intake by babies. Incorporating breastfeeding counselling in hospital and healthcare servicies and facilities will improve infant-feeding practices and thereby child survival. **Acknowledgements:** The study was supported by the World Bank.

009 (161)

Infant and Young Child-feeding Practices in Urban Areas of Bangladesh

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Background: Knowledge on feeding practices of infant and young children (IYC) is crucial for undertaking or improving health and nutrition programmes in a country or community. The health and nutrition status and infant and young child feeding (IYCF), one of the determinants of health and nutrition, is not well-studied in urban Bangladesh. **Objective:** The study was conducted (a) to document the knowledge, attitudes, and practice of urban mothers/caregivers of 0-24 month(s) old infants and young children regarding breastfeeding (BF) and complementary feeding(CF) and (b) to identify the barriers of optimum IYCF practices. **Methodology:** A cross-sectional survey was conducted among mothers/caregivers of 0-24 months old infant and young children in 4 metropolitan cities. In total, 6,082 respondents were identified through multi-stage cluster sampling. Interviews with a structured questionnaire, PRA technics, and Lycard scale for attitude assessment were used for collecting data. **Results:** This is the largest study in urban Bangladesh on IYCF situation. The prelacteal feeding rate was 71%, onset of BF within half an hour was 17% ,and that within 24 hours was 79%. Eleven percent expelled colostrum before BF. Exclusive BF rate at 5 and 6 months were 20% (95% CI 16-24.5) and 7% (95% CI 4.7-10.6). About 60% of mothers initiated CF before 6 months of age. One-third of children were given BF and CF with feeding bottles. Knowledge, attitudes, and perceptions of caregivers on IYC feeding were varied and deviated; but most of them had positive attitude towards exclusive BF, family food as ideal CF, continued BF for 2 years and need for fathers' active role in CF. **Conclusion:** Exclusive BF rate is very low and CF is inappropriate in onset and inadequate in quality. Based on existing positive attitude of caregivers and emerging urban primary healthcare infrastructure, effective communication strategy should be adopted to improve the IYCF situation. **Acknowledgements:** The support of the Asian Development Bank and Urban Primary Health Care Project, Ministry of Local Government, Rural Deve.opment & Cooperatives is acknowledged.

9:35 am - 10:35 am (Venue: CSD Conference Room)
Scientific Session 3: Management of Diarrhoeal Diseases I

010 (001)

Impact of Deworming on Nutritional Status and Incidence of Diarrhoea among Urban Slum Children of Kolkata, India

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Background: Intestinal helminthic infestations are a very common childhood problem in India. **Objective:** The present study was undertaken to measure the impact of periodic deworming with albendazole on the growth status of and diarrhoeal incidence among children aged 2-5 years and also to assess the feasibility of such administration by health workers. **Methodology:** It was a double-blind, placebo-controlled, randomized, community-based intervention trial with 702 children being randomly allocated into either albendazole (study) or placebo (control) groups. The study group received 400 mg albendazole twice at 6-monthly intervals. **Results:** There was a significant increase in mean weight of children in the study group compared to the control group at 3 months, 6 months, and 9 months following albendazole administration ($p<0.007$, $p<0.010$, and $p<0.001$ respectively) The children in the albendazole group also suffered from significantly less episodes of diarrhoea than their control counterparts (relative risk 1.3; 95% confidence interval 1.07-1.53) with a reduction of 28%. The health workers could satisfactorily administer the correct dosage, and there were no adverse effects. **Conclusion:** Periodic mass deworming with albendazole may prove to be a safe and effective method that may be adopted at the community level or as an integral part of school health services, and it is expected to improve the growth of children and reduce the incidence of diarrhoea among them. **Acknowledgements:** The financial support of the Indian Council of Medical Research is acknowledged.

011 (071)

Reduced Susceptibility of Enteric Bacterial Pathogens to Ciprofloxacin

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Background: Ciprofloxacin, a member of antimicrobial agent fluoroquinolones, is highly effective in treating shigellosis, typhoid fever, and cholera. However, recent reports on suboptimal clinical responses (delayed treatment response, therapeutic and microbiological failures) to ciprofloxacin therapy in otherwise susceptible infections due to reduced susceptibility (partial resistance) of causative agents to ciprofloxacin are worrying. **Objective:** The reduced ciprfloxacin susceptibility among *Shigella* and *Salmonella enterica* serotype Typhi isolates was studied to develop a marker for detecting reduced ciprfloxacin susceptibility. **Methodology:** In total, 286 (*Shigella* 154, *S. enterica* serotype Typhi 132) clinical isolates were tested for minimum inhibitory concentration (MIC) of ciprofloxacin by the E-test and agar dilution method in addition to antimicobial susceptibility testing by the disc-diffusion method. **Results:** An increase in ciprofloxacin MIC (range 0.064-0.5

μg/mL, MIC 90 0.5 μg/mL) indicating reduced ciprfloxacin susceptibility was detected in 134 (47%) isolates, more frequently in *Shigella* (71%) than *S.* Typhi (18%, $p<0.01$). Reduced ciprfloxacin susceptibility was more frequent in multi-drug-resistant strains than susceptible strains. These isolates were uniformly resistant to nalidixic acid by the disc-diffusion method and by MIC (≥32 μg/mL) according to the Clinical Laboratory Standards Institute (CLSI; formerly NCCLS) guidelines showing the utility of nalidixic acid resistance as a marker for detecting reduced ciprofloxacin susceptibility. Ciprofloxacin (5 μg) disc-diffusion zone diameters of ≥24 mm as break-point for reduced susceptibility had 98% sensitivity and 100% specificity when compared with a ciprofloxacin MIC of 0.25 mg/mL as break-point for reduced susceptibility in *S.* Typhi. **Conclusion:** Laboratories should test enteric pathogens for reduced ciprofloxacin susceptibility by newly-proposed disc-diffusion zone diameters. More studies are needed to determine the impact of reduced ciprofloxacin susceptibility of enteric pathogens on the outcome of drug therapy to overcome this emerging problem. **Acknowledgements:** The financial support of the United States Agency for International Development, Washington, DC, is acknowledged.

012 (061)

Fluoroquinolone-resistant *Shigella flexneri:* A New Therapeutic Challenge

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Background: Increasing antibiotic resistance has emerged as a major challenge in the treatment of shigellosis as multi-drug-resistant *Shigellae* are being increasingly reported. Fluoroquinolones are often used in the treatment of shigellosis in this part of India. At the 1,359-bed tertiary care referral centre of Postgraduate Institute of Medical Education and Researach, which caters to a population of >4 million in neighbourhood of Chandigarh, North India, antibiotic resistance in *Shigellae* is being constantly monitored due to changes in the serogroup distribution and increasing antibiotic resistanace. In 2003, there was an outbreak of ciprofloxacin-resistant *Shigella dysenterae* serotype 1, which caused a serogroup shift which soon reverted in 2004 to *S. flexneri*. Ciprofloxacin-resistant *S. dysenteriae* serotype 1 has caused outbreaks in Northeast India and Bangladesh leading to a regional alert in South Asia. Ciprofloxacin resistance in *S. flexneri* has been reported sporadically from various countries. **Objective:** The present communication reports an alarming level of ciprofloxacin resistance in *S. flexneri* that has emerged as a therapeutic challenge in the region. **Methodology:** *Shigellae* isolated from stool samples were identified by the standard biochemical methods and confirmed by serotyping. Antibiotic susceptibility was performed as per the NCCLS guidelines. Minimum inhibitory concentration (MIC) for nalidixic acid and ciprofloxacin was performed by the agar dilution method of NCCLS and E-test respectively. Clinical and treatment details of patients were noted. **Results:** Of 40 *Shigellae* isolated from 793 stool samples (5%), submitted over a 10-month period in 2005, 21 (52.5%) were *S. flexneri* (isolated from 19 patients). Age of patients ranged from 3 months to 50 years (12 children, 7 adults). All children were aged less than 5 years. Acute dysentery was the commonest presentation with an average duration of illness of 11.3 days. All strains were resistant to nalidixic acid (MIC >128). Sixteen (84,2%) patients had ciprofloxacin MIC from 8 to 64. All patients were treated with ciprofloxacin/ofloxacin which are the drugs of choice in the region. Six patients, who were given ceftriaxone (2 patients) and amikacin (4 patients), did not show any clinical response. Three patients showed partial response, who also responded to amikacin. **Conclusion:** Forty-seven percentage of patients either did not respond or responded partially to fluoroquinolones. Due to indiscriminate use, fluoroquinolones will soon be ineffective in the region for the treatment of shigellosis.

013 (119)

Oral Rehydration Solution with Amylase-resistant Starch or Rice-ORS in Malnourished Children with Cholera

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Background: Recently, amylase-resistant starch (ARS) added to a standard WHO-ORS has been shown to reduce stool weight and duration of diarrhoea in adults with cholera. Rice-based ORS also reduces stool weight in cholera patients. **Objective:** The efficacy of modified glucose-based ORS plus ARS or rice-based ORS was compared with modified glucose-based ORS in the treatment of severely-malnourished children with cholera. **Methodology:** In an open randomized controlled clinical trial, 175 severely-malnourished children (<70% weight- for-length), aged 6-60 months, with cholera were studied in 3 treatment groups: 58 children received modified glucose-ORS, 59 received modified glucose-ORS plus ARS, and 58 received rice-ORS. The study was carried out in the Dhaka hospital of ICDDR,B: Centrre for Health and Population Research from July 2001 to December 2004. The Research Review and Ethics Committees of ICDDR,B approved the study protocol. The main outcome measures were stool weight and duration of diarrhoea. Continuous variables were compared using ANOVA or non-parametric tests where appropriate and dichotomous variables were compared with χ^2 or Fisher's exact test. **Results:** The mean stool weight in the 1st and 2nd 24 hours was significantly reduced in the rice-based ORS group compared to the glucose-based ORS and glucose-based ORS plus ARS groups (rice-ORS vs glucose-ORS plus ARS group vs glucose-ORS, stool weight [g] mean±SD, 1,639±1,023 **vs** 2,177±1,133 vs 2,357±1,496, p=0.006 respectively during 1st 24 hours); 956±1,087 vs 1,437±1,210 vs 1,676±1939 respectively during the 2nd 24 hours, p=0.031. Requirement of unscheduled intravenous therapy was also similar in the 3 groups. There was no significant difference in duration of diarrhoea in any treatment group. **Conclusion:** Rice-based ORS reduces stool weight in severely-malnourished children with cholera. However, ARS added to glucose-based ORS has no significant effect in these children. The findings of the study confirm the beneficial effect of rice-based ORS in cholera. **Acknowledgements:** The study was funded by Nestle Foundation, Lausanne, Switzerland.

11:00 am - 12:30 pm (Venue: Sasakawa Auditorium)
Scientific Session 4: Advocacy and Social Equity

014 (033)

Factors Associated with Physical Violence against Pregnant Women in Bangladesh

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Background: Apart from being a gross violation against human rights, violence during pregnancy has many adverse consequences for a woman and her foetus. Still little research has been conducted on the factors associated with violence during pregnancy using population-based data. **Objective:** The study explored the magnitude of physical violence against pregnant women in Bangladesh and the factors associated with such violence. **Methodology:** Data for the current analysis were drawn from a study conducted during 2000-2004 in rural and urban Bangladesh as part of the WHO multi-country study on domestic violence against women. All ever-pregnant women (n=2,553) covered by the population-based survey of reproductive-age women were included in the current analysis. Multilevel logistic regression models were used for the analyses. Approval of the Research and Ethical Review Committees of ICDDR,B: Centrre for Health and Population Research was obtained. **Results:** About 10-12% of ever-pregnant women reported being physically abused during pregnancy. In the urban area, women aged more than 15-19 years had husbands with an education beyond 10th grade, had higher spousal communication score, and were from the highest income quartile, were less likely to be abused during pregnancy. On the other hand, women whose fathers physically abused their mothers and husbands had a similar history, Muslim women, and women living in communities where worry about the level of crime in the area was more prevalent were more likely to be abused. History of abuse of each of the spouses' mother by father and religion were positively associated with this violence in the rural area as well. Involvement of women in income earning was another risk factor. However, only perceived support from natal family in crisis and better spousal communication were negatively associated with abuse in pregnancy in this site. **Conclusion:** The determinants of violence during pregnancy were not exactly the same in urban and rural areas, which needs to be taken into account in designing interventions. Male education and spousal communication need to be promoted for addressing this violence. An important message for advocacy is that violence against women is a learnt behaviour, and presence of this violence in family increases the likelihood of generational transmission. **Acknowledgements:** The study used the protocol and questionnaire developed by the WHO Multi-country Study on Women's Health and Domestic Violence. This research was funded by the Urban Primary Health Care Project of Bangladesh under the auspices of the Government of Bangladesh and Asian Development Bank (ADB) (Bangladesh Urban Primary Health Care Project and ADB Loan no. BAN/SF 1538).

015 (057)

Household Income as a Determinant of Child Malnutrition: Can Nutrition Education Improve Nutritional Status of a Resource-poor Family Where Other Livelihood Opportunities Are Challenged?

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Background: Although income poverty is recognized as an important determinant of malnutrition, the relationship between household income and nutrition is not straightforward. Indepth analysis is required to better understand this relationship and to identify factors influencing the household decision-making process, especially regarding food consumption. **Objective:** The study was conducted to assess individual household income and expenditure and to see whether this is related to the nutritional status of household members. **Methodology:** Parallel surveys of (i) household economy and (ii) nutrition were conducted in an upland village with approximately 200 households in Kurigram district of Bangladesh. All the households of the village were interviewed, and anthropometric measurement among children aged less than 5 years was performed. All sources of household income and expenditure in the year preceding the survey were collected. Household income was expressed as disposable income (defined as the amount of money left to the household after it had met its basic food energy needs)/adult equivalent (AE). A minimum standard of living threshold was set, in terms of each household's ability to afford a basic set of non-food goods. **Results:** The study revealed that 49% of households fell below the standard of living threshold. Child stunting tended to fall with increasing disposable income only above the 4th and 5th disposable income quintile. The difference between the poorest and the richest children was about 1 z-score (4 cm of height). Household food and non-food consumption was least in the poorest 2 income deciles, static in the middle-income group, and only increased above a disposable income level of approximately Tk 4000-5000/AE/year. Dietary quality was, on average, low at all income levels. The poorer households consumed an even lower-quality diet as dietary quality was compromised to obtain sufficient food energy and to meet minimum non-food needs. It was estimated that, by minimizing food quality, the poorest households could afford approximately 300 additional kcal/AE/day. **Conclusion:** The findings suggest that (a) the poorest households cannot afford an adequate quality or quantity of diet and (b) the middle-income group (which has disposable income above standard of living threshold and could, therefore, afford more and/or better-quality food) prefers productive investments to food consumption. Only the richest households consume an adequate and better-quality diet. It indicates that nutrition education is unlikely to influence the consumption patterns and nutritional status of the poorest and middle-income groups, without a substantial increase in household income.
Acknowledgements: The study was funded by the Department for International Development (DFID).

016 (027)

Prevalence, Severity, and Determinants of Malnutrition in Children Aged Less Than 5 Years in Ultra-poor Households in Rural Bangladesh

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Background: Poverty and malnutrition form a vicious circle that primarily affects infants and young children. To reduce extreme poverty, BRAC has recently launched an innovative programme, namely 'targeting the ultra-poor'. Indicators of malnutrition among children aged less than 5 years may offer a suitable option to assess the impact of the programme in reducing poverty and malnutrition. **Objective:** The study was conducted to estimate the prevalence and severity of malnutrition and explore the determinants among children aged less than 5 years in BRAC-targeted ultra-poor households. **Methodology:** A cross-sectional survey of 426 children aged 6-59 months was undertaken during July-September 2003. Multistage cluster sampling was used for selecting the target households. The nutritional status was assessed by using anthropometric indices. Ethical clearance was obtained from the Bangladesh Government. **Results:** The prevalence of stunting, wasting, and under-weight was 60%, 22%, and 68% respectively (z-score <-2). Severe forms of stunting, wasting, and under-weight (z-score <-3) were present in 33%, 2%, and 28% of the children respectively. In total, 231 (54%) children showed sign of both stunting and under-weight, and 16% were both wasted and stunted. Children aged 12-23 months had the highest prevalence (71% stunted, 81% under-weight, and 46% wasted). Boys and girls were equally affected. Logistic regression showed that having diarrhoea (odds ratio [OR]=2.10, confidence interval [CI] 1.20-3.67) or any other illness (OR=1.89, CI 1.15-3.09) in the preceding month, ill health as perceived by mothers (OR=2.81, CI 1.66-4.79), and prolonged breastfeeding (OR=2.54, CI 1.54-4.19) significantly increased the risk of wasting. Perceived ill health and prolonged illness (>7 days) were associated with higher risk of under-weight (OR=2.31, CI 1.27-4.23 and OR=1.70, CI 0.98-2.95 respectively). An analysis of 24 hours of recall data relating to dietary intake on a sub-sample of 65 children revealed that the wasted and under-weight children had significantly lower energy intake than their normal counterpart ($p < 0.05$). **Conclusion:** Malnutrition continues to be a major problem among young children in ultra poor households. It appeared to be higher than that previously detected elsewhere in Bangladesh. A comprehensive primary healthcare programme considering malnutrition control within ultra-poor programme is essential, especially targeting children aged less than 5 years.

017 (010)

Comparison of Health and Nutritional Status between Tribal and Bengali Children Aged 0-23 Month(s) in Rural Bangladesh

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Background: Approximately, 10% of the populations in Durgapur and Kalmakanda upazilas in Netrokona district are Tribal. No information on health and nutritional status of children is available comparing between the Tribal and the Bengali populations. **Objective:** The study compared the health and nutritional status of children, their feeding practices, and nutritional status of mothers. **Methodology:** A cross-sectional study was conducted in Durgapur and Kalmakanda upazilas in Netrokona district during December 2004-January 2005. Fifty-seven pairs of Tribal and 243 pairs of Bengali mothers and children aged 0-23 month(s) were studied. Feeding practices of children, their morbidity, race, and socioeconomic status, and maternal educational level were recorded. Weight and length/height of mothers and children were measured. **Results:** The prevalence of under-weight and stunted children was significantly lower in the Tribal populations compared to the Bengali populations (29% vs 51%, p=0.006 and 25% vs 54%, p<0.001 respectively), but wasting was comparable (14% vs 19%, p=0.430). A greater percentage of Bengali mothers was suffering from under-nutrition compared to Tribal mothers (55% vs 21%, p<0.001). Introduction of pre-lacteal feeding was significantly lower in tribal children compared to Bengali children (49% vs 74%, p=<0.001). Continuation of exclusive breastfeeding up to 6 months and introduction of appropriate complementary feeding at the age of 6-8 months were significantly higher in Tribal children compared to Bengali children (68% vs 35%, p<0.001 and 30% vs 3%, p=0.036 respectively). A significantly higher proportion of Bengali children was suffering from lower respiratory infections compared to Tribal children (12% vs 2%, p=0.023). The prevalence of diarrhoea was comparable between the two groups (25% vs 28%, p=0.598). Results of multivariate regression analysis revealed that Bengali children were 2 times more likely to be under-weight (odds ratio [OR]=2.00, 95% confidence interval [CI] 1.04-3.83) compared to Tribal children, and children of under-nourished and illiterate mothers were at more risk of being under-weight than children of well-nourished and literate mothers (OR=1.69, 95% CI 1.04-2.75 and OR=1.87, 95% CI 1.16-2.99 respectively). **Conclusion:** Tribal children and mothers are nutritionally better-off than Bengali children and mothers. Comparatively appropriate feeding practices and lower prevalence of lower respiratory infections have been observed in Tribal children. Maternal under-nutrition and illiteracy are the risk factors of under-weight in these children. **Acknowledgements:** The study was supported by the United States Agency for International Development (USAID) as a part of Child Survival Project Grant.

018 (095)

Health and Nutritional Status of Vegetarian Tribal School-going Children: Findings from a Residential Christian Missionary School in Northern Remote Area of Bangladesh

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Background: Vegetarianism due to cultural practice or religious ritual is not uncommon in Bangladesh. However, there are no scientific reports from Bangladesh that evaluated their health and nutritional status, particularly those aged 10-18 years, during their critical period of growth and development. **Objective:** The study was conducted to assess the nutritional status and common health problems of the vegetarian tribal school-going children. **Methodology:** This cross-sectional study was conducted, in November 2005, among 416 school-going Garo tribal children aged 10-18 years, residing in the dormitory of Seventh Day Adventist-operated Christian Missionary school located at a remote area of Dhobaura sub-district (hilly area of northern Bangladesh) of Mymensingh district. A field-tested questionnaire was used for collecting data on health status, and a team of 5 public-health physicians measured the nutritional status using the standard procedures. Weight was measured to nearest 500 g and height to 0.5 cm, and body mass index (BMI) was calculated. **Results:** Of the total 416 respondents, 227 (55%) were males. The mean$\pm$SD age of girls and boys was same (13.0$\pm$2 years vs 13.0$\pm$2.0 years, p=0.280). Their heights were also similar (145$\pm$7 cm vs 146$\pm$12 cm, girls vs boys, p=0.276). Girls were significantly heavier than boys (weight: 41$\pm$7 kg vs 39$\pm$9 kg, p=0.035; body mass index [BMI]: 19$\pm$2 vs 18$\pm$2, p<0.001; and BMI <18.5, 32% vs 68%, p<0.001 respectively). Scabies topped the list of all health problems (78% vs 22%, boys vs girls respectively, p<0001). Eye problems (refractive errors, burning, watering, and pain in the eyes during stressful visual work or exposure to sunlight) were the 2nd commonest health problem (75% vs. 25%, girls vs boys respectively, p<0001). Other observed problems were hyperacidity (14%), fungal skin infection (11%), and ear, nose, and throat-related problems (8%). **Conclusion:** The nutritional status of these vegetarian school-going children appears to be similar to their non-vegetarian peers in Bangladesh. Health intervention programmes should give more emphasis on health-education issues, such as personal hygiene to combat skin problems. Periodic check-ups and correction of refractive errors may be useful to minimize their eye problems.A longitudinal study could be done to find out the changes over period, especially that of growth and development.
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019 (192)

Household Food Insecurity Affects Infant-feeding Practices in Matlab, Bangladesh

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Background: Although household food security (HHFS) is an important determinant of the dietary intake and nutritional status of children, the effects of HHFS on infant-feeding practices are unknown. **Objective:** The study investigated the effects of HHFS on infant-feeding practices in rural Bangladesh. **Methodology:** In total, 843 infants who were born between May 2002 and June 2003 to women who participated in the MINIMat (Maternal and Infant Nutrition Intervention in Matlab) study in Bangladesh were studied. Data on HHFS and socioeconomic status (SES) were obtained from pregnant women. Data on feeding history and morbidity were collected monthly until infants were 12 months old. A food security, scale based on an 11-item measure of HHFS, was created. Scales were also created to describe infant-feeding behaviours at 0-6, 7-9, and 10-12 months relative to the current recommendations of WHO/UNICEF. The effects of HHFS on infant-feeding practices were studied using lagged, dynamic, and difference models of longitudinal data analysis adjusted for various infant and maternal variables. **Results:** Both HHFS and SES were negatively associated with infant-feeding practices at 3-6 months of age and positively associated with these practices at 6-9 and 9-12 months of age in all the 3 types of adjusted models. Feeding at the previous interval was positively associated with infant-feeding practices at 3-6 and 9-12 months of age but was negatively associated with these practices at 6-9 months of age. Other factors (lagged morbidity and change in morbidity, sex of infant and birth-weight, and mother's age and parity) were not consistently associated with infant-feeding practices. **Conclusion:** The use of 3 different models permitted to identify the associations of HHFS with infant-feeding practices that were robust and consistent. These findings suggest that mothers living in better-off, food-secure households were not meeting current infant-feeding recommendations when their babies were 3-6 months old. When babies were 6-12 months old, however, it was mothers living in poorer, food-insecure households who were not meeting these recommendations. Efforts to support proper infant-feeding practices should be directed to mothers in food-insecure households, particularly during the second half of infancy. **Acknowledgements:** KKS was supported by a Fogarty-NIH Training Grant (5 D43 TW001271) to KMR, and data collection was supported by UNICEF, DFID, SIDA, USAID, CHNRI, and other donors.

11:00 am - 12:30 pm (Venue: Seminar Room)
Scientific Session 5: *Helicobacter pylori* Infection in Children

020 (002)

Helicobacter pylori Infection and Its Significance in North Indian Children

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Background: *Helicobacter pylori* infection, one of the most common bacterial infections in human, is thought to be acquired in childhood. However, its clinical significance in children in the absence of ulcer disease remains unclear. **Objective:** The association of *H. pylori* and its various genotypes with abdominal pain, severity of gastritis, and gastric epithelial cell apoptosis in children were investigated. **Methodology:** In total, 240 children—58 with upper abdominal pain (UAP) and 182 without UAP--were studied for *H. pylori* infection by rapid urease test, culture, ureA PCR, and histopathology. *H. pylori* strains from infected children were analyzed for vacA genotypes and cagA by PCR. Biopsies from children infected with cagA-positive, single typeable vacA strain were evaluated for severity of gastritis by histopathology and gastric epithelial cell apoptosis by terminal uridine deoxynucleotidyl nick end labelling. **Results:** The overall prevalence of *H. pylori* infection in children was 34.2% (82/240)--in the UAP group 53.4% (31/58) and in the non-UAP group 28% (51/182), and the difference between the groups was significant ($p<0.001$). Sixty-seven (82%) children were infected with a single strain and 15 (18%) with more than one strain. Seventeen (21%) strains were untypeable either for signal or mid-region sequence. Among the single typeable strains, the most common vacA genotype was s1a/m2 (n=21), followed by s1a/m1 (n=17) and s2m2 (n=14). Seventy-five (91.5%) strains were cagA-positive. s1a/m1 genotype was strongly linked to UAP (odds ratio=5.04). Higher proportions of children infected with s1a/m1 and s1a/m2 vacA genotypes had more severe chronic inflammation than s2/m2 genotype (s1a/m1 vs s2/m2, $p=0.05$; s1a/m2 vs s2/m2, $p=0.01$). s1a allele was independently associated with more severe inflammation than s2 ($p=0.02$). Gastric epithelial cell apoptosis was significantly higher in children infected with s1a/m1 and s1a/m2 strains than s2/m2 ($p<0.0001$). **Conclusion:** *H. pylori* infection was strongly associated with UAP in children, and s1a/m1 vacA genotype played an important role in this disorder. vacA genotypes with s1a allele have a higher pathogenic potential. A high prevalence of cagA in *H. pylori* strains, including s2/m2 vacA genotype, was totally different from the West and calls for a detailed study of Cag pathogenicity island. **Acknowledgements:** The study was supported by Science and Technology, Government of Uttar Pradesh, India, through grant no. CST/D-2465.

021 (016)

Evaluation of Non-invasive Methods for the Diagnosis of *Helicobacter pylori* Infection in Symptomatic Children

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Background: Several invasive and non-invasive tests are available to detect *Helicobacter pylori* infection. An ideal test for *H. pylori* is non-invasive or minimally invasive, highly accurate, inexpensive, and readily available, and enables differentiation between active or past infection with the organism. **Objective:** The aim of the study was to evaluate the accuracy of 4 non-invasive tests for *H. pylori* infection in children. **Methodology:** Four non-invasive methods used included: a commercial ELISA test to determine specific IgA and IgG antibodies against *H. pylori* (Serion GmbH), ^{13}C urea breath test, and HP stool antigen test--HpSA (Premier Platinum HpSA, Meridian Diagnostics). Thirty-one patients (19 female, 12 male, aged 7-18 years) with symptoms and signs indicating possible *H. pylori* infection were assessed and compared with upper endoscopy (EGDS), histology, and culture results. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated for each diagnostic test. **Results:** Accuracy data, calculated from data of patients (sensitivity, specificity, positive predictive value, and negative predictive value respectively), were as follows: *H. pylori*-specific IgA 36%, 96%, 90%, and 61%; *H. pylori*-specific IgG 84%, 81%, 81%, and 84%; HpSA 63%, 88%, 85%, and 69%; and ^{13}C urea breath test 91%, 83%, 86%, and 89%. Results of classic discriminative analysis (descending diagnostic value) were the combination of ^{13}C urea breath test and HpSA testing (87.8%) and ^{13}C urea breath test and serology (87.2%). The combination of all the 4 tests was 85.7%, the combination of HP-specific IgA and IgG was 83.4%, and the combination of HP-specific IgA and IgG and HpSA was 80.0%. Among the non-invasive methods evaluated, the ^{13}C urea breath test was the best choice for detection of *H. pylori* infection. The accuracy of IgA and IgG testing and HpSA testing was lower. The same was applied to the combination of all four tests. **Conclusion:** In this study, the serological tests (specific IgG and IgA against *H. pylori*) and HpSA testing had a fair diagnostic value, which does not suffice for screening, making these 3 tests of secondary importance. Among all the tests evaluated, the value of ^{13}C urea breath test was the greatest. It also demonstrated a greater diagnostic value as an individual test, when compared with the combination of IgA and IgG testing or with the combination of serological tests and HpSA testing. Due to its high diagnostic value, ^{13}C urea breath test is considered to be the single most important screening test before EGDS for children with symptoms and signs, indicating possible *H. pylori* infection. The combination of all the four tests and the combination of ^{13}C urea breath test and HpSA testing or ^{13}C urea breath test and serology (IgA and IgG) can also be useful. According to these conclusions, it is possible to reduce the quantity of invasive tests performed, since they are unpleasant and unfavourable for children.

022 (047)

Is Endoscopic Nodular Antritis a Sign for *Helicobacter pylori* Infection in Children?

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Background: Endoscopic nodular antritis in children is described to have a high correlation with *Helicobater pylori* infection. **Objective:** The study was carried out to investigate the accuracy of using antral nodularity as a marker for *H. pylori* infection in children. **Methodology:** This prospective study included 468 children in whom upper digestive endoscopy was performed for gastrointestinal symptoms between 6 June 2003 and 14 October 2005, and gastric antral mucosal biopsy was taken. Sixty-seven children were diagnosed as having endoscopic nodular antritis and were included in the study. Nodular antritis was defined as antral gastritis with endoscopic findings characterized by a miliary pattern and prominent lymphoid follicles in biopsy specimens. Demographics, clinical characteristics, endoscopic features, and pathologic features were recorded. *H. pylori* were recognized in gastric biopsy on H&E sections; a modified Giemsa stain was performed in biopsy suspicious for *H. pylori*. The results were expressed as number and percentage or mean±SE. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated. Comparisons of quantitative measurements were also performed with Student's *t* test. Informed parental written consent was obtained prior to participation in the study. **Results:** The prevalence of nodular antritis in children was 14.3% (67 of 468) and consisted of 31 (46.3%) of 67 males and 36 (53.7%) of 67 females. Age of children ranged from 3 to 18 years (mean age 9.2±0.4 years). The prevalence of nodular antritis increased gradually with age. Twenty-six (38.8%) of the 67 children with endoscopic nodular antritis had recurrent abdominal pain. *H. pylori* infection was identified in 68 (14.5%) of the 468 children. Endoscopic nodular antritis had a poor accuracy rate to determine *H. pylori* infection (sensitivity-40.3%; positive predictive value-39.7%) and was observed in 27 (39.7%)of the 68 *H. pylori*-positive patients and in 40 (10%) of 400 *H. pylori*-negative patients. **Conclusion:** Endoscopic nodular antritis is a poor predictor for H. pylori infection in children. During endoscopy, gastric biopsies should always be obtained in children to establish the presence of *H. pylori* infection. The prevalence of *H. pylori* infection in the present study was 14.5%, which reflects that *H. pylori* infection is a common health problem in India.

023 (079)

Helicobacter pylori Infection in Recurrent Abdominal Pain: A Sri Lankan Experience

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Background: Recurrent abdominal pain is a common problem in Sri Lanka affecting nearly 10% of school children. The aetiology of this condition remains unclear. Investigations on the role of *Helicobacter pylori* infection in recurrent abdominal pain have given conflicting results. Previous studies on *H. pylori* have found a low prevalence of infection among Sri Lankan children. **Objective:** The study was carried out to determine a

possible association between *H. pylori* infection and childhood recurrent abdominal pain. **Methodology:** A randomly-selected group of school children identified as having recurrent abdominal pain during an epidemiological study in the Gampaha district, Sri Lanka, was investigated for *H. pylori* infection using a microwell-based ELISA (FemtoLab *H. pylori*; Connex GmbH, Germany) that detect *H. pylori* antigens in stools. Stool samples were collected in clean containers and stored at -200C until analysis. Recurrent abdominal pain was defined according to Apley criteria. A group of school children from same district was recruited as controls. **Results:** Thirty-nine children with recurrent abdominal pain [16 (41%) males, age 5-15 years (mean age 7.9 years, SD±3 years)] and 20 healthy controls [10 (50%) males, age 5-15 years (mean age 9 years, SD±2.7 years)] were recruited in the study. *H. pylori* stool antigen test was positive in 2 (5.1%) children with recurrent abdominal pain compared to one (5%) child in the control group ($p>0.05$). **Conclusion:** *H. pylori* infection does not appear to be associated with recurrent abdominal pain in Sri Lankan school children. **Acknowledgements:** The study was funnded by the University of Kelaniya, Sri Lanka.

024 (109)

Serum Ferritin, Haemoglobin, Soluble Transferrin Receptor, and *Helicobacter pylori* Infection in Peri-urban Community Children in Bangladesh

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Background: Both iron deficiency anaemia and *Helicobacter pylori* infection are common in developing countries. Also *H. pylori* is strongly associated with chronic gastritis and peptic ulcer disease, which leads to atrophy of the parietal cell of stomach and finally decreased gastric acid output, which is a well-known risk factor for anaemia. Few studies suggested a link between *H. pylori* infection and iron-deficiency anaemia in adults. **Objective:** The aim of the study was to investigate the association between *H. pylori* infection and iron status in asymptomatic children of periurban community. **Methodology:** The study was conducted in Nandipara near Dhaka city. In a double-blind placebo-controlled field trial, status of *H. pylori* infection was determined in 1,036 children aged 2-5 years by ^{13}C-urea breath tests (UBT). The haemoglobin (Hb) level was quantified by the cyanmethemoglobin method; serum ferritin and soluble transferrin receptor (sTfR) were assessed by enzyme-linked immunosorbent assay (Ramco, Houston). Informed consents were obtained from parents or legal guardian of children. The tests were done on admission and on Day 30 and Day 90. **Results:** Of the 1,036 children, 74% were infected with *H. pylori*, as determined by positive UBT. Compared to non-infected children, serum ferritin and the Hb levels were significantly lower in *H. pylori*-infected children (mean±SD, 10.6±1.5 vs 10.3±1.2, g/dL for Hb, $p=0.01$; 23.1±20.2 vs 19.1±16.1, ng/mL for serum ferritin, $p=0.003$). There was, however, no difference in sTfR between the infected and the non-infected children (mean±SD; 8.8±4.4 vs 8.6±4.8 respectively, micro g/m, $p=0.28$). The prevalence of iron deficiency (serum ferritin <12 ng/mL) and iron-deficiency anaemia (Hb <11.0 g/dL plus serum ferritin <12.0 ng/mL or sTfR >8.5 micro g/mL) in *H. pylori*-infected children was significantly higher than in noninfected children (52% vs 61%, $p=0.007$, odds ratio=1.45, 95% cinfidence interval 1.90-1.93). The difference in prevalence also existed when iron deficiency was defined by serum ferritin <12 ng/mL or sTfR >8.5 micro g/mL. **Conclusion**: The significantly lower serum ferritin and Hb levels and the higher prevalence of iron deficiency and iron-deficiency anaemia indicate an association between *H. pylori* infection and

iron deficiency or iron-deficiency anaemia in peri-urban community children in Bangladesh. **Acknowledgements:** The financial support of the National Institutes of Health, Maryland, USA, is acknowledged.

025 (140)

Phenotypic and Genotypic Characterization of *Campylobacter* Strains Isolated in Bangladesh

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Background: *Campylobacter jejuni* is a leading cause of gastroenteritis in both developed and developing countries and leads to significant morbidity and mortality. **Objective:** The main purpose of the study was to characterize *Campylobacter* strains isolated in Bangladesh by different phenotypic and genotypic methods and to determine the prevalence of different pathogenic genes among those isolates. **Methodology:** Fifty-eight *Campylobacter* strains were isolated from 300 stool specimens collected from 2% of surveillance system patients attending the Dhaka hospital of ICDDR,B: Centre for Health and Population Research, from July to December 2002. These 58 strains were identified as *Campylobacter* species using the standard microbiological and biochemical methods. These strains were selected for extensive characterization at both phenotypic and genotypic levels using different techniques, including biochemical characterization, antibiogram, plasmid profiling, PCR, and pulsed-field gel electrophoresis (PFGE). **Results:** Of the 58 strains, 40 were identified as *C. jejuni* by hippurate hydrolysis test. However, by species-specific PCR, 39 were identified as *C. jejuni*, and 5 were identified as *Campylobacter coli*. Antibiotic susceptibility test of *C. jejuni* strains revealed that 27 strains (67.5%), 15 strains (37.5%), and 13 strains (32.5%) were resistant to sulphamethoxazole-trimethoprim, ciprofloxacin, and nalidixic acid respectively, and 4 (10%) strains were resistant to ampicillin and tetracycline. On the other hand, all *C. coli* strains were resistant to sulphamethoxazole-trimethoprim, and 3 (60%) strains were resistant to tetracycline and ciprofloxacin. No *C. jejuni* or *C. coli* isolates were resistant to erythromycin. The major pathogenic genes, namely cdtA, cdtB, ciaB, and virB11, were analyzed in *C. jejuni* and *C. coli* by PCR. Most *C. jejuni* contained both cdtA (92.5%) and cdtB (97.5%) genes. cdtA was absent from all *C. coli* strains, whereas cdtB gene was detected in 2 (40%) strains. Thirty-six (90%) of the *C. jejuni* strains contained the ciaB gene, whereas 2 (40%) *C. coli* strains contained the ciaB gene. No *virB11* was detected in either *C. jejuni* or *C. coli* strains. PFGE analysis revealed that heterogeneous clones were disseminated among *C. jejuni*. **Conclusion:** Overall, it appeared that a significant burden of *C. jejuni* prevails in Bangladesh, and a variety of clones were found. This is the first report of the prevalence of pathogenic genes and clonality of *C. jejuni* isolated in Bangladesh. **Acknowledgements:** The study was funded in part by the Bill and Melinda Gates-Government of Bangladesh Fund of the ICDDR,B.

11:00 am - 12:30 pm (Venue: CSD Conference Room)
Scientific Session 6: Facility-based Management of Severe Malnutrition

026 (206)

Low-cost Intervention Not Enough to Reduce Case Fatality in Hospitalized Severely-malnourished Children in Uganda

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Background: Despite poor quality of healthcare having been documented as a major cause of early deaths among hospitalized severely-malnourished children, little has been done to provide information on quality-improvement interventions to reduce early deaths in resource-constrained settings of Africa. The study was set out to map causes of early deaths and implement simple low-cost actions to reduce mortality among children admitted with severe malnutrition. **Objective:** The study was carried out to assess the risk factors of early deaths among hospitalized severely-malnourished children aged less than 5 years and to determine the effects of simple agreed interventions on mortality among children admitted with severe malnutrition. **Methodology:** This intervention study was conducted in 3 phases--baseline, intervention, and post-intervention--between 2002 and 2005 in the paediatric wards of Mulago Hospital, Uganda. In total, 450 severely-malnourished children, aged less than 5 years (weight-for-height <-3 z-score or oedema)--220 before and 230 after the intervention--were enrolled consecutively and followed till outcome. Demographics, health characteristics, blood and urine specimens were collected at admission for biochemical, haematological, microbiological, serological and immunological indices, and daily records on patient management were checked. The key intervention was communication to change behaviour of early transfusion and fluid infusion through meetings, workshops, posters, and job-aids posted in wards. Data were analyzed using EPI Info version 6 and SPSS Version 11.5. **Results:** There was a reduction in the transfusion and infusion rate (27% to 9% and from 32% to 15% respectively), Deaths associated with transfusion and infusion were reduced (24% to 4% and from 26% to 9% respectively). There were significant differences in the pre- (adjusted odds ration [OR]=3.5, confidence interval [CI] 1.76-6.9, $p<0.001$and OR=3.1, CI 1.57-5.96, p=0.001 respectively) and the post-interventions (adjusted OR=0.20 CI 0.36-1.16, p=0.072 and OR=1.64 CI 0.64-4.20, p=0.30 respectively), but the overall case fatality did not change. **Conclusion:** Simple behavioural change interventions may reduce early hospital deaths among children admitted with severe malnutrition but do not reduce case fatality.

027 (058)

Protocolized Management of Children with Severe Malnutrition: Lessons Learnt from A Tertiary-level Government Hospital

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Background: Despite high rate of malnutrition rate among children in Bangladesh, limited facilities are available to treat children with severe malnutrition. Strengthening the capacity of the government health facilities is crucial to address such a widespread problem at the local and national levels. **Objective:** The study was conducted to test the feasibility of implementing protocolized management of children with severe malnutrition in a tertiary government hospital and to measure the efficacy of the protocol on clinical outcome. **Methodology:** Save the Children UK conducted a 2-year project in collaboration with Dhaka Medical College Hospital (DMCH). Six of 40 paediatric beds of DMCH were dedicated for this project. All concerned doctors and nurses were trained on the adopted version of the WHO protocol, and one nutritionist was deployed by SCUK to facilitate the implementation process. A DMCH cook was also trained on preparing special diet for the treatment of severe malnutrition. **Results:** In total, 177 children, aged less than 5 years, with either weight-for-height <70% or bi-pedal oedema were admitted and were treated following an adopted version of the WHO protocol. On admission, 41% of the children had oedematous malnutrition, and the mean weight-for-height percentage of children without oedema was 64.5±8.16. Fifty-nine percent of the children had associated complications, of whom 31% had pneumonia, followed by 24% septicaemia. The overall mortality rate was 15% with 85% in children aged less than 2 years, and 71% of deaths occurred within 4 days of admission. The recovery rate was 37%; 31% took DORB (Discharge on Risk Bond), and 14% were absconded. The mean rate of weight gain in marasmic and kwasiorkor children was 14.0±8.0 and 13.0±8.0 respectively. Cost of food and other logistics, excluding manpower were Tk 30 per patient per day, which is equivalent to government allocation to per patient. The major challenges faced by the project were: lack of separate nutrition unit and as such crisis of ownership, frequent staff turn-over, and lack of proper accountability and monitoring mechanism. **Conclusion**: Although the overall clinical outcome did not achieve the internationally-set standard, other long-term benefits, such as improved capacity of health service providers, and the teaching value of this project claims continuation of this type of initiative. Considering cost-effectiveness, the Government should encourage more piloting of this type of projects and incorporate protocolized management in the treatment of malnutrition in all government health facilities in phases. **Acknowledgements:** The support of the Pediatric Department of the Dhaka Medical College Hospital is acknowledged.

028 (030)

Outcome of Hospital Management of Severely-malnourished Children Aged Less Than 5 Years: Comparison of WHO Protocol and Locally-adapted ICMH Protocol

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Background: The WHO protocol for the management of severe malnutrition at hospitals has limitations for its graded feeding and dependence on difficulty to avail of vitamin-mineral mix (CMV). Whereas, the Institute of Child and Mother Health (ICMH) protocol is locally adapted and easy to follow where 2-hourly feeds were made up with whole cow's milk, sugar, and soya oil to provide 100 kcal in 100 mL/kg.day. Micronutrient deficiency was corrected by locally-available minerals and vitamins orally instead of CMV, but no comparative evaluation between these protocols is yet available. **Objective:** The study was carried out to compare the effectiveness of ICMH protocol with WHO protocol for the management of severely-malnourished children. **Methodology:** A quasi-experimental clinical trial was conducted in 2 hospitals with 60 age- and sex-matched severely-malnourished children--30 in each treatment arm. Children at the Ad-din Hospital (group I) were managed according to the WHO protocol, and those at ICMH (group II) were managed according to the ICMH protocol. Child's weight and height/supine length were recorded on admission, and clinical data, such as appetite, weight, oedema, etc., were collected daily. Comparison was made in terms of weight gain, hospital stay, and mortality. **Results:** The mean ages of the children were 18.33±13.76 months and 17.9±14.17 months in group I and group II respectively. Two-thirds of them were marasmic in both the groups. The mean weight gain in the 2 groups was 11.18±4.09 and 11.06 ±3.92 g/kg.day respectively. There was no difference in weight gain by type of malnutrition and age-category in any group. Time taken for oedema to subside (7.3±2.3 days vs 8±1.8 days) and improvement of appetite (6.5 to 7.3 days vs 6.7 to 8.4 d days) were similar. The mean duration of gaining target weight was 28.32±11.48 days and 27.92±6.18 days in the 2 groups respectively. The mortality rate was 6.7% in each group. **Conclusion:** A similar outcome in the management of severe malnutrition can be achieved following the simpler and easier ICMH protocol with cheaper and easily-available items. So, the ICMH protocol may be used in all hospitals, including primary referral centres, such as Upazilla Health Complex of Bangladesh for case management of severe malnutrition.

029 (130)

Outcome of Standardized Case Management of Children, Aged Less Than 5 Years, with Severe Protein-energy Malnutrition in Selected Hospitals of Dhaka City

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Background: To improve overall treatment outcome of severe protein-energy malnutriton (PEM) in children, some hospitals in Bangladesh have introduced standardized protocol suggested by the World Health Organization (WHO). However, the outcome of this intervention has not been evaluated. **Objective:** The study was conducted

to find out recovery, defaulter, transfer and death rates of children with severe PEM treated in the selected hospitals of Dhaka city. **Methodology:** This retrospective and descriptive study was carried out at the Department of Nutrition and Biochemistry of the National Institute of Preventive and Social Medicine, Dhaka, during June 2002-May 2003. Treatment records of children with severe PEM were reviewed for 388 patients in Dhaka Shishu Hospital (DSH), Ad-din Hospital, and Institute of Child and Mother Health (ICMH). All the 3 hospitals introduced the WHO standardized manual after partial modification locally. Data were collected using a checklist based on the WHO standard manual, and statistical analysis was done using SPSS for Windows software (version 10.5). **Results:** Marasmus cases topped the distribution (61.1%), followed by kwashiorkor (24.7%) and marasmic kwashiorkor (14.2%). Recovery, defaulter, death and transfer rates were 62.4%, 21.4%, 13.7%, and 2.6% respectively. Death rates varied across facilities (DSH-16.7%, Ad-din-10.7%, and ICMH-13.9%) apparently but not statistically ($p>0.05$). However, mortality rates in all the hospitals were in poor level. The mean±SD length of hospital stay (days) in the Ad-din Hospital (21.4±11.3) was significantly ($p<0.05$) longer compared to other two hospitals (DSH: 11.5±6.2 and ICMH: 8.9±5.7). The mean±SD daily weight gain (g/kg.day) was significantly ($p<0.05$) better among children treated at the Ad-din Hospital (10.9±9.2) than among children treated at the DSH (6.8±6.4) and ICMH (11.7±12.1). Outcome may be attributed to associated conditions of patients on admission and also to adherence to the management protocol. The study revealed also that patients' records remained incomplete in all the hospitals which missed important information. Faulty case-management practices, viz. over-use of intravenous fluids and blood transfusion, inappropriate diets and antibiotics, less use of micronutrients, etc. were evident. **Conclusion:** These hospitals showed poor performance in controlling mortality rate among the children with severe PEM according to the WHO criteria and should review their respective clinical management procedures and performances and should adhere more to the WHO protocolized guidelines. **Acknowledgements:** The support of the authorities of DSH, Ad-din Hospital, and ICMH is acknowledged.

030 (068)

Malnutrition and the Immune Response

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Background: The malnourished child is more susceptible to infection. It is well-recognized that this increased susceptibility is secondary to being immunocompromised. **Objective:** The objective of this comprehensive review is to demonstrate the impact of malnutrition on the immune system. It will also review the impact of nutritional rehabilitation on the immune response. **Methodology:** A complete review of the literature involving the impact of malnutrition on the immune system is reported in this review, in addition to the authors' own original research. **Results:** Malnutrition has a significant impact on the cellular immune response, including a decrease in delayed cutaneous hypersensitivity, depressed T cell numbers, decreased blast cell transformation to mitogenic stimulation, and decreased cytokine production. All of these deficits are rapidly reversed with nutritional repair. Although immunoglobulin levels are elevated in malnourished children as a result of repeated infections, malnourished children have depressed antibody responses to certain antigens in addition to a depressed secretory IgA response. These deficits recover with nutritional repair. While polymorphonuclear leukocyte function is relatively intact, malnourished children have depressed serum complement levels and depressed haemolytic complement activity. In addition, up to 30% of malnourished children have detectable anti-complimentary activity, i.e. a substance in their serum which activates the compliment system. Subsequently, it was demonstrated that up to 50% of malnourished children had circulating endotoxin. With nutritional repair, the

complement deficits are reversed as circulating endotoxin disappears. **Conclusion:** The malnourished child has depressed cellular immunity, humoral immunity, and complement activity. All of these deficits are reversed with nutritional repair. **Acknowledgements:** The financial support of the NIH Grant no. 11044 is acknowledged.

031 (117)

Day-care Management of Severe Malnutrition in Children in an Urban Clinic in Dhaka, Bangladesh

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Background: Childhood malnutrition still remains a clinical problem throughout the developing world and is associated with 54% of deaths among children aged less than 5 years. There was a 47% reduction in child mortality after the implementation of a standardized management protocol at the Dhaka hospital of ICDDR,B. Evaluation of the standardized protocol became necessary at small district hospitals or day-care clinics. An institutional care at day-care clinics with antibiotics, micronutrients, and feeding could be an effective alternative to hospitalization. **Objective:** The study was conducted to test a management protocol for severely-malnourished children on a day-care basis, when hospitalization is not possible. **Methodology:** Severely-malnourished children aged 6-23 months were enrolled at the Radda clinic after refusal of admission. During acute phase, children stayed at the clinic from 8:00 am to 5:00 pm daily receiving milk-suji, which was also provided in a hot pot for night hours. Antibiotics, vitamin A, multivitamin, folic acid, zinc, potassium, and magnesium were given daily. Children were shifted to the day-care nutrition rehabilitation unit (NRU) after becoming free from acute illness where they received 4 meals daily. After discharge, they were followed up fortnightly for 6 months. **Results:** In total, 264 children were enrolled during February 2001-May 2003. Of these children, 56% were infants, 51% male, 68% breastfed. 78% were marasmic, 21% marasmic kwashiorkor, and 1% kwashiorkor. Thirteen percent of the children had malnutrition alone, 35% had pneumonia with malnutrition, 35% had diarrhoea with malnutrition, and 17% had pneumonia, diarrhoea, and malnutrition. The duration of clinic stay during acute and NRU phases was 8 and 15 days respectively. Oedematous children became oedema-free in 7 days. Children gained weight (g/kg.d) more rapidly during the acute phase (9 ± 6) than NRU phase (6 ± 5). The daily calorie intake gradually increased from 80- 160 kcal/kg with 1-4 g/kg protein during acute phase, which further increased to 170-220 kcal/kg and 4-5 g/kg protein during the NRU phase. 216 (82%) children were successfully managed, 31 (12%) did not comply, and 17 (6%) referred to hospitals. One (0.4%) child died during the NRU phase, and 4 (1.5%) died after discharge. **Conclusion:** Severely-malnourished children can be successfully managed on a day-care basis at established day-care clinics, provided adequately-trained and motivated staff and facilities are available at the clinic. **Acknowledgements:** The study was funded by the World Bank (NCOE): October 2000-December 2001 and Government of Bangladesh Match Fund: January 2002- May 2003.

1:30 pm - 2:00 pm (Venue: Sasakawa Auditorium)
Plenary 2: Gut Flora and Malnutrition

032 (211)

Any Role for Intestinal Bacterial Community in Malnutrition?

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Thirty years ago, protein deficiency was perceived to be the major nutritional problem of children in developing countries. This idea was later challenged when it became clear that protein requirements were over-estimated and that protein deficiency was almost always associated with an insufficient energy intake. The term 'protein malnutrition' was then replaced, by 'energy-protein malnutrition'. Increasing the energy intake of young children during the complementary feeding period then became a priority. In addition to the deficit in food intake, other medical and environmental factors may also contribute to malnutrition. Thus, protein and energy deficit is often associated with a deficit in minerals and vitamins; in addition, an imbalance between the nutrients is also common. Early studies on the pathophysiology of malnutrition are now turned into strategic and practical consequences for the prevention and treatment of severe malnutrition. Recently, major inputs were proposed at different levels: (a) At the global level, based on clinical trial results, well-defined preventive and curative interventions are identified for a large series of identified causes of death, with economic and strategic consequences; (b) At the regional level, Community Therapeutic Care (CTC) aims at treating the majority of severely-malnourished children at home, build local capacity to better manage care of acutely-malnourished children, and address repeated cycles of relief and recovery. It greatly benefited from the development of ready-to-use therapeutic food (RUTF); (c) At the village or family level, the use of linear programming is an efficient method to address practical questions like: (a) Is it possible to design a diet suitable for complementary feeding period using locally-available foods? and (b) If this is possible, what is the minimum budget needed for designing a diet, covering the nutritional requirements of at least 97% of children? To further improve the quality of life of malnourished children, it may be time to add new pathophysiological input. So far, the intestine bacteria community has essentially been regarded as a source of infection. Nowadays, it may be appropriate to consider it as an ecosystem that can also play a positive role in the protection against infection and a nutrition partner. New methods are emerging, which can study the bacterial community in stools of children living at home. They open new possibilities of clinical research to evaluate the functional role of colonic bacteria.

2:10 pm - 3:40 pm (Venue: Sasakawa Auditorium)
Scientific Session 7: Aetiology of Diarrhoeal Diseases

033 (136)

Diarrhoeal Illness in a Cohort of 0-2-year Old Children in Rural Bangladesh: Microbiology

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Background: Acute diarrhoea is one of the leading causes of morbidity and mortality in children in most developing areas of the world. It is important to establish the causative agents of diarrhoea across different settings and populations. Recent advances in microbiological techniques have greatly increased the rate of isolation of enteric pathogens, including newer ones. Enhanced laboratory capacity, coupled with its application in the context of a longitudinal study, permits a more complete picture of the epidemiology of diarrhoea. **Objective:** The study was conducted to determine aetiology-specific incidence of diarrhoea, and the pathogenicity of infectious agents, in a community-based birth cohort of 252 newborns till 24 months of age in rural Bangladesh. **Methodology:** Stool specimens or rectal swabs were collected for diarrhoeal episodes recorded during 1993-1996 and on a routine monthly basis through twice-a-week household surveillance by the female community health workers. Diarrhoeal samples were compared with non-diarrhoeal samples to calculate isolation rates and pathogenicity of diarrhoeal agents. **Results**: In total, 1,750 diarrhoeal specimens and 5,679 non-diarrhoeal specimens were tested. An infectious agent was identified in 58% of the diarrhoeal and 21.6% of the non-diarrhoeal specimens. The most commonly-isolated organisms from all specimens were enterotoxigenic *Escherichia coli* (ETEC), enteroadherent *E. coli*, *Shigella*, *Campylobacter jejuni*, *Giardia*, and rotavirus. ETEC (ST and LT-ST toxin types, but not LT-only toxin), enterotoxigenic *Bacteroides fragilis*, *Shigella*, and rotavirus were associated more often with disease than with asymptomatic infections. Aetiology-specific infections were associated with acute episodes. Mixed infections were common. **Conclusion:** The enteropathogens isolated were essentially the same as those found in other tropical, rural settings. This study also identified *B. fragilis* as a pathogen. Regarding prevention, ongoing vaccine efforts focusing on *Shigella*, rotavirus, and ETEC would be useful in this population. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) is acknowledged.

034 (201)

Enterotoxigenic *Escherichia coli* is a Major Cause of Acute Watery Diarrhoea in Children in Bangladesh

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Background: Enterotoxigenic *Escherichia coli* (ETEC), a pathogen with multi-valent virulence attributes, is a common cause of diarrhoea among children in developing countries, including Bangladesh. It has been associated with malnutrition, growth retardation, and growth faltering, especially in children aged less than 3 years. **Objective:** Serious efforts are being made to monitor the prevalence of ETEC, emergence of new colonization factors, and virulence antigens and to study the protection afforded by natural ETEC infection so as to better understand the factors and interventions that will help prevent such infections. To achieve this, studies were carried out in a cohort of 321 children aged 0-2 year(s) to follow the infection/re-infection pattern and natural protection that is attained by prior exposure to ETEC. **Methodology:** The study was conducted in an urban field site in Mirpur, Dhaka, and children were followed during their first 2 years of life. Stools were monitored during diarrhoeal episodes and at regular monthly intervals to determine the prevalence of ETEC and other viral, parasitic and bacterial infections. Serum was collected to determine immune responses to heat-labile toxin and colonization factors (CFs) of ETEC. **Results:** The study showed that ETEC was the most common cause of diarrhoea in the cohort, peaking at 7 months of age with a first infection seen within 6 days of birth. Among the pathogens, ETEC was the most common (19.5%), followed by rotavirus (10%) and *Campylobacter jejuni* (2.5%). *Vibrio cholerae,* and *Shigella*-associated diarrhoea were detected at very low rates. In addition, by 2 years of age, about 48% of the infants were colonized with *Helicobacter pylori*, several within one month of age. Analyses showed that, by 2 years of age, a child could have up to 6 episodes of ETEC-associated diarrhoea. Diarrhoea with CFA/I or CS5+CS6 expressing ETEC protected against further episodes of diarrhoea from ETEC expressing the homologous CFs; CS6 and LT expressing ETEC did not provide such protection. **Conclusion:** The results of the study will help identify the immune responses that provide protection against disease and identify vaccination strategies for the development of a protective ETEC vaccine. **Acknowledgements:** The study was supported by Sida-SAREC funds.

035 (139)

Isolation and Characterization of *Shigella*-like Organisms Associated with Acute Diarrhoea in Bangladesh

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Background: Shigellosis is one of the major diarrhoeal diseases in Bangladesh and other developing countries. A significant number of strains (4%) were isolated between 2000 and 2004, which had characteristics typical of *Shigella* but could not be identified to the species level and were, therefore, designated as *Shigella*-like organisms. **Objective:** The main purpose of the study was to characterize non-agglutinating *Shigella*-like organisms using various phenotypic and genotypic techniques and to determine the clonal relationship with other serotypes of *Shigella* species. **Methodology:** Forty-three *Shigella*-like organisms (SLO) were isolated from diarrhoeal patients at ICDDR,B: Centre for Health and Population Research, Dhaka, between January 2000 and June 2004. Of these 43 strains, 8 were included in this study for extensive characterization both at phenotypic and genotypic levels using different techniques, including serotyping, antibiogram, biochemical characterization, plasmid profiling, and pulsed-field gel electrophoresis (PFGE). **Results:** All the 8 strains had biochemical characteristics typical of *Shigella* and of the species *Shigella dysenteriae*. All the strains harboured the 140-MDa invasive plasmid and had the ipaH gene, and the representative strains were positive for keratoconjunctivitis in the guinea pig eye, indicating that these are virulent strains possessing invasive ability. Antisera developed against the representative strains in rabbits did not agglutinate any of the existing and provisional serovars of *Shigella* species revealing that these strains did not belong to any of the recognized or provisional serovars and were serologically indistinguishable. All the strains were resistant to multiple antibiotics, such as ampicillin, tetracycline, and sulphamethoxazole-trimethoprim. None of these isolates was resistant to mecillinum, nalidixic acid, ceftriaxone, and ciprofloxacin. The plasmid profiles and PFGE analysis revealed that all the Bangladeshi isolates were clonal. **Conclusion:** The overall results of these isolates showed that these strains did not belong to any of the recognized or provisional serovars of *Shigella* species. So, these 8 strains isolated in Bangladesh should be included as a new provisional serotype of *S. dysenteriae* designated as KIVI-162. **Acknowledgements:** The study was funded in part by Bill and Melinda Gates-Government of Bangladesh Fund of ICDDR,B.

036 (005)

Prevalence, Pathogenesis, and Antibiotic Susceptibility Profiles of *Aeromonas* Isolates from Stool Samples of Patients in the Venda Region of South Africa: A Preliminary Report

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Background: During the past decade, mesophilic aeromonads have been frequently recognized as responsible for several diseases in both developed and developing countries. Previous studies in the Venda region have demonstrated that *Aeromonas* species were common. However, the identity and pathogenicity of these isolates

have not been characterized. **Objective:** This study determined the prevalence, the haemolytic and haemagglutination activities, and the antibiotic susceptibility profiles of *Aeromonas* species in the Venda region. **Methodology:** Stool samples were collected from patients visiting 3 health centres in the Venda region from December 2004 to May 2005. *Aeromonas* species were isolated and identified using the API 20E system. The beta-lactamase production and antibiotic susceptibility profiles of the isolates to 28 antibiotics were determined using the disc-diffusion method and analyzed according to the NCCLS guidelines. The haemolytic and haemagglutination activities of the isolates on human, sheep, pig and chicken red blood cells were determined using the plate and slide methods. **Results:** In total, 104 (33.66%) *Aeromonas* were isolated from 309 samples, of which 89 (85.6%) were *Aeromonas hydrophila,* 12 (11.5%) *A. sobria*, and 3 (2.9%) A. *caviae*. All the strains of *A. hydrophila* and *A. caviae* produced beta-haemolysis on sheep blood, while 8 of the 12 strains of *A. sobriae* were haemolytic on sheep blood. The haemolytic activities of the isolates were variable on other bloods. Twenty-five (28.1%) strains of *A. hydrophila*, 5 (41.7%) *A. sobri*, and 2 *A. caviae* were beta-lactamase producers. There was a high level of resistance to penicilllins with 100% resistance to penicillin G, amoxicillin, and ampicillin, followed by cefuroxime (79%), chloramphenicol (74%), and erythromycin (65%). The carbapenems were the most active with only 7% resistance to meropenem and 11% to imipenem, followed by ciprofloxacin (12%), amikacin (13%), and cefepime. **Conclusion:** The study has demonstrated multiple resistance to different antibiotics and high production of beta-lactamase by all the 3 species of *Aeromonas* characterized. Most isolates demonstrated pathogenic characteristics based on their haemolytic and haemagglutination ability. The genetic characterization of the isolates will further confirm their pathogenicity and the origin of multiple antibiotic resistance.

037 (170)

Post-diarrhoeal Corneal Blindness in Children of Bangladesh: Are We Doing Enough to Prevent It?

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Background: An estimated 42,000 children are blind in Bangladesh, and 32% of them are blind from preventable causes, such as vitamin A deficiency mostly following diarrhoea and measles. **Objective:** A prospective study was conducted in a tertiary-level eye hospital to document the role of diarrhoea in developing childhood blindness due to vitamin A deficiency and infection. **Methodology:** The study was conducted at the Departments of Pediatrics and Cornea of a tertiary eye hospital between June 2002 and May 2003. All patients aged 1-10 year(s) who presented with a recent (less than one month) bilateral central corneal opacity and a definite history of diarrhoea in the preceding month were included in the study. The trained paediatric and cornea specialists examined each patient. B-scan (ocular ultrasonogram) was done in all patients to evaluate the status of posterior segment to exclude cataract, vitrous opacity, retinal detachment, etc. **Results:** In total, 36 children, including 21 females and 15 males, were enrolled in the study. Following treatment in the hospital, 29 patients still had severely low vision due to bilateral thick central corneal opacity. Two patients improved significantly with appropriate treatment with vision better than 6/12, while 3 ended up with 6/18, and 2 others with 6/60. Eight of these children had cataract (3 bilateral). The history-taking revealed that 8 of the 36 patients received vitamin A capsules within 6 months of the diarrhoeal episode, while 3 had received vitamin A during or after the occurrence of diarrhoea. None had any eye examination before presenting to this study group, and none had received any medication for eye. The parents of these children knew how to rehydrate a diarrhoea patient but none of them was aware of the importance of eye care during and immediately after a diarrhoeal episode. **Conclusion:** There is a lack of awareness among primary care physicians and attendants of children suffering from diarrhoea regarding

the importance of adequate eye care to prevent serious ocular complications like blindness. Proper treatment and preventive measures can minimize the occurrence of ocular complications in children with diarrhoea. **Acknowledgements:** The support of Dr. Niaz Rahman of Bangladesh Eye Hospital who helped with B-scan of the study patients is acknowledged.

038 (126)

Diagnosing Infectious Diarrhoea from Flatus: Studies in Cholera and Rotavirus Infection among Bangladeshis

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Background: The microbiological diagnosis of infectious diarrhoea may take several days using the conventional techniques. Volatile organic compounds (VOCs) present in diarrhoeal stools may have characteristics specific to diarrhoeal aetiology. VOCs from faecal samples can be used for the rapid diagnosis of infectious diarrhoea in European patients (Gut 2004;53(1): 58-61). **Objective:** The study was carried out to investigate the VOCs emitted from stool samples from Bangladeshi patients with cholera and rotavirus infection. **Methodology:** Fresh stool samples were frozen at -20 ^{O}C until used. Later, stools were thawed and incubated at 37 ^{O}C in a headspace device for 3 hours. VOCs were pre-concentrated using solid phase micro-extraction fibres and were analyzed by gas chromatography and mass spectroscopy and in-house fabricated e-nose system in parallel analyses. Stool samples from 6 patients with cholera and 6 patients with rotavirus were studied. Data were compared with those from healthy controls from Bangladesh and the UK. **Results:** Gas emitted from cholera stool samples (6/6) contained a unique biomarker (*p-menth-1-en-8-ol*). Rotavirus stool samples contained a different biomarker (dodecane); the latter is related to the marker that has been reported in the Europeans with rotavirus, using a different GC protocol. Neither biomarker was found among the controls from Bangladesh. The e-nose system produced different patterns of responses from cholera, rotavirus, and control samples (both in Bangladesh and the UK). **Conclusion:** While cholera may be easily diagnosed, other forms of gastrointestinal infection often require laborious, expensive laboratory tests. Data presented here build on the collection of novel biomarkers that could underpin rapid, near-patient testing for the diagnosis of infectious diarrhoea. Such markers may be identified by a simple-to-use, inexpensive sensor-based device which would have the capability to diagnose a range of gastrointestinal disorders.

2:10 pm - 3:40 pm (Venue: Seminar Room)
Scientific Session 8: Infant and Young Child Feeding I

039 (054)

Responsive Complementary Feeding in Rural Bangladesh

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Background: It is now widely recognized that malnutrition can partly be attributed to caregiver-child interaction during feeding episodes. Current conceptual frameworks emphasize the importance of responsiveness (including active and social behaviour), psychomotor abilities of the child to self-feed, and a non-distracting feeding environment. **Objective:** This observational study had 3 main objectives: (a) to define operationally key terms, such as responsive and active feeding, and observe their frequency in a rural Bangladesh sample; (2) to examine whether self-feeding, responsive and active behaviours of the mother and child varied with child's age and amounts eaten; and (c) to determine the associations between mother and child behaviours. **Methodology**: Fifty-four mother-child pairs were observed during one feeding episode, and behaviours were coded for 5 categories, namely self-feeding, responsive, active, social and distracting behaviours. Children were aged between 8 and 24 months. The Ethical Review Committee of ICDDR,B approved the study. **Results:** The results indicated that the 5 behaviours could be observed and reliably coded. Two-thirds of the mothers had an active feeding style, but only a third were responsive; the 2 styles did not overlap. Child self-feeding was associated with more mouthfuls eaten, but there was no association between self-feeding and child age. Older children were more negatively responsive (refusing offered food). The positively responsive mothers tended to have active children who signaled their desire for food and who ate more mouthfuls. The positively active mothers adopted different strategies to encourage eating, such as verbally directing the child to eat and diverting the child's attention. These mothers tended to have children who were negatively responsive and refused food. **Conclusion:** The responsive feeding framework, once operationalized, has the potential to identify specific behaviours that support or impede mother-child interaction during complementary feeding. Responsive feeding and encouragement of age-appropriate self-feeding should be the main goals of nutrition interventions. A pilot study which evaluated a 4-session intervention with these aims showed that such feeding practices can be acquired by mothers and children. Compared to baseline measures, children who attended the group ate more mouthfuls, had fewer refusals and engaged in more self-feeding. Mothers also encouraged more self-feeding. **Acknowledgements:** The financial support of the Plan Bangladesh is acknowledged.

040 (081)

Breastfeeding Initiation and Determinants of Exclusive Breastfeeding in an Urban Population of Western Nepal

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Background: Breastfeeding practices have wide sociocultural connections and vary according to geographic regions. Published literature on breastfeeding initiation and exclusive breastfeeding is not available for urban population of western Nepal. **Objective**: The study was conducted to assess rates of breastfeeding initiation and exclusive breastfeeding within 2 months after delivery and to determine the factors influencing exclusive breastfeeding. **Methodology:** A cross-sectional survey was conducted in Pokhara municipality, western Nepal, during August-September 2005. Mothers, attending immunization clinics, who were having babies aged less than 2 months were included. Two trained health workers interviewed the mothers using a pretested semistructured questionnaire after obtaining consent. Exclusive breastfeeding was defined as mother reporting that nothing else but breastmilk was being given from birth till the time of the interview. Data were analyzed using the SPSS package. Descriptive statistics and univariate statistics were applied to compare the demographic factors of exclusive breastfeeding and non-exclusive breastfeeding groups. Univariate and logistic regression analyses were done to explore the factors influencing the decision of the mothers to exclusively breastfeed. **Results:** In total, 385 mothers were interviewed. The rates of initiation within one hour and within 24 hours were 72.7% and 84.4% respectively. Exclusive breastfeeding was practised by 82.3% of the mothers. Breastmilk/colostrum was given as first feed to 332 (86.2%) babies, but 17.2% of them were either given expressed breastmilk or were put to breast of other lactating mothers. Prelacteal feeds were given to 14% of the babies. The common prelacteal feeds given were formula feeds (6.2%), sugar water (5.9%), and cow's milk (2.8%). Complementary feeds were introduced by 12.7% of the mothers. By logistic regression analysis, friends' feeding practices, type of delivery, and baby's first feed were the factors influencing exclusive breastfeeding practice of the mothers. **Conclusion:** Despite the higher rates of initiation and exclusive breastfeeding, practices, such as prelacteal feeds and premature introduction of complementary feeds, are of great concern in this urban population. There is a need for promotion of good breastfeeding practices among expectant mothers and also the community, especially the family taking into the account the local traditions and customs. **Acknowledgements:** The authors are grateful to the staff of UNICEF and Pokhara Municipal Corporation for their cooperation during the study. The authors also thank all the mothers who willingly participated in the study. The authors also thank Ms Renu Rana Bhat for work in conducting and supervising the interviews during the data-collection period.

041 (160)

Surveillance Study on Breastfeeding and Complementary Feeding Situation and Nutritional Status of Mothers and Children in Bangladesh

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Background: Breastfeeding and complementary feeding are crucial for child health, growth and development. In Bangladesh, there are several nutrition-intervention programmes, including promotion of breastfeeding and, to some extent, complementary feeding in the government and non-government sectors. It is essential to know the status and, change over time, of infant feeding and nutritional status of children and mothers. **Objective:** The study was conducted (a) to find out the existing breastfeeding and complementary feeding practices nationwide, (b) to relate child and maternal nutrition with the breastfeeding practices, and (c) to relate child growth with breastfeeding. **Methodology:** It was a regular 6-monthly surveillance being carried out since July 1998 in nationally-representative samples from all divisions. In each round, mothers of about 3,000 children aged 0-2 year(s) were interviewed with a structured questionnaire, and length/height and weight of mothers and children were recorded. **Results:** The prevalence of prelacteal feeds declined from 73-88% in the initial rounds to 47-78% in the last few rounds. The exclusive breastfeeding rate at 0-3 month(s) improved from 58-63% to 69-82%. The highest exclusive breastfeeding rates at 5 and 6 months were in the 6th and 7th rounds; otherwise, it was maintained at 28-36% up to the 8th round. There was a decline of exclusive breastfeeding at the 9th and 10th rounds; thereafter the trend was upward, the latest rate being 33% and 26% respectively for 5 and 6 months. About one-third to half of the infants were given complementary feed before 6 months of age. The mean body mass index of mothers was 18.8 to 19.8 in the first 4 rounds, whereas it was 20.3 to 20.9 in the last 4 rounds. **Conclusion:** There was a gradual improvement in the indicators of optimum breastfeeding, but the rates are still far away from the acceptable range. Programmatic thrust should be given to reduce prelacteal feeds, increase exclusive breasfeeding rates, and improve complementary feeding status. **Acknowledgements:** The financial and technical support of the Bangladesh Breastfeeding Foundation and National Nutrition Programme is acknowledged.

042 (037)

Influence of Nutritional Status of Mothers on Children Aged Less Than 5 Years and Factors Affecting It in Rural Bangladesh

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Background: The prevalence of malnutrition in Bangladesh is among the highest in the world. In Bangladesh, 42% of mothers have chronic energy deficiency and 45% are ansemic, while about 50% of children aged less than 5 years are nutritionally vulnerable. **Objective:** The purpose of the study is to determine the effect of nutritional status of mothers on their children and to investigate the correlates of the nutritional status of children.

Methodology: Data for this study were derived from the Nutritional Surveillance Project (NSP) of Helen Keller International during January 2004-January 2006, conducted in 24 upazilas (sub-districts) of Bangladesh. In this study, Chittagong division (without Chittagong Hill Tracts) was selected. From each sub-district, 15 randomly-selected villages (clusters) were selected. From each selected cluster, 25 households (with at least one child aged less than 6 years.) were systematically selected for detailed interview. The study is based on 9,000 households obtained from four sub-district of Chittagong division. Data were analyzed in terms of both household characteristics and socioeconomic background of mothers. **Results:** The findings suggested that most mothers came from poor socioeconomic background. Chi-square analysis demonstrated that there was a strong association ($p<0.000$) between the nutritional status of mothers measured in terms of body mass index and the nutritional status of their children measured in terms of height-for-age. The wealth index calculated through principal component analysis demonstrated that there existed income inequality because nutritional status was worse among children who were from the hardcore poor. Results of logistic regression analysis showed that education of mothe's, household economic status, access to electricity, TV, and involvement of mothers in income-generating activities were the important determinants of nutritional status and consequently to their children in rural Bangladesh. The findings indicated that the prevalence of high malnutrition among children, aged less than 5 years, whose mothers were also malnourished. These malnourished mothers gave birth to malnourished children. **Conclusion:** The implication of the findings is that malnutrition is highly correlated with poverty. Within a community, poor children suffer from higher rates of malnutrition than better-off children do. Unless poverty of the hardcore poor is alleviated, there is a little prospect of improving the nutritional status of mothers and their children in Bangladesh. **Acknowledgements:** The authors gratefully acknowledge the Helen Keller International for using the NSP dataset for the study. The financial support of Bangladesh Women's Health Coalition is highly acknowledged.

043 (123)

Importance of Correctly-defined Nutritional Status

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Background: On admission at hospital, nutritional diagnosis is not always done. Studies have shown that there is an underestimate of diagnosed malnutrition in hopitals in developing countries. Since diagnosis based on anthropometry is time-consuming, the authors wanted to study if there was a significant link between the diagnoses at entry and the effectuated treatment. **Objective:** The study was conducted to evaluate the clinical impact of correct diagnosis of malnutrition in a tertiary hospital-setting in a developing country. **Methodology:** All children aged 1-60 month(s) admitted to the Pediatric Department, Maputo Central Hospital, Mozambique, during 16 January-15 February 2003 (n=984) were included in this prospective study. Each child was investigated, weighed, and measured (study data, [SD]) during the first 24 hours by one of the researchers. At discharge, hospital data (HD) from the file were recorded. The definitions of malnutrition used were: low weight-for-age: <-2 WAZ (severe: <-3 WAZ)/low height-for-age : <-2 HAZ (severe: <-3 HAZ)/low weight-for-height: <-2 WHZ (severe: <-3 WHZ); acute malnutrition: WHZ <-2 or oedema; moderate acute malnutrition: WHZ<-2 and ≥-3 without oedema; severe acute malnutrition: WHZ <-3 or oedema. All data were analyzed using the Epi Info 6 and SPSS. The Ethical Committee at the Central Hospital, Maputo, approved the stusy. **Results:** The malnourished children (SD) had a mean/median stay of 10.0/9.0 days if diagnosis of malnutrition (HD) was done compared to 5.0/4.0 days without diagnosis of malnutrition (HD). If the children where classified as malnourished

(HD), 57.1% got some kind of nutritional support and, if not, only 2.5% were given nutritional support. **Conclusion:** The length of stay in general was significantly higher in the presence of acute malnutrition (SD) but was even more dependent on the diagnosis (HD). The length of stay of malnourished children (SD) was twice longer if the diagnostic of malnutrition has been notified in the file (HD). The nutritional treatment is highly dependent on the right diagnosis.

044 (208)

Health and Nutritional Status of Young Children of Adolescent Mothers: Experience from a Diarrhoeal Disease Hospital in Bangladesh

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Background: Children of adolescent mothers are at increased risk of morbidity and deaths worldwide. Understanding of health and nutritional status of adolescent mothers and characteristics of their children attending healthcare facilities could be useful in considering the importance and type of preventive interventions. **Objective:** The study was conducted to assess the clinical and nutritional features and socioeconomic characteristics of first-birth order children, aged less than 5 years, of adolescent mothers attending the Dhaka hospital of ICDDR,B: Centre for Health and Population Research with diarrhoeal diseases. **Methodology:** For this case-control analysis, relevant information was extracted from the electronic database of the Dhaka hospital surveillance system of ICDDR,B and first birth-order children (n=380), aged 1-30 month(s), of both sex, of mothers aged ≤19 years, who attended the hospital during 1996-2001. These children constituted cases, and children (n=562, first-birth order) of same age (1-30 month[s]) of either sex born to mothers aged 25-29 years constituted controls. **Results:** A significantly higher proportion of children borne to adolescent mothers was stunted (41% vs 26%, p<0.001) and under-weight (49% vs 39%, p<0.001) than the control children. Fifteen percent were severely stunted, 20% were severely under-weight, 18% were wasted, and 3% were severely wasted. The cases tended to be more stunted than the controls (41% vs 26%, p<0.001). A higher proportion of cases (78% vs 58%, p<0.001) was infants, and the mothers of the cases were more likely to be illiterate than the controls (44% vs 28%, p<0.001). Clinical dehydration (some or severe) was more frequent among the cases (27% vs 17%, p<0.001), and a higher proportion of them required hospitalization for ≥48 hours (30% vs 19%, p<0.001). The cases had lesser (<US $83) monthly income than the controls (67%.vs 48%, p<0.001). Fewer cases had received high-potency vitamin A capsule in the preceding 6 months (45% vs 55%, p<0.001), ORS at home (91% vs 97%, p<0.001), and DPT immunization (59% vs 81%, p<0.001). Clinical pneumonia (abnormal lungs findings) was more frequent among the cases (6% vs 3%, p=0.005). In logistic regression, the first birth-order children borne to adolescent mothers were significantly associated with lack of DPT immunization, failure to use ORS at home, pneumonia, illiterate mothers, stunting, under-weight, and wasting, after controlling for covariates. **Conclusion:** Children of adolescent mothers are likely to be more malnourished, have lesser opportunities for immunization and vitamin A supplementation, and are more likely to suffer from infectious diseases, particularly pneumonia. Therefore, development of strategies to reduce marriage during adolescence, development of strategies for identification and curative and preventive health management of such children would be very important to reduce morbidities and improve health and nutrition. **Acknowledgements:** The study was funded by ICDDR,B: Centre for Health and Population Research and the United States Agency for International Development (USAID) collaborative agreement under HRN-A-00-96-90005-00.

2:10 pm - 3:40 pm (Venue: CSD Conference Room)
Scientific Session 9: Nutrition and Child Development

045 (084)

Effects of Psychosocial Stimulation on Growth and Development of Severely-malnourished Children in a Nutritional Rehabilitation Unit

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Background: Psychosocial stimulation during nutritional rehabilitation of severely-malnourished children improves their development; however, no such programme has been evaluated in Bangladesh. **Objective:** The objective was to establish a programme of psychosocial stimulation and parent education at the Nutritional Rehabilitation Unit (NRU) of the Dhaka hospital of ICDDR,B and determine its impact on the growth and development of children. **Methodology:** Severely-malnourished children (weight-for-age <50% or weight-for-length <70% or presence of oedema), aged 6-24 months, admitted to the NRU were enrolled. The first 45 children received nutritional supplements and routine hospital care (control group). The next 54 children and their mothers participating in an intervention of daily individual play sessions using home-made toys with trained play leaders and group sessions with mothers concerning child-rearing practices and toy-making, in addition to same nutrition supplements, constituted the study group. After discharge from the NRU when the nutritional status of the children improved to moderate malnutrition, follow-up visits (both in hospital and home) and play sessions were continued for another 6 months (total mean±SD visits 20.56±3.4). The children's nutritional status and development were assessed on enrollment to and discharge from the NRU and at 6-month follow-up. The children's development was assessed using the revised version of Bayley Scales of Infant Development, and their behaviour was rated on Wolke's five, 9-point scales. **Results:** Thirty-nine control and 33 study children (73% of the total sample) were available at 6-month follow-up. At enrollment and at discharge, both the groups had extremely low and similar developmental scores; however, their growth and development differed at final follow-up. In multiple regression analyses of the 6-month developmental outcomes controlling for age, initial scores, and socioeconomic variables that were significant in the initial bivariate analyses, the study intervention significantly correlated with mental (B±SE=7.5±1.6, $p<0.001$) and motor scores (3.3±1.3, $p=0.01$), weight-for-age (0.44±0.2, $p=0.02$), but not with length-for-age (0.4±0.2, $p=0.07$) or weight-for-length. **Conclusion:** Psychosocial stimulation improves mental and psychomotor development and growth of severely-malnourished children receiving nutritional rehabilitation. **Acknowledgements:** The financial support of Sida-SAREC in conducting the project is acknowledged.

046 (008)

Development of High-risk Newborns—A Follow-up Study from Birth to One Year

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Background: Survival of high-risk newborns is on the rise in Kerala subsequent to advanced perinatal care. Developmental delay is anticipated in these infants, and simplified screening methods will be helpful for rapid developmental assessment. **Objective:** The pattern of neuro-developmental outcome in high-risk newborns from birth to one year was evaluated with the Denver Development Screening Test (DDST) simultaneously with the Trivandrum Developmental Screening Chart (TDSC), a simplified method for rapid developmental assessment **Methodology:** This was a prospective follow-up study conducted in the neonatology unit and child development clinic of the Department of Pediatrics, Pushpagiri Medical College, Pushpagiri Institute of Medical Sciences and Research Centre, during April 2004-July 2005. Fifty-five high-risk newborns, defined by standard criteria, were followed up. Risk factors were categorized as prenatal, natal and postnatal. A scoring system was applied to classify these babies into mild, moderate and severe risk groups. They were periodically assessed till the age of one year for growth and development parameters. Growth was compared with 2000 CDC charts. For developmental assessment, DDST, and TDSC were applied. Amiel-Tison angles was assessed for muscle tone. Early intervention therapy was advised to all babies. Babies with developmental delay were grouped as mild, moderate, and severe. Statistical analysis was done using Kappa and chi-square tests. **Results:** Thirty-five babies had mild, 13 had moderate, and 7 had severe risk factors. In the mild-risk group, 83% came out normal, and 17% had mild delay. Of the moderate-risk group, 46% were normal, 38% had mild delay, 8% had moderate, and 8% had severe delay. Of the severe-risk group, 14% had moderate delay and 86% had severe delay. A highly significant association ($p<0.001$) was observed between the risk score and the severity of developmental delay. Kappa statistics revealed that TDSC and DDST were in excellent agreement (0.84) with each other. Babies who received early intervention therapy came out with minimum impairment. **Conclusion:** Babies with severe risk factors have worst neuro-developmental outcome. TDSC is equally good in detecting developmental delay compared to DDST and can be used as a rapid screening method by training paramedical staff.

047 (115)

Can Food and Micronutrient Supplementations during Pregnancy Influence Infants' Subsequent Development and Behaviour?—Findings from the MINIMat Trial in Bangladesh

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Background: Maternal under-nutrition and low birth-weight are highly prevalent in developing countries. Many countries have nutritional supplementation programmes during pregnancy to improve the situation. However, the

impact of prenatal supplementations on infants' developmental outcome has not been adequately studied. **Objective:** The study was conducted to determine the effect of early (8-10-week pregnancy) versus late (19-week pregnancy) food supplementation along with multiple micronutrients (UNICEF/WHO/UNU formulation, 15 micronutrients) or 30 mg iron+400 µg folate or 60 mg iron+400 µg folate during pregnancy on development of their infants. **Methodology:** A large randomized trial examined the effect of food and multiple-micronutrient supplementation to pregnant women on birth outcomes (n=5,000) in the Matlab field site of ICDDR,B. Development and behaviour of a sub-sample of infants (n=2,853) born to these women were assessed at 7 months of age using 2 problem-solving tests (PSTs: cover and support), Bayley motor-scale, and Wolke's behaviour ratings. Seventy-four percent of eligible infants were tested. Baseline characteristics of lost children were similar across the groups. Treatment effects were examined using intention-to-treat analyses with micronutrient interventions (3 levels) and food (2 levels) as factors. **Results:** There was no main effect of prenatal supplementations on the development of the infants. However, infants of thin mothers (body mass index [BMI] <18.5 kg/m^2 on enrollment) demonstrated significant benefits from early food supplementation on two PSTs and behaviour ratings, whereas those of other mothers did not. They had higher scores on the support (BMI x early food $p<0.03$) and cover (BMI x early food $p<0.05$) tests, were less fussy, more cooperative during tests, and vocalised more (BMI x early food $p<0.04$ for all) than children of similar mothers given late food supplementation. Significant benefits on motor development (BMI x micronutrients $p=0.05$) and activity (BMI x micronutrients $p<0.05$) were also observed among infants of thin mothers who received multipl- micronutrient supplements. BMI of mothers had an independent effect on children's development. **Conclusion:** Infants of thin mothers showed small but statistically significant benefits in child development from multiple micronutrient and early-food supplementations. The findings support the current practices of targeting thin mothers. However, the effect sizes were small, and their public-health importance is not clear. This can only be determined with longer follow-up. The relationship between BMI of mothers and children's development emphasizes the importance of maternal nutrition. **Acknowledgements:** The support of UNICEF, DFID, USAID, CHNRI, Sida, ICDDR,B, World Bank, and others is acknowledged.

048 (014)

Assessment of Iodine Deficiency Disorders in Purulia District, West Bengal, India

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Background: Iodine deficiency disorders (IDD) are major public-health problems in India, including West Bengal. Since 1992, the National IDD Control Programme has been in operation in all the states of India but the existing programme needs to be continuously monitored through recommended methods and indicators. **Objective:** The study was conducted to assess the prevalence of goitre and status of urinary iodine excretion (UIE) level and to estimate iodine content of salts at the household level in Purulia district, West Bengal, India. **Methodology:** A cross-sectional, school-based study was conducted in July 2005 among 2,400 school children aged 8-10 years. The World Health Organization (WH) recommends the school children of this age-group for IDD survey. Sample size was based on assumed goitre prevalence of 50%, 95% confidence interval (CI), a design effect of 3, and relative precision of 10%. The multi-stage '30 cluster' sampling methodology and indicators for assessment of IDD, as recommended by the joint WHO/UNICEF/ICCIDD consultation, were used for the study.

Goitre was assessed by the standard palpation technique, urinary iodine excretion was analyzed by the wet digestion method, and salt samples were tested by spot iodine testing kit. Investigators were trained to minimize observer-variation. **Results:** The total goitre rate (TGR) was 25.9% (95% Cl 24.1-27.1), with grade I and grade II (visible goitre) being 19.5% and 6.4% respectively. The goitre prevalence did not differ by sex, but a significant difference was observed in respect of age. The median urinary iodine excretion level was 9.25 mcg/dL (normal >10 mcg/dL), and 31.6% of the children had value less than 5 mcg/dL. Only 33.4% (801/2400) of the salt samples tested had adequate iodine content of >15 ppm, and 36.6% salt samples had no iodine. **Conclusion:** The high goitre prevalence (25.9%) and median urinary iodine (9.25 mcg/dL) below the optimum level (>10 mcg/dL) indicate existence of current iodine deficiency in Purulia district. The district is still in the iodine-deficient state. Moreover, the salt iodization level far below the recommended goal (>90%) highlights IDD as major public-health problems in the district. Intensified information, education and communication activities, along with sustained monitoring, are urgently required. **Acknowledgements:** The authors gratefully acknowledge the financial and other support provided by the UNICEF, Kolkata.

049 (053)

Effectiveness of a Low-tech Approach to the Management of Feeding Difficulties in Children with Cerebral Palsy in Bangladesh

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Background: The majority of children with cerebral palsy have feeding difficulties, resulting in chronic malnutrition and respiratory disease, reducing quality of life for caregiver and child, and causing early child mortality. In well-resource countries, high- and low-tech medical interventions, ranging from gastrostomy tube-feeding to parent training, are available. In Bangladesh, the former is not viable, and the latter is scarce, and its effectiveness is not fully evaluated. **Objective:** The study was conducted to evaluate a training programme for caregivers of children with cerebral palsy in terms of its impact on the effectiveness of mothers' feeding practices, as defined by the level of nutritional intake, risk of aspiration, and distress caused to the child during feeding. **Methodology:** A prospective intervention study is being conducted in the Child Development and Neurology Unit of Dhaka Shishu Hospital (April 2005-May 2006). Thirty-eight caregivers and their children with cerebral palsy, who complied with the inclusion criteria underwent a home baseline assessment (caregiver interviews, feeding observations, and anthropometric measurement) and received initial advice on feeding methods and nutrition. This was followed either by 6 fortnightly group-training sessions (set 1) or non-intervention (set 2). The participants were reviewed twice following this period to evaluate caregiver compliance and changes to the child's overall health, nutritional status, ability to eat, and distress caused to the child and caregiver during feeding. The set-2 participants will shortly be enrolled in groups and re-assessed again post-training. The study was approved by the Ethical Review Committees of the Institute of Child Health, London and the Institute of Child Health, Dhaka. **Results:** Initial follow-ups of the first set of children (n=16) showed caregiver compliance scores of 48-76%, high caregiver satisfaction levels, and improvements in most areas assessed. The preliminary results from the second set (n=24) showed compliance scores averaging only 35% with lower satisfaction scores and levels of improvement observed. **Conclusion:** An intervention programme involving an individual assessment of need, followed by the attendance at a series of group-training sessions, can be effective in improving the feeding practices of caregivers of children with cerebral palsy in Bangladesh, thereby facilitating improved child health and development, and the well-being of child and caregiver during mealtimes. **Acknowledgements:** The financial assistance of CityCell is acknowledged.

050 (104)

Does Quality of Psychosocial Stimulation at Home Predict Rural Bangladeshi Children's Development and Behaviour?

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Background: Psychosocial stimulation at home is known to affect children's development. **Objective:** The aim of the study was to examine if the quality of psychosocial stimulation at 18 months of age predicted children's development and behaviour. **Methodology:** The project was part of a large study of nutritional supplementation of over 3,000 pregnant women in rural Bangladesh. A sub-sample of 789 children at 18 months of age was examined. The children's language comprehension and expression were assessed by mothers' report; their mental (MDI) and psychomotor (PDI) development indices were assessed with the Bayley scales; and their behaviour during the test, including response to examiner, activity, emotional tone, cooperation, and vocalization, was rated on Wolke's scale. Home observation for measurement of environment (HOME) was used for assessing the quality of psychosocial stimulation at home. Six sub-scales, i.e. Organization of physical and temporal environment (OP), Stimulation (St), Maternal involvement (Mi), Play materials (Pm), Punishment (Pun), and Emotional and Verbal Responsivity (EVR), were used. Their socioeconomic status was also recorded. **Results:** Bivariate correlations were conducted to see if any of the developmental outcomes correlated with the total HOME scale, its sub-scales, or any of socioeconomic status. The OP and Pm sub-scales significantly correlated with all the outcomes, while Mi correlated with all, except approach and activity, and St significantly correlated with all, except approach, emotional tone, and cooperation. The EVR sub-scale significantly correlated with language measures only, whereas Pun did not correlate with any of the outcomes. The total HOME significantly correlated with all the developmental outcomes. Multiple regressions were then conducted to determine if the total HOME scale predicted development after controlling for the socioeconomic status variables that significantly correlated with the developmental outcomes. The HOME significantly predicted MDI ($B \pm SE = 0.4 \pm 0.1$, $p<0.001$), PDI (0.4 ± 0.1, $p=0.006$) activity (0.02 ± 0.01, $p=0.03$), and language comprehension (0.5 ± 0.06, $p<0.001$) and expression (0.02 ± 0.003, $p<0.001$). **Conclusion:** Although the homes were all in poor villages, the quality of psychosocial stimulation was a predictor of children's language, mental and psychomotor development, and activity. Programmes aimed at improving the quality of psychosocial stimulation at home have been effective in similar populations and should be encouraged. **Acknowledgements:** The financial support of UNICEF and DFID in conducting the project is acknowledged.

4:15 pm - 4:35 pm (Venue: Sasakawa Auditorium)
Guest Lecture 1: Probiotics in Health

051 (221)

Importance of Commensal Bacteria in Gut Immunology—The Role of Probiotics

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The intestine is the largest lymphoid organ in the body by virtue of lymphocytic numbers and quantity of immunoglobulin produced. Interactions of resident intestinal microbes with the luminal contents and mucosal surface play important roles in normal intestinal development. To maintain homeostasis in the extensive and vulnerable mucosae in adults, they are protected by specialized anti-inflammatory immune defenses, such as the formation and export of secretory IgA (SIgA) antibodies and induction of tolerance against innocuous soluble substances and commensal bacteria. The neonates, however, especially the premature, who possess a highly-immunoreactive intestinal submucosa underlying a single layer of epithelial cells, are continuously exposed to the luminal environment. Understanding the interactions of the intestinal ecosystem with host and luminal nutritional environment, especially in regard to human milk and probiotics, has major implications for the pathogenesis of diseases that affect not only the intestine but also distal organs, such as the lung and brain.

4:15 pm - 4:35 pm (Venue: Seminar Room)
Guest Lecture 2: The Need for Effective Nutrition Programmes

052 (220)

Nutrition Programmes: Way Forward for Developing Countries

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Malnutrition remains a pervasive problem in both developing and developed countries despite adequate economic and skilled human resources. Developing countries are worse affected as they have a double-burden of malnutrition. On the one hand, there are high levels of intrauterine growth retardation, low birth-weight, protein-energy malnutrition, and other deficiency disorders. On the other hand, there is increasing obesity, type 2 diabetes, cardiovascular diseases, and cancers. Optimizing nutritional status in a country would promote health, prevent and cure diseases, provide economic gains through increased productivity, and help achieve the Millennium Development Goals. Such benefits are only possible through the implementation of an evidence-based nutrition programme. This presentation aims at drawing up a roadmap for nutrition programmes in developing countries on the basis of the new nutrition paradigm comprising deficiency disorders, obesity, and diet-related chronic disease. The presentation draws on personal experience of nutrition research, clinical work, programme activities in Bangladesh, and international initiatives over the past two decades. Discussions with various experts also added important insights. After the institution of a number of piece-meal programmes nationally and internationally, the first comprehensive global initiative for nutrition began with the World Declaration at the International Conference on Nutrition (ICN) in Rome in 1992. This consensus statement was reached after a 3-year consultation at country, regional and international levels and signed by policy-makers of 158 countries. Today, when the annual global deaths of 6 million children, aged less than 5 years, are associated with malnutrition, 35 million people will die of diet-related chronic disease, and 80% of these deaths will be in low- and middle-income countries. The 9 themes from the World Declaration on Nutrition address both deficiency disorders and diet-related chronic disease and, therefore, remain the gold standard of nutrition programmes for all nations. These 9 themes are:

1. Incorporating nutritional objectives, considerations, and components into development policies and programmes
2. Improving household food security
3. Protecting consumers through food quality and safety
4. Control, management, and prevention of infections and infectious diseases
5. Promoting, protecting, and supporting breastfeeding and complementary feeding
6. Caring for the socioeconomically-deprived and nutritionally-vulnerable populations
7. Preventing and controlling micronutrient deficiencies
8. Promoting appropriate diets and healthy lifestyles
9. Assessing, analyzing, and monitoring nutrition situations

While developing a national nutrition programme, countries should adapt these themes to their own needs, base the programme on a life-cycle approach and, in the process, and never feel that such a comprehensive programme is in anyway over-ambitious.

4:15 pm - 4:35 pm (Venue: Seminar Room)
Guest Lecture 3: Essential Care of the Newborn

053 (227)

Demystifying Newborn Care among Health Service Providers

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To achieve the Millennium Development Goal for child survival (MDG-4), neonatal deaths need to be prevented through evidence-based, cost-effective and low-tech interventions (Neonatal survival. Lancet 2005) by health service providers at all levels. In Bangladesh, of all neonatal deaths, one-fifth die due to birth asphyxia, two-fifths die for premature birth or low birth-weight, and 45% die from possible serious infections which include acute respiratory infection (ARI) and diarrhoea (Bangladesh Demographic and Health Survey 2004). Neonatal mortality has remained at plateau, accounting for 60% of infant deaths in the last 5 years (59-41/1,000 livebirths). Until recently, there have been little real efforts to tackle the specific health problems of the newborns systematically; it does not mean just inclusion of a new programme, it rather means adapting the efforts of maternal and child programmes to scale up services in seamless continuum of care (World Health Report 2005). However, neonatal health is no longer going unnoticed in Bangladesh as the Health, Nutrition and Population Sector Programme 2003-2006 of the Government, professional bodies (Bangladesh Medical Association, Bangladesh Pharmaceutical Society, Obstetrical and Gynaecological Society of Bangladesh, Bangladesh Neonatal Forum), development partners (Save the Children US--Bangladesh, United Nations Children's Fund, World Health Organization, non-govermental organizations), and donors (Gates Foundation, United States Agency for International Development, Department for International Development, Welcome Trust) have planned to address the issue through collaborative technical and financial efforts. Awareness about newborn health at policy level has improved; training on newborn health and health-education materials are now available for widespread use; and newborn health programmes are linked to ongoing programmes, such as Integrated Management of Childhood Illness, skilled birth attendant, reproductive health, and NGO Service Delivery Program (Saving Newborn Lives Program Evaluation, 2004). Essential newborn care includes clean cord-cutting, dry and wrap the baby just after birth, exclusive breastfeeding, and delayed bathing. To ensure essential newborn care, inputs should include: (a) Orientation for the service providers from pre-service to in-service curricula; (b) Updated knowledge and practices of simple techniques instead of high-tech by the service providers, Kangaroo Mother Care (KMC) to prevent hypothermia in preterm/low-birth-weight babies, mouth-to-mouth resuscitation to manage birth asphyxia, injectable antibiotics for neonatal sepsis at the facility and household levels; and (c) Special attention to manage the sick newborn in the case of failure of referral from house to hospital or next level. Increased awareness of newborn danger signs among mothers, family members, and service providers need a nationwide strategic planning which remains a challenge.

DAY 2: Tuesday, 7 February 2006

9:00 am - 9:30 am (Venue: Sasakawa Auditorium)
Plenary 3: Diarrhoeal Diseases and Malnutrition in the Child-survival Agenda

054 (225)

Challenge of Diarrhoeal Diseases and Malnutrition in the Global Child-survival Agenda

Zulfiqar A. Bhutta (bhutta@akunet.org)

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Abstract not received

9:35 am - 12:30 pm (Venue: PHSD Conference Room)
Rotavirus Vaccine Symposium

9:35 am - 9:55 am

055 (231)

Assessing Rotavirus Disease Burden—The Asian Rotavirus Surveillance Network

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The first meeting of the Asian Rotavirus Surveillance Network (ARSN) in early 1999 anticipated the imminent arrival of RotaShield in the region. The World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), Program of Appropriate Technology (PATH) and Industry supported the initiative, the philosophy of which was to provide decision-makers with up-to-date reliable local disease-burden data and to develop rotavirus experts and advocates among local opinion leaders. RotaShield's withdrawal as a result of its association with intussusception did not substantially affect the initiative as a number of other vaccine candidates were soon to become available once safety had been confirmed. The first phase on the Asian Network included 36 centres in 9 countries submitting data from late 2000. Data collection followed a generic WHO protocol assessing hospital-based admissions for diarrhoea and the proportion due to rotavirus. Serotype data were also collected from most countries and economic burden data from some countries. From 2003, the second phase of the ARSN started with support of the Rotavirus Vaccine Program and the addition of a further 10 countries. Main Sresults of the first phase of the ARSN were published in 2005.

09:55 am - 10:15 am

056 (247)

Rotavirus Vaccine Trials in Bangladesh: Past, Present, and Future

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Background: A safe and effective rotavirus vaccine is urgently needed to reduce the enormous disease burden associated with illness due to rotavirus. Tetravalent rhesus-human reassortant rotavirus vaccine (RRV-TV) was associated with intussusception following introduction in the United States, leading to accelerated development of alternative vaccine candidates with a strong recommendation to study in parallel the safety and efficacy in developed and developing countries. Two new candidate vaccines have recently been shown to be highly effective and safe and have potential for the prevention of rotavirus-associated morbidity and mortality. **Objective:** The presentation describes completed, ongoing and planned rotavirus vaccine studies in Bangladesh. **Methodology:** The first rotavirus vaccine study in Bangladesh was conducted with RRV-TV among infants in Matlab during

1998-1999. Safety, reactogenicity and immunogenicity studies with oral live human rotavirus (HRV) vaccine (RIX4414) among toddlers and infants with "all in one formulation" (vaccine and buffer in the same vial) were completed in urban Dhaka during 2002-2004. Another immunogenicity study among infants is ongoing with "commercial formulation" of HRV (vaccine and buffer in separate vials). The design of a proposed efficacy trial at Matlab surveillance area is also being presented. **Results:** The RRV-TV vaccine was safe and highly immunogenic. The human rotavirus vaccine (RIX4414) was safe and well-tolerated in toddlers and infants. The solicited symptoms were generally mild and of short duration. The immunogenicity of the vaccine with "all in one formulation" was low. This formulation is no longer developed. The results of immunogenicity study with "commercial formulation" are being analyzed. There were no cases of intussusception. **Conclusion:** While the RRV-TV vaccine was safe and inmmunogenic within Bangladesh setting, its withdrawal by U.S. has impacted negatively the possible use of the vaccine in developing countries. Currently, only the HRV vaccine (RIX4414) is studied for safety and immunogenicity. Field effectiveness trials are needed to confirm the reported efficacy and safety elsewhere of the two new vaccine candidates. Effective vaccines are highly desirable in developing countries where the public-health disease burden is most devastating. **Acknowledgements:** The studies were supported by the USAID, NVPO, PATH, WHO, and GSK.

10:15 am - 10:35 am

057 (232)

Enhanced Framework for Diarrhoeal Disease Control

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Diarrhoeal disease remains the second leading killer of children aged less than 5 years and is responsible for approximately 2 million deaths each year. Rotavirus vaccines, zinc supplementation, and low-osmolarity oral rehydration solution (ORS) represent a new generation of interventions in the effort to reduce the burden of diarrhoeal disease. However, qualitative research surveys indicate that healthcare providers and decision-makers in developing countries are generally unaware of these new interventions and their potential for greatly reducing diarrhoeal morbidity and mortality. Accelerated introduction requires a knowledgeable public-health community. The PATH's Rotavirus Vaccine Program has developed an innovative, comprehensive approach to raising awareness of and stimulating demand for these new interventions among healthcare providers and decision-makers. This approach should result in an accelerated uptake of rotavirus vaccines and more efficient use of limited resources. The presentation outlines this unique approach, the evidence supporting its establishment, and details of model programmes underway in several countries, and an overall description of PATH's Rotavirus Vaccine Program.

11:00 am - 11:20 am

058 (233)

Development of a Bovine-human Reassortant Vaccine (Rotateq)

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Bacakground: Rotavirus gastroenteritis is a leading cause of illness and death among children worldwide and is potentially preventable by vaccination. Reassortant human X animal rotavirus strains are one pathway for development of rotavirus vaccine candidates. **Methodology:** In a blinded manner, at least 60,000 healthy infants aged 6-32 weeks were studied. These infants were randomly assigned (1:1, V:P) to receive at 4-to-10-week intervals 3 oral doses of live-pentavalent human-bovine (WC3 strain) reassortant rotavirus vaccine containing human strain VP7 for G1, G2, G3, G4, and P[8], or placebo. Active surveillance was used for identifying subjects with intussusception and other adverse events and rotavirus-associated gastroenteritis-related illness, and healthcare use. Safety and immunogenicity were also studied for other childhood vaccines given concomitantly. **Results:** Of 69,274 infants randomly assigned, 34,035 in the vaccine group and 34,003 in the placebo group, were monitored for intussusception and other serious adverse events. Eleven cases of intussusception (6 in the vaccine group and 5 in the placebo group, RR=1.6; 95% CI 0.4-6.4) occurred within 42 days after any dose and 27 cases (12 in vaccinees and 15 in placebo recipients) occurred within one year after the first dose. The vaccine reduced hospitalizations and visits to emergency department relating to rotavirus serotype G1, G2, G3, or G4-associated gastroenteritis and occurring 14 or more days after completion of the 3-dose series for up to 2 years by 94.5% (95% CI 91.2-96.6). In the sub-study, involving 2,834 subjects in the vaccine group and 2,839 subjects in the placebo group, efficacy against any G1, G2, G3, or G4 rotavirus-associated gastroenteritis occurring at least 14 days after the third dose through the first full rotavirus season after vaccination was 74.0% (95% CI 66.8-79.9); efficacy against severe gastroenteritis was 98.0% (95% CI 88.3-100). The vaccine reduced clinic visits for G1, G2, G3, or G4 rotavirus-associated gastroenteritis by 86.0% (95% CI 73.9-92.5) and visit to emergency department/hospitalizations by 96% (95% CI 88.5-100). Seroresponses to antigens that are markers for responses to concomitantly-administered vaccines were non-inferior for all vaccines studied, except for the response to pertactin, for which vaccinees had lower GMTs than did placebo recipients ($p<0.05$). **Conclusion:** The pentavalent rotavirus vaccine was efficacious in preventing rotavirus-associated gastroenteritis; it decreased the incidence of severe disease and the use of healthcare resources. The risk of intussusception was similar in vaccine and placebo recipients.

11:20 am - 11:40 am

059 (234)

A Monovalent Human Rotavirus Vaccine for the Developing World

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Rotavirus is the most common cause of severe gastroenteritis in children, accounting for an estimated 600,000 deaths worldwide in children aged less than 5 years. Those particularly affected are children of the developing world with the number of diarrhoea episodes estimated at around 1.4 billion per year, of which up to 21% are due to rotavirus. As a result of this high burden of disease, the World Health Organization has highlighted the

development of an effective vaccine as a priority. In 2005, after an extensive clinical evaluation, GlaxoSmithKline launched a new live, attenuated oral rotavirus vaccine--RotarixTM. This vaccine contains the G1P8 human rotavirus strain and is administered according to a 2-dose schedule completed no later than the age of 6 months. Clinical studies performed worldwide in 26 countries, including developing and developed countries, involved over 100,000 subjects and showed the vaccine to be effective and well-tolerated with a safety profile similar to placebo in terms of incidence of solicited symptoms, including fever, diarrhoea, or vomiting. Furthermore, safety with respect to intussusception showed no differences between placebo and vaccine recipients. The vaccine was highly immunogenic in previously-uninfected infants in terms of anti-rotavirus IgA antibody seroconversion rate and vaccine intake (70-100%). In these clinical studies, the human rotavirus vaccine was co-administered with routine childhood vaccines against DTPa**,** hepatitis B, and *Haemophilus influenzae* type b, the afforded protection being maintained for all vaccines. Co-administration studies have also shown that RotarixTM may be effectively co-administered with either the oral or inactivated polio vaccines, allowing simple integration into existing vaccination schedules. Vaccine efficacy showed that more than 85% of infants were protected against severe rotavirus disease following immunization, reaching 100% against the most severe dehydrating episodes. In settings where multiple rotavirus serotypes were circulating, the vaccine was also effective with 91% protection against emerging G9 serotypes and 86% protection against the G3 serotype. These studies have been conducted as an integral part of a wider ongoing programme not only examining vaccine efficacy and safety but also epidemiology to support vaccination as the most cost-effective intervention to reduce the burden of disease caused by rotavirus.

11:40 am - 12:00 pm

060 (235)

Alternative Rotavirus Vaccine Candidates

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It is exciting that 2 effective rotavirus vaccines will soon be licensed in several countries. However, the experience with rhesus-human reassortant vaccine (RotaShield) and intussusception suggests that other candidates should also be developed, in case either or both are withdrawn for any reason. It is unclear at present whether these two imminent vaccines will be affordable for developing countries which bear the greatest burden of disease due to rotavirus. Other candidates are being developed. They include another variation on animal-human reassortants, attenuated human rotavirus strains, and a lamb rotavirus vaccine licensed in China. NIH has developed a hexavalent bovine (UK)-human reassortant vacine soon to enter clinical trials. It has the standard G specificity for serotypes 1,2,3, and 4, plus G8 and G9 specificity to cover recently-emerging serotypes. Two doses given at 0-4 week(s) and 4-8 weeks avoid administration when the natural intussusception risk is the highest. A unique monovalent human G3 strain (RV3) isolated from asymptomatic newborns, who were protected against subsequent disease, has been prepared as a vaccine and tested in Phase II clinical trials in Australia. Titre has been increased to improve immunogenicity, and further trials will soon commence. Two naturally-occurring bovine-human reassortant rotavirus vaccine candidates have been prepared as pilot lots for clinical trials in India. They were also isolated from asymptomatic neonates. A monovalent G10 lamb rotavirus vaccine is licensed in China, but information about efficacy and safety is awaited. It is of considerable technical and ethical interest that RRV-TV (RotaShield) has now been licensed to another company and may be introduced in settings where mortality due to rotavirus is high. The stated objective for the NIH candidate, for RV3, and for the Indian neonatal candidates, is provision of a low-cost, effective and safe vaccine, accessible to all children. It is hoped that pricing of vaccines imminently available, and/or success with one of the alternatives, will ensure that this goal is soon reached.

12:00 noon - 12:20 pm

061 (236)

Rotavirus Vaccines—The Challenges Which Remain

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Due to high global mortality and burden of disease of rotavirus infection, the World Health Organization (WHO) has prioritized rotavirus vaccines for children in developing countries for the past 20 years. Previous consultative WHO meetings in February 1997 and February 2000 prioritized rotavirus vaccine research and development and recommended that rotavirus vaccine development should address pertinent questions for their safety, efficacy, and effectiveness in infants in developing countries. In particular, the WHO recommended the evaluation of the rotavirus vaccine candidates within the EPI schedule and concomitant administration with OPV. In addition, the WHO recommended the evaluation of the vaccines in Africa and Asia, where the vaccines were least tested, but arguably most needed. Despite these recommendations, data only on the interaction of one of the candidates with OPV are available, and neither candidate has been evaluated in efficacy trials in Africa and Asia. In Africa and Asia, where the global burden of rotavirus mortality is the highest, the WHO has coordinated the clinical evaluation of the human rotavirus vaccine candidate in a series of trials considering issues, such as the reactogenicity and immunogenicity of the vaccine, the interaction with OPV, the influence of maternal antibody at the young age, and the dose regimen for infants in these settings. A safety trial of the vaccine in HIV-infected infants is ongoing, as is a Phase III efficacy trial in South Africa. After the setback of RotaShield® with intussusception, the new rotavirus vaccine candidates have had to consider proving a negative association with this rare clinical condition. Despite large-scale safety and efficacy studies conducted by the major international pharmaceutical companies, it is likely that only post-marketing surveillance, once the vaccines are introduced, will resolve the issues satisfactorily. The WHO has recommended that post-marketing surveillance is needed in countries planning to introduce the vaccine into the national immunization schedule. Other challenges include the financing and supply of vaccine for the developing world. Past experience with other vaccines have shown prices are likely to drop, and supplies are likely to increase when the emerging vaccine manufacturers from developing countries are involved. There are several rotavirus vaccine candidates which are proposed to be developed with vaccine producers in Brazil, China, India, Indonesia, etc. Although most of these candidates have Phase II immunogenicity data, they are several years away from full clinical dossiers on their effectiveness and safety in infants in developing countries. Thus, in the short term, financing and supplies of the new rotavirus vaccines remain a problem for widespread use. Finally, challenges regarding the licensure and registration of rotavirus vaccines remain a problem for the international community and the Vaccine Fund, although this is likely to be resolved once the 2 new vaccines are licensed by the FDA or EMEA early this year. Thus, although 2 new rotavirus vaccines appear to be safe and efficacious in certain populations and several other candidates are under development, significant challenges remain for the use and implementation of a rotavirus vaccine in infants in developing countries where the need is the highest.

9:35 am - 10:35 am (Venue: Sasakawa Auditorium)
Scientific Session 10: Newborn Care

062 (179)

Newborn-care Practices in Rural Gaibandha, Bangladesh

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Background: Neonatal mortality in Bangladesh remains high, i.e. above 40 per 1,000 livebirths, accounting for 47% of all child deaths. A large proportion of births continues to occur at home in many parts of Bangladesh. Unhygienic and unsafe traditional birth-care practices may contribute to high neonatal mortality and morbidity in rural Bangladesh. **Objective:** The study was undertaken to describe newborn-care practices in a large rural population in Bangladesh. **Methodology:** The female interviewers conducted a newborn-care practice interview by visiting the homes of newborns within ~18 hours after birth in the context of an ongoing community-based trial evaluating the effect of newborn is vitamin A supplementation on early infant mortality. The interview obtained detailed information about the delivery, postnatal cord care, and newborn-care practices, including the placement of the newborn after birth, time to bathing, emollient use, breastmilk and other feedings, and subsequent wrapping, if any. This analysis is based on data from a consecutive series of 5,637 enrolled newborns from February 2004 to February 2005. **Results:** Over 95% of births took place at home, and a trained person attended only 6% of these births. A quarter of births took place outside the main home, in a specially-built 'birthing-room', kitchen, or animal shed. More than half of the newborns were placed onto the floor or other unhygienic surfaces (e.g. jute sack or pile of straw). About 15% of newborn babies had their cords cut with unhygienic tools, including old blades, knives, or bamboo slivers, and 8% had potentially harmful substances applied to their umbilicus after cord-cutting (e.g. cowdung, ash, or mustard oil). One-third were bathed or wiped after birth using cold water or cold, wet cloths, and for two-thirds had their vernix washed or wiped off. In 99% of births, mustard oil was rubbed onto the newborn's skin, and 92% of the newborns were wrapped in cloth after being washed and dried. **Conclusion:** Many known harmful traditional birth practices have improved significantly in parts of rural Bangladesh, including cord cutting with a new blade, and keeping newborns wrapped in the first days of life. However, certain potentially harmful practices remain prevalent. These harmful practices include: rubbing newborns with mustard oil or applying potentially dangerous substances to the raw umbilicus. Washing with cold water and removal of vernix from the newborns are also common, and these behaviours are known to increase the risk of infection and may lead to a higher risk of neonatal mortality. Identifying and understanding common birthing and newborn-care behaviours is a necessary first step to plan strategies to reinforce beneficial behaviours and minimize the use of potentially harmful practices adopted by families and/or untrained birth attendants who still deliver over 90% of babies in rural communities in Bangladesh. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and the Bill and Melinda Gates Foundation.

063 (209)

Use of Referral Services for Sick Newborns in a Community-based Intervention in Bangladesh

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Background: The Projahnmo Project in central Bangladesh is implementing an intervention aimed at reducing neonatal mortality through (a) provision of essential obstetric and newborn care, (b) identification and referral of sick newborns in the community, and (c) strengthening of neonatal care in health facilities. **Objective:** This paper describes the trends in compliance with referral by community health workers (CHWs) to Kumudini Hospital when the sick newborns were identified and referred to the hospital. **Methodology:** Data are presented from management information system (MIS), which includes records maintained by the Community Health Workers (CHWs), baseline and periodic household surveys, and qualitative research undertaken at baseline and during implementation to investigate the factors affecting compliance. **Results:** At baseline, 36% of newborns were reported to have been sick. Of these, 94% sought any kind of care. Of those who sought care, 30% did so from hospitals and qualified providers; Kumudini Hospital (the designated referral centre for the project) was used in 18% of cases. The first interim survey conducted after 9 months of implementation of the intervention showed that care-seeking from hospitals and qualified providers rose to 53%, and use of the Kumudini Hospital reached 42%. Corresponding MIS data showed a consistent increase in compliance with CHW referral; a compliance rate of 70% was observed in February 2004, increasing to 90% in July 2005. Incentives for notification of home births increased the likelihood that a CHW could reach the home within 24 hours of birth to facilitate referral if necessary. Training of doctors and nurses, improved supplies and equipment for newborn care, and availability of medicines were also factors influencing greater acceptance of the hospital. Of the sick newborns who appeared at the Outpatient Department (OPD), the proportion who had self-referred increased to 60% in June 2005 from 28% in April 2004. **Conclusion:** Data indicate that care-seeking and referral compliance for the sick newborns have improved in this low-resource community. Active surveillance for illness by the CHWs in the home and education of families on recognition of danger signs and counselling to seek immediate care for serious illness, along with improved linkages between community and hospital and enhanced capacity for care at hospital have contributed to improved care-seeking. **Acknowledgements:** The study was supported by the Wellcome Trust--Burroughs Wellcome Fund, UK, with additional support from the Department for International Development (DFID), UK, United States Agency for International Development (USAID), the Government of Bangladesh (IHP), and Save the Children-US through a grant from the Bill and Melinda Gates Foundation.

064 (041)

Serial Composition of Human Milk in Preterm and Term Mothers

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Background: Human milk is regarded as the best and complete nourishment for a neonate. It is not a uniform body fluid secretion of mammary gland that changes its composition. Complete evaluation of its composition from the region is lacking. **Objective:** The study evaluated the differences in concentration of macronutrients (fat, lactose, protein), minerals (sodium, potassium, calcium, phosphorus), and trace elements (copper, zinc, magnesium, lead) in preterm and term human milk at different intervals of lactation. **Methodology:** In total, 100 mothers were enrolled for the study and were divided into 3 groups on the basis of gestation, viz. group 1 (37-41 weeks), group 2 (33-36 weeks), and group 3 (<33 weeks). Fouteen cases had to be excluded from the study for various reasons. Eighty-six mothers who started breastfeeding or expressed breastmilk formed the study group. Five mL of breastmilk was collected on day 3, 7, 14, and 28 by manual expression and was analyzed. **Results:** Analysis of the results revealed a lower amount of fat and lactose (g/dL) in preterm milk compared to term milk ($p<0.01$). These were found to increase in amount with increasing postnatal age. The protein (g/dL) levels were significantly higher ($p<0.01$) in preterm (4.1 ± 0.52) than term (1.9 ± 0.69) milk. The sodium (mEq/L) levels were higher in preterm (26.1 ± 1.1) than term ($18.9+0.84$) milk ($p<0.01$). These were observed to decrease with incresing postnatal age. The potassium levels were not found to follow a specific pattern of increase or decrease. The calcium (mg/L) was higher in group 3 (242 ± 4.33) compared to term milk (215 ± 5.2).The phosphorus content followed a similar pattern. Copper and zinc showed an increasing trend with postnatal age in group 1. The difference in preterm and term group was significant. Traces of lead were found in 40% of breast-milk samples. Magnesium content did not show any specific trend. **Conclusion:** The composition of preterm and term milk is different and changes with postnatal age. This needs to be kept in mind during supplementation.

065 (113)

Effect of Counselling on Pregnancy Weight Gain, Birth-weight, and Breastfeeding in Urban Poor Women

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Background: Perception and food behaviour during pregnancy are related to under-nutrition during pregnancy and causal to low-birth-weight babies. It was hypothesized that nutrition counselling can improve weight of pregnant mothers leading to reduction in low birth-weight and better subsequent breastfeeding practice. **Objective:** The study was conducted to assess the effect of nutrition counselling on pregnancy weight gain, birth-weight, and practice of breastfeeding. **Methodology:** The study was conducted at the Maternal and Child Health Training Institute (MCHTI), Azimpur, Dhaka, Bangladesh, during January-October 2005. In total, 115 women with 5 months pregnancy coming from low socioeconomic status were randomly selected. The intervention group had 57 subjects, and the control group had 58 subjects. The control group received the routine advice and service from the MCHTI. The intervention group was given detailed nutrition education, and the control group was

observed only from 5 to 9 months during pregnancy. They were under intervention for 4 months before delivery, and after that, birth-weights were measured within 48 hours. After delivery, breastfeeding practice was observed for one month. The results were compared between the two groups using Student's *t*-test and chi-squired test. **Results:** At the baseline, both the groups were similar in nutrition and socioeconomic status. After nutrition intervention, the mean (± SD) body-weight gain was 4.72 kg (±0.98) in the intervention group and 2.98 kg (±0.89) in the control group ($p<0.001$). In the intervention group, the mean (±SD) birth-weight was 2.86 (±0.27) kg, while 2.42 (±0.35) kg was in the control group ($p<0.001$). In the intervention group, 10.5% of the babies had low birth-weight, while 48.3% had LBW in the control group ($p<0.001$). In the intervention group, 52.6% of mothers initiated breastfeeding within 30 minutes after birth compared to 25.9% in the control group ($p<0.001$). The prevalence of prelacteal feeding after birth was 38.6% and 67.2% in the intervention and control group respectively ($p<0.001$). The prevalence of exclusive breastfeeding among one-month-old infants (without any prelacteal feeds) was 64.9% and 37.9% in the intervention and control group respectively ($p<0.05$). **Conclusion:** Comprehensive nutrition education was effective for pregnancy weight gain, birth-weight, and practice of breastfeeding. This education should be scaled up for all maternity services in Bangladesh. **Acknowledgements:** The financial support of Bangladesh Feeding Foundation and the technical support of ICDDR,B are acknowledged.

9:35 am - 10:35 am (Venue: Seminar Room)
Scientific Session 11: Coeliac Disease among Children in Asia

066 (048)

Lymphocytic Gastritis and Childhood Coeliac Disease: Evidence of a Positive Relationship

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Background: Lymphocytic gastritis is a histological entity characterized by intense lymphocytic infiltration (>25 lymphocytes/100 epithelial cells) in the gastric surface and pit epithelium. Its cause has not been established, but an association with *Helicobacter pylori* infection or coeliac disease has been suggested. **Objective:** The study was carried out to evaluate the number of intraepithelial lymphocytes (IELs) in gastric mucosa of children with coeliac disease and to study the presence of *H. pylori* infection in these patients. **Methodology:** This prospective study included 164 children with coeliac disease diagnosed between 6 June 2003 and 14 October 2005 in whom gastric and duodenal biopsy was taken simultaneously. The children were diagnosed as cases of coeliac disease based on the modified ESPGHAN criteria and positive serology. The control consisted of 164 non-coeliac children matched for gender and age (within one year) without any gastric or duodenal ulcer in whom upper digestive endoscopy was performed. *H. pylori* were recognized in gastric biopsy on H&E sections; a modified Giemsa stain was performed in biopsy suspicious for *H. pylori*. The results were expressed as number and percentage or mean$\pm$SE. Comparisons of quantitative measurements between the groups were performed with Student's *t*-test. Informed parental written consent was obtained prior to participation in the study. The study was approved by the ethical committee of Post-graduate Institute of Medical Education & Research. **Results:** The mean age of children with coeliac disease (M:F::99:65) at presentation was 8.2$\pm$0.3 years, and the mean age of onset of symptoms was 3.6$\pm$0.9 years. The main presenting symptoms were diarrhoea in 134/164 (81.7%), anaemia in 128/164 (78%), and failure to thrive in 108/164 (65.8%). Lymphocytic gastritis was found in 69 (42.1%) coeliac patients. Positive cases had a mean of 43.9 IELs/100 surface epithelial cells compared to a mean of 13.4 in negative cases, and 7.8 in non-coeliac controls. Cases not showing lymphocytic gastritis did, however, show significantly increased gastric intraepithelial lymphocytes compared to non-coeliac controls ($p < 0.001$). Nine of 164 cases were positive for *H. pylori*, and 4 of 69 cases of lymphocytic gastritis were *H. pylori*-positive. **Conclusion:** Lymphocytic gastritis occurred in 42.1% of children with coeliac disease. Coeliac disease without lymphocytic gastritis also showed increased gastric intraepithelial lymphocytes. The other cause of lymphocytic gastritis may be *H. pylori* infection in children.

067 (045)

Coeliac Disease in the First-degree Child Relatives [1-15 Year(s)] of Affected Patients

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Background: Coeliac disease in families needs to be actively looked for. Its prevalence among relatives of affected patients in North India has not been evaluated. **Objective:** The study was conducted to assess the prevalence of coeliac disease in first-degree relatives [1-15 year(s)] of established cases. **Methodology:** The study was conducted at the Department of Pediatrics, Dayanand Medical College and Hospital, Ludhiana, Punjab, India, during April 2003-March 2005. Sixty-three first-degree relatives (1-15 years) of established coeliac cases who consented to participate in the study were enrolled. Anti-tissue transglutaminase (tTG) estimation was done as a screening test in all. Upper G1 endoscopy and distal duodenal biopsy were done in all tTG-positive and those tTG-negative cases who gave their consents. Data were tabulated, computed, and analyzed using Pearson's chi-square test, Z test, and Fisher's exact test. **Results:** The serum anti-tTG levels were positive (more than 8 units/mL) in 15 patients, borderline (5-8 units/mL) in one, and negative (<5 units/mL) in 47 cases. Thirteen (86.6%) patients with positive anti-tTG had histological evidence of coeliac disease. The patients with bordline tTG values did not show histological findings of coeliac disease. Four of the 47 tTG negative cases consented for duodenal biopsy, and one showed histological features of the disease. Thus, 14 (22.2%) of 63 cases were proven to have coeliac disease. There was no statistical difference among siblings and offsprings ($p>0.10$). Almost 70% of the study cases were aaged 5-15 years. There was no statistically significant difference in the prevalence of coeliac diseases between males and females. All the 4 major GIT symptoms (malabsorption, constipation, pain-abdomen, and distension-abdomen) were significantly associated with coeliac disease positively in the first-degree child relatives. Nutritional parameters (pallor, weight <80%, height <90%) had a significant ($p<0.01$) association. Histological categories were Marsh I in 2, Marsh II in 2, and Marsh III in 10 cases respectively. **Conclusion:** Coeliac disease is highly prevalent (22.2%) in first-degree relatives (1-15 year[s]) of established cases.

068 (065)

Ninety Percent of Coeliac Disease May be Being Missed

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Background: Data from the Avon Longitudinal Study of Parents and Children (ALSPAC) suggest that the prevalence of coeliac disease (CD) is 1%. Using tissue transglutaminase (TTG) and IgA endomysial antibodies (EMA), 54 of 5,470 children screened proved positive for coeliac dieseae. Within Avon, all small bowel biopsies for formal diagnosis of coeliac disease in children are carried out at Bristol Children's Hospital. **Objective:** The aim of the study was to identify children from ALSPAC (date of birth: 01.04.1991-31.12.1992 and Avon postcodes) who had been formally diagnosed to have coeliac disease. **Methodology:** Since 1990, data have been prospectively collected on all children having endoscopic small-bowel biopsy. These data and centralized computer and dietetic records within Avon have been analyzed. **Results:** Twelve children from Avon diagnosed with coeliac disease since 1.419.91 have birthdays concordant with ALSPAC. This gives a prevalence rate of

1/1,100. All had symptoms. Four had a family history. At time of diagnosis, all were aged over 2 years, 3 were aged 2-5years, 6 were aged 5-10 years, and 3 were aged 10-14 years. Based on screening data, 140 children from Avon would be expected to have coeliac disease. However, only 12 of these children have been diagnosed with coeliac disease. This suggests that 90% of children with possible coeliac disease may be being missed. The screening data also recorded that children with positive screening tests were lagging behind in growth by 9 months. There are other well-documented long-term health hazards of untreated coeliac disease. **Conclusion:** The data suggest taht all children should be screened for coeliac disease.

069 (049)

Brush-border Enzyme Activities in Relation to Histological Changes in Paediatric Coeliac Disease

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Background: In coeliac disease, abnormalities of brush-border enzyme activities have been detected in the course of the disease activity. The correlation between brush-border enzyme activities and mucosal injury is unconvincing. **Objective:** The study was conducted to evaluate the brush-border enzyme activities (disaccharidases and alkaline phosphatase) in the duodenal mucosa of North Indian children with coeliac disease and to examine its relation to duodenal mucosal morphology. **Methodology:** This prospective study (January 2004-April 2005) included 71 children with coeliac disease and 29 controls (GERD patients) in whom upper gastrointestinal endoscopy was performed and distal duodenal biopsies were taken for histological assessment, and estimation of disaccharidases and alkaline phosphatase activities. Each bioptic sample was graded according to the modified Marsh classification. Lactase, sucrase, maltase, and alkaline phosphatase activities were estimated in duodenal biopsy homogenates from patients with coeliac disease and GERD. The association between enzyme activities and duodenal morphology was examined. The results were expressed as number and percentage or mean±SE. Comparisons of quantitative measurements between the groups were performed with Student's *t*-test. Informed parental written consent was obtained prior to participation in the study. **Results:** The mean age of 71 patients with coeliac disease (M:F::43:28) was 6.0±0.3 years, and the mean age of onset of symptoms was 2.7±0.4 years. The main presenting symptoms were diarrhoea in 55/71 (77.5%), anaemia in 56/71 (78.9%), and failure to thrive in 49 of the 71 pateints (69%). Sixty-four (90.1%) of 71 coeliac disease patients showed grade III (destructive) lesion, while it was grade 0 in all the GERD patients. In the coeliac disease and GERD patients, the mean level (IU/g protein) of lactase was 12.1±0.9 vs 24.4±1.0 ($p<0.001$), of sucrase was 25.9±1.9 vs 42.5±1.9 ($p<0.001$), of maltase was 56.6±3.5 vs 76.1±13.0 (NS), and of alkaline phosphatase was 602.8±56.2 vs 1,359.3±51.2 ($p<0.001$) respectively. The mean disacchridases and alkaline phosphatase levels were not significantly different in patients with mild lesions (Marsh grade II and IIIa) compared to those with control. However, the mean lactase, sucrase and alkaline phosphatase levels were significantly lower ($p<0.001$) in the coeliac disease patients with moderate (Marsh grade IIIb) and severe (Marsh grade IIIc) lesions compared to controls. **Conclusion:** A generalized decrease of disaccharidases and alkaline phosphatase activity were seen in duodenal mucosa of children with coeliac disease. The lactase, sucrase and alkaline phosphatase levels significantly correlated with mucosal injury in children with coeliac disease.

9:35 am - 10:35 am (Venue: CSD Conference Room)
Scientific Session 12: Pathogenesis of Diarrhoeal Diseases

070 (006)

Shiga Toxin Binding to Intestinal Neuroendocrine Cells—A New Step in Pathogenesis!

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Background: Shiga toxin (Stx) is an important virulence factor of enterohaemorrhagic *Escherichia coli* (EHEC), but its mode of interaction with human intestinal epithelium is unclear. **Objective:** The study was carried out to assess the localization of binding of Stx 1 and 2 with human intestinal mucosa and to see if this changes in inflammatory states. **Methodology:** Human intestinal mucosal biopsies, obtained with ethical approval and informed consent from children undergoing endoscopy for routine investigation of intestinal complaints, were frozen, cryosectioned, and incubated with Stx 1 and 2. Stx binding was identified using Stx 1 and 2-specific antibodies. Histologically normal (n=26) and abnormal (n=29, from cases of coeliac disease, inflammatory bowel disease, autoimmune enteropathy, and tufting enteropathy) samples from the duodenum, terminal ileum, and colon were studied. **Results:** Normal mucosa: The main site of binding was to endothelial cells in the lamina propria. However, binding was observed on pericryptal fibroblasts, Paneth cell granules, and neuroendocrine cells. Stx 2 bound to more neuroendocrine cells than Stx 1. Abnormal mucosa: There was no change in the pattern or amount of Stx binding in histologically-abnormal mucosa. **Conclusion:** (a) The hypothesis that inflammation increases Stx binding is not supported by this work; (b) Stx binding to pericryptal fibroblasts may interfere with mesenchyme-endoderm interplay and affect normal epithelial cell development; and (c) Stx binding to neuroendocrine cells may induce an early diarrhoeal response via motility changes as in cholera infections and represents a previously-unrecognized step in pathogenesis of EHEC. **Acknowledgements:** The work was supported by NIH grant no. R37AI21657 to J.B. Kaper and by BBSRC grant no. D13600 (A.D. Phillips).

071 (055)

Clinical Efficacy of Cefpodoxome Proxetil Compared with Cefixime for Treatment of Typhoid Fever in Children

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Background: The third-generation oral cephalosporin--cefixime--, although scientifically not well-evaluated in Bangladesh for the treatment of typhoid fever, has been found to be clinically effective in typhoid fever in studies conducted elsewhere, including Pakistan, and is now well-practised in Bangladesh. Although cefpodoxome proxetil is similar to cefixime in its pharmacological and antimicrobial properties but cheaper than cefixime, to date there have been no published controlled studies evaluating cefpodoxome proxetil in typhoid fever. **Objective:** The study was conduacted to evaluate the clinical efficacy of cefpodoxome proxetil for children suffering from typhoid fever and to compare it with that of cefixime. **Methodology:** The study was conducted in medical out-patient department of Dhaka Shishu Hospital, the largest tertiary-care teaching hospital for children

in Bangladesh, during March 2003-June 2004. One hundred and four children, aged 6 months to 12 years, with clinical feature, suggestive of typhoid fever (not severe enough requiring hospitalization), supported by either positive blood culture for *Salmonella* or positive Widal test or both, were allotted in a randomized double-blind prospective clinical trial to receive therapy with either oral cefpodoxome proxetil (16 mg/kg.day divided every 12 hours, n=53) or oral cefixime (20 mg/kg.day divided every 12 hours, n=51) for 10 days. The two groups were comparable in their baseline general characteristics, duration and severity of illness. MICs for all *Salmonella* isolated were determined for both the antibiotics. **Results:** The overall clinical efficacy was similar in the 2 groups with only 2 (1 in each group with culture-positive typhoid) children failed to respond clinically, although showed bacteriological cure, and underwent change of therapy. The time of defervascence was comparable in both the groups (4.28±2.27 vs 3.99±1.82 days, p=not significant). The MIC of cefpodoxome proxetil of total 30 *Salmonella* Typhi isolated (16 in cefpodoxome proxetil and 14 in cefixime) was <4 microgram/mL (range 2-8 microgram/mL), while that of cefixime was <0.5 microgram/mL (range 0.25-1 microgram/mL). No significant side-effects were observed in both the groups during treatment, and no child relapsed in the 2 groups during 3-month follow-up. Cefpodoxome proxetil reduced the treatment cost at around 33% compared to cefixime. **Conclusion:** The findings of the study suggest that oral cefpodoxome proxetil is a clinically-effective, safe and cheaper option for the treatment of non-severe typhoid fever in children. **Acknowledgements:** The financial support of Aristopharma Ltd. is acknowledged.

072 (085)

Bacteraemia: A Risk Factor for Hypoglycaemia among Severely-ill Children, Aged Less Than 5 Years, with Diarrhoea

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Background: Risk factors for hypoglycaemia are well-described, but their association with bacteraemia among severely-ill diarrhoeal children, aged less than 5 years, is not well-documented. **Objective:** The study was conduced to describe the clinical features and the risk factors for hypoglycaemia in severely-ill children, aged less than 5 years, with diarrhoea. **Methodology:** In this prospective, unmatched case-control study, all children of either sex, aged 0-59 month(s), with hypoglycaemia at the time of admission to the Special Care Unit (SCU) of the Dhaka hospital of ICDDR,B during January 1999-December 2004 constituted the cases (n=65), and randomly-selected 195 (case to control ratio 1:3) non-hypoglycaemic children admitted to the SCU during the same period constituted controls. The clinical, socioeconomic and demographic information, laboratory features, course of illness, and outcome were compared between the groups. **Results:** In total, 10,187 severely-ill patients were admitted to the SCU during the study period, and 10% systematic sample (n=967) of the patients, irrespective of their age, were screened into the study. Of these, 782 (81%) were children aged less than 5 years, 75% were infants, 20% were aged 12-35 months, and 5% were aged 36-59 months with equal sex distribution. During the study period, the blood glucose levels were determined for 598 (62%) of these children soon after their admission to the SCU, and 65 (11%) of them had hypoglycaemia (cases) and, from the remaining 533 nonhypoglycaemic children, 195 ((case to control ratio 1:3) were selected as controls. Sixty-eight percent of cases had dehydrating diarrhoea. In univariate analysis, hypoglycaemic children more frequently had shorter (<72 hours) history of diarrhoea (75% vs 58%, p=0.01), documented convulsion (28% vs 11%, p=0.001), shorter (<72 hous) hospitalization (52% vs 33%, p=0.01), and higher case-fatality rate (28% vs 14%, p=0.02). Eleven percent of the cases and 5% of the controls were bacteraemic. Logistic regression analysis demonstrated a significant association of bacteraemia with hypoglycaemia, meaning that the bacteraemic children were 4 times more likely

to be hypoglycaemic (odds ratio [OR]=3.9, 95% confidence interval [CI] 1.2-12.1, p=0.02), had a shorter history of diarrhoea before hospitalization (OR=2.6, 95% CI 1.3-5.5, p=0.01), and were older than one year (OR=3.3, 95% CI 1.3-8.6, p=0.01). No association between malnutrition and hypoglycaemia was observed. **Conclusion:** Documented hypoglycaemia in seriously-ill children older than one year presenting with a shorter history of diarrhoea should alert clinicians on the possibility of bacteraemia, and management should be done accordingly. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) and Centre/Core Donors is acknowledged.

073 (187)

Llama-derived Antibody Fragments Capable of Neutralizing Rotavirus in vitro and in vivo

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Background: Rotavirus is a leading cause of severe diarrhoea in infants. Currently, no specific therapy is available, although oral rehydration solution (ORS) has substantially reduced mortality from dehydration. Therefore, the development of cheap anti-viral products for the prevention or treatment of the disease is urgently needed. **Objective:** The study was conducted to determine the feasibility of producing llama-derived antibody fragments (VHH) by *Saccharomyces cerevisiae*, which can neutralize rotavirus in an in-vivo mouse model and have a broad specificity towards common human rotavirus strains. **Methodology:** A llama was immunized with a G3 rotavirus strain (RRV). Using the modern biotechnological techniques, cDNA fragments encoding for binding domains of heavy chain only antibodies (VHH fragments) were obtained and expressed in *Escherichia coli* and *S. cerevisiae*. ELISA tests were used for identifying the VHH fragments which recognized RRV (G3,P[3]) and CK5 (G3). Rotavirus neutralization activity of rotavirus-specific VHH fragments was tested in vitro via plaque neutralization assays and infection inhibition using an indirect immunofluorescence assay (IFA). A mouse pup model of rotavirus-associated diarrhoea was used for testing the same in vivo. Immunoelectron microscopy (IEM) was used for determining the specificity towards human rotavirus isolates from faecal samples. **Results:** From ELISA tests, 23 unique VHH fragments were identified which were able to bind to RRV and CK5. Nine of these fragments were able to neutralize CK5 in a plaque assay. After transferring the DNA fragments to the baker's yeast *S. cerevisiae*, the VHH fragments produced were re-tested in the plaque neutralization assay and in an IFA. Four fragments were selected for further in-vitro and in-vivo experiments. From the in-vivo model it was found that one fragment in particular was able to reduce the occurrence (30 % vs 100% in untreated group) and the duration (0.33 days vs 2.87 days in untreated group) of diarrhoea in the mouse pups. This fragment, VHH1, also showed broad specificity and in-vitro neutralization capacity towards very common circulating rotavirus stereotypes worldwide. **Conclusion:** Monovalent antibody fragments directed against a common G3 rotavirus strain can be effectively produced by the food grade yeast *S. cerevisiae* and can reduce morbidity of rotavirus-induced diarrhoea in mice. **Acknowledgements:** Part of this work was supported by an EU framework grant.

11:00 am - 12:30 pm (Venue: Sasakawa Auditorium)
Scientific Session 13: Low Birth-weight

074 (167)

National Low Birth-weight Survey of Bangladesh, 2003-2004

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Background: Low birth-weight (LBW) has serious implications for the growth, development, health, and survival of children and adults. Small-scale studies in Bangladesh have indicated that the prevalence of LBW may be among the highest in the world. However, there is no nationally-representative data to assess the scale of the public-health problem and to provide baseline data against which to measure progress towards its alleviation. **Objective:** The aim of the study was to provide nationally-representative data on the prevalence of LBW. **Methodology:** Adolescent girls and women who had missed at least 2 menstrual periods in 107 randomly-selected rural and urban clusters in Bangladesh were enrolled in the survey and followed up to delivery. Of the 4,414 pregnancies identified, there were 3,843 live-births. A total of 3,085 birth-weights (1,548 boys and 1,537 girls) were measured within 72 hours of delivery and included in analysis. Birth-weight was measured using Seca Baby Scales to the nearest 10 g (n=1,740) and UNISCALEs to the nearest 100 g (n=1,345). Ethical clearance was obtained from the Bangladesh Medical Research Council. **Results:** The mean birth-weight of infants was 2,632 (SD 433) g. The prevalence of LBW (<2,500 g) was 36%, and <1% of infants were born with very low birth-weight (<1,500 g). At least 77% of the LBW infants were growth-retarded, confirming that intrauterine growth retardation is the major cause of LBW in Bangladesh. The prevalence of LBW was higher in rural areas (37%) than in urban areas (29%). Other risk factors for LBW included low socioeconomic status, low level of parental education, young (<20 years) or old (>35 years) maternal age, primigravidity, multigravidity, short stature, lack of antenatal check-ups, and iron supplementation during pregnancy, pre-term delivery, and lack of adequate rest during pregnancy. **Conclusion:** The prevalence of LBW in Bangladesh (36%) is more than twice the 15% threshold that indicates a public-health problem. Integrated and complementary strategies are needed to address the major causes of LBW, with special attention given to the health and nutrition of adolescent girls and women before their first pregnancy and between pregnancies and to pregnant women themselves. **Acknowledgements:** The financial support of UNICEF is acknowledged.

075 (153)

No Additional Effect on Birth-weight by Daily Prenatal Multiple Micronutrients Compared to Iron-Folate in Bangladesh: Findings from the MINIMat Trial

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Objective: This project asks if prenatal supplementation with 15 micronutrients (according to UNICEF/UNU/WHO) give an additional effect on size at birth compared to iron-folate supplements with either 30 or 60 mg iron, and if

an early start (week 8) of food supplementation has an additional effect on birth anthropometry compared to the usual start (2nd trimester) of the programme. **Methodology:** The study was performed in Matlab, Bangladesh. Identifying pregnancies around week 8, 4,436 women consented to participate in the study and were randomized to one of 6 treatment groups in a factorial design. Micronutrients were supplied from week 14. Food supplements--600 kcal per day--were based on rice, pulses, molasses, and soybean oil. **Results:** In total, 3,282 singleton babies had an average birth-weight of 2,700 g (SD 411). There was no difference in birth-weight, birth-length, head circumference, or gestational age at birth between micronutrient groups. Usual start of food supplementation produced the same overall effect as early start. There was some significant interaction in effects on birth-weight between the food and the micronutrient supplementations; the public-health consequence of this is uncertain. **Conclusion:** No evidence was produced to support a shift in policy from prenatal iron-folate supplementation to multiple micronutrients in relation to size at birth. **Acknowledgements:** The study was initiated in collaboration with, and financially supported by UNICEF, with additional support from DFID, USAID, CHNRI, Sida, ICDDR,B, and World Bank.

076 (155)

Prevention of Low Birth-weight: Impact of a Home-visitors Network

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Background: Low birth-weight (LBW) is a very powerful determinant of neonatal mortality and is highly prevalent in developing countries. LBW could be prevented by improving the nutrition and health status of pregnant women. However, in many countries, few women use prenatal care, or they use it irregularly or too late in pregnancy. **Objective:** The study was undertaken to document the impact of a home-visitors network on the use of prenatal care in the frame of an on-going research project on the prevention of LBW in Burkina Faso. **Methodology:** A home-visitors network was set up in a population of 12.000. The following steps were followed: identification and selection of female home-visitors (FHVs) by community representatives; training of FHVs in nutrition counselling and community-based follow-up. Each FHV is responsible for up to 200 women. They detect early pregnancies; encourage women to use health facilities for antenatal care, treatment, and delivery; and provide multi-micronutrients and malaria prophylaxis under direct observation. Their performances are checked by the Lot Quality Assessment procedures. Formative supervision is provided by 2 sociologists. **Results:** There was a dramatic increase in the use of prenatal care since the setting up of the FHV network. Evaluation was made between April 2004 and July 2005. The median age at first antenatal visit has lowered to 20 weeks (IQR: 14-26). Sixty-four percent (588/963) and 44% (410/963) of pregnant women received at least 3 and 5 full months of micronutrient supplements respectively. Eighty percent of pregnant women now deliver in health services. Interviews among a panel of pregnant women revealed a high degree of satisfaction with home-visits. **Conclusion:** FHVs can greatly improve the use of prenatal care and micronutrient coverage of pregnant women, with expected positive impact on maternal and child nutrition. Community-based recruitment, shared cultural background, and tight supervision are strong points to be considered. The sustainability of the network in the absence of external input is still to be tested. **Acknowledgements:** The financial support of the Nutrition Tiers Monde and Belgian General Directorate for Development Cooperation is acknowledged.

077 (183)

Change in Maternal Mid-upper Arm Circumference in Pregnancy As a Predictor of Low Birth-weight

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Background: The prevalence of low birth-weight (LBW, <2.5 kg), which increases the risk of mortality and morbidity among infants, is high in Bangladesh. Maternal pre-pregnancy nutritional status and weight gain during pregnancy have previously been shown to be independently associated with LBW. How maternal mid-upper arm circumference (MUAC) and its change during pregnancy can serve as a predictor of LBW is not well-understood. **Objective:** The study was undertaknen to examine early and late pregnancy MUAC as a predictor of LBW in rural Bangladesh. **Methodology:** MUAC is measured as part of the early (~8 weeks gestation) and late pregnancy (>28 weeks gestation) assessments of women enrolled in the JiVitA Project's maternal nutrition community trial. Birth-weight is measured at home using a digital infant scale. This analysis is restricted to women with baseline MUAC measured at <20 weeks gestation and term babies measured within 48 hours after birth (n=6,474). **Results:** The mean (±SD) birth-weight was 2,507±40 g, and the prevalence of LBW was 49%. A positive linear relationship was found between birth-weight and maternal MUAC both early and late in pregnancy after adjusting for maternal age, parity, and education ($p<0.01$). Low maternal MUAC (<22.5 cm) in either early or late pregnancy was associated with an increased risk of LBW (odds ratio [OR]=1.5, 95% confidence interval [CI] 1.4-1.7 and OR=1.7, 95% CI 1.5-1.9 respectively). MUAC decreased during pregnancy for >50% of women. In a linear regression model, a change in MUAC during pregnancy was associated with birth-weight, in the direction of the change, after adjusting for maternal age, parity, education, and early pregnancy MUAC ($p<0.01$). Among women with low early pregnancy MUAC, losing >1.5 cm in circumference was associated with a 2.4-time higher odds of having an LBW baby (95% CI 1.4-4.4). For women with an initial MUAC >22.5 cm, losing >1.5 cm in circumference was associated with a 1.3-time higher odds of having an LBW baby (95% CI 1.1-1.6). **Conclusion:** Maternal wasting, reflected by a single low MUAC (<22.5 cm) during pregnancy, is associated with a ~1.5-fold higher risk of LBW. A low-MUAC mother who loses >1.5 cm in upper-arm circumference during pregnancy is nearly 2.5 times more likely to have an LBW newborn than a woman not experiencing such a loss in body mass. A single MUAC provides a simple, inexpensive and reliable approach to identify mothers at high risk of bearing an LBW infant. Assessing change in MUAC with 2 measurements can identify mothers of even greater risk of having an intrauterine growth-retarded infant. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and Bill and Melinda Gates Foundation.

078 (129)

Low Birth-weight is Associated with Altered Immune Function in Rural Bangladeshi Children

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Background: A number of studies have now provided evidence for the early-life programming of adult chronic disease risk. Recent studies have further shown that early-life events may have long-term implications for later immunocompetence and susceptibility to infectious diseases. **Objective:** The aim was to investigate the impact of birth-weight on immune function in pre-school-age children. **Methodology:** Children (age range 4-6 years) born in Matlab, a rural area of Bangladesh, with weight and length measured within 72 hours of birth were studied. C-reactive protein (CRP) was measured by immunoturbidometric assay; lymphocyte subpopulation was quantified by flow cytometry; lymphocyte proliferation was studied by tritiated thymidine uptake method; thymopoiesis was measured by T cell receptor excision circle (TREC) analysis; and rate of lymphocyte turnover was determined by Telomere length assay. **Results:** Children born with low birth-weight (<2,500 g; LBW group, n=66) had significantly higher levels of CRP (p=0.02) in serum and lower percentage of pan-T cells (CD3) in peripheral blood (p=0.04) compared to children with normal birth-weight (=2,500 g; NBW group; n=66). Birth-weight affected the percentage of CD3 lymphocytes (p=0.04). Level of TRECs in peripheral blood mononuclear cells was significantly lower in LBW compared to NBW (p=0.03). No significant difference was observed in the lymphocyte proliferation response between the two groups. **Conclusion:** The results showed that LBW in Bangladeshi children had a significant effect on the proportion of CD3 lymphocytes and CRP in pre-school children. Low levels of TRECs in the LBW children indicated decreased thymic T-cell production and impaired thymic export function. The acquired cellular immune deficiency in pre-school children may add further importance to public-health interventions aimed at improving maternal weight gain during pregnancy and reducing LBW. Duration of immunodeficiency caused by LBW and its reversibility on nutritional rehabilitation are an important area of research that needs further definition. **Acknowledgements:** The study was conducted at ICDDR,B with the support from the World Bank Development Grant Facility for ICDDR,B and the Swedish Agency for Research Cooperation with Developing Countries (Sida/SAREC agreement support; grant 2002-2004).

079 (210)

Early Findings from a Cluster-randomized Community-based Newborn Health Intervention Trial in Sylhet, Bangladesh

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Background: In Bangladesh, neonatal mortality remains high at 41 per 1,000 livebirths and contributes almost half of deaths of chlidren aged less than 5 years, indicating that traditional child-survival interventions have had a limited impact on the newborns. Little information is available on feasible and affordable models of integrated healthcare for mothers and the newborns in high-mortality, resource-poor settings. The PROJAHNMO project addresses these issues and is being implemented in a population of about 500,000 in rural Bangladesh. **Objective:** The study was conducted to evaluate the impact of a community-based maternal and newborn-care intervention package on neonatal mortality. **Methodology:** PROJAHNMO is evaluating the effectiveness of a maternal and newborn-care intervention package informed by formative research, behavioural trials, and available evidence. The intervention components include: (a) behaviour change communications to improve maternal and newborn-care practices and care-seeking; (b) management of illness of the newborn; and (c) strengthening health facilities. Two service-delivery models--home-based care (HC) and community-based care (CC)--are being evaluated in a cluster-randomized trial. The community health workers in the HC areas provide education, identify and manage serious neonatal illness through home-visits. The community mobilizers in both the intervention areas provide education to women and men through community meetings. The traditional birth attendants and family members were orientated on clean delivery, danger sign recognition and referral, and immediate newborn care. The facility-based providers were trained on essential newborn care. Baseline and periodic household surveys of recently-delivered women provide feedback on the coverage and quality of implementation. **Results:** The project achieved high intervention coverage; 80% of pregnant women and their families received 2 or more antenatal home-visits for education, and 57% and 67% of babies born at home were visited by the workers within 3 and 7 days of birth respectively for providing education and newborn care. Improved behaviours and practices are being adopted, including care-seeking for maternal and newborn complications. Improvements were seen in both the intervention areas, but were more in the HC area. **Conclusion:** The community-based health workers are accepted by the communities and have brought about positive changes in behaviours and practices relating to maternal and newborn care in a traditional society. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) and Saving Newborn Lives Initiative (SNL) of Save the Children-USA through a grant from the Bill and Melinda Gates Foundation is acknowledged.

11:00 am - 12:30 pm (Venue: Seminar Room)
Scientific Session 14: Management of Diarrhoeal Diseases II

080 (086)

Factors Associated with Severe Malnutrition among Hospitalized Children, Aged Less Than 5 Years, with Diarrhoea

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Background: Severe malnutrition is a major health problem among children, aged less than 5 years, in Bangladesh and many developing countries, which significantly contributes to their deaths due to other health problems. Understanding of the factors associated with hospitalization of such population due to diarrhoeal diseases, might help develop appropriate preventive strategies and their clinical management. **Objective:** The study was carried out to identify the clinical and nutritional features and complications among severely-malnourished children aged less than 5 years, attending the Dhaka hospital of ICDDR,B with diarrhoeal diseases. **Methodology:** For this case-control analysis, relevant information was extracted from the electronic database of the Dhaka Hospital Surveillance System and identified 7,692 children of both sex, aged 0-59 month(s), who attended the hospital during 1996-2001. Children presenting with severe (<-3 z-score) under-weight, stunting, or wasting constituted cases, and those presenting with better nutritional status constituted controls. **Results:** Of the total 7,692 children, 1,418 (18%) were severely under-weight, 1,074 (14%) were severely stunted, and 261 (4%) were severely wasted. The attendance of severely-malnourished cases peaked during April-May and August-September. The proportion of malnourished children increased with advancing age (chi-square for trend=167, $p<0.001$). Severely under-weight children were less often breastfed (12% vs 19%, $p<0.001$), were more often either unimmunized or partially-immunized against DPT (25% vs. 14%, $p<0.001$) and unimmunized against measles (31% vs. 20%, $p<0.001$), had less often received high-potency vitamin A capsule in preceding 6 months (32% vs 44%; $p<0.001$), were more commonly infected with *Vibrio cholerae* O1 (19% vs 10%; $p<0.001$) and *Shigella* (7% vs 5%; $p<0.008$), and were more frequently presented with bloody-mucoid stools (2% vs 1%; $p<0.001$), and their monthly family income was more often likely to be less than 5,000 taka (US$80) (84% vs 56%, $p<0.001$) than better-nourished children. In logistic regression, the severely-malnourished children were more likely to be older than 11 months (OR 5.5, 95% CI 4.7-6.4, $p<0.001$), have illiterate mother (OR 1.5, 95% CI 1-1.8, $p<0.001$), non-sanitary defaecation site (OR 1.3, 95% CI 1.2-1.5, $p<0.001$), history of measles (OR 1.6, 95% CI 1.2-2.0, $p<0.001$), dehydrating diarrhoea (OR 1.6, 95% CI 1.4-1.9, $p<0.001$), abnormal lung sounds (OR 1.3, 95% CI 1.0-1.7, $p=0.01$), and hospitalization longer than 47 hours (OR 1.7, 95% CI 1.5-2.0, $p<0.001$). Infants were more likely to be non-breastfed (OR 2.8, 95% CI 1.8-3.1, $p<0.001$) and are less likely to receive ORS at home before reporting to health facility (OR 2.4, 95% CI 1.3-3.9, $p<0.001$), The 36-59 months old children were more likely to have illiterate mothers (OR 2.3, 95% CI 1.5-3.6, $p<0.001$) and hospitalization for longer than 47 hours (OR 1.9, 95% CI 1.1-3.5, $p=0.026$) than their well-nourished counterparts. **Conclusion:** With advancing age, young children, particularly the non-breastfed, with illiterate mothers, presenting with dehydrating diarrhoea and abnormal chest auscultation findings, and history of measles are more likely to be severely malnourished and require longer hospitalization. Therefore, children should receive preventive care, such as immunization, promotion of breastfeeding by their mothers, and early efficient management of young children may lessen their

morbidity. **Acknowledgements:** The study was funded by ICDDR,B: Centre for Health and Population Research and the United States Agency for International Development (USAID) collaborative agreement number HRN-A-00-96-90005-00.

081(106)

Comparison of D-xylose Hydrogen Breath Test with Urinary D-xylose Test in Indian Children with Coeliac Disease

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Background: Urinary or plasmatic D-xylose tests have been widely used in screening for intestinal malabsorption in patients with coeliac disease. However, both these tests appear to be of limited value in the diagnosis of coeliac disease, and a quarter of coeliac patients with biopsy-proven villous atrophy have normal urine D-xylose test. Thus, if this conventional urinary D-xylose test is used in screening for intestinal malabsorption, a significant number of patients may be misdiagnosed as normal. D-xylose hydrogen breath test may be better a parameter in screening for intestinal malabsorption in patients with coeliac disease. **Objective:** This study was planned to compare D-xylose hydrogen breath test with urinary D-xylose tests in screening for intestinal malabsorption in patients with coeliac disease**. Methodology:** In total, 68 children with coeliac disease (confirmed by serology and duodenum biopsy) were enrolled for the study. Their symptoms were diarrhoea, abdominal fullness, abdominal pain, anaemia, and short stature. Five g urinary D-xylose test and D-xylose hydrogen breath test were performed simultaneously according to the standard methods. Chi-square test was used for comparing the percentage of abnormal urinary D-xylose and D-xylose hydrogen breath test. Ethical clearance was taken from the Institute, and informed consents were obtained before starting the study. **Results:** Of the 68 children, 41 were boys and 27 girls; their age ranged from 5 to 14 years (mean age 8.54±3.56 years). Five g urinary D-xylose test was abnormal in 50% of the cases, while 5 g D-xylose hydrogen breath tests in 69.9% of the cases. Five g D-xylose breath test was abnormal in all those cases in whom 5 g D-xylose urine test was abnormal. D-xylose hydrogen breath test was able to pick up 19.9% extra cases of malabsorption in Indian children with coeliac disease. **Conclusion:** The findings of the study indicate that the performance of 5 g D-xylose hydrogen breath test is better than 5 g urinary D-xylose test in screening for intestinal malabsorption in patients with coeliac disease. **Acknowledgements:** The financial support of the Department of Gastroenterology, Post-Graduate Institute of Medical Education and Research, Chandigarh, is acknowledged

082 (108)

Incidence of Inflammatory Bowel Disease in Bangladeshi Migrants Is Increasing

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Background: Inflammatory bowel diseases (IBD), Crohn's disease (CD), and ulcerative colitis (UC)) are thought to be uncommon in the South Asians. As a result, the study of CD and UC among such migrants to countries in which these diseases are common, such as the UK, allows researchers to study the effect of migration in the

incidence of such diseases and to speculate about the role of environmental factors in their aetiologies. **Objective:** The study was carried out to determine the incidence of IBD in Bangladeshi migrants. **Methodology:** Tower Hamlets, a region of eastern London, has a relatively large population from Bangladesh. All have ready access to healthcare and so are a suitable population to study. In the early 1990s, a retrospective study was reported that found that Bangladeshi migrants and their children had relatively little IBD. A prospective study of new cases has recently been completed (Am J Gastroenterol 2004). Cases were identified from pooled hospital lists and the population based on census data. **Results:** Among Bangladeshis, 6 cases of UC and 5 cases of CD were identified during 1981-1989 (incidence: 2.4 and 2.3/100,000/year respectively). During 1997-2001, there were 16 cases of UC and 19 cases of CD (incidence: 8.2 and 7.3/100,000/year respectively). The mean age at diagnosis was 28 years for UC and 19 years for CD. Thirteen of the 16 UC patients were born in Bangladesh compared to 8 of the 19 CD cases. The incidence in the Europeans during this time had not changed significantly--6.2 and 4.4/100,000/year for UC and CD respectively. **Conclusion:** Recently, the British Bangladeshis have at least as much IBD as the Europeans. Children born in Bangladesh appear more likely to acquire UC when they live in the UK, while those born in the UK acquire CD. These data suggest that early environmental exposure influences the risk of IBD. One current hypothesis suggests that a lack of exposure to helminths increases the risk of IBD, perhaps by influencing the immune response.

083 (096)

Nosocomial Infections among Patients Admitted to an Urban Diarrhoeal Disease Treatment Facility in Bangladesh

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Background: Nosocomial infections are associated with increased morbidity and deaths and high healthcare costs. The magnitude of the problem in healthcare set ups in Bangladesh and among patients with diarrhoeal disease globally is sparse. **Objective:** This preliminary study was initiated to examine and improve quality of patient care and specifically to evaluate the usefulness of repeated surveys for determining the trends and types of nosocomial infections in patients suffering from diarrhoea with paediatric population comprising a large majority. **Methodology:** Following adequate training and upon reaching a good inter-individual agreement among the investigators in identifying possible nosocomial infections, a chart review of patients admitted to the longer-stay in-patient ward of the Dhaka hospital of ICDDR,B: Centre for Health and Population Research was concducted. Relevant information was extracted to perform basic statistics. Nosocomial infection was defined as any new culture-proven infection or development of characteristics of infection, at any anatomical site, at least ≥48 hours after admission to hospital without proven prior incubation and those occurring up to 3 days following discharge from hospital. **Results:** In total, 4,980 (96%) charts of 5,206 patients admitted during the study period were reviewed. The rate of nosocomial infections in August, September, November, and December of 2004 was 5.0%, 5.5%, 8.3%, and 8.8% respectively and that in May, June, July, and August of 2005 was 7.4%. 6.3%, 8.2%, and 6.9% respectively, with an overall rate of 7.05%. Pneumonia, sepsis, urinary tract infections, skin infections, cholera, and unclassified varieties (only elevated body temperature) constituted 49%, 32%, 6%, 3%, 1%, and 9% respectively of the identified nosocomial infections. **Conclusion:** Despite some fluctuations in the number of admissions, the rates of hospital-acquired infections did not widely vary during the months surveyed. The standard methods, including cultural studies, require resources that may not be affordable to resource-poor set-ups. The present survey indicates that, despite limitations, a periodic survey can be useful in following the trends

and types of infections, which might help define low-cost prospective surveys and in clinical decision-making processes. **Acknowledgements:** This research was supported by ICDDR,B: Centre for Health and Population Research, which is supported by countries and agencies that share its concern for the health problems of developing countries.

084 (143)

Impact of Breastfeeding Counselling on Relactation in Non-breastfeeding Mothers in a Diarrhoeal Disease Hospital

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Background: The World Health Organization and United Nations Children's Fund recommend exclusive breastfeeding (EBF) during the first 6 months of an infant's life and continued breastfeeding for at least 2 years along with appropriate complementary food. However, many mothers stop breastfeeding in the first few weeks after the baby's birth. It may still be possible to revert such mothers back to breastfeeding, which is called 'relactation'. Many mothers who relactate can produce enough milk to breastfeed their babies. **Objective:** The study was conducted to assess if relactation is possible through providing breastfeeding counselling to mothers when their infants are admitted with diarrhoea. **Methodology:** The study was conducted at the Dhaka hospital of ICDDR,B: Centre for Health and Population Research during March 2000-October 2003. The reasons for stopping breastfeeding were ascertained, and breastfeeding counselling was provided to mothers attending their infants admitted to the hospital with diarrhoea. A trained breastfeeding Counsellor provided individual counselling to the identified mothers having infants aged 0-5 month(s) and helped them with appropriate techniques, such as correct positioning and attachment. The feeding status of infants was recorded at discharge. **Results:** In total, 512 non-breastfed mothers were enrolled for the study, and 420 (82%) of their babies were aged less than 90 days and 92 (18%) were aged over 90 days. At discharge, 17 (3.3%) babies were exclusively breastfeeding, 397 (77.5%) were partially breastfeeding, and relactation was not established in 98 (19.2%) mothers. **Conclusion:** Breastfeeding counselling, which includes demonstration of effective techniques and provision of relevant information and support, can also help mothers who have stopped breastfeeding their babies to start relactation. As these mother-infant pairs could not be followed up at home, it remains unknown how many mothers continued the practices following discharge of their babies from the hospital and for how long. Further studies with provision for follow-up are needed so that the improved practices can be sustained and the babies are benefited. **Acknowledgements:** The support of the World Bank and ICDDR,B's Core fund is acknowledged.

085 (072)

Effect of Black Tea Extract on Infectious Diarrhoea

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Background: The high incidence of diarrhoea in developing countries emphasizes the need for a commonly-available and low-cost consumable that can effectively prevent or treat enteric diseases. There is some evidence suggesting that tea has anti-microbial and anti-diarrhoeal properties. Tea is characterised by a high content of polyphenols. **Objective:** The study was conducted to determine the anti-microbial activity of different black tea extract (BTE) sub-fractions on enteric pathogens in vitro and to evaluate the effect of BTE on the incidence and severity of diarrhoea in *Escherichia coli* (O149:K91:K88ac)-infected piglets. **Methodology:** BTE was separated into 3 sub-fractions; (1) a non-aqueous fraction containing catechins, theaflavins, and flavonols, (2) an aqueous fraction containing thearubigins and flavonol glycosides, and (3) a fraction devoid of phenolic compounds. Overnight bacterial cultures of enteric pathogens were prepared, and the BTE sub-fractions were tested for their growth inhibitory capacity in vitro. Three groups of piglets (n=33 per group), approximately 4 weeks old, post-weaning, were fed a regular diet supplemented with BTE (0%, 0.4%, or 0.8%) for 27 days. All piglets were inoculated with *E. coli* on day 6 (5 mL; ~1.3x106 cfu/mL). Parameters, such as body weight, feed intake, general health, incidence of diarrhoea, and consistency of faeces were measured regularly. Significance was tested by ANOVA and set at $p<0.05$. **Results:** The aqueous and non-aqueous BTE sub-fractions dose dependently inhibited the growth of enteric pathogen in vitro. In the animal study, BTE did not affect growth, feed intake, and feed efficiency of the piglets during the first 14 days post-weaning. However, after day 14, BTE reduced these variables. The incidence of watery diarrhoea increased until day 8 and decreased thereafter. From day 14 onwards, the incidence of diarrhoea was lowest in piglets fed 0.8% BTE. The incidence of diarrhoea was generally highest in the control group. Ranking the incidence of diarrhoea during the 27-day period from high to low resulted in 0% BTE >0.4% BTE >0.8% BTE. **Conclusion:** The anti-microbial property of BTE is localized in the fractions containing phenolic compounds, and treatment with BTE reduces the incidence of *E. coli*-induced diarrhoea in piglets.

11:00 am - 12:30 pm (Venue: CSD Conference Room)
Scientific Session 15: Obesity in the Developing World

086 (050)

Childhood Obesity and Metabolic Consequences

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Background: The prevalence of metabolic syndrome is high among obese children and much more among South Asian populations. **Objective:** The study was carried out to evaluate the incidence of metabolic syndrome (MS) and non-alcoholic steato-hepatitis (NASH) among obese Sri Lankan children and to identify the best predictors of metabolic derangements. **Methodology:** Obese children (body mass index [BMI] >95 centile; NCHS) aged above 2 years were studied. Height, weight, hip, and waist (WC) circumferences were measured and BMI (kg/m^2) calculated. Fasting blood sugar, serum insulin, lipid profile, SGOT/SGPT were assessed. Fat mass was assessed using tetra-polar bioelectrical impedance analysis (BIA). Metabolic syndrome was defined as an association of a WC above 98th centile (UK growth charts 2004) with 2 or more of the following: serum triglyceride >150 mg/dL, HDL cholesterol <40 mg/dL, hypertension (systolic [SBP] or diastolic [DBP] blood pressure > 95th centile), and impaired glucose tolerance. Impaired glucose tolerance was defined as either having fasting glucose >100 mg/dL or 2-hour OGTT >140 mg/dL or diagnosed patient with diabetes or insulin resistance based on homeostatic model (HOMA-IR). HOMA-IR values above the 4th quartile were taken as indicative of insulin resistance. Ultrasonically intra-abdominal fat distribution was assessed. NASH was diagnosed when a patient had elevated SGPT with SGPT/SGOT ratio >1 and USS evidence of fatty infiltration. **Results:** Seventy obese (40 boys) children were studied. Their mean age was 9.2 (3.0) and 9.7 (2.5) years for girls and boys respectively. In both the groups, the mean BMI was 25.9. The mean percentage of fat mass assessed by BIA was 48.6% for girls and 47.5% for boys. The mean WC was 84 cm in girls and 84.2 cm in boys. Sixty-nine of them had WC above the 98th centile. The percentage of fat mass had a stronger association with BMI ($r=0.8$, $p<0.001$) than with WC ($r=0.56$, $p<0.001$). However, WC showed a stronger relationship to SBP, DBP, HOMA-IR, and triglycerides than BMI. The mean insulin resistance was 2.08 (1.8), and the 4th quartile was >2.51. Metabolic syndrome was diagnosed in 11 (18%) of the 62 children on whom all criteria were assessed. Of the 56 children on whom ultrasonogrphy was performed, 22 (40%) had evidence of fatty infiltration of liver, and 8 (14%) had evidence of NASH. Males had a significant association between mesenteric fat thickness and metabolic markers, but it was not seen among females. **Conclusion:** A significant proportion of obese Sri Lankan children had developed MS and NASH. WC is a better predictor of metabolic derangements than BMI. Excess fat deposition-related metabolic consequences possibly originate in an earlier age in boys than in girls.

087 (051)

Classifying Obesity in Children of Different Ethnic Origins

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Background: Obesity is defined as presence of excess body fat associated with adverse health outcome. Since direct fat estimation is not practical in clinical practice, body mass index (BMI) has been used as a surrogate measure. However, the ability of present BMI cut-off values to diagnose obesity across different ethnic groups is questioned. **Objective**: The study focused on determining the ability of present IOTF BMI-based cut-off values in diagnosing obesity in children of different ethnic and socioeconomic backgrounds. **Methodology**: The study was conducted at the University of Queensland, Australia, involving 5-15-year old white Caucasian (AC) and migrant Sri Lankan (ASL) children from September 2003 to March 2004. Children of same age-group, living in Sri Lanka (SL), were studied at the University of Colombo, based on the same protocol from September 2004 to April 2005. Height and weight were measured, and body mass index (BMI) was calculated. Fat mass (FM) was assessed based on the 2C body composition model using the isotope (D^2O) dilution technique. Criterion diagnosis of obesity was made based on absolute %FM of above 98 centile (UK growth charts 2004). The ethical review committees of both the universities approved the study. **Results:** There were 109 (M/F:48/61) in the AC group, 42 (M/F:27/15) in the ASL group, and 234 (M/F:152/82) in the SL group. Based on %FM, the number of obese children was 24 (22%), 10 (24%), and 105 (45%) of the AC, ASL and SL group respectively. Based on the IOTF cut-off values, only 14 children (1 AC and 13 SL) were diagnosed as obese. IOTF cut-off had a low sensitivity (0-10%) but high specificity (98.5-100%) for all the 3 groups. There were no significant differences in FM and BMI between the children of the 3 groups. However, the SL group had a significantly higher %FM than the AC group. ASL group had %FM value between the other two groups but there was no significant difference between the ASL group and others. BMI, age, sex, and site of origin of groups together explained 44% of variance in %FM. On comparing the %FM of the 3 groups at a fixed BMI value, the SL group had the highest %FM, while the AC had the lowest %FM. Comparing with the AC children, the ASL children averaged 3.04% higher %FM at a fixed BMI, while the SL children averaged 6.08% higher %FM. **Conclusion:** The IOT-based cut-off values are not suitable for diagnosing obesity in children of Australian Caucasian and Sri Lankan origin. Ethnicity and the living environment may have to be taken into consideration when preparing diagnostic criteria for obesity.

088 (056)

Double Burden of Malnutrition in Bangladesh: Trends of Under- and Over-weight among Women, 2000-2004

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Background: Albeit under-nutrition and communicable diseases dominate the current disease burden in resource-poor countries, the prevalence of major risk factors for diet-related chronic diseases is increasing. **Objective:** The study was conducted to determine the current prevalence of and trends in under- and over-weight among Bangladeshi women and to explore socioeconomic risk factors for over-weight. **Methodology:** Nationally-representative data on women of reproductive age from rural (n=242,433) and urban poor areas (n=39,749), collected by the Helen Keller International's Nutritional Surveillance Project (NSP), in collaboration with the Institute of Public Health Nutrition, Government of Bangladesh, during 2000-2004, were analyzed. Ethical clearance was granted by the Bangladesh Medical Research Council. **Results:** While the prevalence of chronic energy deficiency (CED) and body mass index (BMI), <18.5 kg/m$^{2)}$ continue to be a major nutritional problem among Bangladeshi women (rural: 38.8%, urban poor 29.7%; p<0.001), 9.1% of urban poor and 4.1% of rural women had BMI=25 kg/m^2 indicating over-weight (p<0.001). In addition, 9.8% of urban poor and 5.5% of rural women were found to be 'at risk of over-weight' (BMI 23.0-<25 kg/m^2) according to the World Health Organization cut-off for Asian population. Trend analyses showed that, during 2000-2004, the prevalence of CED decreased (urban poor: 33.8%-29.3%; rural: 42.6%-36.6%), but over-weight increased (urban poor: 6.8-9.1%; rural: 2.8%-5.5%). Over-weight was associated with age. The prevalence of over-weight was the lowest among women aged 15-19 years (urban poor 2.2% vs rural 0.9%; P<0.001) and was the highest among women aged 35-40 years (urban poor: 14.2% vs rural: 5.7%; p<0.001). Multivariate regression analysis revealed that over-weight was significantly associated with higher socioeconomic status after adjusting for age. Rural women with at least 10 years of education had a 7.2-fold increased risk of being over-weight compared to non-educated women (95% confidence interval 6.5-8.0). The proportion of monthly expenditure spent on food was also associated with over-weight. **Conclusion:** The recent increasing trends in the prevalence of over-weight among both urban poor and rural women along with a high prevalence of CED indicate the emergence of the double burden of malnutrition in Bangladesh. The public-health programmes should address both extremes of malnutrition by promoting optimal dietary behaviour and lifestyle practices. **Acknowledgements:** The authors acknowledge the Royal Embassy of the Netherlands for financial support, and IPHN, the partner NGOs, and participating families for their support during data collection.

089 (138)

Increasing Trend of Body Mass Index ≥23 in Bangladeshi Mothers of Children Aged Less Than 5 Years

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Background: In 2005, 35 million people in the world would have died of chronic diseases--80% in developing countries. In most developing countries, the number of over-weight young women exceeds under-weight women in both rural and urban areas. The Bangladesh Demographic and Health Survey (BDHS) has been collecting nationally-representative anthropometric data on mothers of children aged less than 5 years for the last 3 surveys. In the BDHS 2004, the prevalence of over-weight or obesity (BMI ≥25) in ever-married women aged 15-49 years was reported for the first time to be 5.8% and 19.5% for rural and urban areas respectively. These over-weight data cannot be compared with the previous datasets as these were not analyzed for the prevalence of over-weight prior to this study. **Objective:** The BDHS 1996-1997, 1999-2000 and 2004 datasets were analyzed to derive the trend values and associated risk factors for increasing BMI in mothers of children aged less than 5 years. **Methodology:** The datasets were downloaded from the Measure DHS homepage, mothers (≥20 years of age) of children aged less than 5 years were selected, and trends over time were analyzed for 3 categories of maternal BMI--'<18.5' (under-weight), '18.5-22.9' (normal), and '≥23' (at-risk BMI), the last being the new proposed cut-off for Asian populations at risk of chronic diseases. After defining maternal BMI ≥23 as the independent variable, multivariate regression analysis was carried out to identify the associated risk factors. **Results:** Anthropometric parameters were analyzed for 3,253, 3,732 and 3,953 mothers from the 1996-1997, 1999-2000 and 2004 datasets respectively. In rural areas, the prevalence of maternal under-weight fell from 55% in 1996-1997 through 48% in 1999-2000 to 40% in 2004. Concomitantly, at-risk BMI increased in rural areas from 5.1% through 6.7% to 10.2%. In urban areas, the prevalence of maternal under-weight fell from 34% in 1996-1997 to 28% in 1999-2000, and then to 26% in 2004, and the corresponding prevalence of at-risk BMI was 24%, 28%, and 26%. Multivariate regression analysis showed that maternal at-risk BMI was positively associated with increasing wealth (asset) index quintile, maternal age, and maternal education and was inversely associated with presence of wasting or stunting in the youngest child. **Conclusion:** This rising trend in BMI ≥23 means that this population is now at increasing risk of chronic diseases. There is an urgent need to undertake large-scale representative surveys to assess dietary intake, physical activity, tobacco use, hypertension, cardiovascular diseases, type 2 diabetes, and cancer. Simultaneously, the public-health nutrition programme design and implementation also needs to be reviewed to address this new paradigm of nutrition-related chronic diseases.

090 (162)

Double Burden of Disease in Rural Districts and Urban Slums of Bangladesh

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Background: Although wasting, stunting, and under-weight of children aged less than 5 years and maternal under-weight have all fallen in Bangladesh in the last decade, these still remain high compared to other countries. These high rates of malnutrition now co-exist with over-weight/obesity (BMI ≥25) in ever-married women aged 15-49 years estimated in 2004 to be 5.8% and 19.5% in rural and urban areas respectively. In this setting, Plan Bangladesh has started the Integrated Nutrition Project (INP) in four rural upazilas in three districts and in 3 urban slums of Dhaka, covering a total population of 650,000. As a first step, a baseline evaluation was carried out for the demographic, health and nutrition status of children aged less than 5 years and their mothers. **Objective:** The baseline evaluation data were analyzed to assess the nutrition status and its determinants in children aged less than 5 yeras and their mothers. **Methodology:** Data were collected in January 2005 using a structured questionnaire and anthropometric equipment. Descriptive and logistic regression analyses were carried out on 1,928 children aged less than 5 years with mothers aged ≥20 years. **Results:** In total, 1,115 households were visited--88% in rural and 12% in urban slums. A little over 36% of household heads were farmers, 16% were labourers, and 7% were in office jobs. The mean family size was 5.3, and the mean monthly per-capita income was Taka 452. A little below 54% of the children were male, and 46% were female. Wasting, stunting, and under-weight were 7.4%, 42%, and 38% respectively. Severe wasting, stunting, and under-weight were observed to be 1.6%, 15%, and 8.4% respectively. Among rural mothers, the prevalence of under-weight (BMI <18.5) was 29%, normal BMI (18.5-22.9) was 61% and at-risk BMI (≥23) was 10%. In urban slum mothers, the corresponding values were 18%, 55%, and 27%. Logistic regression analysis showed that at-risk BMI was associated with urban residence, increasing age, and maternal education status. **Conclusion:** The surprisingly high levels of maternal BMI ≥23 are consistent with nationally-representative data of the BDHS, which have also demonstrated significant levels of maternal over-weight. This double burden of disease (i.e. concomitant existence of high levels of under- and over-nutrition) in the INP areas needs to be addressed by Plan Bangladesh in the form of healthful diet and lifestyle promotion alongside existing under-nutrition interventions. **Acknowledgements:** The support of the Plan Bangladesh is acknowledged.

1:30 pm - 2:00 pm (Venue: Sasakawa Auditorium)
Plenary 4: Community-based Management of Acute Malnutrition

091 (214)

Treating Acute Malnutrition Seriously

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Each year, approximately 1.7 million childhood deaths are associated with severe acute malnutrition and another 3.5 million with moderate acute malnutrition. Despite this vast burden of preventable mortality and morbidity, acute malnutrition has been largely ignored. The very term 'acute malnutrition' is absent from the World Health Organization (WHO) nomenclature; the child-survival movement discusses nutrition exclusively in terms of under-weight (defined by weight-for-age); growth-monitoring programmes contain no indicator of acute malnutrition; and the indicators included in IMCI are subjective, unquantifiable, and difficult to use in practice. The failure of centre-based treatment strategies to deliver affordable population-wide benefits to those suffering from acute malnutrition and the resulting absence of viable treatment options are probably the major factors promoting this glaring omission. During the past 4 years, new community-based approaches to the management of acute malnutrition, with a focus on encouraging early diagnosis and facilitating access to treatment, have attained excellent outcomes and high cost-effectiveness. A series of 20,976 cases of severe acute malnutrition treated in 21 community-based therapeutic care (CTC) programmes operating in Malawi, Ethiopia, and Sudan demonstrated recovery rates of 78.1% and mortality rates of 4.3%. Coverage rates were approximately 73%. Seventy-four percent of these severely-malnourished children were treated solely as outpatients. Initial data indicate that the costs-effectiveness of these emergency CTC programmes varied between $12 and $132 per year of life gained. This range of cost-effectiveness compares favourably with other mainstream child-survival interventions, such as vitamin A provision and oral rehydration therapy for diarrhoeal disease. These results have prompted the WHO to begin the process of re-orientating their treatment guidelines towards a community-based approach to severe acute malnutrition. In addition, the WHO should adopt the term 'acute malnutrition' defined by middle-upper arm circumference or weight-for-height indicators; add middle-upper arm circumference as a standard indicator in growth monitoring programmes; replace the current use of 'visible severe wasting' with a middle-upper arm circumference indicator for the diagnosis of severe acute malnutrition in IMCI; and develop standards for the local production of ready-to-use therapeutic foods. **Acknowledgements:** The information described here has been drawn from the CTC Research and Development Programme, a collaboration between Valid International and Concern Worldwide. This programme has been funded by (in alphabetical order) the Canadian International Development Agency, Concern Worldwide, Development Cooperation Ireland, FANTA Project using funds provided by the United States Agency for International Development (USAID), Save the Children UK, Torchbox Limited, Valid International, and World Health Organization.

2:10 pm - 3:40 pm (Venue: Sasakawa Auditorium)
Scientific Session 16: Anaemia and Iodine Deficiency during Childhood

092 (060)

National Prevalence of Anaemia among Children, Adolescents, and Mothers in Bangladesh Increased Drastically

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Background: Globally, around 4.5 billion people suffer from iron deficiency and anaemia, and the prevalence of anemia previously reported for Bangladesh was very high. Anaemia reduces growth and development, productivity, disease resistance, and delayed intrauterine development at individual level, causing vast economic losses at the national level. **Objective:** The national prevalence of anaemia among vulnerable population groups in rural Bangladesh was assessed and compared with results of previous surveys within the country. **Methodology:** A nationally-representative, multi-stage cluster sampling was applied to sample households in rural Bangladesh in February-March 2004 through the Nutritional Surveillance Project of Helen Keller International, in collaboration with the Institute of Public Health Nutrition, Government of Bangladesh. Data of 1,227 preschool children, 1,309 adolescents, and 1,490 mothers were analyzed. Capillary haemoglobin (Hb) was measured using Hemocue®. Anaemia was defined as Hb <110 g/L (pre-schoolers, pregnant mothers), Hb <120 g/L (adolescent girls aged 13-19 years, adolescent boys aged 13-14 years, non-pregnant women), Hb <130 g/L (adolescent boys aged 15-19 years). The data were weighed for divisional population size differences and analyzed using SPSS (v 11.5). Ethical permission was granted. **Results:** The prevalence of anaemia amoong the population groups by age (pre-schoolers), sex (adolescents), and pregnancy status (mothers) is presented in the table.

	Pre-school children					Adolescents (13-19 years)		Mothers	
	6-11 m	12-23 m	24-35 m	36-47 m	48-59 m	Female	Male	Pregnant	Non-pregnant
n	134	300	305	300	188	661	648	102	1388
Proportion (%)	92.0	85.0	65.0	57.3	47.1	39.7	30.9	38.8	46.0
95% confidence interval	87.4-96.6	80.9-89.0	59.6-70.3	51.7-62.9	40.0-54.2	36.0-43.5	27.4-34.5	29.4-48.3	43.3-48.6
m=Month									

The overall prevalence of anaemia among pre-schoolers was 67.9%. **Conclusion:** The anaemia prevalence in Bangladesh is very high. Compared to a previous survey by the NSP in October-November 2001 that applied the same methods for Hb measurements, the prevalence increased by 9.4-31.1% within pre-schoolers' age-groups (all ages: 18.7% increase) and by 12.1% among non-pregnant women. Another smaller survey in the same areas in

October-November 2004 also showed an increased prevalence. Effective low-cost and population-wide accepted measures providing iron, such as sprinkles or supplementation, and effective disease control are urgently needed to reverse deterioration of the anaemia status of the Bangladeshi population. **Acknowledgements:** The financial support of the Royal Embassy of the Netherlands and the support of IPHN, the partner NGOs, are acknowledged.

093 (168)

Anaemia Survey of Urban Bangladesh and the Rural Chittagong Hill Tracts, 2003

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Background: The prevalence of anaemia has been studied in Bangladesh since the early 1960s as part of national nutrition surveys among small samples of women and children. Helen Keller International and the Institute of Public Health Nutrition conducted anaemia surveys in rural Bangladesh, first in 1997-1998 and again in 2001. Until 2003, there were no representative data on the prevalence of anaemia in urban areas and the Chittagong Hill Tracts (CHT). **Objective:** The study provides data on the prevalence of anaemia in pre-school children, adolescents, and women of child-bearing age in urban areas and rural areas of the CHT of Bangladesh. **Methodology:** In the urban areas, 861 children aged 6-59 months, 1,341 adolescents aged 13-19 years, 500 pregnant women, 665 breastfeeding women, and 884 non-pregnant non-lactating (NPNL) women were randomly sampled from 15 non-slum and 15 slum clusters. In the CHT, 462 children aged 6-59 months, 631 adolescents aged 13-19 years, 368 pregnant women, 436 breastfeeding mothers, and 419 NPNL women were randomly sampled from 15 clusters. The haemoglobin concentration of the subjects was determined using a HemoCue photometer, and information on the demographic and socioeconomic status of their households was collected. Ethical clearance was obtained from the Bangladesh Medical Research Council. **Results:** Anaemia was a severe public-health problem (defined as ≥40%) in both urban areas and CHT among pre-school children (urban 56%; CHT 62%), pregnant women (urban 41%; CHT 49%), and among adolescents in the CHT (43%). Anaemia was a moderate public-health problem (defined as 20-39%) in adolescents in urban areas (23%) and in non-pregnant women in urban areas (34%) and the CHT (39%). The most affected population groups were children aged 6-23 months, followed by children aged 24-59 months and pregnant women. **Conclusion:** Because of the severity of the public-health problem and the potential threat to health, survival and development of present and future generations, the prevention and control of anaemia should be given immediate priority in the health and nutrition sectors of Bangladesh, particularly pre-school children who are not currently the target of anaemia-prevention efforts. **Acknowledgements:** The financial support of United Nations Children's Fund is acknowledged.

094 (059)

Poor Coverage of Micronutrient Supplements among Pregnant and Postpartum Women in Bangladesh

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Background: Anaemia and vitamin A deficiency are common among pregnant and lactating women in developing countries, including Bangladesh, and pose major health risks for mothers and their children. Women in Bangladesh generally cannot afford a micronutrient-rich diet, especially when nutritional demand increases. The Government of Bangladesh has a policy for providing iron supplements to women during pregnancy till 3 months postpartum, deworming medicine in pregnancy, and a high-potency vitamin A capsule (VAC) within 6 weeks of delivery. **Objective:** The study was undertaken to assess the coverage of micronutrient supplements among pregnant and lactating women in rural and urban poor areas in Bangladesh and to examine the associations with maternal and household characteristics. **Methodology:** Data were collected by the Nutritional Surveillance Project of Helen Keller International in collaboration with the Institute of Public Health Nutrition in 2004 from 40,009 rural and 6,226 urban poor mothers with a full-term pregnancy in the previous 3 years. The mothers were asked to quantify receipt of iron supplements during their last pregnancy and within 3 months postpartum, deworming medicines during pregnancy, and a VAC within 6 weeks postpartum, besides collecting socioeconomic information. **Results:** During pregnancy, 38.0% of rural and 42.6% of urban poor women received <100 iron tablets, and 12.1% and 17.0% respectively received ≥100 tablets, while a large portion received none (49.9 rural, 40.4% urban poor). A few women (0.6% rural, 0.6% urban poor) took deworming tablets. Iron supplements within 3 months postpartum were received by 28.0% of rural and 25.7% of urban poor women, and even fewer (2.9% rural, 12.1% urban poor) received a VAC. In rural Bangladesh, 29.5% of women who took iron supplements during their pregnancy received these through the government facilities, and 27.9% bought these from pharmacies. The coverage varied significantly by region and was higher with higher maternal education, larger land size, and in higher expenditure quintiles. **Conclusion:** The findings highlight that reaching women in Bangladesh with micronutrient supplements during pregnancy and postpartum is still a challenge. Strengthening distribution mechanisms, effective monitoring, and increased awareness among mothers under the forthcoming sector programme are necessary to reach all pregnant and breastfeeding women with iron and vitamin A supplementation, as appropriate. **Acknowledgements:** The financial support of the Royal Embassy of the Netherlands and the support of IPHN, the partner NGOs, are acknowledged.

095 (199)

Effect of Daily versus Once Weekly Home-fortification with Sprinkles on Haematological and Iron Status among Young Children in Rural Bangladesh

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Background: Anaemia is a public-health concern in Bangladesh as in many other developing countries. Anaemia, most commonly caused by iron deficiency, impairs the physical and mental development of infants and young children. Micronutrient sprinkles are a strategy of 'home fortification' to increase iron and other micronutrient contents of weaning food. In search of an acceptable and more cost-effective approach, a trial to compare the efficacy of daily and intermittent iron supplementation needs to be done to prevent and treat anaemia. **Objective:** The study was conducted to determine whether there was a significant effect on haemoglobin (Hb), serum ferritin (sFt), and serum transferrin receptor (sTfR) from a given dose of iron in sprinkles provided daily or once weekly over an 8-week period and to determine whether the effect was significantly different between the 2 intervention groups. **Methdology:** This was a double-blind cluster-randomized trial. This community-based study was conducted in rural areas of Kaligonj sub-district in Bangladesh. In total, 136 children aged 12-24 months with mild to moderate anaemia (Hb 70-109 g/L) were included in the study. Thirteen villages were randomly allocated such that children in individual villages received either daily (n=70, 12.5-mg elemental iron), or once weekly (n=66, 30-mg elemental iron) doses of sprinkles for 8 weeks. Hb, sFt, and sTfR were assessed at start and end of the intervention. **Results:** From the start to the end of the intervention, Hb and sFt increased, while sTfR decreased significantly within both daily and weekly groups ($p<0.01$). There were no significant differences in increases in Hb and sFt between the daily (mean±SD for Hb: 16.1±13.2 g/L and median for sFt: 10.6 µg/L) and weekly groups (Hb: 12.3±13.3 g/L and sFt: 5.7 µg/L). In addition, decrease in sTfR was not significantly different between the groups (daily: median for sTfR -2.5 mg/L and weekly: -1.8 mg/L). The prevalence of anaemia (Hb <110 g/L), depleted iron stores (sFt <12 µg/L), and tissue iron deficiency (sTfR >8.5 mg/L) significantly decreased within each group ($p<0.01$) with no difference between the groups. **Conclusion:** Home fortification of complementary foods with sprinkles given either daily or once weekly for 8 weeks to mildly and moderately anaemic young children improved the haematological and iron status to a similar extent. **Acknowledgements:** The financial support of the Hospital for Sick Children, Canada, is acknowledged.

096 (024)

Effectiveness of Daily and Flexible Home Fortification with Micronutrient Sprinkles to Control Childhood Anaemia in Rural Bangladesh

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Background: Iron-deficiency anaemia is a major public-health problem in developing countries. Children aged 6-24 months are one of the most vulnerable groups. Sprinkles consisting of iron and vitamins in powder form is effective and safe for treating childhood anaemia. Efficacy trial in Bangladesh, testing daily and weekly administration of sprinkles, revealed that caregivers preferred more flexible instructions for use of sprinkles. **Objective:** The study compared the effectiveness of daily and flexible administration of sprinkles on haematological status, adherence, and acceptability in rural Bangladesh. **Methodology:** A sample of 362 children (haemoglobin=70 g/L) aged 6-24 months were cluster-randomized to receive 60 sprinkles sachets either (a) daily over 2 months, (b) flexibly over 3 months, or (c) flexibly over 4 months. With flexible administration, mothers decided how frequently to give sprinkles, not exceeding one sachet per day. Each sachet contained 12.5 mg iron, 5 mg zinc, 300 µg vitamin A, 160 µg folic acid, and 50 mg vitamin C. Haemoglobin concentration (Hb) was measured at baseline, end of intervention, and 6 months post-intervention. Adherence was assessed monthly by counting the number of sachets used. Acceptability was assessed after the intervention using focus-group discussions. **Results:** At baseline, Hb (99±14 g/L) and prevalence of anaemia (77%) did not differ among the groups. Hb increased significantly from baseline by 11 g/L, 13 g/L, and 17 g/L in daily 2-month, flexible 3-month and flexible 4-month group respectively ($p<0.05$). The prevalence of anaemia decreased by 65% in the flexible 4-month group compared to 51% in the daily 2-month and 54% in the flexible 3-month groups ($p<0.05$). The percentage of children who maintained non-anaemic status 6 months post-intervention was significantly higher in the flexible 4-month (82%) and flexible 3-month (80%) groups than the daily 2-month (53%) group ($p<0.01$). Adherence was significantly higher in the flexible 4-month group (98%) compared to the flexible 3-month (93%) and daily 2-month (88%) groups ($p<0.01$). Most mothers found both the flexible administration models of home fortification more acceptable than daily due to perceived benefits. **Conclusion:** The biological response and acceptability of a flexible administration of sprinkles over 4 months was greater to daily administration for the control of anaemia among young children in a community-based setting. **Acknowledgements:** The financial support of the Hospital for Sick Children, Canada, is acknowledged.

097 (043)

Implementing a Data Audit Trail for a Micronutrient Supplementation Trial—A Process of Good Clinical Practice

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Background: In defining and implementing an audit trail for a clinical trial, one attests to the sequential events that occur from the completion of a case record form to the final cleaning of data. This is now a standard requirement of Good Clinical Practice (GCP). **Objective:** The objectives of the study were to document (a) the number and type of case record forms (CRFs) that have left the field site; (b) CRFs that have arrived at the data centre; (c) processing status of CRFs after arrival: not yet entered, query generated, entered into database, archived; and (d) cleaning status of database. **Methodology:** The audit trail of the Micronutrients Study (MICS) was developed around the ICH-6 GCP guidelines. The field staff registers each CRF leaving the field site on a data-tracking form (DTF). At the data centre, the data staff verifies forms received against forms listed on the DTF. Teleform, an optical scanning system, is the method of data entry. Automated range and consistency checks determine the processing status of the CRF. Queries are listed on a second DTF. Both DTF-2 and CRF are returned to the field. Forms without queries are archived, and the scanned data filed into the database. A snapshot of the database is taken bi-monthly for post-entry data cleaning, which aims at identifying additional errors. Any changes to the database or CRF are electronically documented. **Results:** Implementation of the above-described audit trail system required considerable staff training to follow the standard operating procedures around each step. Approximately, 21,000 CRFs were processed. Queries were generated for about 9.4% of the CRFs. Some programming errors in the range and consistency checks and in the database filing were corrected along the way. A final CRF-to-database comparison revealed that the remaining error rate in the database was ±1% for most key variables. **Conclusion:** The audit trail that the MICS implements accounts for forms and serves as a time- and cost-effective method to trace forms and error corrections, especially during the validation processes, and, therefore, forms an integral part of the quality control and assurance procedures of the study. **Acknowledgements:** The study was supported by the National Institute of Allergy and Infectious Disease of the National Institutes of Health, USA (5UOIA 1058371-05) and the Wellcome Trust (063009 and 62925).

2:10 pm - 3:40 pm: (Venue: Seminar Room)
Scientific Session 17: Insights into Diarrhoea

098 (205)

Disease Burden of Rotavirus-associated Diarrhoea and Treatment cost in Northern Ghana

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Background: Diarrhoea due to rotavirus infection is an important cause of mortality and morbidity in children aged less than 5 years in developing countries. It is estimated that there are between 110,000 and 150,000 deaths due to rotavirus-associated diarrhoea in children in sub-Saharan Africa each year The development and introduction of a safe and effective vaccine for use in infancy in developing countries is expected to dramatically reduce morbidity and mortality associated with rotavirus infection. Lack of information on the burden of disease and the under-estimation of the vaccine's potential value, have formed a vicious cycle contributing to limited vaccine availability to developing countries. **Objective:** The objective of the study was to estimate the burden of rotavirus disease and treatment cost in Northern Ghana and to provide evidence-based data that will help in the advocacy for the introduction of rotavirus vaccines in Ghana. These included estimates of the hospitilization rates for diarrhoea and rotavirus-associated diarrhoea and the treatment cost of severe diarrhoeas. **Methodology:** During October 2003-September 2004, a hospital-based surveillance for severe diarrhoea was conducted in Navrongo, Northern Ghana. Rotavirus was detected by ELISA, RT-PCR, and PAGE, and the treatment cost estimation was performed with the generic protocol of World Health Organization for the estimation of the economic burden of diarrhoeal disease. **Results:** More than 40% of emergency room visits were attributable to, and rotavirus infection was associated with 39%, of all diarrhoea observed. Rotavirus shedding was common in children between 3 and 17 months of age. The diarrhoea-related hospitalization rate was 46/1,000 admissions, of which more than 36% were attributable to rotaviruses. The median length of hospitalization for rotavirus-associated diarrhoea was 4.5 days and rotavirus G1, G2, G3, and G9 strains were the most common genotypes detected. Rotavirus G2 strains were usually associated with very severe disease requiring hospitalization. Three treatment regimes were observed for the treatment of severe diarrhoea. In the case of inpatients, 10% were treated for diarrhoea as a single cause of hospitalization, 60% were prescribed diarrhoea and anti-malaria drugs, and 29% received treatment for diarrhoea, bronchopneumonia, dysentery, and acute respiratory infection. While the estimated average outpatient cost of treating diarrhoea in combination with other diseases ($4.35) or treating the diarrhoea alone ($4.10) was not significantly different, such was not the case with inpatients. In the case of inpatients, the average cost of treating diarrhoea in combination with other diseases was $133.86 while for diarrhoea alone it was $97.40. The cost of hospitalization was influenced very much by the treatment option chosen by the physician. **Conclusion:** A high burden of diarrhoea exists in Navrongo with one in 6 children with diarrhoea being hospitalized with severe disease. Rotavirus is a major cause of hospitalization for diarrhoea with an associated high treatment cost. A rotavirus vaccination programme will significantly reduce the burden of disease associated with rotavirus diarrhoea which is a major cause of hospitalization in Northern Ghana.
Acknowledgements: The financial support of the World Health Organization (WHO) and the Rotavirus Vaccine Programme is acknowledged.

099 (171)

Rotavirus Genotypes and Clinical Severity in Hong Kong over Three Rotavirus Seasons

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Background: Rotavirus is the leading cause of severe childhood gastroenteritis worldwide. As part of the Asian Rotavirus Surveillance Network, prospective hospital-based surveillance for childhood diarrhoea was conducted at 4 government hospitals in in Hong Kong. **Objective:** The study compared rotavirus genotypes and clinical severity in Hong Kong over 3 rotavirus seasons. **Methodology:** Hospital staff collected stool specimens from children aged less than 5 years admitted with a primary or secondary diagnosis of diarrhoea. Children without a stool sample after admission or with vomiting only were excluded. Stool samples were assayed for rotavirus by EIA. Clinical data abstracted from case notes by research staff were linked to laboratory results. A modified Vesikari score was used for assessing severity. Genotyping was undertaken on 300 rotavirus-positive samples, with 100 samples randomly selected from each of 3 rotavirus seasons (1 December-31 March in 2000, 2001, and 2003). **Results:** G1 predominated in all seasons (49% overall, 57% in season 1, 38% in season 2, and 51% in season 3). The overall prevalence of other genotypes was G3 (23%), G2 (15%), G9 (5%), G4 (4%), G12 (1%), non-typeable (1%), and negative (1%). There were statistically significant shifts in genotype prevalence by season (e.g. season 1: G2 (22%), G3 (8%), and G9 (0%) vs season 3: G2 (4%), G3 (34%), and G9 (10%) [all $p < 0.002$]. All G12 samples (n=3) occurred in season 1. The median modified Vesikari scores [interquartile ranges] did not differ significantly between the genotype groups ($p=0.23$). There was a non-significant trend to greater use of intravenous fluids in the G1 and G9 groups than in the other groups (Fisher exact $p=0.06$). This difference became significant ($p=0.03$) if G1 (71%) was compared with all groups combined (58%) for all seasons but became non-significant when the analysis was adjusted for season. Depending on criteria used, only 2-20% of infants with G1 and 2-6% of infants in other groups combined were assessed to be dehydrated. **Conclusion:** Although a trend to greater use of intravenous fluids was noted in children with G1 rotavirus-associated infections, this trend was not seen when adjusting for seasonality and is of uncertain clinical significance. G1 was most prevalent over 3 consecutive rotavirus seasons, genotype prevalence shifted significantly by season, and the emerging strain G9 was less common than G3 and G2. **Acknowledgements:** The financial support of the Hong Kong Research Grants Council, WHO Department of Vaccines and Biologicals, and Merck & Co. Inc. is acknowledged.

100 (184)

Sequence Analysis of the VP7 and VP4 Genes of G1P[8] Rotavirus Strains Circulating in Africa between 1995 and 2002

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Background: In Africa, an estimated 150,000-200,000 deaths occur each year due to rotavirus-associated infection. Rotavirus strains G1P[8] and G1P[6] commonly circulate in Africa, and a G1P[8] vaccine strain is currently being tested in South Africa. **Objective:** The aim of the study was to evaluate the conservation or variation in the nucleotide and corresponding amino acid sequences of the antigenic regions of the VP4 and VP7 genes of group A G1P[8] rotavirus strains circulating in Africa between 1995 and 2002. **Methodology:** Seventy-four stool samples (positive for group A rotaviruses), collected between 1995 and 2002 from various African countries, were analyzed. These were subjected to polyacrylamide gel electrophoresis, VP6 sub-grouping ELISA, and VP4 and VP7 genotyping to prepare a cohort of G1P[8] strains whose VP4 and VP7 genes were sequenced and compared with reference sequences. **Results:** Various point mutations were noted that localized to VP7 antigenic site A and C at position 94 and 217 respectively, while antigenic site B was conserved. The VP4 antigenic site showed relatively more variation at nucleotide and amino acid levels with amino acid substitutions noted, particularly at residues 104, 113, and 120. **Conclusion:** The mutation at position 94 and 217 of the VP7 gene allowed the G1P[8] strains to be clustered into 2 groups. These mutations were conserved over time, and geographical situation may either imply that there is little immunogical pressure at these particular antigenic sites, or significantly, there are at least 2 groups of G1P[8] rotavirus strains distributed across Africa that may respond differently against G1P[8] vaccine. **Acknowledgements:** The financial support of the Poliomyelitis Research Foundation (PRF) is acknowledged.

101 (070)

Cloning and Sequence Analysis of an ADRV-N-like Rotavirus First Detected in an Adult Diarrhoeal Case in Bangladesh

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Background: The ADRV-N was first identified in an outbreak of adult diarrhoea involving more than 1000 cases in China in 1997. The RNA pattern of the causative rotavirus was 4-2-1-1-1-1-1, which was similar to the group B rotavirus. However, the virus was not detected as group B rotavirus and described as belonging to a new group of human rotavirus (HRV). **Objective:** Since 2000, the authors have been studying rotaviruses causing diarrhoea in adults and children in Bangladesh to know the prevalence of group A and group B rotaviruses. Of 1,402 faecal specimens collected until 2002, RNA patterns typical to the group B rotavirus were found in 14 specimens, and an unusual RNA paterren was found in one specimen. **Methodology:** The unusual HRV, designated B219, was detected in a specimen from a 65-year old female patient with severe diarrhoea in April 2002. RNA pattern of B219 was different from any known groups of rotavirus, and the stool specimen containing this virus was

negative for RT-PCR for detection of rotavirus A, B, and C. By cloning of cDNA using single primer amplification method, sequences of five viral genes (gene 5, 6, 7, 8, and 9) were determined. **Results:** Each of the B219 genes 5, 6, and 8 which was considered to encode NSP1, VP6, and NSP3, respectively, had almost identical nucleotide length to that reported for ADRV-N, and showed 89-95% identities to these ADRV-N genes. Gene 7 and 9 were suggested to encode NSP2 and VP7, respectively, based on partial similarity of deduced amino acid sequences to known rotavirus sequences. All the B219 gene sequences determined in this study showed considerably low identities (less than 60%) to equivalent genes of group A, B, or C rotaviruses, as reported for ADRV-N. **Conclusion:** These findings suggested that B219 and ADRV-N may belong to a novel rotavirus group which is genetically distinct from group A, B, and C rotaviruses. Distribution of the novel rotaviruses (B219 and ADRV-N) in China and Bangladesh suggests the wide circulation of the virus in Asian countries. **Acknowledgements:** The financial support of the Ministry of Sports, Science, Culture and Education (Monbusho), Japan, is acknowledged.

102 (007)

IL8 Response to Bacterial Exposure in vitro

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Background: The acute inflammatory response to bacterial infection is an important part of host defenses. This is mediated by NFkB activation, inducing an IL-8 response that stimulates neutrophil infiltration. This pathway is also implicated in inflammatory bowel disease and may represent an inappropriate reaction to the normal flora. **Objective:** The study was conducted to set up an in-vitro model of bacterial stimulation of IL-8 production and to determine the virulence factors that influence this host response. **Methodology:** HEp-2 cells and non-polarized (NPCC) and polarized (PCC) Caco-2 cell lines were exposed to IL-1 beta and a prototypic enteropathogenic *Escherichia coli* (EPEC) strain, E2348/69, over a 6-hour period. Cell IL-8 transcriptional activity was measured by RT-PCR, and ELISA was used for measuring IL-8 protein in culture supernatants. HEp-2 cells were then exposed to a range of bacteria (K12 *E. coli*, lactobacilli, and mutant strains of E69 [signaling negative, non-motile, non-adherent]) to assess which virulence factors were associated with an IL-8 response. **Results:** IL-1 beta produced increased IL-8 mRNA and IL-8 protein in all cell lines. Levels decreased from HEp-2 to NPCC to PCC. E69 induced a rise in IL-8 RNA and protein within 4-6 hours in HEp-2 and NPCC but not in PCC. Deletions in E9 of flagella, bundle-forming pili, and type 3 secretion system structural genes, escN and espA, reduced the HEp-2 cell IL-8 response. In comparison, lifA and espF deletions enhanced IL-8 levels. **Conclusion:** A model of IL-8 response to bacterial exposure has been established. EPEC flagella and adhesins induce IL-8, but EPEC appears to have the ability to reduce the IL-8 response. **Acknowledgements:** The work was supported by the Crohn's in Childhood Research Appeal.

103 (217)

Small-molecule CFTR Inhibitors as Potential Therapy for Enterotoxin-mediated Secretory Diarrhoeas in Developing Countries

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Intestinal fluid secretion in many types of diarrhoeas involves active secretion of chloride into the intestinal lumen by enterocytes, which creates the driving force for sodium and water secretion. The cystic fibrosis transmembrane conductance regulator (CFTR) chloride channel provides the principal route for chloride secretion at the luminal membrane in enterotoxin-mediated secretory diarrhoeas produced by infection with *Vibrio cholerae* and *Escherichia coli*. Using high-throughput screening, a diverse collection of more than 200,000 small, drug-like molecules was tested for inhibition activity against CFTR. The thiazolidinone CFTRinh-172 produces a voltage-independent CFTR chloride channel block with sub-micromolar inhibitory potency (Ma *et al*. J Clin Invest. 2002;110:1651-8). CFTRinh-172 is rapidly absorbed across the intestinal wall and undergoes enterohepatic re-circulation and accumulation in intestine. The glycine hydrazide GlyH-101 blocks the CFTR anion pore at its lumen-facing surface (Muanprasat *et al*. J Gen Physiol 2004;124:125-37). Recently, a series of highly water soluble, non-absorbable GlyH-101 analogs that rapidly, fully, and reversibly blocked CFTR-mediated chloride current, including compounds coupled to a polyethylene (PEG) backbone, was synthesized (Sonawane *et al*. Faseb J 2006;20:130-2). The thiazolidinones and glycine hydrazides block by >90% of cholera toxin-induced fluid secretion in mouse intestinal loops, without inhibiting intestinal fluid absorption. Thee results provide proof-of-concept for reducing intestinal fluid loss in secretory diarrhoeas by small-molecule CFTR inhibitors. With regard to applications in developing countries, the compounds are stable, inexpensive to synthesize and, because they act on host cells, are not subject to development of resistance.

2:10 pm - 3:40 pm: (Venue: CSD Conference Room)
Scientific Session 18: Liver Diseases in Children

104 (105)

Seroprevalence of Antibodies to Hepatitis A Virus in Urban Indian Children

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Background: Hepatitis A is more frequent among children. Most children in endemic areas acquire immunity through sub-clinical infections. IgM antibody appears early in illness and persists for 90 days, whereas IgG appears more slowly and persists for many years. **Objective:** The study was undertaken to assess the seroprevalence of antibodies to hepatitis A among urban Indian children aged less than 10 years and to evaluate the modes of transmission of the disease and feasibility of hepatitis A vaccine. **Methodology:** This prospective study was conducted on 150 urban Indian children, aged less than 10 years, attending the Pediatric OPD of Batra Hospital and Medical Research Centre, New Delhi, India. Sera were tested for qualitative detection of antibody to hepatitis A virus. **Results:** The overall seroprevalence of antibodies to hepatitis A virus was 62.7%, indicating that most individuals were infected early in childhood mainly through sub-clinical infection. The change in seroepidemiology increased significantly with increasing age. The seropositivity among males was 61% and among females 65%. There was decreasing seroprevalence rate with increasing socioeconomic strata of children aged 2-10 years. Better living condition and hygiene status decreased exposure to virus in higher socioeconomic strata. The majority of individuals from high socioeconomic strata lacked natural immunity and remained at constant risk of infection. The seroprevalence of antibodies was 65% in southern Delhi, 65.2% in other parts of Delhi, and 57.4% in non-capital residents. The children drinking municipal water were more seropositive (82.1%) compared to those drinking tap-water (27.5%) and well-water (50%). Those who used a water-purification method had definitely decreased seroprevalence (38.2%). The children using common toilet were more seropositive (96.7%) than those using private toilets (54.9%). The majority of the population belonged to middle- and upper-lower socioeconomic classes, and the susceptible population to hepatitis A virus was more so in upper socioeconomic classes. So, only such group of children should be offered hepatitis A vaccination as they are at a high risk. **Conclusion:** The overall seroprevalence of hepatitis A is declining in India. The majority of children are immune by early childhood sub-clinical infections**.** The seroprevalence of hepatitis A increases with increasing age. The seroprevalence of hepatitis A declines with improving socioeconomic strata, making the individuals from high socioeconomic strata more susceptible to hepatitis A virus infection.

105 (035)

Biliary Atresia in Infants: Experience at a Tertiary-care Centre in Bangladesh

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Background: Biliary atresia in early infancy is a difficult diagnostic problem. It is crucial to differentiate it from neonatal hepatitis for proper management because prognosis of biliary atresia depends on timely surgical intervention. **Objective:** The study was conducted to evaluate the clinical profile, liver function tests, and imaging study results of biliary atresia in Bangladeshi infants. **Methodology:** The study was conducted at the Pediatric Gastroenterology Unit of the Bangabandhu Sheikh Mujib Medical University, Dhaka, during July 1998-September 2005. Clinical profile, liver function tests, imaging study results, and liver biopsy findings were retrospectively evaluated in 26 biliary atresia infants who presented with cholestatic jaundice. Biliary atresia cases were diagnosed on the basis of clinical (full-term with good birth-weight, persistent pale stool), biochemical (moderate elevation of serum bilirubin), ultrasonographic (non-visualized or contracted gall bladder, gall bladder contraction absent after meal), scintigraphic (absent tracer excretion), and characteristic histological findings. **Results:** Twenty-six (33.8%) of 77 cholestatic infants studied had biliary atresia. Their mean age at onset of jaundice and mean age at presentation were 5.2 days and 3.3 months respectively. The infants were aged 40 days to 6 months, and 16 (61.6%) were boys. Persistent pale stool and hepatomegaly were found in all the cases. Serum total bilirubin was found moderately elevated (mean±SD; 10.9±3.4 mg/dL). Gall bladder contraction after meal was absent in 21 (80.8%) cases, while it was non-visualized in 5 (19.2%) infants. Hepatobiliary scintigraphy showed absent tracer excretion in all the cases even 24 hours after 3 mci of mebrofenin (BrIDA) administration. Characteristic histological features of biliary atresia (bile ductular proliferation, portal tract fibrosis, and bile plugs in portal triads) were found in 19 (73.1%) infants, while in 7 (26.9%) cases histological features of biliary cirrhosis were seen. **Conclusion:** Biliary atresia comprised one-third of the cholestatic infants studied. Although cholestatic jaundice developed early, most studied cases presented late.

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Community Perceptions of 'Jaundice' in Rural Bangladesh (Matlab)

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Background: Viral hepatitis contributes significantly to the burden of disease in developing countries. The biomedical term 'jaundice' is used in rural Bangladesh for describing a distinct disease entity, potentially different from the clinical condition associated with viral hepatitis. Little data exist to describe this disease entity and its relationship to the biomedical condition of the same name. In Matlab, the term 'jaundice' is used interchangeably with a local term '*hoilda palong*'. **Objective:** The purpose of the study was to define the disease entity 'jaundice' in rural Bangladesh and to preliminarily describe local explanatory mechanisms and treatment pathways for 'jaundice'. This study is a first step towards understanding the role and importance of viral hepatitis from a

community perspective and begins to address the foundation for future interventions targeting viral hepatitis in rural Bangladesh. **Methodology:** A qualitative study was conducted in the Matlab intervention area, nested within an ongoing longitudinal study of hepatitis E virus infections, to explore and define this community's perception of 'jaundice'/'*hoilda palong*'. The study explored the treatment pathways for this condition, within the explanatory framework of this illness. The Community Health Research Workers (CHRWs) visited each household in one Study Block to identify any cases of potential acute hepatitis, using a morbidity index. In total, 100 interviews were conducted with individuals who complained of 'jaundice' to the CHRWs or of their family members. Several traditional healers or *'Kabiraj'* were also interviewed as they play an important role in defining the community's understanding of various disease entities. Trained Field Research Assistants interviewed the respondents using a structured questionnaire, and a separate team conducted in-depth interviews. **Results:** Of the 100 respondents, all believed they were suffering from 'jaundice', but 59% complained about yellow eyes and skin, which are the main visible symptoms of clinical jaundice. About 84% complained about loss of appetite, 79% about fever, and 54% about yellow-coloured urine. For treatment, 58.9% sought help from a *Kabiraj*, 19.6% from village doctors, 10.7% from shamans/spiritual healers, and 7.1% sought no treatment; a small number sought help from both a *Kabiraj* and a doctor. Treatments for 'jaundice' varied from pastes and pomades to ritual consumption of blessed foods. Amulets and scared garlands were also frequently used as a means of treating this disease entity. In defining 'jaundice', the *Kabiraj* did not identify yellow eyes/skin, urine, and clay-coloured stool as necessary symptoms of 'jaundice'. The *Kabiraj* most often looked for loss of appetite, fever, or yellow-coloured urine as necessary to diagnose 'jaundice'. **Conclusion:** The use of the term 'jaundice' is ubiquitous in the Matlab community, and there is some overlap with the biomedical understanding of jaundice (as associated with acute viral hepatitis). However, there are other components of the local disease entity 'jaundice' which do not fit into the allopathic paradigm, making the term extremely insensitive and unspecific as a proxy for biomedical jaundice. The chief complaints of 'jaundice' are readily found in other illnesses, including gastric illness, viral fever, and dehydration. This also leads to a community perception that 'jaundice' is widely prevalent as it is readily diagnosed by the traditional health providers. Transient health problems, such as viral fever or temporary dehydration leading to concentrated, yellow urine are at high risk of being mislabelled as 'jaundice'. Treatment-seeking behaviours for this illness consist almost exclusively of folk and spiritual remedies, with little or no allopathic support sought. As national programmes introduce hepatitis B vaccination and pharmaceutical companies promote hepatitis immunizations, improved community education may be warranted to clarify existing misperceptions of jaundice as understood in these rural areas. **Acknowledgements:** The HEV Matlab Study is supported by a grant (1 R01 AI51/31/2004) from NIH-NIAID, USA.

107 (063)

Prevalence of Hepatitis B Infection among Patients of Agartala Government Medical College Hospital during 2001-2005

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Background: Conservative estimates suggest that there are about 350 million carriers of hepatitis B virus (HBV) worldwide. One-third of the world's population has been infected with HBV. HBV infection is endemic in Asia and sub-Saharan Africa. Based on HbsAg, different regions were categorized as high: >7% in Africa, intermediate: 2-7% in India, Middle East, and Eastern Europe, low: <2% in the USA, Western Europe, and Australia. **Objective:** The study was carried out to recognize the epidemiological hepatitis B infection and its distribution among different age, sex, and high-risk groups, to see the overall positivity rate among patients of the Agartala Government Medical College Hospital and their risk factors, to understand the factors that define the development of HbsAg, and also to appreciate the sequel of HBV infection and its clinical profiles. **Methodology:** In total, 21,121 patients of the Hospital were screened and examined with details as per the

research protocol in the Department of Microbiology, Agartala Government Medical College, during 2001-2005. The study design was based on clinical evaluation and serological testing. Five mL clotted blood were collected aseptically for serological test of HbsAg by the ELISA method according to kit specifications. The Government of the State permitted to conduct the study. **Results:** Over the 5-year study period, 1,017 of the 21,121 patients were positive for HbsAg. Of the HbsAg-positive patients, 930 (88.79%) were male, and 114 (11.20%) were female, and had a history of blood transfusion (n=4, 0.39%), vaccination (n=10, 0.98%), addiction (alcohol) (n=389, 38.24%), diabetes (n=15, 1.47%), instrumentation (n=93, 9.14%), and kidney dialysis (n=93, 0.29%) respectively. Most hepatitis patients had complaints of fatigue (n=826, 81.21%), loss of appetite (n=780, 76.69%), nausea (n=650, 63.41%), abdominal pain (n=430, 42.28%), and joint pain (n=126, 12.38%). The dominant age-group included patients aged 40-59 years (n=460, 45.23%) and 20-39 years (n=259, 25.46%). There was a steady yearly increase of hepatitis B infection in the Medical College Hospital since 5 years. The overall incidence was 4.81% for hepatitis B surface antigen. **Conclusion:** The overall incidence of 4.81% is high and is similar to the findings of the NHMANES (National Health Survey, USA) on 14,000 specimens collected during 1988-1992. The survey found the HBV infection rate to be 4.8% (3.2% in Whites, 13.7% in African Americans). **Acknowledgements:** The financial support of the Agartala Government Medical College and Government of Tripura is acknowledged.

108 (080)

Response to Lamivudin Treatment in Children with Chronic Hepatitis B Virus Infection

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Background: Lamivudin is a nucleoside analog with potent inhibitory effect on hepatitis B virus replication. The beneficial effect of lamivudin therapy in children with chronic hepatitis B virus infection has not been well-evaluated. **Objective:** The efficacy of oral lamivudin therapy in Bangladeshi children with chronic hepatitis B virus infection was evaluated. **Methodology:** This is an ongoing study that started from July 2001 at the Paediatric Gastroenterology Unit of the Bangabandhu Sheikh Mujib Medical University, Dhaka. Sixty-nine children, aged 2-13 years, had so far been given 3 mg/kg single oral dose of lamivudine for at least one year depending on the response to therapy. Indications for anti-viral therapy were: (a) chronic hepatitis B virus infection, (b) raised serum ALT level, and (c) serum HBeAg positivity. Children were followed up at a 3-month interval for at least one year and, at each visit, complete blood count, serum ALT, HBeAg, and anti-HBe were done. **Results:** Thirty-four children did not turn up for regular follow-up, and another 14 have not completed the one-year therapy yet. Therefore, these 48 children wree excluded from this communication. Only 21 children have so far completed at least one-year therapy, and 14 (66.7%) of them have lost HBeAg, and the mean±SD time required for HBeAg clearance was 6.81±4.61 months. Twelve (57.14%) of the 21 children have seroconverted, and the mean±SD time required for seroconvertion was 10.0±6.13 months. HBeAg loss was not observed in 7 (33.3%) children. The median serum ALT value before therapy was 89 IU/L (range 52-1400 IU/L), and the median time required for ALT normalization after starting therapy was 3.5 months (range 1-13 month[s]). The mean±SD follow-up period of the studied children was 1.95±0.79 years, and none developed any adverse effects relating to long-term lamivudin therapy. **Conclusion:** Higher rates of HBeAg loss and seroconversion were observed among the studied Bangladeshi children. Reasons for high drop-out are to be identified, and a study with large sample size is required to draw a definite conclusion.

4:15 pm - 4:35 pm (Venue: Sasakawa Auditorium)
Guest Lecture 4: Liver Transplantation—Can Developing Countries Afford It?

109 (083)

Liver Transplantation in the Developing World

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Paediatric liver transplantation is well-established in the developed world. The indications have been clearly defined, as have contra-indications like Alper's syndrome, haemophagocytic lymphohistiocytosis, HIV positivity, metastatic liver disease, disseminated hepatocellular carcinoma, and uncontrolled sepsis[1]. The questions that remain unanswered are the role of liver transplantation in certain metabolic disorders, like propionic and methylmalonic acidemia and the type of transplant (auxiliary vs orthotopic) in certain conditions. In contrast, the questions pertaining to liver transplantation in the developing world are of a more fundamental nature. The questions frequently asked are: whether there is a need for such a programme? Would it not be easier to send patients abroad? Is it possible to develop an indigenous programme?[2] India with a population of 1,000 million, there is a yearly requirement of 2,500 paediatric liver transplants. In the Apollo Centre, 10.6% of all hepatobiliary referrals qualified for a transplant using internationally-accepted criteria (Table 1). The medical conditions necessitating liver transplantation were similar to that in the West with biliary atresia being the commonest indication. However, most children with biliary atresia were either diagnosed late or had not undergone the *Kasai* procedure. With 2,500 children dying of liver failure each year, clearly there is a need. Would it not be simpler to send these children abroad rather than embarking on an indigenous programme? For a child from the developing world to receive a liver transplant in the West is not only a costly exercise but also entails a long-waiting period as being a foreigner, he/she would get a low priority on the cadaver waiting lists which are understandably biased to favour the state health-entitled native population. In contrast, starting a liver transplantation programme in a developing country would not only enormously save a lot of foreign exchange and improve access to those who cannot travel abroad but would also help elevate the level of facilities and expertise in allied specialties, thus improving the standard of healthcare in these countries as has been seen in the West. There is, therefore, a strong case for developing liver transplantation programmes in the developing world. The experience at the Apollo Hospitals over the last 7 years has shown that it is possible to establish a programme, but there are certain unique hurdles that need to be overcome[3]. The social evaluation in the study setting is extremely important. Low socioeconomic and educational levels along with an unstructured family and insufficient social assistance have a considerable impact on practicality of a transplant taking place, the follow-up and overall outcome of patients undergoing transplantation in the developing world[4]. Most patients are referred late for a transplant, quite often when they are not transplantable. The sub-optimal management of the patients in the pre-transplant phase results in a sizeable number being unfit for transplantation[5]. Cost is still a formidable problem for most patients and absence of medical insurance and state funding further aggravates the problem. Besides, there is a clear bias against the girl child with most families hesitating to spend on transplantation for a girl (Table 2). There is a paucity of reliable cadaver organ supply primarily due to low awareness about organ donation. This has necessitated the development of living-related liver transplantation (Table 3). Thus, while the medical indications surrounding paediatric liver transplant remain similar to the West, it is the economic constraints and different patient attitudes and expectations that eventually influence patient selection for a transplant. It is learnt over a period of time that innovative steps, like use of indigenous materials and drugs, involvement of philanthropic organizations, and motivation of people for organ donation, can go a long way in making liver transplantation a reality in the developing world.

Table 1. Hepatobiliary referrals (1.10.97 to 31.08.04) n = 1343	
Neonatal cholestasis	322
Acute liver disease	565
Chronic liver disease	214
Fulminant hepatic failure	60
Miscellaneous	182
LT criteria satisfied	142
Neonatal cholestasis syndrome	98
Fulminant hepatic failure	24
Hepatoblastoma	2
HCC	1
Cryptogenic	12
Wilson's disease	4
Tyrosinaemia	1

Table 2. Assessment for transplantation	
Criteria for LT Satisfied	142
Unfit	58
Fit	84
Refused (girls 40, boys 16)	56
Economic factors for refusing LT	41
Willing for liver transplanatation	28
Cadaver only	17*
LRLT	11$
*16 died on waiting list $3 waiting	

Table 3. Results of transplantation, 10 transplants, 9 patients	
Cadaver	1
Living-related liver transplanatation	8
Re-transplant	1
Successful	5
Longest follow-up - 7 years	

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4:15 pm - 4:35 pm (Venue: Seminar Room)
Guest Lecture 5: Hepatitis C in Children

110 (228)

Hepatitis C in Children: Treatment Outcomes and Can We Afford to Treat It?

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Hepatitis C is the result of infection with hepatitis C virus (HCV RNA virus). Over 200 million people around the world are infected with hepatitis C; an overall incidence of around 3.3% of the world's population. About 80% of newly-infected patients progress to chronic infection. Cirrhosis develops in 10-20% of persons with chronic infection, and liver cancer develops in 1-5% of persons with chronic infection over 30 years. The goal of treatment is to prevent complications of HCV infection. This is principally achieved by eradication of infection. Infection is considered to be eradicated when there is sustained virologic response (SVR), defined as the absence of HCV RNA in serum by a sensitive test at the end of treatment and 6 months to 1 year later. There have been substantial improvements in the success of HCV treatment, and there are currently several treatments approved by the FDA. In randomized clinical trails in adults, the highest overall SVR rates have been achieved with the combination of weekly subcutaneous injections of long-acting peginterferon alfa and oral ribavirin, which represents the current standard of care. The response is better for non-genotype 1 (70-80%) compared to 40-50% in genotype. The present recommendation is to use the combination therapy for one year in genotype 1 compared to 6 months in other genotypes. Interferon and ribavirin are approved by the FDA for use in the treatment of hepatitis C in children. The drug has been used in the dose of 3 MU/M^2 3 times a week for 6-12 months, along with a dose of 15 mg/kgbid of ribavirin. Preliminary uncontrolled studies suggest that children have a better rate of response to interferon therapy than adults and that they tend to have fewer side-effects. A meta-analysis of 10 studies of IFN use in children has shown a response rate of 70% in non-type 1 and 27% in type 1 patients. Casiraghi *et al*. suggested from their experience with 31 patients with hepatitis C infection over a follow-up of 30 years that progression of HCV infection in the absence of additional risk factors is very slow in the first 3 decades of life. However, Bortolotti *et al*. have reported a small number of children with compensated and decompensated cirrhosis in the fist decade of life. Guido *et al*. found low-grade fibrosis in 77.6% of 112 children with HCV. Both age of patient and duration of infection correlated with the stage of fibrosis. In children, in the absence of underlying diseases and hepatotoxin, there are no definite models to predict which patients will go on to have significant liver disease. Favourable treatment response in adults and children correlated with a shorter duration of infection and less fibrosis. In addition, after sustained viral response, there is reversal of hepatic fibrosis, and it reduces the risk of liver failure and hepatocellular carcinoma. There is also evidence that treatment response is better in children with lesser side-effects than adults. A cost-effectiveness analysis was done by Sinha and Das on different strategies of management of chronic hepatitis C infection in children, and it showed that all treatment strategies decreased the number of patients developing decompensated cirrhosis and HCC and also the number of orthotopic liver transplants in the lifetime of the model cohort, and this was more effective in terms of quality-adjusted life-years saved and at the same time cheaper when compared with the strategy of no treatment. It is suggested to treat hepatitis C in children under study protocols both locally and internationally. A large sample size would give better results and help develop clear-cut recommendations for the treatment of hepatitis C in future. Combination therapy and therapy with PEG IFN and ribavirin in paediatric patients are needed.

4:15 pm - 4:35 pm (Venue: CSD Conference Room)
Guest Lecture 6: Inflammatory Bowel Disease in Children

111 (226)

Inflammatory Bowel Disease in Asians: Is It Being Missed?

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Inflammatory bowel disease (IBD) is common in most industrialized countries, and childhood IBD accounts for nearly 30% of total cases. Various studies from these countries have documented an increase in the incidence, mainly of Crohn's disease (CD) over the last few decades. The reasons for the increase is not clear, but epidemiological observations have led to many postulates. Unfortunately, there are no uniform, clear diagnostic criteria which are evidence-based. To address this problem, recently the IBD Working Group of ESPGHAN has recommended "The Porto criteria" which details the consensus-based diagnostic criteria for the diagnosis of childhood IBD. This will bring uniformity in ascertainment of newly-diagnosed IBD cases, and a resulting prospective database is hoped to facilitate future epidemiological studies greatly. The first national prospective survey of childhood IBD was from the British Isles and was published in 2001. It is the largest prospective study in children to be reported so far (Arch Dis Child 2003;88:995-1000 and Lancet 2001;357:1093-4). This survey, documented an incidence of 5.2/100,000 children aged less than 16 years per year. The incidence of IBD in developing countries has been postulated as being low but data is limited. Although infective colitis is much more common, IBD should be suspected and investigated in unusual cases of colitis which do not respond to treatment of common infective agents. Mehta *et al*. from India reported that 5% of children admitted for colonic disorders were diagnosed as ulcerative colitis. A recent very large prospective, adult study from Punjab suggested that the prevalence of ulcerative colitis may be similar to that in the UK (Gut 2003;52:1587-90). Interestingly, incidence of IBD in Asian population resident in western countries appears to be higher than that in native population both in children and adults. Epidemiological studies from Leicestershire in the UK, where a high proportion of residents is immigrants from southern Asia, mostly from India and Pakistan, has shown that the mean annual incidence of ulcerative colitis in people of southern Asian origin was significantly higher at 13.7/105 compared to 6.1/105 in native Europeans. Among the South Asians, incidence of ulcerative colitis was high in Hindus and Sikhs, whereas Muslims showed an incidence similar to that of Europeans (Gut 1992;33:687-93). In contrast to ulcerative colitis, incidence of CD in Hindus was significantly lower than in Europeans. The mean annual incidences for CD during 1980s were 4.7/105 in Europeans, 2.4/105 in Hindus, 3.4/105 in Sikhs, and 5.4/105 in Muslims (28). In paediatric IBD, the recent data from British Isles have shown that a significantly greater proportion of children, aged less than 5 years, of Asian origin feature with IBD (25% vs 6%) with a relative risk of 3.9. (Arch Dis Child 2003;88:995-1000) The reason for this phenomenon is not clear but suggests that IBD among Asians may not be as uncommon as previously thought.

4:40 pm - 5:40 pm: (Venue: Sasakawa Auditorium)
Scientific Session 19: Community-based Therapeutic Care

112 (172)

Home-based Therapy for Childhood Malnutrition with Ready-to-use Therapeutic Food: The Results of an Operational Programme

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Background: Research projects treating childhood malnutrition often show better clinical outcomes than operational programmes. Results of research have shown that home-based therapy with ready-to-use therapeutic food (RUTF) has achieved a recovery rate of 79% and a case-fatality rate of 3% in the treatment of childhood malnutrition in Malawi. **Objective:** The study was conducted to determine the clinical outcomes of an operational programme using home-based therapy with RUTF for childhood malnutrition. **Methodology:** Twelve Nutritional Rehabilitation Units (NRUs) adopted the same management protocol as was used in a previous research study. Children were admitted if they had mild oedema (<0.5 cm of pitting on the dorsum of the foot) or a weight-for-height z-score (WHZ) <-2, and a good appetite. They received RUTF which provided 733 kJ/kg.d (175 kcal/kg.d) and 5.3 g protein/kg.d. Children were admitted directly from home, or after a brief stay in an inpatient therapeutic feeding centre and were followed fortnightly. They were discharged after they reached weight-for-height z-score >-1, and oedema was resolved for 4 weeks or after receiving 8 weeks of RUTF, whichever came first. Local staff were taught at their worksite by a nurse trainer familiar with the protocol and provided with teaching-laminated cards. The primary outcomes in the study were recovery, defined as WHZ >-2 and resolution of oedema, case-fatality rate, and the rate of weight gain during the first 4 weeks. **Results:** In total, 2,820 children aged 6-59 months were treated from December 2004 through May 2005. The protocol was successfully implemented at 11 of the 12 NRUs. 1,664 (59%) children had oedema, 338 (12%) had WHZ <-3 without oedema, and 818 (29%) had -3 <WHZ <-2 without oedema. 1,777 (63%) children were admitted directly from home. 2,535 (90%) children recovered, 38 (1.3%) relapsed requiring subsequent inpatient treatment, and 52 (1.8%) died. Of the 52 children died, 14 had oedema and WHZ <-2, 20 had oedema with WHZ >-2, 10 had no oedema and WHZ <-3, and 8 had no oedema and -3 <WHZ <-2. The rates of weight gain in children with oedema, children without oedema and WHZ <-3, and children without oedema and -3 <WHZ <-2 were 3.3±3.1, 6.3±6.8, and 4.0±4.2 g/kg.d respectively (mean±SD). **Conclusion:** Home-based therapy with RUTF for severe and moderate childhood malnutrition can be successfully administered in a therapeutic operational programme in rural Malawi. **Acknowledgements:** The support of the World Food Programme and United Nations Children's Fund is acknowledged.

113 (031)

An Education Intervention of 'Food-Health-Care' Model Prevents Malnutrition among Bangladeshi Young Children

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Background: Malnutrition is one of the most important preventable risk factors for morbidity and mortality among children. **Objective:** The study was conducted to explore the effectiveness of an educational intervention to prevent malnutrition in young children by promoting timely, adequate, and safe complementary feeding along with appropriate caring practices and health-seeking behaviour. **Methodology:** A community-based randomized controlled trial based on the UNICEF model of nutrition triangle concept was conducted among 605 normal and mildly-malnourished children, aged 6-9 months, in 131 Community Nutrition Centres (CNCs) under the Bangladesh Integrated Nutrition Project (BINP), during 1999-2001, in 4 different divisions of rural Bangladesh. The intervention group received nutrition education weekly for 6 months, while the control group did not receive any nutrition education. Both the groups were observed for next 6 months to see the sustainability of effects. Data were collected through a structured questionnaire for socioeconomic status, feeding pattern, morbidity, and anthropometry. Data were analyzed by SPSS/PC+(SPSSwin12 Inc. USA) and NCHS statistical package. **Results:** A significant increase in frequency of complementary feeding was observed in the intervention group compared to the control group after the intervention (83.8% vs 19.4%, $p<0.001$) and after observation (88.5% vs 21.1%, $p<0.001$). The intervention group had mean weight gain exceeding that of the control group after the intervention (1,088 g vs 994 g, $p<0.001$) and even after observation (2,211 g vs 1,562 g, $p<0.0001$). The prevalence of illness from diarrhoea, acute respiratory tract infection, and fever was less in the intervention group than in the control group after the intervention (26.11% vs 19.44%, $p=0.315$) and after observation (17.22% vs 11.7%, $p=0.221$). After 6 months of the intervention, the proportion of infants with moderate malnutrition was significantly lower in the intervention group compared to the control group (17% vs 24%, $p<0.001$) and even after 6 months of observation; moderate malnutrition was lower in the intervention group compared to the control group (12.3% vs 32.7%, $p<0.001$), and the proportion of normal and mildly-malnourished children was higher in the intervention group than in the control group (87.7% vs 64.3%, $p<0.001$). **Conclusion:** Nutrition education using the nutrition triangle model was seen to prevent malnutrition in infants, otherwise, infants would have become significantly malnourished. **Acknowledgements:** The financial support of the World Bank and technical support through the BINP, Ministry of Health and Family Welfare, Government of Bangladesh, are acknowledged.

114 (062)

Community-based Therapeutic Care for Severely-malnourished Children during Emergency Relief Operations

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Background: Community-based therapeutic care (CTC) is a public-health intervention based on the principles of coverage, access, and cost-effectiveness. The model attempts to maximize population-level impact by focusing on providing effective therapeutic care to the majority of acutely-malnourished people as outpatients, using techniques of community mobilization to engage the affected population and maximize coverage and compliance. **Objective:** The study was carried out to assess the impact of a new approach--community-based therapeutic care--to the treatment of severe malnutrition during emergencies. The presentation aims at presenting key issues in the success of community-based management of severe malnutrition and the main outcomes of programmes to date. **Methodology:** Fourteen CTC programmes for severely-malnourished children were implemented across Africa between September 2000 and June 2004. Criteria for admission to a programme were a weight-for-height percentage of the reference median (WFH) less than 70% or a mid-upper arm circumference of <11 cm or bilateral pitting oedema. Those with severe acute malnutrition with no medical complications were treated in an Outpatient Therapeutic Programme (OTP). The patient attended an OTP site weekly or fortnightly to receive ready-to-use therapeutic food (RUTF) and medical treatment. Children who were acutely malnourished and had additional serious medical complications were treated in an inpatient Stabilization Centre until well enough to be transferred to the OTP. Important aspects of the programme design included minimizing both physical and sociocultural barriers to accessing care. **Resutlts:** Monitoring data from the first 7,400 severely-malnourished children treated in the 14 programmes were analyzed. Across these programmes, the death rate was 4.7%, the cure rate was 76.8%, and the default rate was 10.6%. All met the international standards for these outcome measures laid out by the Sphere Project and were significantly better than results from the TFCs. The coverage of 9 CTC programmes operating in rural environments was assessed. The average coverage in these programmes was 73%, substantially higher than the 50% coverage standard for rural populations stipulated by Sphere and was considerably higher than coverage rates reported elsewhere for centre-based therapeutic feeding programmes. **Conclusion:** The CTC performed well against the international standards for therapeutic care laid out by the Sphere Project and achieved high coverage of the affected populations. **Acknowledgements:** The research described here has been drawn from the CTC Research and Development Programme, a collaboration between Valid International and Concern Worldwide. This programme has been funded by (in alphabetical order) the Canadian International Development Agency, Concern Worldwide, Development Cooperation Ireland, FANTA Project using funds provided by the United States Agency for International Development (USAID), Save the Children UK, Torchbox Limited, Valid International, and World Health Organization (WHO).

115 (122)

Home-based Therapy for Oedematous Malnutrition with Ready-to-use Therapeutic Food

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Background: Standard recommendations are that children with oedematous malnutrition receive inpatient therapy with a graduated feeding regimen. **Objective:** This case series investigated outcomes using exclusive home-based therapy for children with kwashiorkor with a high-energy, high-protein diet. **Methodology:** Children, aged 1-5 year(s) with oedema enrolled in one of 2 therapeutic nutritional studies in Malawi in 2003-2004 were included in this series. Eligible children had mild oedema (<0.5 cm pitting on the dorsum of the foot), good appetite, and no complications. They were treated at home with ready-to-use therapeutic food (RUTF) which provided 733 kJ/kg.d (175 kcal/kg.d) and 5.3 g protein/kg.d. They were followed up fortnightly for up to 8 weeks. The primary outcome was clinical status after treatment. Children were classified as having either simple oedematous malnutrition, weight-for-height z-score (WHZ) >-2, or wasting and oedematous malnutrition, WHZ <-2. Outcomes were classified into 3 categories: recovered, failure to gain weight or relapsed, or died. Secondary outcomes included weight gain, change in arm circumference, and statural growth. **Results:** Two hundred nineteen children participated--134 with simple oedematous malnutrition and 85 with wasting and oedema. Of the children with simple oedematous malnutrition, 95% recovered (127/134), 1% relapsed (1/134), and 4% (5/134) died. Of the children with wasting and oedematous malnutrition, 65% (55/85) recovered and 7% (6/85) died. Children had weight gain of 2.8 (3.2) g/kg.d (mean, SD), statural growth of 0.24 (0.27) mm/d, and a rate of mid-upper arm circumference growth of 0.3 (0.4) mm/d. **Conclusion:** Outcomes were acceptable compared to local and international standards. This suggests that oedematous malnutrition without anorexia or clinical evidence of infection may be successfully treated exclusively with home-based therapy with RUTF. **Acknowledgements:** The financial support of United States Department of Agriculture (USDA) and Children's Nutrition Research Centre is acknowledged.

4:40 pm - 5:40 pm (Venue: Seminar Room)
Scientific Session 20: Parasites, Diarrhoea, and Atopy

116 (012)

Cryptosporidiosis in Children in Kuwait: A Molecular Trail to Mode of Transmission

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Background: Cryptosporidiosis is recognized worldwide as a significant cause of diarrhoeal diseases in both adults and children, especially in children aged less than 2 years. **Objective:** *Cryptosporidium* spp., isolated from young children in Kuwait, were characterized at the molecular level to understand the transmission of infection. **Methodology:** Over a 2-year period, faecal specimens from 97 Kuwaiti children with persistent diarrhoea found to be positive for *Cryptosporidium* spp. by microscopy were genotyped and subtyped with a small sub-unit rRNA-based PCR-restriction fragment length polymorphism analysis. Informed consent was taken from all individuals included in the study. The Ethical Committee, Faculty of Medicine, Kuwait University, approved the study. **Results:** The median age of infected children was 4.9 years, and the majority (>70%) of infections occurred during the cooler months--January to April--indicating a marked seasonal variation. More than 85% of the children with cryptosporidiosis had only *Cryptosporidium*-associated infection. Sociodemographic information did not reveal any particular mode of transmission of infection. Genotyping of the organisms isolated showed that 92 (95%) children had *Cryptosporidium parvum*, 4 (4%) had *C. hominis*, and 1 (1%) had both *C. parvum* and *C. hominis*. Altogether, 9 subtypes of *C. parvum* and *C. hominis* were observed. **Conclusion:** The study revealed a very different distribution of *Cryptosporidium* genotypes in Kuwaiti children compared to other tropical countries. The genotypes and subtypes isolated are discussed in relation to the seasonality and possible mode of transmission of this infection in Kuwait. **Acknowledgements:** The financial support for this study was provided by Kuwait University Research (Grant no. 03/03).

117 (020)

Entamoeba histolytica-associated Diarrhoeal Illness Is Negatively Associated with the Growth of Pre-school Children: Evidence from a Prospective Study

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Background: The enteric protozoan parasites--*Cryptosporidium*, *Giardia,* and *Entamoeba histolytica* cause diarrhoea in children. It has been shown that infection due to *Cryptosporidium* is associated with growth failure of children in the first 2 years of life, whereas the effect of *Giardia*-associated infection on growth is disputable and that of *E. histolytica* is unknown. In addition, the association of these infections in the pre-school years with growth is not known. **Objective:** The aim of the present study was to investigate the association of enteric protozoa-associated diarrhoeal illness with the nutritional status and growth of pre-school children after 3 years

of follow-up. **Methodology:** The subjects of the present study were 221 children from Mirpur, an urban slum in Dhaka. The children were entered into the study at the age of 2-5 years and followed prospectively for diarrhoeal illness for 3 years by every-other-day visits by health assistants. Children received oral rehydration and specific antimicrobial therapy as appropriate for diarrhoea. Half of these children had antibodies against *E. histolytica* Gal/GalNac lectin in their blood at the time of enrollment. Weight and height of the children were measured at entry and at 4-month intervals. *Cryptosporidium* and *E. histolytica* were diagnosed by commercially-available stool antigen detection kits. *Giardia* was diagnosed by conventional microscopy. **Results:** 18%, 16%, and 26% of the children had diarrhoeal illness associated with infection due to *C. parvum*, *E. histolytica,* and *Giardia* respectively over the 3-year period of observation. *Cryptosporidium* and *Giardia*-associated diarrhoeal illness did not show any association with the growth of the children. Children with *E. histolytica*-related diarrhoeal illness had a significantly lower weight-for-age z-score (-0.103$\pm$0.120 vs 0.176$\pm$0.052, p=0.038) at the end of 3 years of observation. Similarly, the change in height-for-age z- score over 3 years was significantly lower in children with *E. histolytica*-associated diarrhoeal illness (-0.348$\pm$0.186 vs 0.142$\pm$0.08, p=0.018). Children who suffered from *E. histolytica*-associated diarrhoeal illness were 2.93 times (95% confidence inerval [CI] 1.01-8.52, p=0.047) more likely to be malnourished and 4.69 times (95% CI 1.55-14.18, p=0.006) more prone to be stunted after 3 years of follow-up. **Conclusion:** *E. histolytica*-associated diarrhoeal illness was negatively associated with growth of pre-school children. Further studies would be required to determine if prevention of *E. histolytica*-associated diarrhoea improves the nutritional status of children. **Acknowledgements:** The support of a grant (AI-43596) from the National Institutes of Health through the University of Virginia (UVA) is acknowledged.

118 (093)

Lower Titre of *Ascaris* IgE and Asthma Symptoms: Association among 3-year Old Bangladeshi Slum Children

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Background: Among Bangladeshi children, bronchial asthma is more prevalent in rural areas where helminthic infectious burden is high, contrary to the world trend. The authors demonstrated that high titre of anti-*Ascaris* IgE and pneumonia history have an increased association with symptoms of bronchial asthma in children in Matlab. **Objective:** The association between serum levels of anti-*Ascaris* IgE and its dose-response relationship to asthma was examined in a cross-sectional design on 3-year-old Bangladeshi children in an urban slum, where helminthic infectious load might be lower than Matlab. **Methodology:** The study was conducted in Kamalapur, a slum area in Dhaka, from June to October 2002. All 760 children who completed the former study in 1999 regarding pneumonia and zinc and still lived in Kamalapur among 1,182 participants were targeted. Symptoms of asthma were identified using the ISAAC (International Studies of Asthma and Allergy in Childhood) wheezing questionnaire. Children were tested for serum levels of total and specific IgEs to *Ascaris* and dust-mite and also for infection due to intestinal helminths. Information on their socioenvironmental factors was collected. **Results:** Ten percent of the children experienced current-wheezings. The median anti-*Ascaris* IgE level was significantly higher in children who experienced wheezing during the previous 12 months than in children who did not (2.55 vs 1.23 UA/mL, Mann-Whitny, p=0.012). The risk for wheezing associated increasingly and independently with anti-*Ascaris* IgE levels only in the highest quartile of anti-*Ascaris* IgE with odds ratio in the highest category

(3.18 [95% confidence interval {CI}]1.37-7.40], p=0.010). However, the dose-response relationship was not identified. The odds ratios were adjusted for sex, history of pneumonia, parental asthma, *Trichrus*-associated infection, and specific IgE. Other risk factors were history of pneumonia (OR=2.50; 95% CI .12-5.37; p= 0.02) and parental history of asthma. The prevalence of *Ascaris*-associated infection among wheezing children and non-wheezing children was 34% and 36% respectively without significant difference. **Conclusion:** It is concluded that increased association is ambiguous between anti-*Ascaris* IgE and asthma symptoms among 3-year old Bangladeshi slum children. This may be because of the comparative low titre of anti-*Ascaris* IgE and a lower helminthic infection load. **Acknowledgements:** The financial support of the Nissan Science Foundation, Japan, is acknowledged.

119 (112)

Acute-phase Protein Levels, Diarrhoea, *Trichuris trichiura,* and Maternal Education are Predictors of Serum Retinol: A Cross-sectional Study of Children in a Dhaka Slum, Bangladesh

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Background: Vitamin A deficiency is a major public-health problem in many developing countries, and identification of contributing factors is important. The acute-phase response, which may occur in infections and/or trauma, is associated with depressed serum retinol concentration and may lead to over-estimation of the prevalence of low serum retinol. **Objective:** The objectives were to identify the predictors of serum retinol concentration, while controlling for acute-phase proteins and to assess the prevalence of low serum retinol in both whole population after correcting for the effect of serum C-reactive protein (CRP) (using multiple categories) and in healthy sub-group. **Methodology:** A cross-sectional study of 579 apparently healthy children, aged 3-7 years, from a Dhaka slum, Bangladesh, was conducted. The effects of age, gender, serum CRP, and alpha$_1$-antichymotrypsin, reported morbidity (during last 2 weeks), *Ascaris lumbricoides* and *Trichuris trichiura*-associated infections and parental education on serum retinol concentration were estimated using multiple linear regression analysis. **Results:** The mean±SD serum retinol was 0.84±0.27 µmol/L. Elevated serum CRP levels, reported diarrhoea, reported nasal discharge, and *T. trichiura*-associated infection were negative predictors of serum retinol concentration, while maternal education was a positive predictor. Using serum CRP concentrations, <1 mg/L as reference, CRP levels of 2-<5, 5-<10, and ≥10 mg/L were associated with lower serum retinol concentrations of 0.12, 0.16, and 0.32 µmol/L respectively. The prevalence of low serum retinol (<0.70 µmol/L) fell from 31.2% to 15.6% in the whole population, after correcting for the effect of CRP and was 20.1% in the healthy sub-group (CRP <2 mg/L). **Conclusion:** The prevalence of low serum retinol was high but over-estimated due to the effect of CRP. Interventions are needed to address low serum retinol in Bangladesh. Controlling diarrhoea, nasal discharge, and *T. trichiura*-assosciated infection and improving maternal education may be important interventions. Multiple categories and cut-offs to indicate elevated acute phase proteins need further research. **Acknowledgements:** The financial support of the Thrasher Research Fund, USA and Danish International Development Assistance (DANIDA), Ministry of Foreign Affairs of Denmark is acknowledged.

4:40 pm - 5:40 pm: (Venue: CSD Conference Room)
Scientific Session 21: Improving Health Systems for Better Childcare

120 (038)

Use of Urban Depot-holders Improving Selected Healthcare Services for Children Aged Less Than 5 Years

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Background: In 2003-2004, the NGO Service Delivery Programme (NSDP) conducted a pilot to introduce depot-holders in 3 types of urban area in Bangladesh. The depot-holders distributed ORS packets, raised awareness of essential service package (ESP) available in NGO clinics, and referred children for diarrhoea, acute respiratory infection (ARI), and EPI. They received an honorarium plus 50% of profits from selling ORS and also received 50% of service charge paid by clients referred by them to the static and satellite clinics. **Objective:** Assessment of the effect of introduction of urban depot-holders on the use of selected child healthcare services for children aged less than 5 years in 'A', 'B', and 'C' types of municipality areas. **Methodology:** Data were collected through baseline and endline household surveys among women, reviewing service statistics, and in-depth interviews with the depot-holders, NGO staff, and community women. Changes in selected indicators were identified in intervention and control areas to assess intervention-related changes. **Results:** At the endline survey, a higher proportion of women knew about the depot-holders who were identified as sources of information on ARI and child immunization. Significantly higher proportions of women at endline received services from the depot-holders, such as ORS packets, children being referred for EPI vaccination. and vitamin A capsules. The coverage of EPI increased considerably from baseline to endline in 'B' type of municipality; BCG 37% to 96%, DPT3 33% to 91%, and coverage of measles 28% to 84%. Service statistics indicated an overall increase in the number of client contacts for most services. In type 'B' and 'C' municipalities, there were considerable increases in the number of service contacts for childhood diarrhoeal diseases. In municipality type 'A', positive changes were more pronounced among women in poor housing and there with considerable increase in the number of contacts for diarrhoeal diseases and ARI. Both NGO staff and women in the community valued the activities of depot-holders in the locality. **Conclusion:** In general, positive changes were observed on the use of selected child healthcare services in the intervention areas. For successful programme implementation, the depot-holders should be equipped with clear field operation guidelines to help them identify families with specific needs for child health services. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) is acknowledged.

121 (098)

Unlocking the Potentials: Ward Health Committees are Making Difference in the Urban Health System in Bangladesh

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Background: In Bangladesh, half of the urban population--nearly 20 million people--reside in municipalities, where over 25% of children live in households with absolute poverty. Municipalities are supposed to provide preventive health and limited curative care to their dwellers with support from the Ministry of Local Government, Rural Development & Co-operatives, but paucity of technical capacity from the Ministry, lack of political and administrative relationships with the Ministry of Health and Family Welfare, and limited resources of municipalities have prevented community health services from meeting the real needs of poor municipality residents. From 2000 to 2004, Concern Bangladesh has strengthened the urban health system in Bangladesh, originally in 2 peripheral municipalities--Saidpur and Parbatipur--in the northern part of the country, followed by recent scale-up to 7 surrounding municipalities in partnership with respective municipalities. **Objective:** The study compared the results of service coverage and health practices among mothers with young children on selected child-survival indicators. **Methodology:** The study was integrated into the design of the intervention. Baseline survey and evaluation research were carried out in Saidpur with 425 and 570 mothers and in Parbatipur with 422 and 342 mothers of children aged less than 2 years respectively. The survey design was based on simple random sampling of 38 mothers per administrative ward. **Results:** The results achieved by this programme were impressive both in terms of capacities of the local groups at ward levels and in coverage and practice levels. For example, the coverage of child immunization increased from 45% to 71% in Saidpur and 49% to 83% in Parbatipur; antenatal care increased from 58% to 89% in Saidpur and 61% to 87% in Parbatipur; and health-facility deliveries increased from 25% to 48% in Saidpur and 24% to 39% in Parbatipur. Improved behaviours were observed, e.g. immediate breastfeeding increased from 18% in Saidpur and 34% in Parbatipur to 47% and 75% respectively. In addition, continuous feeding (food and liquids) to children during diarrhoea also improved, from 18% to 63% in Saidpur and 25% to 64% in Parbatipur. **Conclusion:** With a bounty of the government and private health providers, the studied municipalities do not need more service providers. Instead, they need better coordination and targeting of existing health services to reach the most vulnerable families. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) is acknowledged.

122 (196)

Transferability of Successful Elements of Public-health Intervention in Reducing Mortality among Children Aged Lesss Than 5 Years in Bangladesh

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Background: Small-scale solutions tested in Matlab by ICDDR,B: Centre for Health and Population Research during the 1980s that were transferred to the national health system contributed to improved management and were widely acclaimed achievements of the family-planning programme in Bangladesh. Transferring of other successful elements of public-health interventions tested by ICDDR,B to the national health system has been examined. **Objective:** The study was conducted to assess additional efforts needed by the national health system to achieve further reduction in mortality of children aged less than 5 years in Bangladesh. **Methodology:** The mortality ratio of children, aged less than 5 years, admitted for treatment of pneumonia and diarrhoea to the health facility of the national health system in Abhoynagar, Mirsarai, and Matlab sub-districts during 2000-2004 was examined and compared with the intervention area of ICDDR,B. **Results:** The proportions of average mortality among children were 16% in Abhoynagar, 23% in Mirsarai, and 26% in Matlab sub-districts and 22% in the intervention area of ICDDR,B. Twenty-five percent of 1,025 children in Abhoynagar, 28% of 2,014 children in Mirsarai, 11% of 3,642 children in Matlab, and 18% of 7,608 children in the intervention area of ICDDR,B were admitted to the health facility for the treatment of pneumonia. The mortality ratio of pneumonia was 3:100 in Abhoynagar, 5:100 in Mirsarai, 3:100 in Matlab, and 2:100 in the intervention area of ICDDR,B. Thirteen percent of 2,402 children in Abhoynagar, 26% of 2,367 in Mirsarai, 1% of 1,169 in Matlab, and 17% of 9,324 in the intervention area of ICDDR,B were admitted for the treatment of diarrhoea. The mortality ratio of diarrhoea was nil in all the study areas of the national health system, but it was 0.2:100 in the intervention area of ICDDR,B. **Conclusion:** Despite a lot of commonalities in perceived susceptibility, perceived severity of disease, perceived benefits, perceived barriers to action, social environment and experience, and uniformity with the national health system, ICDDR,B is now marching ahead of the Millennium Development Goals (MDGs) of reducing 2 important causes of mortality among children aged less than 5 years. A greater understanding of the intervention administered by ICDDR,B is needed to assist the Government of Bangladesh in achieving the MDGs of reducing mortality among children aged less than 5 years and transferring the potentials of low mortality ratio and requirements of additional resources to be absorbed by the national health system are needed.

123 (039)

Strategy to Promote Home Fortification with Sprinkles for Controlling Anaemia among Young Children

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Background: Home fortification with sprinkles, delivering iron and other essential vitamins and minerals, is effective and safe for treating and preventing anaemia among infants and young children. To scale up this intervention, a country-specific and comprehensive strategy needs to be developed to promote the acceptability and use of sprinkles on a sustainable basis. **Objective:** The study was undertaken to identify the factors that may influence the acceptance and use of sprinkles. **Methodology:** Trial for Improved Practices (TIPs), an intervention-based behaviour-change research methodology, was used for gathering information from potential consumers. The study was conducted during August-September 2004 on 334 mothers of children aged 6-24 months living across 9 upazilas of urban and rural Bangladesh. The mothers attended education sessions in groups where they were also provided with educational materials. In addition, each mother was given 60 sachets of sprinkles for their child with instructions to use one sachet per day. At the end of the 60-day TIPs, data were collected from the mothers on different aspects of the intervention using quantitative and qualitative research tools. **Results:** Awareness of anaemia was low among the mothers and other caregivers. After initial education sessions, the mothers and other caregivers readily accepted the use of sprinkles for their children and liked using them. The mean compliance with sprinkles use was 81%. Most mothers reported that their children had greater appetite after receiving sprinkles, and their children seemed to like foods mixed with sprinkles. Some mothers mentioned preparing specific weaning foods to use with sprinkles. If side-effects occurred (like diarrhoea and constipation), these did not dissuade the mothers from continuing to provide sprinkles to their children. When asked about the most effective media to promote the concept of home fortification with Sprinkles, most mothers identified television and radio. Most mothers indicated that they would be willing to purchase sprinkles if available in the market and would pay an average of Tk 0.82 per sachet. **Conclusion:** High compliance and positive attitudes towards the use of sprinkles suggest that mothers were ready to accept home fortification with sprinkles. These results can be used for helping scale-up sprinkles for potential country-wide distribution to children in Bangladesh. **Acknowledgements:** The financial support of Hospital for Sick Children, Canada, is acknowledged.

DAY 3: Wednesday, 8 February 2006

9:00 am - 9:30 am (Venue: Sasakawa Auditorium)
Plenary 5: Obesity in Childhood

124 (067)

Childhood Obesity: A Growing Nutritional Threat in the Developing World

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Background: Childhood obesity and its secondary complications have been recognized as growing threats to the nutritional well-being of middle and upper-class children in the developing world. **Objective:** The objective of this review is to describe the growing threat of childhood obesity in the developing world and also to describe a model programme of diet, exercise and behaviour modification on reduction and maintenance of weight in children. **Methodology:** A discussion of the increasing prevalence of childhood obesity in the developing world will be followed by a discussion of a model outpatient programme designed to effectively treat and maintain weight loss in obese children. A comprehensive effective programme includes a low-calorie, high-protein diet, a moderate progressive exercise programme, nutrition education, and behaviour modification. The ideal weight loss programme includes rapid, metabolically safe weight loss, preservation of lean body mass, positive psychological reactions, normal activity, growth, and maintenance of weight loss. **Results:** The prevalence of childhood obesity has significantly increased over the last decade in the developing world. The increased prevalence in the developing world has been found in the growing middle- and upper-class populations with its increasing dietary intake and sedentary lifestyle. The morbidity associated with childhood obesity in the developing world is the same as that in the developed world and includes hypertension, hyperlipidemia, type 2 diabetes, asthma, sleep apnea, and reduced exercise capacity. The psychosocial problems faced by the obese adolescent include: pre-occupation with weight, passivity, negative self -image, and withdrawal from peers. While on the comprehensive weight loss programme, children lost an average of one kg of fat per week or 10 kg per 10 weeks. Lean body mass was maintained. Weight loss was maintained over a 5-year period. With weight reduction, fasting insulin levels decreased as did total and LDL cholesterol, triglyceride levels, and blood pressure. HDL cholesterol increased. In addition, with weight loss, the children's psychosocial profiles improved significantly with decreases in depression and increases in self-esteem scores. **Conclusion:** Childhood obesity is becoming a worldwide problem. With no intervention, over 70% of obese adolescents will become obese adults. Recognizing this worldwide trend is critical so that early interventions can be established to prevent the continued spread of the disease. Establishing an effective model for weight reduction using a combination of diet, exercise, and behaviour modification can help avoid the complications of adult obesity occurring as a result of untreated obese children becoming obese adults.

9:35 am - 12:30 pm (Venue: PHSD Conference Room)
Vaccine Financing Workshop

9:35 am - 9:55 am

125 (242)

Vaccines for the Prevention of Diarrhoea

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The highest-priority vaccines for enteric diseases include: typhoid, rotavirus, cholera, enterotoxigenic *Escherichia coli,* and *Shigella*. There are now have good vaccines for the first three, but vaccines for the last two are still under development. Many countries will soon begin incorporating oral rotavirus vaccine into national programmes. This vaccine has the potential of saving up to 600,000 lives annually and of averting millions of illness episodes. Vaccines for typhoid and cholera are urgently needed in many poor countries, but their use has been limited for many programmatic factors. A critical challenge will be to help policy-makers understand that many enteric diseases are also 'vaccine-preventable'.

9:55 am- 10:15 am

126 (243)

Data for Decision-making

Lara Wolfson (wolfsonl@who.int)

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As decisions have to be made between competing priorities within the health and development sector, it is becoming increasingly important that these decisions are based on the best available evidence, including consideration of likely health benefits that will accrue, and sound assessments of the associated costs. In this talk, an overview will be given of the types of data required by decision-makers as they consider the future development of immunization programmes, particularly focusing on the type of epidemiological and economic evidence that is required to consider the introduction of a new vaccine. Current tools and data repositories will be discussed, and examples given of different analyses used for advocacy in financing immunization.

10:15 am - 10:35 am

127 (244)

Examples of Cost-effectiveness Models and Presenting Data to Decision-makers

Damian Walker (damian.walker@lshtm.as.uk)

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In concert with the efforts to increase global provision, economic evaluations of newer and relatively costly vaccines for children have proliferated. Unfortunately, it is clear that an economic evaluation is neither necessary nor sufficient to a decision to implement vaccination. Part of the problem rests with how results are presented. Thus, this talk provides guidance to future analysts on how best to present cost-effectiveness data to decision-makers focusing in particular on summary measures, the cost-effectiveness plane (a graphical tool for presenting data on the costs, effects, and cost-effectiveness of alternative health technologies) and allowing for uncertainty. Decisions about what is 'acceptable value for money' in healthcare requires some benchmark, or 'threshold', level of cost-effectiveness. Therefore, the presentation also spends time describing alternative benchmarks available to decision-makers to aid the interpretation of cost-effectiveness data. However, improved presentation of findings will not solve the problem entirely. The talk concludes by arguing that the optimal role of economic evaluation, the 'moments' in decision-making, when it might be most influential, remain undefined. Thus, what is needed is a better understanding of the decision process to ensure the role of future economic evaluations as important decision tools in the implementation of new vaccines. Without this attention, economic evaluation risk is being regarded by decision-makers as little more than academic exercises.

11:00 am - 11:20 am

128 (245)

The Singapore Model: A Case Study

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In Singapore, polyclinics (government primary care clinics) provide 60% of all childhood immunizations, with private medical practitioners taking the balance. Singapore has a national childhood immunization programme in place which offers vaccinations against tuberculosis, diptheria, tetanus, pertussis (DTP), poliomyelitis, measles, mumps, rubella (MMR), and hepatitis B. All these immunizations, except hepatitis B, are fully subsidized by the Government and are provided free of charge at all polyclinics. Besides these vaccinations, childhood vaccines, which are not subsidized, are also available in the polyclinics, and these include acellular DTP and varicella vaccines. Using acellular DTP vaccines as an example, the uptake of these vaccines will be compared with those of whole-cell DPT vaccines. Some problems encountered will be discussed.

11:20 am - 11:40 am

129 (246)

Sustainable Financing for Immunization

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As immunization efforts expand, increasing financial resources are required to fund programmes, and the experience of country's development of financial sustainability plans (FSPs) as part of GAVI Phase I will be reviewed. Several promising new financing mechanisms are key components of GAVI Phase II, including bridge financing, and the International Financing Facility for Immunization (IFFIm), and an overview of the status of these mechanisms will be discussed. Finally, the potential advantages and disadvantages of additional financing options under development or consideration, including revolving funds, advance market commitments, debt forgiveness, and IDA buydowns will be discussed.

9:35 am - 10:35 am (Venue: Sasakawa Auditorium)
Scientific Session 22: Environment and Health

130 (144)

Phenotypic and Molecular Characteristics of *Escherichia coli* Isolated from the Aquatic Environment of Bangladesh

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Background: Although *Escherichia coli* remains the important aetiological agent of infantile diarrhoea in Bangladesh, studies have focused mostly on clinical strains, but very little is known about the environmental ones. **Objective:** Despite *E. coli*-related diarrhoea being attributed mainly to drinking natural contaminated water, molecular characterization of *E. coli* is limited to strains of patient origin. The present study was, thus, designed to get a clear picture of the nature, frequency, and distribution of *E. coli* strains in the aquatic environment of Bangladesh. **Methodology:** In total, 160 *E. coli* strains isolated (November 2000-Deccember 2003) from ponds, rivers, and lakes across 13 districts of Bangladesh were studied for antibiotic resistance by the disk-diffusion method, plasmidprofile by the Birnboim and Doly method, and virulence gene content by PCR. Furthermore, 96 randomly-selected strains were subjected to serological studies using 176 O-antisera and 56 K-antisera. Clonal relatedness of selected strains (n=22) was examined by the CDC-adopted PFGE procedure. **Results:** Serotyping revealed O161 to be the predominant serotype (21%), followed by O55 and O44 (13%) each, and 11 were untypeable. Serotype-based categorization revealed that 47% of these belong to enteropathogenic *E. coli* (EPEC) and 30% to enterotoxigenic *E. coli* (ETEC). Most of the 160 strains tested were resistant to commonly-used antibiotics. Plasmid profiling showed a total of 17 different bands ranging from 1.3 to 40 kb. However, 35% of the strains did not contain any detectable plasmid, implying no correlation between plasmid presence and drug resistance. Virulence gene profiling revealed 97 strains to harbour gene for ST, and 2 had gene for Stx, whereas none had genes for LT. A dendrogram derived from the PFGE patterns of 22 strains of 3 pre-dominant serogroups indicated 2 major clusters--one containing mainly serogroup O55 and the other O8. Three strains of identical PFGE profiles belonging to serogroup O55 were isolated from 3 distinct areas, which may be of epidemiological significance because this serogroup might serve as the progenitor for serogroup O157:H7. **Conclusion:** The most significant finding of the present study was the isolation of *E. coli* strains from the aquatic environments with the genetic potential to produce both ST and Stx. Of significance also was the demonstration of dominant serogroups of this region and isolation of O91: H- and O172: H- that have rarely been reported from Bangladesh. Although Shiga toxin-producing *Escherichia coli* strains are not a major health problem in Bangladesh, the strains with the genetic potential to produce Stx may be of significance in this region. **Acknowledgements:** The study was funded by a grant from the Ministry of Science & Information and Communication Technology, Government of Bangladesh. ICDDR,B acknowledges with gratitude the commitment of the Ministry of Science & Information and Communication Technology, Government of Bangladesh, to the Centre's research efforts.

131 (156)

Bacterial Contamination of Tubewell Water in Bangladesh and Probable Sources of Contamination

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Background: In Bangladesh, tubewells are subjected to various bacterial contaminations due to proximity of latrines and other contaminating sources and periodical inundation during flood. **Objective:** The study assessed the bacterial contamination of tubewell water and its relationship with the nearby possible sources of contamination. **Methodology:** In total, 207 water samples were collected from the tubewells of Brahmanbaria, Comilla, and Sirajgonj districts of Bangladesh. The tubewells were chosen on the basis of inundation during flood in 2004. Sample collection, transportation, and processing were carried out following the standard procedures. Total coliform, faecal coliform, and thermotolerant *Escherichia coli* were enumerated by the membrane filtration technique. A questionnaire was developed to find out the possible sources of contamination, and data were collected at the time of water sampling. **Results:** Of the 207 tubewells, 41%, 29%, and 13% had detectable total coliform, faecal coliform, and thermotolerant *E. coli* respectively. Seventy-three percent of the tubewells were close to unsanitary latrines, and 70% had other contamination sources, such as ditch, pond, canal, cowshed, and/or large water body within 10 metres. Sixty-two percent of the tubewells were without platform, and 24% of these platforms were cracked. In addition, 87% of the tubewells were without a good drainage system. **Conclusion:** A large proportion of tubewells in these communities is contaminated with a low-to-moderate level of faecal organisms. The tubewells were not optimally placed or optimally constructed, but, with the marked crowding in Bangladesh, the options for ideal placement of tubewells are limited. Since diarrhoea is a major cause of death in Bangladesh, the health consequence of this contamination requires further evaluation. **Acknowledgements:** The financial support of the United Nations Children's Fund (UNICEF) is acknowledged.

132 (157)

Synergistic Action of Point-of-use Disinfectants on Contaminated Surface Water in Bangladesh

M. Ansaruzzaman, Z.H. Mahmud, S.B. Neogi, A.K. Mallik, A. Matin, K.S. Rahman, G.B. Nair, S.P. Luby, David A. Sack, and M.S. Islam (sislam@icddrb.org)

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Background: In low-income countries where safe drinking-water is scarce, infantile diarrhoea causes an estimated 1.7 million deaths a year. Access to safe drinking-water can reduce the infantile diarrhoea and deaths. **Objective:** The study evaluated the synergistic action of alum, bleaching powder, and lime in purifying contaminated surface water for drinking purpose. **Methodology:** Twenty-five surface water samples collected from different sources, e.g. ponds, rivers, and canals, were examined quantitatively for total aerobic bacteria (TAB), total coliform (TC), faecal coliform (FC), and faecal streptococci (FS) following the standard procedures. Direct and enrichment culture for *Vibrio* spp., *Aeromonas* spp., and *Plesiomonas shigelloides* were also done. Bio-physicochemical parameters, such as pH, dissolved oxygen, salinity, turbidity, residual chlorine,

conductivity, total dissolved solids, zooplankton, and phytoplankton were analyzed. Toxigenic *Vibrio cholerae* O1 and *V. cholerae* O139 (10^9 CFU/100 mL) were artificially inoculated into surface water, and the synergistic effects of disinfectants, such as alum, bleaching powder, and lime, were also assayed. **Results:** Alum, bleaching powder, and lime synergistically removed completely a concentration of $9.5X10^8$-$1.0X10^9$ CFU/100 mL of *V. cholerae* O1 and *V. cholerae* O139, $5.5X10^4$-$1.2X10^5$ CFU/100 mL of TC and FC, and $5.5X10^2$-$1.2X10^3$ CFU/100 mL of FS. The disinfectants when used individually for the treatment of same water mentioned above could not purify the water up to the acceptable limit recommended by the World Health Organization (WHO). With combined effect of alum, bleaching powder, and lime, no significant decrease of pH was found, but a significant decrease of turbidity was observed (from 37 nephelometric turbidity unit [NTU] to 1.5 NTU), and no residual chlorine was present after treatment. The contact time was optimized and found that half-an-hour treatment was enough to purify the water to meet the WHO standard. The technique is very simple, and a volume of 20 litre-contaminated water could be treated optimally with negligible cost. **Conclusion:** The use of this combined disinfectants is the simplest, easiest and cheapest method of purifying contaminated surface water. Access to safe drinking-water will eventually reduce morbidity and mortality due to diarrhoea in children in Bangladesh. **Acknowledgements:** The financial support of the Government of Bangladesh for Improved Health for the Poor (IHP) Project is acknowledged.

133 (158)

Extent of Faecal Contamination of Drinking-water Sources in 2004 Flood in Dhaka City, Bangladesh

M.S. Islam (sislam@icddrb.org), A. Brooks, M.S. Kabir, I.K. Jahid, A. Matin, M.S. Islam, D. Goswami, C.P. Larson, Y. Wagatsuma, G.B. Nair, and S.P. Luby

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Background: Floods occur almost every year in Bangladesh during the rainy season. During the flood periods, water sources get contaminated with human excreta. In the flood of 2004, 38 of 64 districts were affected in Bangladesh, and a total of 201,762 cases and 87 diarrhoea-related deaths were recorded during 12 July-22 August 2004. **Objective:** The study was conducted to assess the extent of faecal contamination of drinking-water sources in Dhaka city and to investigate the effectiveness of various point-of-use disinfectants for water treatment. **Methodology:** In total, 300 water samples were collected from drinking-water sources of 20 different houses in Kamalapur, Dhaka city, from August 2004 to January 2005. The level of faecal contamination was monitored by estimating total and faecal coliform, faecal streptococci, and total aerobic bacterial counts following the standard procedures. The presence of toxigenic *Vibrio cholerae* was also monitored following the enrichment culture technique. Chemical parameters, including total dissolved solids, dissolved oxygen, hardness, chloride, and pH were also monitored. The efficacy of 4 disinfectants, including halotab, zeoline 2000, alum, and bleaching powder, were tested as-point-of-use water-treatment agents. **Results:** Among the 300 water samples tested, unacceptable levels of contamination of total coliform (TC), faecal coliform (FC), total aerobic bacteria (TAB), and faecal streptococci (FS) were found, and the levels ranged from 23.8% to 95.2%, 28.6% t0 95.2%, 19.1% to 83.3%, and 33.3% to 90% respectively. The isolation rates of *V. cholerae* O1 and O139 were both 0.33%, and non-O1/non-O139 was 7.1%. All the chemical parameters, except pH, were within the acceptable limits according to the guidelines of the World Health Organization (WHO) for drinking-water. The pH value in 8 sites fell below the WHO-published standards. **Conclusion:** Among the disinfectants, halotab was most effective against total aerobic bacterial population, followed by Zeoline-200, bleaching powder, and alum. The study demonstrated that, during floods, a range of drinking-water sources get contaminated, and point-of-use water treatment is needed to decontaminate water before drinking, which could reduce waterborne diseases among flood-affected people. The study is important from public-health point of view. **Acknowledgements:** The research was funded by the emergency fund provided by the United Nations Development Progamme (UNDP) and the Government of Japan.

9:35 am - 10:35 am (Venue: Seminar Room)
Scientific Session 23: Malnutrition and Response to Feeding

134 (029)

Growth of Malnourished Children Attending a Partial-day Treatment Programme in the Dominican Republic

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Background: The World Health Organization (WHO) provides detailed recommendations on inpatient treatment of malnourished children; however, resources for inpatient treatment are not always available in developing countries. There is only limited information on the impact of day treatment programmes. **Objective:** The study was conducted to evaluate the use and impact of a partial-day treatment programme for malnourished children. **Methodology:** All children admitted to the child nutrition rehabilitation programme in the Dr. Elias Santana Hospital in Santo Domingo, Dominican Republic, during 2 July 2004-19 July 2005, were invited to participate in the study (n=74). Key data were extracted from a baseline questionnaire and the medical records. The partial-day treatment programme runs Monday through Friday mornings. The suggested admission criteria include weight-for-height (WFH) <-2 SD with a discharge target of ≥-1 SD WFH. Children attend with their caregivers and consume milk-based formula prepared as per the WHO guidelines. Additional formula is sent home for afternoon feeds. A fortified milk preparation is recommended for weekends. Both participating hospital and Conjoint Health Research Ethics Review Board of the University of Calgary approved the study. **Results:** Of the 74 children who were admitted to the programme, 56 were included in the analysis (76%). The mean rate of weight gain during the first 4 weeks of the rehabilitation phase was 3.3 g/kg.day (SD 12.7 g/kg.day), with 20% (11) of the children achieving the minimum recommended rate of ≥5.0 g/kg.day. Twenty-five percent (14) achieved their target weight within this timeframe. Of 43 children no longer in treatment, 54% (23) reached their target weight. The duration of treatment for these children ranged from 10 to 290 days. They attended a mean of 78% (SD 19%) of possible treatment days. On consecutive treatment days, 44% (19) of these children had a mean weight gain rate ≥5.0 g/kg.day, while 28% (12) achieved this rate during non-attendance days. **Conclusion:** There was substantial variation in growth rates of children attending the clinic with the mean growth rates falling in the poor category. Although some children may have benefited from the partial-day treatment programme, alternatives strategies should be considered for this clinic. **Acknowledgements:** The financial support was received from the University of Calgary, Canada. The first author is supported by the Alberta Heritage Foundation for Medical Research and the Canadian Institutes of Heath Research.

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Nitrogen Absorption and Nitrogen Balance in Malnourished Children Recovering from Shigellosis Receiving Plant-based and Animal-based Diet

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Background: Studies have shown better absorption of protein and enhanced catch-up growth with an animal-based high-protein (15% energy from protein) diet (AP), but AP may have limited applications due to higher cost. **Objective:** The study was conducted to determine the intake of macronutrients and to quantify absorption of

nutrients from plant-based high-protein diet (15% energy from protein) (PP) and to compare with AP and low-protein diet (7.5% energy from protein, usual diet for poor communities in Bangladesh) (LP). **Methodology:** Thirty-one moderately-malnourished children, aged 24-59 months, convalescing from shigellosis, were randomized to PP (n=11), AP (n=9), and LP (n=11). Cost to prepare 4,200 kJ from PP, AP, and LP was 0.15, 0.75, and 0.11 US dollar respectively. After 2 weeks of adaptation with these diets, a 72-hour metabolic study was performed. **Results:** The baseline characteristics of the children were comparable among the 3 groups. The average daily energy intake and coefficients of carbohydrate and energy absorption were similar in all the groups (483-496 kJ/kg.d, 89-91%, and 87-89% respectively). The mean±SD coefficients of nitrogen absorption and nitrogen balance (g/kg.day) were 81±6% and 0.35±0.21 in the PP, 82±5% and 0.36±0.80 in AP, and 73±4% and 0.13±0.06 in LP groups (comparable between the PP and the AP group, and both the groups were significantly higher than the LP group). **Conclusion:** The results showed higher absorption of nitrogen and nitrogen balance from high-protein diets whether derived from plant or animal source, which is supposed to help in more deposition of tissue protein. Plant-based high-protein diet, which is less expensive, may be used for nutritional rehabilitation in low-income countries. **Acknowledgements:** The financial support of the International Atomic Energy (IAEA), Vienna, Austria and Core fund are acknowledged.

136 (021)

Impact of Gluten-free Diet on Clinical Profile and Anthropometry in Children with Coeliac Disease

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Background: There are many reports of coeliac disease in India, but the follow-up profile of these children on gluten-free diet is not adequately evaluated. **Objective:** The study was conducted to evaluate the impact of gluten-free diet over 6 months in children with coeliac disease on clinical profile and anthropometeric parameters. **Methodology:** The study was conducted in the Department of Pediatrics, Dayanand Medical College, Ludhiana, India. Twenty-five children with confirmed coeliac disease on the basis of tTG and duodenal histology were included. All of them were put on strict gluten-free diet. The clinical profile and anthropometry were re-evaluated at 3 and 6 months. Data were statistically analyzed. **Resutlts:** Seventy-two percent of the children were aged above 5 years; 52% were from urban areas. Seventy percent of childen, who presented before 5 years of age, were from urban areas, whereas 63% of those presenting after 10 years belonged to rural areas. Forty-eight of the cases had onset of symptoms before 3 years of age, but 72% presented to hospital after 5 years of age (p=0.1944). All the children had failure to thrive and pallor, followed by abdominal distention (76%), abdomen pain (72%), diarrhoea (68%), and irritability (36%). Diarrhoea was common in younger patients (p=0.4984) and FTT in older cases (p=0.4112). After gluten-free diet for 6 months, no patients had diarrhoea and abdomen pain. Distention-abdomen and pallor were present only in 1 and 2 cases respectively. All the patients had protein-energy malnutrition at presentation, 48% had grade III/IV protein-energy malnutrition as per the 50th percentile of the National Center for Health Statistics. At 3 and 6 months of gluten-free diet, a significantly (p=0.003 and p=0.005 respectively) less number of cases had protein-energy malnutrition. Initially, 80% of the cases had height-for-age below 90% of the 50th centile for normal. The number was significantly less (p=0.0225) at 6 months of gluten-free diet. **Conclusion:** Six months of gluten-free diet had a remarkable impact on clinical profile and anthropometry status of children with coeliac disease. The effect was better in the younger age-group.

137 (114)

Effect of Exclusive Breastfeeding Counselling on Iron and Zinc Status of Infants of the MINIMat Study, Bangladesh

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Background: The MINIMat study is a randomized study combining nutritional interventions directed to the mother and promotion of exclusive breastfeeding with the aim to reduce the high frequency of low-birth-weight infants and improve infant growth and development in Bangladesh. **Objective:** In the context of high prevalence of maternal malnutrition and low birth-weight, this analysis assessed whether randomization to counselling on exclusive breastfeeding has an effect on iron and zinc status of infants. **Methodology:** The study included randomization to counselling on exclusive breastfeeding or the usual general health-education message. Trained interviewers collected information on maternal background factors. Venous blood was collected from infants at 6 months of age. Samples from 1,000 infants were analyzed for plasma ferritin and serum zinc. **Results:** Intent to treat analysis with *t*-test showed no significant difference between the 2 randomization groups on plasma ferritin and zinc. However, within the strata of high education (≥6 years in formal school) and within the high socioeconomic groups (highest tertile of an asset score), children born to mothers who had been counselled on exclusive breastfeeding had statistically significant higher serum zinc levels. No effect could be seen on iron status of infants as assessed by plasma ferritin. **Conclusion:** Randomization to counselling on exclusive breastfeeding did not generally improve zinc or iron status in infants at 6 months. However, children in high socioeconomic status groups appeared to benefit from the intervention. Analysis of actual feeding practices is needed to assess if the difference in zinc status in these groups is due to better implementation of exclusive breastfeeding in high socioeconomic groups.

9:35 am - 10:35 am (Venue: CSD Conference Room)
Sceintific Session 24: Infant and Young Child Feeding II

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National Assessment of Status of Infant and Young Child Feeding in Bangladesh

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Background: "Global Strategy for Infant and Young Child Feeding (IYCF)" was approved by the World Health Assembly in May 2002 and was endorsed by the United Nations Children's Fund. The World Health Organization and LINKAGES jointly developed a tool for assessing IYCF in any country to find out the strengths and weaknesses of policy and programmes of the country and plan for improvement in this area. **Objective:** The IYCF status in Bangladesh was assessed to find out the strengths and weaknesses of the existing policies and programmes on breastfeeding and complementary feeding, developing concensus among stakeholders and to outline future direction. **Methodology:** APPAR toolkit, developed by IBFAN Asia Pacific, has been used for the assessment. It consists of 3 parts: IYCF practices, national IYCF policies and targets, and national IYCF programme. Recent epidemiological and statistical reports and policy documents were reviewed. A national workshop has been organized involving many of the stakeholders relating to infant and young child feeding from the government and non-government organizations and development partners to develop consensus on the status of IYCF indicators. **Results:** The exclusive breastfeeding rate was 25.9%, 98.5% of babies were breastfed within one hour, the median duration of breastfeeding was 30 months, 44.4% of babies were given complementary feeding before 6 months, and timely complementary feeding was given to 60% of infants. The national policy on IYCF partially exists which clearly promotes optimum breastfeeding but lacked in working guidelines for complementary feeding. The national committee and plan of action are yet to be developd. More than 80% of maternity facilities were converted to baby-friendly hospitals, but the programme lacks a monitoring system from the Government. International code of marketing breastmilk substitute has been followed to frame national law, but its monitoring and implementation needs further care. Legislations are available for maternity protection as per the International Labour Orgqnization standard, but it is not followed in all sectors. In health and nutrition care, service providers get some training on IYCF, and their policies support IYCF, but practices should be improved. Community outreach and support mechanism are there, but counselling service should be strengthened. Information support is also present, which needs more materials. Appropriate policies and programmes on infant feeding and HIV are yet to be agreed upon. Policies of infant feeding during emergencies exist to some extent. **Conclusion:** Consensus-based national assessment of IYCF is a rapid assessment process and has potential to ensure participation of key role players in improving IYCF. The assessment results should be used in forward planning of national programmes and undertaking local actions. **Acknowledgements:** The support of Bangladesh Breastfeeding Foundation, Government of Bangladesh, and IBFAN Asia Pacific is acknowledged.

139 (026)

Mid-arm Circumference as a Valid Indicator of Birth-weight—A Hospital-based Study on Bangladeshi Neonates

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Background: Morbidity and mortality of newborns largely relate with birth-weight. Detection of low birth-weight is important for the prediction of neonatal survival. **Objective:** The study was conducted to examine the validity of mid-arm circumference in screening low-birth-weight babies. **Methodology:** This was a cross-sectional analytic type of study conducted during July 2000-December 2001. In total, 560 liveborn babies of both sexes were selected. The study was conducted at the Bangabandhu Sheikh Mujib Medical University and Dhaka Medical College Hospital, Dhaka. Both neonatal unit and OBS/GYN unit were included. Weight of newborns were measured using a locally-modified baby scale within 24 hours of birth. Mid-arm circumference of left arm was measured to the nearest 0.1 cm with a non-elastic flexible tape. **Results:** Of the 560 newborns, 53% were male, and 47% were female. Their mean postnatal age was 12.2 hours with SD of ±7.4 hours. Five percent of the neonates had birth-weight of less than 1,500 g, 18.6% less than 2,000 g, and 46.6% less than 2,500 g. Mid-arm circumference for preterm, term and post-term babies were 7.6±0.7 cm, 9.6±0.9 cm, and 9.9±0.7 cm respectively. It was observed that the cut-off value of 9 cm was a significant indicator of low birth-weight (<2,500 g), with a sensitivity and specificity of 96.2% and 97.3% respectively. Similarly, a cut-off value of 8 cm indicated birth-weight of <2,000 g, with a sensitivity and specificity of 94.7% and 91.1% respectively. A cut-off value of 6.8 cm could identify very low birth-weight (<1,500 g), with a sensitivity and specificity of 85.7% and 94.7% respectively. **Conclusion:** The results showed significant correlation of birth-weight with mid-arm circumference (r=O.956). A simple, water-proof flexible tape having 3 different colours for different cut-off values may be recommended for community use.

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*Former Professor, MCH, NIPSOM

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The 'Baby Square'—A Low-cost Screening Tool to Identify High-risk Neonates in Rural Communities

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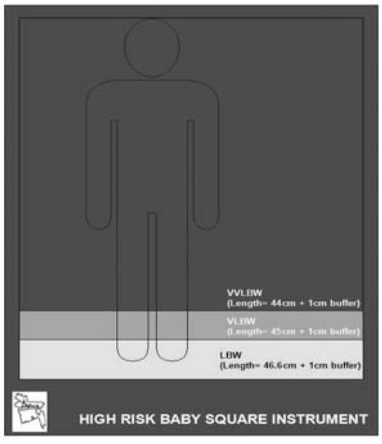
Background: Low birth-weight (LBW, <2.5 kg), moderate low birth-weight (MLBW, <2.0 kg), and very low birth-weight (VLBW, <1.5 kg), as defined in this analysis, are dose-gradient risk factors for poor infant survival and growth. Birth-weight is closely correlated with anthropometry of newborns. Measuring neonates remains

challenging in resource-poor settings, where >90% of births occur at home. Measurement tools are needed so that appropriate measures can be taken to increase newborn survival. **Objective:** The study was carried out to validate a novel, low-cost, home-based tool to assess neonatal length as a proxy for birth-weight in rural Bangladesh. **Methodology:** A 45x30 cm rectangle was printed onto a vinyl sheet, within which an outline of a baby was printed to guide placement of newborn. A 45-cm rectangular length was chosen for testing, based on the median LBW infant-length survey data from South Asian populations. Six hundred community field workers (~8th grade education) were given a 2-hour training on this 'Baby Square'. In the context of the ongoing JiVitA trial, the field workers visit newborns immediately after birth and assess whether their head-to-heel length fits within the Baby Square. An anthropometrist visited each newborn <48 hours after birth and measured length and weight using a digital infant scale, providing a 'gold standard'. The sensitivity (Se) and specificity (Sp) of the Baby Square were examined in identifying <45-cm long newborns to test the tool's accuracy under field conditions. Using ROC analysis, comparing anthropometrist-determined lengths and weights, the optimal length cut-offs were identified for detecting LBW, MLBW, and VLBW. In total, 6,836 newborns measured <48 hours after birth were included in the analysis. **Results:** Of 12,563 enrolled births, 49.7% had birth-weight of <2.5 kg, 13% <2.0 kg, and 2.2% <1.5 kg. Using the Baby Square, the field workers were able to correctly identify infants whose measured lengths were either <45 cm or >45 cm ~70% of the time. However, nearly 50% of false positives and negatives were within 1.5 cm of the 45 cm cut-off. A 45-cm newborn-length performed well in identifying MLBW newborns (Se and and Sp 83%) but only achieved a Se of 42% with a Sp of 98% in detecting LBW. The ROC analysis suggested that 46.6 cm was the optimal birth-length in this population for detecting LBW (Se=80%, Sp=76%), and 44 cm was ideal for predicting VLBW (Se=83%, Sp=85%). **Conclusion:** This novel, inexpensive (<US $0.15) Baby Square shows promise as a method for trained lay workers to identify newborns of low birth-weight under rural home-delivery conditions. Minor training of field workers is needed to position the infant's head and to straighten its legs (to reduce false positives). The findings suggest that inclusion of a 1.5 cm 'buffer' (i.e. to 46.5 cm) could reduce false negatives. This first study showed that the present Baby Square did well in classifying babies above and below 2 kg, with a sensitivity and specificity of 83%. In this population, where 13% of babies have a birth-weight of 2 kg, this tool may provide a viable field solution to the identification of high-risk newborns for special home or facility-based care. A Baby Square is presently under development, and testing of that will seek to optimize cut-offs for all the 3 birth-weight categories. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and Bill and Melinda Gates Foundation.

Currently validated 'Baby Square'



Proposed 'Modified Baby Square'

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Prelacteal Feeding Delays Breastfeeding Initiation in Rural Bangladesh

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Background: While breastfeeding is known to be 'universal' in Bangladesh, prelacteal feeding and delayed initiation of breastfeeding are still a norm in many rural areas of the country. A vicious cycle is formed when a newborn is fed prelacteals as this decreases its urge to suckle; this delays breastmilk letdown and subsequently causes the caregivers to continue prelacteal feeding. This practice exposes the newborn to different types of infectious agents and challenges an already weak premature or immature gastrointestinal system. **Objective:** The study was conducted to describe prelacteal feeding and its effect on the initiation of breastfeeding in northwestern rural Bangladesh. **Methodology:** JiVitA is a maternal and infant health research project, being implemented in 19 unions of rural Gaibandha. In JiVitA, newborn babies are visited, on average, within 18 hours of delivery. At this early visit and at 3 months postpartum, trained female interviewers collect detailed data on prelacteal feeding, time of initiation of breastfeeding, and various morbidities. For this analysis, data for 32,848 births were used. Time to breastfeeding initiation was compared between infants fed and not fed prelacteals. **Results:** Most (90.74%) newborns were fed prelacteals. Of them, 43% were fed honey, 52% animal milk, and 39% sugar (non-exclusively). The overall mean time of initiating breastfeeding was 35.9 hours (SD $\pm$28.4). Prelacteal feeding delayed breastfeeding by 32.1 hours ($p<0.0001$) in contrast to babies not fed prelacteals. More newborns fed honey (17.2%) experienced episodes of diarrhoea (loose watery stools) in the first 3 months compared to those who were not fed prelacteals (13.77%) (RR=1.25; $p<0.01$). **Conclusion:** Despite efforts to reduce prelacteal feeding, this practice remains ubiquitous in parts of rural Bangladesh. The harmful effects of prelacteal feeding and its influence on delaying initiation of breastfeeding should be emphasized in the newborn care behavioral interventions intended to reduce neonatal morbidity and mortality. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and Bill and Melinda Gates Foundation.

11:00 am - 12:30 pm (Venue: Sasakawa Auditorium)
Scientific Session 25: Child Health

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Community-based Estimation of Prevalence of Birth Defects in Rural Bangladesh

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Background: Birth defects are among the leading causes (20-50%) of infant mortality. An estimated 3-5% of all births result in a birth defect. Over 4,000 specific defects have been described; many are difficult to identify in resource-poor settings. Community-based data on the prevalence and types of birth defects in rural South Asia are sparse, stressing the importance of conducting reliable birth-defect surveillance and prevalence estimation. **Objective:** The study was conducted to (a) develop a prototype community birth-defect surveillance system in rural Bangladesh, based on trained lay report, physician verification, and expert diagnosis and (b) to provide initial prevalence estimates of birth defects by type in rural Bangladesh (Gaibandha district). **Methodology:** Every 3-month-old child born to a mother enrolled in the JiVitA maternal nutrition trial undergoes a systematic anatomical review for gross abnormalities by a trained lay interviewer. The interviewer records the location and describes any unusual feature ('abnormality') on the child's body. A research physician later examines each case at home and determines whether any reported (or unreported) abnormality is a birth defect. High-resolution digital photos are taken of the child and of any abnormality. Lesions are described and drawn onto standardized frontal and posterior infant illustrations on a data form. After preliminary diagnoses, the images and notes are uploaded to a secure Internet site, where an expert teratologist who issues confirmatory diagnoses can review data. Finally, verbal autopsies are screened for reported birth defects in infants deceased at <3 months of age. These are findings from 30,403 infants who have had a 3-month lay interviewer screening, 1,900 of whom have been examined by the JiVitA research physicians. **Results:** Of the 30,403 infants examined, 6,152 (20.2%) reportedly had >1 'abnormality'. Of 7,446 reported abnormalities, 5,417 (73%) were birth spots or marks. Primary sites for reported abnormalities were the buttocks (n=1,572, 5.2%) and chest (n=1,123, 3.7%). Of the 1,900 physician-reviewed and photographed cases, 30.5% were birth defects. Single and multiple defects were found in 26.1% (n=495) and 4.4% (n=83) of the children respectively. The common sites of visible birth defects were the ears (10%), chest (7.9%), head (shape or size) (3.4%), and nose (2.9%). Field diagnoses of confirmed birth defects to date revealed the most common birth defects as congenital hernias (19.6%), pre-auricular defects (9.6%), pits (depressions in the skin) (9.6%), nasal malformations (8.2%), hemangiomas (6.0%), and skin tags (5.4%). Among various others (35%), there were 1.1% lip/palate clefts, 7.4% other craniofacial abnormalities, and 7.6% digit/limb defects. Of physician-confirmed defects, 18% were presently undiagnosed. **Conclusion:** A medical and digital-technology-supported rural birth-defect surveillance system has been developed as part of the JiVitA Project. The lay screening seeks to identify 'anything abnormal', and by overstating the cases, sensitivity was presumably maximized. Specificity is improved by sequential stages of research physician's examination and provisional diagnosis, followed by an expert review of the photographic data. Visible birth defects are commonly seen in rural Bangladesh, but potentially fatal birth defects are missed unless detected using verbal autopsy-recall methods. Together, these data will form the basis for generating evidence-based birth defect-prevalence estimates by type, and as associated risk factor data, in the future. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and Bill and Melinda Gates Foundation.

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Care-seeking Pattern and Outcome of Otitis Media in a Birth Cohort in Rural Bangladesh

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Background: The burden of otitis media is the highest in the first 2 years of life. Both viral and bacterial aetiologies are common. Knowledge on the natural history and care-seeking patterns of the disease will help formulate appropriate guidelines for its management. **Objective:** The study was conducted to know the burden, care-seeking patterns, and the course of treated and untreated episodes of otitis media in the first 2 years of life. **Methodology:** Trained community health workers (CHWs) visited the houses of 252 babies born between August 1993 and September 1994 in rural Mirzapur, Bangladesh, to collect data on occurrence, recurrence, duration, and caretakers' care-seeking patterns for the episodes. A study algorithm was followed for diagnosis. **Results:** Forty-six percent (115/252) of the subjects developed 375 episodes of otitis media. A single episode was observed in 20% (n=49) and recurrent episodes in 26% (n=66) of the subjects. Perforation with discharge developed in 85% (322/375) of episodes. The duration was <1 week, ≥1 to <3 weeks, ≥3 to ≤6 weeks in 48% (182/375), 33 % (122/375), and 14 % (52/375) of the episodes respectively. In 7.5% (19/252) of the subjects, episodes lasted >6 weeks. Thirty-four percent (85/252) of the subjects visited a physician at least once, and 12% (30/252) never visited a physician. During the first episode, 60% (68/115) and during recurrence 47% (153/326) of the subjects sought physician-care and received antibiotics. Recurrence occurred in 60 % (41/68) and 53 % (25/47) of treated and untreated children after the first episode. Among those with recurrence (n=66), 153 vs 173 episodes were physician-visited. The mean duration in physician-treated and untreated recurrent episodes was 12±17.4 days and 17.13±20 days respectively ($p<0.04$). All episodes of <6 weeks duration showed resolution. Of those with episodes of >6 weeks duration, 6 vs 13 subjects visited a physician. **Conclusion:** The study demonstrates resolution in episodes lasting <6 weeks even without treatment. While formulating guidelines for management, cheap, quick laboratory-based diagnostic procedures that distinguish bacterial and viral aetiologies will limit the indiscriminate use of antibiotics. All episodes lasting >6 weeks should be evaluated to prevent hearing impairment, delays in language development, and lowered school performance that can result from long duration of episodes. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) is acknowledged.

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An In-depth Examination of Childhood Drowning in Rural Bangladesh

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Background: While reductions in infectious diseases have resulted in impressive declines in child mortality in Bangladesh, drowning is becoming proportionately more important as a major cause of deaths, accounting for

19% of deaths of children aged 1-4 year(s). **Objective:** The objective of the study was to describe the local explanatory model of drowning and identify the behavioural factors increasing the risk for drowning deaths. **Methodology:** Qualitative research was conducted over 13 months in Matlab, Bangladesh. Methods included free-listing exercises and open-ended interviews with families who had lost a child or experienced a near-death due to drowning and with families with at least one child aged less than 5 years living near a body of water. **Results:** Next to diarrhoea, fever, and pneumonia, drowning was perceived as the fourth leading cause of child deaths. Causal explanations were primarily associated with 'evil spirits'. The perceived risk factors associated with drowning included the rainy season, households located near ditches or ponds, times when mothers were too busy, and a lack of understanding among children about the dangers of water. When a young child was discovered in a body of water, parents often did not touch the child. The local belief was that if a parent touches a drowning child, the child will automatically die. After the child was rescued from the water, the primary focus was on extracting water from its stomach. The traditional practices included spinning the child or applying pressure to the child's back. If there was no sign of improvement, care was sought from the local health providers. The data also revealed that mothers were commonly blamed for drowning incidents. **Conclusion:** In Matlab, people have developed explanatory models for drowning deaths. The research identified the locally-constructed beliefs and practices that may increase the incidence of drowning. Future efforts are required to address these beliefs and to assess the feasibility, cultural acceptability, and effectiveness of strategies designed to prevent drowning deaths. **Acknowledgements:** The financial support was provided by United States Agency for International Development (USAID) and DFID.

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Effect of Age, Parity, and Previous Outcome on Pregnancy in Rural Bangladesh

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Background: Many factors contribute to pregnancy failures in rural Bangladesh. In addition to nearly 15% of pregnancies ending prematurely (miscarriages, stillbirths), about 17% of pregnancies, for various reasons, are terminated by menstrual regulation. Early marriage (mean age in Gaibandha ~16 years), unwanted pregnancies, and unmet contraceptive needs contribute to the high risk of pregnancy failure in this population. It is important to both describe the endpoints of pregnancy and to identify maternal determinants which increase the risk of pregnancy failure. **Objective:** The study was undertaken to describe pregnancy outcomes among rural Bangladeshi women by maternal age, parity, and previous pregnancy outcomes. **Methodology:** Since August 2001, over 58,000 pregnancies have been enrolled and followed through 12 months postpartum in the JiVitA maternal mortality reduction trial in Northwest Bangladesh. New pregnancies are identified within ~8 weeks of gestation under a 5-weekly pregnancy surveillance system. Trained interviewers collect data on pregnancy outcomes at 3-month postpartum. In total, 46,670 pregnancies with birth outcomes were used for these analyses of outcomes by age-categories (<20, 20-29, 30-39, >40). **Results:** About 69%, 4%, and 11% of women had a livebirth, stillbirth, or miscarriage respectively. Nearly, 17% performed menstrual regulation. Maternal age was a strong determinant of pregnancy outcome in this rural population. The percentage of pregnancies ending in livebirths decreased with age, from 80% among women aged <20 years to ~40% among those >40 years. The percentage of women who chose to terminate their pregnancies by menstrual regulation steadily increased from <10% among young mothers (<20 years) to ~50% in the oldest age group (>40 years). The miscarriage rate

(spontaneous abortion <28 week gestational age) increased slightly from 10% among young mothers (<20 years) to 14% among older women (>40 years). The stillbirth rate remained constant (~3.5%) across all the 4 age-groups. Comparing women with parity 0, 1-2, and 3+, the percentage of pregnancy outcomes as livebirths decreased from ~80% to ~50%, as the pregnancy termination by menstrual regulation increased from 5% to nearly 40%. Among multiparous women, a previous history of having had a stillbirth, miscarriage, or menstrual regulation was associated with having the same outcome again, by 2.4 (95% confidence interval [CI] 2.02-2.85), 1.37 (95% CI 1.24-1.51), and 2.19 (95% CI 2.02-2.37) times compared to women with a previous livebirth outcome. **Conclusion:** Maternal age, parity, and previous pregnancy outcomes affect pregnancy outcomes in this rural setting. Pregnancy termination by menstrual regulation may represent a response to learning early about an unwanted pregnancy through urine testing, especially in women aged 40 years and older for whom menstrual regulation represents the most common pregnancy outcome (50%). Especially interesting is the finding that women who performed a menstrual regulation in their most recent pregnancy were more than twice as likely to do so again compared to women with a previous livebirth outcome. Untimely and/or unwanted pregnancies could be averted through programmes aiming at increasing the age of marriage and address unmet needs for contraception. Unsafe termination of unwanted pregnancies endangers maternal lives and may contribute significantly to high rate of maternal mortality in rural Bangladesh. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and Bill and Melinda Gates Foundation.

146 (094)

Interrelationship of Serum Zinc, Copper and Magnesium Levels in Children with Different Nutritional Status in Bangladesh

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Background: Micronutrient malnutrition limits the growth and development of children of developing countries like Bangladesh, where interaction between micronutrients and nutritional status is less-understood. **Objective:** The study was carried out to investigate the interrelationship between nutritional status and serum of zinc, copper, and magnesium levels in 2-5 years old Bangladeshi children. **Methodology:** A cross-sectional study was carried out among 116 children selected from different communities of Dhaka city during January-December 2002. Nutritional status was expressed as weight-for-age z-score (WAZ) of the NCHS median. Well-nourished was classified as having WAZ more than -1 SD, mildly-malnourished as between -2 SD and <-1 SD and moderately-malnourished as between -3 SD and <-2 SD. Severely-malnourished children (WAZ less than -3 SD) and ill children were excluded from the study. Three mL of venous blood was also collected from each subject for the estimation of serum zinc, copper and magnesium level by atomic absorption spectrophotometer (Shimadzu AA-6501S) at the Nutritional Biochemistry Laboratory of ICDDR,B: Centre for Health and Population Research after obtaining written consents from parents. Data were analyzed using the SPSSWIN and ANTHRO software. A probability of less than 0.05 was considered statistically significant. **Results:** Compared to well-nourished children, serum zinc level was significantly lower in both mildly-malnourished children, mean±SD, 0.75±0.08 mg/dL vs 0.69±0.02 mg/dL (p=0.002) and moderately-malnourished children (0.75±0.08 mg/dL vs 0.68±0.02 mg/dL, p=0.001). Serum zinc level was positively correlated with weight-for-age z-score (r=0.37, p<0.001),

whereas the copper level was significantly higher in moderately-malnourished children compared to well-nourished children (1.29±0.19 mg/dL vs 1.16±0.17 mg/dL, p=0.003) but not significantly higher in mildly-malnourished children compared to well-nourished children (1.20±0.16 vs 1.16±0.17 mg/dL). Serum copper level was negatively correlated with WAZ (r=-0.22, p<0.02). The mean magnesium level in well-nourished, mildly-malnourished and moderately-malnourished children was 20.19±1.06, 20.22±1.27, and 20.32±1.77 mg/dL respectively, and a non-significant positive relationship (r=0.683) was found for magnesium level with children's nutritional status. **Conclusion:** The study clearly demonstrated the relationship between serum zinc and copper and nutritional status. So, more attention should be given for the improvement of the micronutrient status of Bangladeshi children. **Acknowledgements:** The technical assistance of the Institute of Nutrition and Food Science, University of Dhaka, is acknowledged.

147 (177)

Does Proximity to Market Influence Dietary Diversity of Pregnant Women in Rural Bangladesh?

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Background: Lack of dietary diversity may increase the likelihood of micronutrient deficiency and caloric insufficiency. Among various determinants of the quality of diet, little is known about the influence of access to markets on dietary diversity. **Objective:** The study was conducted to explore the relationship between dietary diversity, represented by 2 indices (a Food Variety Score and a Food Group Score) during pregnancy and distance to the 2 major types of rural markets. **Methodology:** When pregnant women are enrolled in the JiVitA maternal health community trial, they undergo a 7-day food-frequency recall interview for 28 food items. Each participant's data are also linked to a detailed geographic information system (GIS) in which spatial data on markets and household locations are available. The straight-line distance between each participant's household and the nearest market was calculated (both for small local 'bazaars' having >5 shops and 'urban centres' with >50 shops). A Food Variety Score (FVS) was compiled by summing the number of different foods, among the 28 inquired, consumed in the past week. A Food Group Score (FGS) was defined as the number of defined food groups of varying nutritional contents (10 in total: meat, fish, egg, milk and milk products, vegetable oil, DGLV, legumes and beans, peanuts and corn, other vegetables, and fruits) that were represented in the foods reported to be eaten in the past week. Each woman was placed into either 'high' or 'low' FVS and FGS groups using the median as the cut-off. Spatial analyses and logistic regression were used for determining the odds ratio (OR) for low FVS and FGS scores. This analysis included pregnant women enrolled during January 2004-January 2005 (n= 9,001). **Results:** The mean (±SD) distance from women's households to an urban centre was 3.7±1.7 km, and 0.7+0.4 km to any bazaar. Overall, the median FVS was 6, and FGS was 5, with scores ranging from 0 to 21 and 0 to 10 respectively. A distance from a local bazaar of only 0.5 km was significantly associated with low dietary diversity scores (OR=0.2 [95% confidence interval (CI) 1.1-1.3]). This effect is sustained with increased distance from bazaars. The influence of urban centres on dietary variety was also significant, as living only ≥0.5 km from an urban centre showed an increased risk of a low FVS (OR=2.2 [95% CI 1.6-3.1]). A smaller impact was seen on food group diversity, only when women lived 1 km away from an urban centre (OR of low FGS=1.4 [95% CI 1.2-1.7]). **Conclusion:** In rural Bangladesh, poor road quality and lack of transportation options affect access to markets and penetration of market goods into villages. Proximity to markets seems to be associated with

dietary diversity, defined either in terms of variety of individual foods or food groups reportedly consumed by pregnant women in a given week. A distance of only 0.5-1 km to markets is associated with decline in dietary diversity and, likely, nutritional quality. Continued improvements in rural roads and the penetration of small markets and urban centres may help improve dietary quality. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and the Bill and Melinda Gates Foundation.

11:00 am - 12:30 pm (Venue: Seminar Room)
Scientific Session 26: Severe Malnutrition in the Community

148 (197)

Status of Severely-malnourished Children in BRAC-operating Upazilas of National Nutrition Programme

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Background: Nutritional status, particularly among children in Bangladesh, is still dismal**.** The National Nutrition Programme aims at reducing severe malnutrition among children aged less than 2 years with a package of interventions. The effects of the interventions have not been thoroughly reviewed. **Objective:** The study was conducted to assess the effects of the nutrition interventions on children, aged less than 2 years, suffering from severe malnutrition. **Methodology:** The activities of the National Nutrition Programme are being implemented by BRAC in 53 upazilas. The nutirional status was assessed by weight-for-age z-score (severe malnutrition: -3 WAZ). In this study, retrospective data were collected from 61 randomly-selected community nutrition centres in 3 upazilas. Children, aged less than 2 years, identified as severely-malnourished, were followed up and reviewed case by case. **Results:** Of 530 children identified as severely malnourished, 71.7% remained as severely malnourished and 24.7% turned into moderate, 3.0% into mild and less than one percent into normal after having received food supplementation and nutrition education. Twenty percent of the children were identified as severely malnourished at 0-6 month(s), 51% at 7-12 months, and 27% at 13-24 months. Of the children, 53% are female, and 47% were male. None of the children received appropriate medical treatment for severe malnutrition. Moreover, none of the health facilities at the upazila level was equipped to treat severe cases of malnutrition. **Conclusion:** The status of severe malnutrition among children aged less than 2 years was not improved after providing interventions at the community level. It was observed that none of the children had received any medical treatment for severe malnutrition. It is, therefore, crucial to offer appropriate medical treatment at the community and facility levels to combat severe malnutrition. **Acknowledgements:** The financial support of the BRAC Health Programme is acknowledged.

149 (165)

Effectiveness and Sustainability of Protocolized Management of Severe Child Under-weight among the Dhaka Urban Poor

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Background: Rates of child malnutrition in Bangladesh are among the highest in the world and are particularly high in urban slums. ICDDR,B: Centre for Health and Population Research, therefore, developed and tested a pilot project for identification and protocolized management of severe under-weight among weaning-age children

from among the Dhaka urban poor. **Objective:** The study aimed at examining the effectiveness and sustainability of community-based protocolized management of severely-under-weight weaning-age children. **Methodology:** During a 25-month enrollment period, 465 severely-under-weight weaning-age (6- 23 months) children, who were identified when attending NGO-run primary healthcare clinics serving the urban poor, were enrolled for protocolized management . At enrollment, the children had a mean weight-for-age z-score of -3.88, but weight-for-age z-scores ranged to as low as -5 or less, indicating the existence of very severe degrees of under-weight among the target population. Protocolized management included counselling on a home-prepared energy-dense and nutritionally-adequate diet, an eight-week course of micro-nutrients, outpatient treatment of any infectious disease, scheduled monitoring of nutrition status improvements, assisted referral for facility-based management if referral criteria were met and, for children from households with acute food insecurity or compromised caring capacity, provision of an energy-dense take-home supplement. **Results:** Two hundred ninety-two (62.8%) of the enrolled children improved to moderate under-weight, with a mean weight-for-age improvement between enrollment and discharge of 0.86 weight-for-age z-scores. The mean monthly rate of catch-up growth for children who improved to moderate under-weight was 0.29 weight-for-age z-scores. Recovery rates did not depend on the children's degree of wasting, but were significantly lower for the majority of enrolled children who were already severely stunted. At 6-monthly follow-up, only 44.7% of the recovered children could be found, but 84.2% of them had sustained and even further improved on their weight-for-age at discharge. **Conclusion:** Protocolized management was effective for rehabilitating the majority of the enrolled children from severe to only moderate under-weight and that nutrition status gains were sustained. Active outreach should, however, be incorporated in the protocol to increase community-level impact and to incorporate a preventative approach. **Acknowledgements:** The financial support of the World Bank, the United States Agency for International Development (USAID), Government of Bangladesh counterpart funds to ICDDR,B's Bill Gates Award and of ICDDR,R core funds is acknowledged.

150 (212)

Reducing Malnutrition in Young Children in Urban Slums of Bangladesh Using Positive Deviance Approach

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Background: Positive Deviance (PD) is a 'strength-based' approach based on the premise that some solutions to community problems already exist within the community and just need to be discovered. It mobilizes communities for behaviour change by helping them to discover unusual yet successful strategies and practices among caregivers that help some children to stay healthy and grow well without access to special resources. **Objective:** The purpose of the study was to rehabilitate and reduce moderate and severe form of malnutrition in young children aged less than 2 years in urban slums of Khulna using the PD/Hearth approach and to enable families to sustain the rehabilitation of these children at home on their own. **Methodology:** In total, 443 malnourished children and their mothers/caretakers participated in the 108 PD/Hearth sessions conducted in Khulna from March 2004 to October 2005. The PD/Hearth cycle consisted of nutritional education and rehabilitation through demonstrative feeding by the mother/caretaker over a 12-day period in a comfortable home-like situation, followed by home-visits to the caregivers by volunteer mothers or community nutrition promoters over next 18 days. **Results:** Two hundred fifty-eight malnourished girls and 185 boys participated in the PD/Hearth sessions along with their mothers/caretakers. The mean age of children enrolled in the PD/Hearth was 14.4 months for boys and 15.5 for girls. In first 2 cycles of PD/Hearth, nearly one-third of the children gained

more than 500 g weight. The average weight gain by children who completed one PD/Hearth cycle was 334 g, 2 cycles was 319 g, 3 cycles was 251 g, and 292 g for those completing 4 cycles. The average cost of feeding malnourished child in PD/Hearth session was Tk 8-9, and 81% of this cost was borne by mothers through daily contribution of food/fuel. Visible improvement in 12 days was a crucial motivator for behaviour change. **Conclusion:** PD/Hearth is an effective 'learning by doing' approach when targeted at moderately- and severely-malnourished children. It is not a nutrition programme but an essential element of a larger integrated nutrition/health programme.

151 (207)

CD4 Counts of Severely-malnourished Children Infected and Uninfected with Human Immunodeficiency Virus Type 1

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Background: Although the interaction between HIV infection and malnutrition has been studied, there is very little information on CD4 cell counts and percentages of severely-malnourished children by HIV status. **Objective:** The study was conducted to know the effects of severe protein-energy malnutrition and HIV infection on the proportion of peripheral white blood cells and CD4 cell counts in HIV/AIDS-infected and uninfected children. **Methodolpgy:** The study was conducted in the paediatric wards of the Mulago Hospital, the national referral and teaching hospital in Uganda.Three hundred severely-malnourished children (weight-for-height <-3 z-score or presence of oedema) were studied after informed caretakers' consent. CD4 and CD8 cells were established using the FACScan system. HIV serology was confirmed using enzyme-linked immunoassays (ELISA) for children aged above 18 months and using RNA-PCR for those aged less than 18 months. Data were analyzed using EPI Info version 6/SPSS version 11.5. Complete blood count was done using a coulter counter. **Results:** Of the 300 children, 112 (37%) were female, and their median age was 16 months. There was no difference in HIV status by sex or age. The HIV-positive severely-malnourished children had lower median total white blood cell counts XL^6 (7,600 vs 9,500); absolute lymphocytes counts X L^6 (2,604 vs 3,648); median $CD4^+$ cell counts XL^6 and percentages (324 vs 1,243; 15 vs 35); and median $CD8^+$ cell counts X L^6 (897 vs 718), median CD4:8 ratio (0.53 vs 1.9) than the HIV-negative children. **Conclusion:** Severe protein-energy malnutrition is associated with depletion of haematological and $CD4^+$ cell count in both HIV-positive and HIV-negative children.

152 (077)

Prospective Assessment of Dietary Intake in Malawian Children at Risk for Kwashiorkor

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Background: While kwashiorkor occurs in settings of food shortages, it is not known what foods or nutrients are deficient in diets associated with this form of severe malnutrition. **Objective:** The study was carried out to identify which dietary patterns are associated with the development of kwashiorkor using a prospective case-

control method. **Methodology:** In total, 2,288 healthy children, aged 12-48 months, from 8 rural villages in southern Malawi participated in the study. A food-frequency questionnaire, which included all possible foods in the children's diet, was developed through a series of village focus-group sessions. There were 9 possible frequency answers for each food in the questionnaire ranging from 3/day to <1/month. Upon enrollment, caretakers provided demographic information about the child, anthropometric measurements were made, and the food-frequency questionnaire was completed. Children were then checked for the presence of oedema fortnightly for 10 subsequent weeks. Those who developed oedema were diagnosed with kwashiorkor and removed from the study. Data on the average serving size, available from a previous study, were used for estimating energy, protein, vitamin C, vitamin A, niacin, thiamine, zinc, and iron intake for each child. Seven controls matched for age, weight-for-height z-score, and height-for-age z-score were chosen for each case. Foods that were consumed less than twice a month were not compared. Comparisons between cases and controls were made using Student's *t*-test, and foods with a $p<0.02$ were considered significant. **Results:** Forty-four children developed oedema, 308 children were chosen as controls. Thirty (68%) of the 44 children with kwashiorkor were still breastfeeding compared to 225 (73%) of the 308 controls ($p=0.521$). Of the 32 foods compared, children with kwashiorkor were found to eat significantly less guava ($p=0.017$), papaya ($p=0.003$), and small fish ($p=0.008$). There were no differences in the intake of the main staple foods, rice and corn, or protein-rich foods, such as meat, eggs, or large fish, between the cases and the controls. There were no differences in the intake of energy, protein, vitamin C, vitamin A, niacin, thiamine, zinc, and iron between the cases and the controls. **Conclusion:** Further research is needed to determine what role, if any, the consumption of guava, papaya, or small fish play in the pathogenesis of kwashiorkor. **Acknowledgements:** The support of the Doris Duke Clinical Research Fellow Program is acknowledged.

153 (073)

Nutrition Education Intervention of 'Food-Health-Care' Model Reduces Moderate Malnutrition among Bangladeshi Children

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Background: In Bangladesh, about 45% of children are moderately malnourished who often go unnoticed for intervention. There is an urgent need of incorporating feasible and cost-effective nutrition intervention to reduce moderate malnutrition in children. **Objective:** The study was carried out to explore the efficacy, feasibility, sustainability, and differences in response to a specific nutrition intervention in reducing moderate malnutrition among Bangladeshi children. **Methodology:** A community-based prospective randomized control trial, based on the UNICEF model of nutrition triangle concept, was conducted among 626 children, aged 6-24 months, under the Bangladesh Integrated Nutrition Project (BINP), in 4 divisions of Bangladesh during 1999-2001. During the 6-month intervention period, mothers of the first intervention group received frequent nutrition education (FNE) twice a week for 3 months and weekly for next 3 months and the second group received less-frequent nutrition education (LFNE) weekly for the first 3 months and fortnightly thereafter. All children were observed for next 6 months. Along with monthly anthropometric measurements, information on sociodemographic characteristics and feeding behaviour and morbidity data were collected through a preceded structured questionnaire. Data were analyzed with SPSS/PC+ (SPSSwin12 Inc., USA) and NCHS statistical package. **Results:** After 6 months of the intervention, there was a reduction in proportion of children with moderate malnutrition in both LFNE and FNE groups. About 34% of children in the LFNE group and 27.7% in the FNE group improved from moderate

malnutrition to normal or mild malnutrition (p=0.283). After 6 months of observation, 37% from the LFNE group and 35% from the FNE group (p=0.768) improved to mild malnutrition, and 7.3% from the LFNE group and 9.9% from the FNE goup improved to normal nutritional status (LFNE vs FNE, p=0.448). Increase in mean weight gain was found in both the groups after the intervention (LFNE 1,254 g and FNE 1,206 g, p=0.805) and after observation (LFNE 2,157 g and FNE 2,210 g, p=0.028). The prevalence of illness declined in the observation period (LFNE 11.7% and FNE 12.8%, p=0.831) compared to the intervention period (LFNE 18.9% and FNE 20%, p=0.858). Furthermore, feeding practices and health-seeking behaviour by the caregivers were also changed positively with intervention. **Conclusion:** To reduce moderate malnutrition, LFNE and FNE were equally efficacious, and LFNE should be implemented as a cost-effective and sustainable strategy for reducing moderate malnutrition. **Acknowledgements:** The financial support of the World Bank through the BINP (Ministry of Health and Family Welfare, Government of Bangladesh) is acknowledged.

11:00 am - 12:30 pm (Venue: CSD Conference Room)
Scientific Session 27: Optimizing Management of Diarrhoea and Anaemia

154 (064)

Management of Childhood Gastroenteritis: What Does Need Improvement?

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Objective: The study was conducted to document management of childhood gastroenteritis in the Accident and Emergency Department (A&E), to compare this with the recommendations of the European Society of Gastroenterology and Nutrition, and to note the demographic referral patterns. **Methodology:** The case notes of children presenting consecutively to the A&E Department with the diagnosis of gastroenteritis were examined. Compliance with a number of criteria was studied; these included: history, physical examinations, stool examination, use of oral rehydration solution (ORS), hospital admission, medication, and early resumption of normal feeds. **Results:** In total, 572 children presented with gastroenteritis during October 2003-September 2004 were included in the study. One hundred sixty-one consecutive cases from this period were studied. Most were self-referred (105) with 48 GP referrals. Eighty-five were male, and 76 were female. There was 100% compliance for history of severity of diarrhoea, 99% for urine output, 88% had weight measured, 95% temperature, 99% CRT and degree of dehydration. All children who required intravenous fluids had their stool checked, but only 40% of those had blood in the stools. Only 71% of the children received ORS. All children admitted met criteria for hospital admission. No children had unnecessary medication, and all had resumption of normal feeds after rehydration. There was geographical clustering which was concordant with socially-deprived areas. **Conclusion:** Compared to the published survey 10 years ago, the management of gastroenteritis has improved. Children are no longer receiving unnecessary medication and are not being starved. However, 29% of children are receiving inappropriate fluids, including water and fruit juices, resulting in some cases of hyponatraemia. Further education about the use of ORS is needed. Preventive measures need to be targeted at areas of social deprivation.

155 (222)

Dioctahedral Smectite in Acute Watery Diarrhoea in Children: A Randomized Clinical Trial

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Background: Dioctahedral smectite, a natural adsorbent clay, is capable of adsorbing viruses, bacteria, and other intestinal irritants in vitro. It is claimed to possess beneficial 'anti-diarrhoeal' properties. There is no safe dioctahedral smectite agent which can be used for decreasing the volume and frequency of diarrhoea. Recent data suggest safety in children with diarrhoea, and hence the study was undertaken. **Objective:** The study was conducted to determine the effects and safety of dioctahedral smectite on duration of diarrhoea and frequency of stools per day **Methodology:** The study was conducted at the Diarrhea Treatment Unit, Pediatrics III, Civil Hospital, Karachi, Pakistan. Data were collected from outpatients and recorded on admission (0 hour), at second, fourth and seventh day. Inclusion criteria were: 2 months-15 years of age, acute watery diarrhoea of less than 7 days, and consent of parents. Exclusion criteria were: received antibiotics in last 48 hours, no use of antibiotics

in last 48 hours, and children with persistent diarrhoea. All patients had stool DR; stools for rotavirus (ELISA) and bacterial culture were submitted on the very first day. In total, 100 children, aged 2 months-15 years, with acute watery diarrhoea and mild, moderate, or severe dehydration were included in a randomized controlled trial. After initial rehydration, they received dioctahedral smectite and oral rehydration therapy (ORT) in one arm, and ORT as a stand-alone therapy in the other arm of the study. Both the groups received adequate feeding. **Results:** The clinical characteristics of both the groups were comparable on admission. Patients in the dioctahedral smectite group had significantly fewer stools (1.1±0.21 vs 2.61±1.12) (p=0.0008) on the fourth day. These results suggested a beneficial effect of dioctahedral smectite. There were no adverse effects of the use of dioctahedral smectite. Freshly-dissolved dioctahedral smectite, in a dose of 1.5 g thrice daily for 4 days, significantly shortened the duration of acute watery diarrhoea in children aged 2.33±1.11 years. Dioctahedral smectite significantly reduced the frequency of liquid stools on the fourth day of treatment. The taste of dioctahedral smectite was acceptable to the children, and its administration was not accompanied with any side-effects. Of the 100 patients, 9 were rotavirus-positive by ELISA and 55 had cholera; *Campylobacter* was detected in 9, *Shigella* in 1, *Salmonella* in 3, and *Aeromonas in 2;* and no pathogens were detected in 21 cases. Two patients with *Vibrio cholerae* also grew *Campylobacter jejuni* and *Escherichia coli* each. Stool DR revealed *Entamoeba histolytica* (veg) in 41, *Giardia* (veg forms) in 3, ova in 2, and D/R normal in 34 patients. **Conclusion:** Dioctahedral smectite seems to shorten the duration of acute watery diarrhoea and frequency of diarrhoea. Larger blinded studies are required to make policy decisions. The frequency of rotavirus does not seem to be as high as reported in literature. Cholera remains highly endemic in the region.

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Pathogenesis of Enterotoxigenic *Bacteroides fragilis*-associated Diarrhoea in Bangladeshi Children and Adults

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Background: Enterotoxigenic *Bacteroides fragilis* (ETBF) have recently been associated with diarrhoeal disease in young children and adults. These strains secrete a heat-labile toxin (*B. fragilis* toxin or BFT) that is proposed to be a key virulence protein of ETBF strains. Purified BFT stimulates sub-mucosal inflammation and secretion and modifies intestinal epithelial cell morphology in both small bowel and colon of animals. **Objective:** The goal of the study was to further understand the epidemiology and pathogenesis of intestinal disease caused by ETBF in Bangladesh. Neither the clinical syndromes associated with ETBF infection nor the pathophysiology of these infections in humans has been investigated in details to date. **Methodology:** Stools from diarrhoeal patients, aged 2-60 years, were screened for ETBF by standard microbiology with PCR for the bft gene. Of 1,140 stools screened, 395 (35%) were positive for *B. fragilis*; of these, 84 were ETBF-positive patients and 71 (adults : children, 27:44) were enrolled. Clinical examination and blood and stool (for microbiology, systemic and mucosal immunological responses) were obtained at enrollment and ~21 days later. In a sub-group of adults, sigmoidoscopy was performed with rectal biopsies. **Results:** Twenty-five (35%) patients were aged 2-5 years, and 46 (65%) were older. In initial analyses, ETBF were associated with inflammatory diarrhoea with substantial abdominal pain and tenesmus (65% of patients). These clinical data complement in-vitro studies showing induction of interleukin-8 by ETBF and in-vivo studies demonstrating marked colitis in ETBF-infected mice. The

ETBF patients increased stool neutrophils by microscopy at enrollment compared to their convalescent stools or control stools ($p<0.01$). In preliminary analyses of rectal biopsies from adult patients, pathology revealed an inflammatory component. Patients seroconverted with BFT-specific antibodies detected at day 7 post-diagnosis ($p<0.01$ vs controls). **Conclusion:** In contrast to previous data suggesting that ETBF are associated with non-inflammatory diarrhoea, the initial findings of the study suggest that ETBF frequently induce colonic inflammation that likely contributes to diarrhoea. ETBF also stimulate increases in specific serum anti-BFT antibody responses. The mechanisms by which ETBF upregulate colonic inflammatory responses require further investigation.

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Impact of Iron Supplementation and Anti-helminthic Treatment on Changes in Haemoglobin Status and Parasitic Infections among Anaemic Bangladeshi Children Living in a Slum Area of Dhaka City

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Background: Anaemia is a nutritional problem in many parts of the developing World. In Bangladesh, iron-deficiency anaemia is a major public-health problem. Surveys carried out over the last 30 years have revealed that over 70% of the whole population are anaemic. Bangladesh is also a country with a high prevalence of malnutrition, diarrhoea, and other microbial and parasitic infections, all of which increase the risk of iron deficiency. **Objective:** The objectives of the study were to determine the impact of weekly iron supplementation on haemoglobin and anaemic status; to assess the impact of chemotherapy at 3-monthly interval on the prevalence and intensity of infection of 3 common intestinal parasites; and to determine whether the combination of weekly iron supplementation and regular deworming impacted on haemoglobin levels and anaemia status compared to groups of children receiving either iron supplementation only or chemotherapy only. **Methodology:** The study was conducted in a slum in Dhaka, the capital city of Bangladesh, and involved a double-blind randomized trial of 24 weeks duration with 3 intervention groups and a control to study the impact of iron supplementation and anti-helminthic treatment on changes in haemoglobin status and parasitic infections among 618 anaemic children aged 2-8 years. Ethical clearance was obtained from the Institute of Epidemiology, Disease Control and Research, Dhaka. **Results:** There were significant improvements in the haemoglobin level. After the 24-week clinical trial, the overall haemoglobin levels improved to a mean of 108.9 g/L ($p<0.001$), but this still signifies mild anaemia. The greatest improvement (+5.1 g/L) was seen in the chemotherapy group, while the prevalence of anaemia declined significantly in all groups ($p<0.001$). Significant declines in prevalence and intensities of *Ascaris* ($p<0.001$), Hookworm ($p=0.031$) and *Trichuris* ($p<0.001$) in the chemotherapy-treated groups were observed. **Conclusion:** Iron supplementation alone may be insufficient to improve the nutritional status of children, and regular chemotherapy against intestinal parasites should be included as part of the package of health measures.
Acknowledgements: Institution of Epidemiology, Disease Control and Research, Dhaka, Bangladesh and Community Development Partnership of Dhaka, Bangladesh, provided institutional support. General Pharmaceuticals Ltd, Dhaka, Bangladesh, provided tablets used in the clinical trial. Board of Graduate Studies, Churchill College & Parkes Foundation of University of Cambridge, Cambridge Philosophical Society ,and the Churches' Commission for International Students provided financial support.

158 (198)

Hepcidin and Anaemia: A Review

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Anaemia and iron deficiency are major health issues among children in the developing world. Consequences of iron-deficiency anaemia, such as delayed psychomotor development, inattention, and poor responsiveness to the social environment, impact negatively on an already-disadvantaged population with growth delays in the weaning period. Due to the high burden of infections in children from the developing world, it is difficult to distinguish between true iron-deficiency anaemia and anaemia associated with infection or inflammation. Iron studies are usually not helpful because ferritin levels are affected by infection, and soluble transferrin receptor fails to differentiate between them reliably. Since the management of iron-deficiency anaemia often involves injections of iron due to poor adherence to oral iron, it may be important to differentiate the two conditions. Anaemia of inflammation may not need parenteral iron, and it may even be detrimental. Recently, a novel new peptide hormone, named hepcidin, has emerged as a direct link between infection and iron homeostasis. Hepcidin is a disulfide-bonded peptide expressed predominantly in liver and was found to have antimicrobial properties (hence the name). Its iron regulatory properties were discovered serendipitously in a study of children with glycogen storage disease (type 1a), in whom hepatic adenomas were found to have high levels of hepcidin that were associated with anaemia, which resolved after excision of the tumours. Many animal studies have documented role of hepcidin in iron homeostasis. Hepcidin expression rises with infection or inflammation and induces iron overloading, and falls with hypoxia or anaemia. In humans, it has been shown that the infusion of the cytokine IL-6 (inflammatory model) results in increased urinary hepcidin, with a significant decrease in serum iron and transferrin saturation. From these findings, it is postulated that hepcidin has a direct role in iron regulation by inhibiting dietary iron absorption by enterocytes and macrophage release of iron. The discovery of hepcidin has direct relevance to the paediatric population in poor countries who are constantly exposed to a high burden of infection. Hepcidin may provide a means to distinguish between anaemia of inflammation and iron-deficiency anaemia. It is hypothesized that high levels of hepcidin expression from excessive immune stimulation in the weaning period result in high levels of anaemia with low MCV. A hepcidin inhibitor or reduced exposure to a high burden of infection (e.g. through new immunizations, improved hygiene, less-overcrowded housing conditions, etc.) may be a more appropriate response than iron injections.

1:30 pm - 2:00 pm (Venue: Sasakawa Auditorium)
Plenary 6: Combating Micronutrient Malnutrition

159 (134)

Food-based Approaches to Combat Iron Deficiency during Early Life

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Full-term breastfed infants generally have adequate iron status during the first 6 months of life but, after this time, when body stores have been depleted and requirements are high due to rapid growth and development, iron has to be provided through diet. The amount and bioavailability of iron in complementary foods are, therefore, of special concern, particularly in poor communities where infants and young children are consuming monotonous, cereal-based diets. Traditionally, cereal-based gruels are often one of the first semi-solid foods to be introduced into the infant's diet. These foods can be expected to have low energy and nutrient density and low iron bioavailability due to the presence of phytic acid, the major phosphorus storage compound in cereals and legumes. The inhibitory effect of phytic acid on iron bioavailability can be overcome by ascorbic acid, a potent enhancer of iron bioavailability when present in high quantities. However, home-prepared cereal-based complementary foods contain negligible amounts of ascorbic acid unless foods rich in vitamin C are consumed at the same time. Different approaches to improve iron bioavailability from complementary foods, e.g. by enzymatic degradation of phytic acid and/or by increased consumption of ascorbic acid-rich foods should be explored and adapted to local conditions. In addition, there is a need to develop and evaluate strategies to increase the dietary intake of bioavailable iron by food fortification in developing countries. Centrally-produced complementary foods usually contain added iron and added ascorbic acid. However, because many infants and young children in poor settings do not have access to such foods, innovative solutions, for example "in-home fortification", are urgently needed.

2:05 pm - 3:30 pm: (Venue: Sasakawa Auditorium)
Special Session 1: HIV Infection and Nutrition

160 (224)

HIV in Bangladesh—Current Scenario

Tasnim Azim[1] (tasnim@icddrb.org), Mahmudur Rahman[2], M. Shah Alam[1], Charles P. Larson[1], Sharful Islam Khan[1], Md. Elahi Chowdhury[1], R. Khanam[1], Ezaz I. Chowdhury[1], Imtiaz A. Chowdhury[2], Motiur Rahman[1], Masud Reza[1], Md. A. Salim[3], and A.S.M. Matiur Rahman[3]

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Since the second-generation surveillance was initiated in Bangladesh in 1998 among population groups most at risk of an epidemic, the total HIV prevalence has remained below 1%. However, the HIV epidemic in Bangladesh is evolving rapidly and, in one city, in injecting drug users (IDUs), the HIV prevalence increased from 1.4% to 4.9% from 1999 to 2004. In one neighbourhood in that city, approximately 8% of IDUs were HIV-infected. Simultaneously, recent Behavioural Surveillance Survey (BSS) data indicate an increase in risk behaviours, such as sharing of injecting equipment and a decline in consistent condom use in sexual encounters between IDUs and female sex workers. A prospective cohort study among female IDUs has shown that most women are also sex workers, and a sub-set have both commercial and non-commercial sex partners and share needles/syringes with their non-commercial sex partners. All sources of data indicate that the IDU population is well-integrated into the surrounding urban community, socially and sexually, thus raising grave concern about the spread of HIV infection. Female sex workers have high rates of active syphilis and other sexually transmitted infections but very low rates of HIV infection. Casual female sex workers (i.e. those who sold sex part-time) were sampled in surveillance from 3 border cities. The sex workers in the 2 Northwest border cities commonly reported crossing over the border to India and selling sex while across the border. Sex workers were sampled from Southeast-H1 bordering Myanmar, but the proportions reporting crossing over to Myanmar and selling sex were small. In this city, although no HIV was detected, active syphilis rates were high (10%). Hotel-based sex workers were comparatively younger and had the highest number of clients among all female sex worker groups. Consistent condom use by female sex workers remains low in all groups. From passive case reporting through Voluntary Counselling and Testing centres, the highest rates of HIV infection have been found in migrants returning from jobs abroad and in their families. Migrants who live away from their families for prolonged periods also report higher rates of extramarital sex and commercial sex. As the HIV rates are rising steadily, it will soon be too late to prevent a large-scale epidemic if intervention programmes are not scaled up and adapted to the needs of the communities that they serve. Stigma continues to remain a major barrier to working with marginalized population groups.

161 (237)

Nutrition and HIV: Science vs Hyperbole—Where Is the Intersection?

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WHO Technical Advisory Group on Nutrition and HIV

The HIV pandemic in sub-Saharan Africa has been imposed on populations already afflicted with poverty, poor food security, and chronic malnutrition. From the earliest clinical descriptions and reports, the impact of HIV on

the nutritional status of infected adults and children has been obvious--Slim disease. Despite this, there is a remarkable paucity of clinical data bringing understanding to the metabolic processes that result in the all too common anorexia and wasting. There are even less data describing the benefit of nutritional interventions, macronutrient, and micronutrient in alleviating symptoms and improving the quality and duration of life of infected adults and children. The belated arrival of anti-retroviral drugs, while welcome, adds to the list of unknowns, such as whether the pharmacokinetics of these drugs differ in children who are severely malnourished compared to those who are less under-nourished. In response, the World Health Organization commissioned a technical review on the nutritional requirements of HIV-infected adults and children. Some of the key findings include:

- Energy needs increase by about 10% in adults and children from the time of infection
- During and after severe illnesses, these needs might increase by a further 20-30%. In children, this may be up to 150%
- There is no evidence for increased protein requirements other than in a balanced diet, i.e. 12-15% of the total energy intake
- Anorexia and poor dietary intake are important causes of weight loss
- Improving the diet alone, though, may not result in weight recovery and improvement in clinical status
- To obtain the maximum benefit of anti-retroviral drugs, adequate and appropriate nutritional intake is necessary

The programmatic implications of these findings are complex and are made more difficult by issues of equity, ensuring access to adequate and appropriate food, the commercial and exploitive interests of entrepreneurs, and health systems that in the past have failed to prevent and manage chronic malnutrition in children.

162 (219)

Management of Severe Malnutrition in HIV-infected Children: Recent Review of Current Evidence

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Malnutrition contributes to 53% of deaths of children, aged less than 5 years, in developing countries. Severely-malnourished children often comprise the majority of inpatient paediatric deaths. This is because a higher proportion of them die compared to other paediatric admissions, and this primarily stems from poor understanding of the complexity of physiological changes and of correct case-management among doctors and nurses. Typically, 25-30% of children with severe malnutrition die during hospital treatment; the rate is even higher (50-70%) in African hospitals. Most of these deaths can be avoided by following treatment guidelines. The World Health Organization (WHO), together with international experts, has developed guidelines for treating severe malnutrition and a training course for doctors and nurses. Where the guidelines have been implemented appropriately, mortality has been reduced by at least half. In September 2004, the WHO held a consultation to consider if changes to the WHO malnutrition guidelines may be required as a result of new evidence. The consultation concluded that only limited peer-reviewed new research for the period under review (1998-2004) is done, in which severely-malnourished children had been studied. During this period, however, substantial advances in knowledge about HIV/AIDS have occurred, and there is now increased opportunity for HIV-testing

and anti-retroviral therapy. With regard to HIV/AIDS, changes in the guidelines were, therefore, recommended in relation to treatment of pneumonia and provision of prophylactic co-trimoxazole for severely-malnourished HIV-positive children. Knowledge gaps were identified, particularly in relation to feeding infants aged less than 6 months with severe malnutrition and to the effectiveness and pharmaco dynamics of anti-retroviral therapy in severely-malnourished children who are HIV-positive. To guide policy regarding optimal dietary management of very young severely-malnourished infants, there is an urgent need for observational studies of alternative formulations. Also, in the case of HIV-positive infants where definitive diagnostic virological testing of HIV is not available, research is needed to identify signs that are predictive of HIV, indications for treatment with anti-retroviral and their pharmacokinetics and safety of different anti-retroviral drugs and regimens in severely-malnourished infants and children.

163 (238)

Nutrition and HIV Programming Framework—Evidence and Policy Implications

S.M. Moazzem Hossain[1] (smhossain@unicef.org), Arjan de Wght[2], and Saba Mebrahtu[3]

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Background: The world has over 40 million people living with HIV/AIDS. HIV/AIDS negatively impacts on a person's nutrition status in different ways. During the last few years, there have been several major international meetings establishing goals for children that relate to nutrition and HIV/AIDS. **Objective:** The objective of developing a programming framework is to set priority action for the high HIV-burden countries and strengthen capacity of the major stakeholders to reduce food insecurities among families and individuals infected/affected by HIV and improve their nutritional status. **Methodology:** Systematic reviews commissioned by the World Health Organization (WHO), international consultation meeting, and small working groups to assess programme and policy implications were analyzed. **Results:** Evidence suggests that energy requirements for people living with HIV/AIDS (PLWHA) are increased by 10% for asymptomatic patients, 20-30% for symptomatic patients, and 50-100% for children with weight loss but data are insufficient to suggest increased protein requirement in PLWHA. Optimal nutrition of HIV+ mothers during pregnancy/lactation increases weight gain and improves pregnancy and birth outcomes. It was also found that long-term use of ART was associated with metabolic complications, but the value of ART outweighs risks. There is a need to look at interactions between nutrition and ARVs in chronically-malnourished populations. There is increased evidence that nutrition support during severe infection in people living with HIV/AIDS alters severity and outcome of infections and rate of recovery. The effects of good nutrition on HIV/AIDS are more pronounced if nutrition is promoted from the early stages of the disease. However, most infected people are not aware of their status until opportunistic infections begin to set in. Therefore, there is a need to promote nutrition in the general population and provide nutrition care and support as part of a comprehensive package for individuals and families affected by HIV/AIDS. **Conclusion:** The action that is urgently required for each component is to conduct a situation assessment and analysis, set priority action and advocacy for resource allocation, develop national policies/strategies/protocols, support women and children affected by HIV through nutrition assessment, dietary guidance, community-based care and support, food interventions, micronutrients supplementation, and finally establish a monitoring and evaluation mechanism, conduct operational studies, and document experiences. **Acknowledgements:** Systematic reviews for evidences were commissioned by the WHO Technical Advisory Group, while the international consultation was organized by WHO in collaboration with Ministry of Health, South Africa, United Nations Chidlren's Fund, and other partners.

2:05 pm - 2:25 pm (Venue: Seminar Room)
Guest Lecture 7: Improving Outcome of Management of Severe Malnutrition

164 (229)

Reducing Child Deaths by Improving the Quality of Care of Severely-malnourished Children

Ann Ashworth (ann.hill@lshtm.ac.uk)

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Abstract not received

2:30 pm - 2:50 pm (Venue: Seminar Room)
Guest Lecture 8: Coeliac Disease on the Increase in Asia

165 (230)

Coeliac Disease on the Increase in Asia

Shinjini Bhatnagar (shinjini_bhatnagar@rediffmail.com)

All India Institute of Medical Sciences, New Delhi, India

Abstract not received

2:50 pm - 3:10 pm (Venue: Seminar Room)
Guest Lecture 9: Ethics of Doing Research

166 (213)

Medical Ethics: A Policy for CAPGAN!

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There have a profusion of ethical guidelines in recent years, including some designed specifically for the developing world (e.g. World Health Organization, Nuffield). The focus of these guidelines has generally been for human and animal research ethics committees. Although most paediatricians are aware of the basic principles underlying these guidelines--usually expressed in terms of autonomy (informed consent), beneficence (non-maleficence) and justice, we are usually unfamiliar with the philosophical theories which underlie ethics, such as utilitarianism, deontology, or virtue ethics. In this presentation, the philosophical theories of ethics are being presented and applied to some key issues facing CAPGAN as an organization. The most controversial of these issues is our relationship to the pharmaceutical industry, particularly milk-formula companies, in terms of sponsorship for our congresses. A related issue is our role in advocacy for breastfeeding, and how far we should go to discourage the use of milk formulas (e.g. in severe malnutrition, HIV-infected mothers, etc.). Finally, there is the issue of whether the gold standard for treatment in research studies in children should be universal (what is done in industrialised countries) or determined by available treatments in the local setting. It is hoped that these issues will generate discussion to help us determine a CAPGAN policy on these ethical issues.

4:00 pm - 5:00 pm: (Venue: Sasakawa Auditorium)
Special Session 2: Health and Nutrition of Children and Women in Disaster Situations: Experience from Pakistan and Sri Lanka

167 (225)

Health and Nutrition of Children and Women in Disaster Situations: Experience from Pakistan

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Abstract not received

168 (241)

The Tragedy of the Tsunami of 26th December 2004

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The human tragedy of the Tsunami was overwhelming and unbearable not only to the population of the affected countries but also to the whole world. It caught the attention, especially of the Westerners, some who not only were unaware of the geography of small islands like Sri Lanka, but were even unaware of the existence of some affected countries. Within a matter of 10 minutes, hundreds of thousands of people were killed or their dwellings or occupations destroyed. Multiple tragedies of several family members being killed, houses destroyed, and boats or workplaces destroyed were common consequences. When the Tsunami wave came, people reacted either by fighting the wave or by running away from it (fight or flight). This response either to run or fight is also influenced and modified by one's previous experience. There are also two other possibilities: one is to 'freeze' by fear or 'dissociate' yourself from what is happening which may also be related to previous experience. Initial estimates were tens of thousands of orphans. The most vulnerable to the Tsunami were the elderly and children; women, especially when pregnant, were also vulnerable. Those children who managed to escape were mostly older children or teenagers who managed to grab on to something, usually a tree or a lamp-post. A relatively small younger child population who survived was the ones who were for some reason physically not in an affected area. When a parent or relative grabbed on to the child (although the force of the water and slipperiness dragged many children away from an adult's grasp), some lucky ones survived. A very small number of small kids got thrown on to a higher elevation, such as the roof or a 'Surviving' structure. Those who died did so instantaneously, while those who survived had only scratches on the bodies and deep scars in their minds. One question asked by the Western media was: "Thousands have been killed and in the midst of the tragedy they still can offer a smile? " The answer was: "Sri Lankans have faced tragedies of war, subversion, mass deaths, and floods, and many families and friends have been affected for more than two decades. They have managed to rise positively soon after each of these disasters. It is this resilience in the community that has made them look forward compared to a population like the US that feels/felt completely protected and insulated from massive disasters but yet had to face 9/11". On a negative note, the local and international responses may not have been the most appropriate.

There were both international and local 'experts', after reading some manuals for worldwide disasters, giving out inappropriate message by requesting bottled water and, most adversely, infant milk food and feeding bottles! In a country where breastfeeding is a norm, in disaster where infants and young children also died with their mothers, the risk of breastfeeding mothers stopping breastmilk when receiving 'free' bottled milk, and the likelihood of breastmilk subsequently drying up in the midst of poor sanitation in the refugee camps really spelt another disaster of diarrhoea and dysentery. Thousands of packets of prepared food that went to the refugees within a few hours of the disaster were overwhelming and were often too much, and sometimes it had even gone stale. Although there has been criticism of these aspects together the food/goods were inappropriate or stale. There were some others, including officials, who looted relief rations and medicines. There were politicians who took advantage of the situation, while other politicians may have taken advantage, but did work positively for the benefit of mankind. Two politicians accused of paedophilia took advantage of the situation. One even got bail on false claims. A criticism aimed at those affected was that they were standing in queues to collect more than what they needed. "If there was an excess of dry rations going around, it would be better to be distributed in excess to the people rather than getting into hands of corrupt officials as long as the excesses were not sold or bartered for cigarettes, alcohol, or drugs. Another major issue was: donor groups wanting to give money for only 'tangible' projects. Projects that could be seen and shown to donors were what most people wanted, like building houses, giving boats, temporary shelter, books, school bags, and uniforms. Another human weakness! When money is raised ad hoc without verifying the real needs (that would take a long time to assess), neither the donors nor the collectors can be blamed! Before any assessments were done and before the actual extent of the tragedy was known, money for orphanages was collected in the West, and now they have to build these orphanages whether it is needed or not. There were many interested parties wanting to adopt possibly to be child servant!? The media meanwhile did a tremendous job by focusing the tragedy both locally and internationally. However, all over the world, the media wants sensation on any issue and the Tsunami was one of those 'big' ones! When the 'heat' of sensation of the tsunami was waning off, some media persons, including international ones, were trying hard to sensationalize on the 'fall outs' of the Tsunami which could have become really sensational issues.

169 (250)

Health and Nutrition Status of Earthquake-affected Population in Pakistan

S.M. Moazzem Hossain[1], Kevin Sullivan[2], Leah Richardson[3], and Rifat A. Anis[4]

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Background: On 8 October 2005 (Saturday), a strong earthquake, said to be the most powerful (7.6 on Richter scale) in the region in 500 years, killed more than 78,000 people and caused massive destructions, mostly in the northern parts of Pakistan, Upper Northwest Frontier Province (NWFP), and Azad Jammu Kashmir (AJK). **Objective:** The study looked at the nutrition status of children aged 6-59 months, their mothers, morbidity, mortality, feeding practices, food consumption, water, sanitation and hygiene practices, and programme coverage of some interventions. **Methodology:** Four cross-sectional surveys were conducted during 21 November-26 December 2005 to assess the situation of household residents in Mansehra and Muzaffarabad districts and displaced population of the NWFP and AJK camps. In total, 2,171 households were interviewed in 4 survey areas with a total of 2,442 children aged 6-59 months, and 1,662 mothers were assessed for nutritional status. **Results:** Global acute malnutrition was high (10.5%) among the children, aged 6-59 months, of Mansehra district compared to Muzaffarabad district and the NWFP and AJK camps (5.7%, 6.0%, and 4.2% respectively). Chronic malnutrition, indicating a long-term poor nutrition prior to the earthquake, was at high levels in all 4 areas—44.5%, 38.1%, 54.8%, and 44.0% in Mansehra, Muzaffarabad, NWFP camps, and AJK camps

respectively. In Mansehra community, the point estimate for the crude-mortality rate (CMR) on the day of the earthquake was 168 deaths per 10,000 population per day. In Muzaffarabad community, it was 506 per 10,000 per day, in the NWFP camps 489 per 10,000 per day, and in the AJK camps 537 per 10,000 per day. The camp population particularly had a very high prevalence of diarrhoea with over half of the population, aged less than 5 years, experiencing diarrhoea in the previous 2 weeks. Dysentery as a sub-set of overall prevalence of diarrhoea was also high. The prevalence of acute respiratory infection in all survey populations was extremely elevated at around 60-75% with no important difference between camps and community populations. **Conclusion:** Although the nutrition situation does not indicate a serious crisis, the results should be viewed in the context of the multiple aggravating factors (harsh winter, massive household destruction, high unemployment figures, high morbidity, etc.) existing in the locations at this time. **Acknowledgements:** This joint UNICEF/WFP/WHO survey was conducted in collaboration with the National Institute of Health and Nutrition Wing under the Ministry of Health, Government of Pakistan. UNICEF, Pakistan funded the study with logistic support from the World Food Programme. Emory University/CDC helped in data analysis and interpretation of anthropometry and mortality-related variables.

DAY 1: Monday, 6 February 2006
10:00 am - 11:30 am (Venue: Corridor Café)
Poster Session 1

DIARRHOEAL DISEASES I

170* (011†)

Outbreak of Diarrhoea in Boseth District, Kompongspeu Province, Cambodia

Som Leakhann[1,3] (Leakhann_som@yahoo.com), L. Sary Vong[2,3], E. Sarun[1], C. Thai[3], O. Morn[4], and S. Heng[3,5]

[1]Provincial Health Department of Kompongspeu, National Road 4, Rokathom Commune, Cambodia, [2]Technical Bureau, Cambodia, [3]Communicable Diseases Control Department, Cambodia, [4]Operational District Kong Pisey, Kompongspeu Province, and [5]Ministry of Health, Cambodia

Background: Diarrhoea is a common disease in many countries around the world. In Cambodia, diarrhoea is a major public-health problem, especially among children. Every year, there is at least one outbreak of diarrhoea in Boseth district, Komongspeu province, Cambodia. *Vibrio mimicus* is a main cause of diarrhoea in Boseth district. The main problems are: problem in water supply, absence of safe water and safe food, and existence of poverty. **Objective:** The study was conducted to report the outbreak of diarrhoea in Boseth district in Cambodia. **Methodology:** The weekly report was used for the surveillance of outbreak of diarrhoea, and the monthly report was used as an indicator to compare the new cases. When an outbreak occurs, a team of Communicable Diseases Control Department visits the place of outbreak of diarrhoea. The team interviewed all the cases and selected case controls, at least double the number of cases. Stools were collected from the cases. Some used medicines, and others did not. Water samples were collected from well, pond, and other sources to identify pathogens. Information on food that was taken by the people last day or before the last day was collected. During this time, the food could not be analyzed at laboratory in Cambodia. **Results:** The last outbreak occurred during 13-25 September 2005. There were 41 cases of watery diarrhoea. Ninety-seven percent of the cases did not have latrine, and 90% did not use boiled or safe water. Vibrio was present in 6 main places of water source (340-680/100 mL of water). Water supply was not enough for the village. General education is too low; the health facility is too far away from the village; and geography and infrastructure are not good. **Conclusion:** Diarrhoea is a big problem in the remote area; poor people have lack of education; there is no supply of safe water; and the health facility is not good. Rate of malnutrition will increase; as a result, child health will suffer.

*Indicates the sequential number of abstract/title of presentation in this book

†Indicates the number originally assigned to the abstract

171 (019)

Matlab Variants of *Vibrio cholerae* Possess Gene Clusters Specific to Pandemic Strains

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Background: In recent human history, pandemic strains of toxigenic *Vibrio cholerae* have appeared twice with modified or new genetic traits. New variants of *V. cholerae* were isolated, during 1991-1994, from hospitalized patients with acute secretory diarrhoea in Matlab, a rural area of Bangladesh. The phenotypic and genotypic traits tested previously failed to categorize these toxigenic strains into the classical or the El Tor biotype. These strains, designated as Matlab variants, were found to have representative traits of both the biotypes, reflecting a hybrid nature. Their virulence and pandemic potential is yet to be determined. **Objective:** Virulence-associated and pandemic potential genes of newly-isolated Matlab variants of *V. cholerae* were examined. **Methodology:** Of 24 strains, 5 representatives were included in the study, which was conducted in the Enteric Microbiology Unit of the Laboratory Sciences Division of ICDDR,B: Centre for Health and Population Research. Four gene clusters: *Vibrio* Seventh Pandemic-I (VSP-I), *Vibrio* Seventh Pandemic-II (VSP-II), Vibrio pathogenicity island-1 (VPI-1), and Mannose-sensitive haemagglutinin (MSHA) and 4 individual loci--*rtxC*, *rstC*, *zot*, and *ctxAB*--were examined by PCR using the standard procedures. N16961 strain of the El Tor biotype and 569B strain of the classical biotype were used as reference strains with which the test results were compared. **Results:** VSP-I and II gene clusters, comprising 38 genes and/or ORFs, which are specific traits of the Seventh Pandemic El Tor isolates, were present in all the test strains, including El Tor reference strain, but were absent in classical reference strain. All the genes of MSHA and 2 tested genes of VPI-1 cluster, namely *toxT* and *acfB*, were positive in all the test strains and in *V. cholerae* classical and El Tor reference strains. The major toxin-producing *ctxAB* genes and *zot* were also positive in all the test and reference strains. Between 2 other individual loci, *rtxC* was positive for all the test strains, whereas *rstC* was positive for only 3 of the 5 strains. **Conclusion:** Examination of different genes and/or gene clusters indicates that each of these strains possesses all the traits necessary to initiate a pandemic. The pandemic potential of these strains also underscores the importance of tracking global prevalence and spread of such strains. **Acknowledgements:** The study was funded by the Japan Health Science Foundation. ICDDR,B acknowledges with gratitude the commitment of Japan Health Science Foundation to the Centre's research efforts.

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Risk Factors and Outcome of Convulsion in Children, Aged Less Than 5 Years, Presenting to a Diarrhoeal Disease Hospital in Bangladesh

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Background: Morbidity and mortality from convulsive disorders in children, aged less than 5 years, either as the primary problem or as secondary manifestation to systemic illnesses constitute a significant proportion of

paediatric emergencies in developing countries, including Bangladesh. **Objective:** The objective was to study the presenting features of hospitalized children, aged less than 5 years, with diarrhoea and convulsion, and the risk factors for convulsions in such population. **Methodology:** For this case-control analysis, information was extracted from the electronic database of the Hospital Surveillance System of the Dhaka hospital of ICDDR,B: Centre for Health and Population Research. In total, 256 children of both sexes, aged 0-59 month(s), attending the hospital during 1993-2004, were identified. Those presenting with convulsion (n=64) constituted cases, and randomly-selected 192 children (case to control ratio 1:3) without convulsion were the controls. **Results:** The nutritional status of children with convulsion and controls was similar. Eighty percent of convulsions occurred during hospitalization, and the risk of convulsion was less among infants aged 6-11 months (odds ratio [OR]=0.38, 95% confidence interval [CI] 0.17-0.81, p=0.009). The cases were more likely (38% vs 9%) to have fever (body temperature of >37.8 °C), clinical dehydration (45% vs 31%, p=0.048), and acute lower respiratory tract infection (33% vs 4%, p<0.001). The cases were less frequently immunized against measles (75% vs 87%, p=0.03), more frequently infected with *Shigella* (25% vs 9%, p=0.001) and *Vibrio cholerae* (19% vs 9%), and a higher proportion of them required hospitalization for ≥48 hours (64% vs 28%, p<0.001) than the control children. Thirteen percent of the cases and none in the controls died. In logistic regression, the cases were 3 times more likely to be infected with *Shigella* (OR=3.4, 95% CI 1.4-8.1, p=0.008)**,** 4 times more likely to have fever (>37.8 °C) on admission (OR=4.1, 95% CI 1.8-9.5, p<0.001), 7 times more likely to have lower respiratory tract infection (OR=7.4, 95% CI 2.7-20.6, p<0.001), and 2 times more likely to require longer (>48 hours) hospitalization. **Conclusion:** The study identified fever, lower respiratory tract infection, and shigellosis as significant risk factors for convulsion among children, aged less than 5 years, with diarrhoeal illness. Prevention and/or efficient management of the risk factors might help prevent this complication which is associated with significant morbidity and deaths. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) and ICDDR,B fund is acknowledged.

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Cholera in Bangladeshi infants

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Background: Cholera may lead to deaths among infants and young children if not efficiently managed. However, it is not possible to clinically diagnose cholera, particularly among infants who suffer more from infections due to other enteropathogens, e.g. rotavirus and enterotoxigenic *Escherichia coli* (ETEC). Information on the burden of cholera among infants, particularly in an endemic country, may help clinicians take appropriate therapeutic decisions and define preventive measures. **Objective:** The aim was to study the clinical features of cholera in infants attending a diarrhoea treatment facility and to compare these with those of rotavirus and ETEC-associated diarrhoea. **Methodology:** Infants (n=6,476) enrolled into the Surveillance System of the Dhaka hospital of ICDDR,B: Centre for Health and Population Research (a 2% systematic sample of all patients attending the hospital) during 1996-2004 comprised the study population. Information on isolation of enteric pathogens, illness characteristics, and socioeconomic-demographic and nutritional status was extracted from the electronic database for analyses. **Results:** In total, 7,491 (38%) pathogenic bacteria were isolated from 19,895 stool specimens, including 4,157 (21%) *Vibrio cholerae*. Children, aged less than 5 years, constituted 57% of the total patients, and 6,476 (33%) were infants. Among children, aged less than 5 years, rotavirus was the most frequently-isolated (42%) enteropathogen, followed by ETEC (11%), *Campylobacter jejuni* (11%), *V. cholerae* (5%), *Shigella* (4%), *Salmonella* (2%), and *Cryptosporidium* (1%). Of the cholera cases (4,157), 343 (8%) were infants, and 646 (16%)

were children aged 0-23 month(s). Infants with cholera were significantly more severely (HAZ <-3.0) stunted (13% vs 9% vs 6%) and more severely (WAZ <-3.0) under-weight (18% vs 12% vs 7%) compared to infants infected with ETEC and rotavirus respectively ($p<0.001$ for all comparisons). The malnourished (under-weight, stunted, wasted) infants were significantly ($p<0.001$) more likely to have infection due to *V. cholerae* than the better-nourished infants. When infants with cholera were compared with diarrhoea due to ETEC or rotavirus, a significantly higher ($p<0.001$) proportion of infants (17% vs 3% vs 1% respectively) had severe dehydration, required intravenous saline for correction of fluid-electrolyte deficits (33% vs 9% vs 5% respectively) and also required inpatient admissions (22% vs 12% vs 8% respectively) and longer (≥3 days) hospitalization (34% vs 16% vs 16% respectively). Nearly, all infants (98%) had watery stools and vomiting (88%) in the 24-hour period before attending the hospital. A significantly higher proportion ($p<0.001$) of infants had detectable RBC (25% vs 11% vs 7%) and macrophage (16% vs 7% vs 3% respectively) compared to diarrhoea due to ETEC and rotavirus in stool microscopic examination. Only 3 infants (0.9%) with cholera died due to associated health problems compared to 0.5% and 0.1% of infants infected with ETEC and rotavirus respectively (p=NS for both comparison). **Conclusion:** The results indicate that *V. cholerae* O1 is the fourth common diarrhoeal pathogen in infants, and the prevalence is higher among malnourished children. Cholera should, therefore, be considered in differential diagnosis of cause among malnourished infants presenting to a health facility in Bangladesh with diarrhoea. Strategies for prevention of cholera in infants, including universal practice of exclusive breastfeeding, should be considered. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) and ICDDR,B is acknowledged.

MICRONUTRIENTS, VITAMINS, AND DIETARY INTAKE I

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Development of Osteopenia in Babies of Birth-weight between 1,500 and 1,800 g

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Background: The incidence of low birth-weight (LBW) is very high in India. Approximately, 30% of babies are born with LBW having low reserves of minerals, particularly calcium. These babies are prone to develop hypomineralization of bones (osteopenia), which may further progress to clinical rickets. The American Academy of Pediatrics (AAP) recommends supplementation of calcium 200 mg/kg.day, phosphate 100 mg/kg.day, and vitamin D 400 IU/day to all babies with birth-weight less than 1,500 g. However, it is silent over babies weighing between 1,500 g and 1,800 g at birth. There is also a paucity of data regarding the incidence of metabolic bone diseases in infants with birth-weight between 1,500 and 1,800 g. **Objective:** The aim was to study the development of metabolic bone disease (clinical, biochemical, and radiological) in babies having birth-weight between 1,500 and 1,800 g and to compare the development of osteopenia in TSFD and PTAGA having birth-weight between 1,500 and 1,800 g. **Methodology:** This hospital-based prospective study was conducted at the Neonatal Division of Department of Paediatrics, Safdarjung Hospital and Vardhaman Mahavir Medical College, New Delhi, India. The study was designed to estimate the incidence of osteopenia and development of rickets in infants having birth-weight between 1,500 and 1,800 g. The comparison of biochemical and radiological findings has been made between 'preterm appropriate-for-gestational age' (PTAGA) and 'term small-for-date' (TSFD)

babies. The study included 500 babies with birth-weight between 1,500 and 1,800 g. The ethical clearance was obtained from the Institutional Ethical Committee of the Safdarjung Hospital and Vardhaman Mahavir Medical College. All the subjects were divided into 2 main groups of PTAGA and TSFD and followed for 3 months for changes in levels of serum calcium, phosphate, and alkaline phosphatase and for radiological evidence of hypomineralization of bone (osteopenia). Analysis was made in relation to different weight categories and different gestational ages. An attempt was also made to correlate these with maternal physical and biochemical status. **Results:** The incidence of osteopenia in babies with birth-weight between 1,500 and 1,800 g was 21.2% at 3 months of age. The incidence was significantly higher in PTAGA babies (35%) than in TSFD babies (13.6%). There was a high incidence of osteopenia in babies of birth-weight group of 1,500-1,599 g. The babies with 31 weeks gestation had maximum incidence. The serum calcium and phosphate levels showed a significant falling trend over 3 months in those babies who developed radiological evidence of osteopenia. Serum alkaline phosphatase showed a significant rising trend over 3 months in babies who showed evidence of osteopenia in x-ray. Thus, a serial estimation of serum alkaline phosphatase may help predict the development of osteopenia in babies with birth-weight between 1,500 and 1,800 g. There was no significant correlation between maternal physical and biochemical parameters with the development of osteopenia in the infants. **Conclusion:** The incidence of osteopenia was high in babies with birth-weight between 1,500 and 1,800 g. In the light of the observations made in the study, the American Academy of Pediatrics (AAP) should consider revising its recommendation of supplementing calcium, phosphate, and vitamin D to babies with birth-weight less than 1,500 g only. Rather, it should be extended also to babies weighing 1,500 to 1,800 g.

175 (023)

Comparison of Effects of Red- and Green-seeded Grapes on Lipid Serum Levels of Hyperlipidaemia Subjects

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Background: Cardiovascular diseases (CVDs) are the most important causes of mortality in developing countries, and the incidence has been estimated to be 38.5% in Iran. Dietary factors have a significant influence on the control and preventive effects on CVDs and lowering lipid serum levels. **Objective:** The study evaluated the effects of red- and green-seeded grapes on the levels of total cholesterol, LDL-C, HDL-C, and TG of hypercholesterolaemia subjects. **Methodology:** In a clinical trial, 69 hypercholesterolaemia subjects were randomly selected in 3 categories: red group, green group, and control group. The red group included 22 subjects (18 female, 4 male) aged 50.52±10.6 years, and the control group included 24 subjects (18 female, 6 male) aged 50.85 years. Both the groups were fed 500 g of red- and green-seeded grapes per day for 4 weeks. The control group consisted of 23 subjects (19 female, 4 male) aged 52.3±11.1 years without any treatment. At the beginning of the study, physical activity, height, weight, and body mass index (BMI) were determined. Lipid serum levels (TC, LDL-C, HDL-C, and TG) were measured for 3 times (at the beginning, and after 2 weeks and 4 weeks of the experiment) using the enzyme CHOD PAP method. Dietary intake was also determined for 6 days during the study using a 24-hour recall method. Experimental findings were analyzed statistically using the SPSS software and 2-way repeated measure variance ANOVA methods. Amounts of crude fibre and flavonoids were measured. **Results:** The mean levels of TC in the red group significantly decreased (9.68%) at the end of 4-week experiment ($p=0.002$), but it did not show any significance with the control group. The mean levels of TC in the green group also significantly decreased (7.86%) at the end of experiment ($p=0.007$), but there was no significant difference in the control group. The LDL-C level decreased in the red group (14.68%) at the end of 4 weeks with significant

level of p=00.4, but it did not show significance with the control group. LDL-C in the green group decreased (7.45%), but it did not show any significant difference with the control group at the final 4-week study. There was no significant difference between the red group and the green group. The HDL-C and TG differences were also not significant at the end of experiment. **Conclusion:** The findings showed that whole red- and green-seeded grapes reduce TC and LDL-C levels. Therefore, consumption of grapes with seeds and skin containing flavonoids and fibres are highly recommended to promote health.

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A Study on Nutrient Composition of Home-made Snack Food: Calculated vs Analyzed Values

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Background: In an attempt to partially fill information gap on composition data for foods as consumed by the Bangladeshi population, the present study was undertaken to collect standardized recipes, prepare, and analyze the most commonly-consumed 10 home-made snack foods. **Objective:** The study evaluated the discrepancies between calculated and analyzed values of proximate nutrients of the studied sample. **Methodology:** A survey was conducted among 150 purposively-collected housewives to get a list of home-made snack foods and standardized recipes of these foods using a pre-tested questionnaire. Twenty home-made snack foods were listed as being the most frequently-prepared and consumed by housewives with a minimum citation of 20% of the total citation of 1,019. Ten selected foods were then prepared and analyzed for proximate and mineral composition. The selected foods were *beguni*, *piazu*, chicken roll, *parata*, potato chop, *ruti*, *samucha*, *shingara*, *tikia*, and *vapa pitha*. Both raw and cooked foods were analyzed. **Results:** The results revealed that the protein content of the studied snack foods ranged from 5.76 to 20 g per 100 g. The fat content in the cooked foods was 0.50 to 26.78 g per 100 g. The moisture content ranged from 8.02 to 51.81, carbohydrate from 2.76 to 65. 01 g, ash from 2.13 to 60.13 g, dietary fibre from 4.39 to 29.24 g, and energy from 168.46 to 404.02 kcal per 100 g. The analysis revealed that a greater portion of calorie was mainly derived from fat in these foods. *Samucha* contained the highest amount of calorie, whereas *piazu* contained the lowest amount of calorie. The results showed that all the nutritive values increased after cooking, except the moisture content. The analyzed values were compared with the calculated values from the existing food-composition table using appropriate conversion factors. The results also showed considerable inconsistencies between the analyzed and the calculated values. **Conclusion:** The results indicate that the current local food-composition tables are not so helpful for formulating dietary calculation or to estimate the nutritive values of cooked foods, as consumed by Bangladeshi population. **Acknowledgements:** The technical and financial support of the Institute of Nutrition and Food Science, University of Dhaka, is acknowledged.

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Impact of Zinc Supplementation on Malnourished Bangladeshi Children with Shigellosis

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Background: Several studies have shown that zinc supplementation reduce the clinical severity of diarrhoea, growth faltering, and morbidity of malnourished children. **Objective:** The study was conducted to assess the impact of zinc supplementation on clinical recovery, weight gain, growth, and morbidity in moderately-malnourished children with shigellosis. **Methodology:** A randomized, double-blind, controlled trial was conducted among 56 moderately-malnourished children with shigellosis, aged 12-59 months, at the Dhaka hospital of ICDDR,B: Centre for Health and Population Research. Children were allocated to receive either elemental zinc (20 mg d-1) with multi-vitamin or multi-vitamin alone in 2 divided daily doses for 2 weeks. Children were followed up every 2 weeks at home for 6 months. The duration of illness, disappearance of blood and mucous in stool, weight gain during clinical recovery, length gain, weight gain, and episodes of illness during follow-up were assessed. Data were analyzed using SPSS/PC+ version 12.0 and EPI STAT version 6. **Results:** The zinc-supplemented children had no significant reduction (7%) in duration of recovery compared to the placebo group (p=0.2). However, the mean time of recovery (2.1 vs 2.5 days, p=0.01) was shortened in the zinc-supplemented under-nourished children (weight/age <70%) compared to the placebo group. During the recovery stage, there was no significant difference in days of disappearance of blood in stool (p=0.6), mucous in stool (p=0.2), and tenesmus (p=0.6) between the two groups. There was 40% more weight gain (52 vs 37 g/kg, p<0.01) in the zinc-supplemented group compared to the placebo group. During follow-up, the zinc-supplemented group had 20% more weight gain (30 vs 25 g/kg/month, p=0.5) and 43% more length gain (1.0 vs 0.7 mm/cm/month, p=0.9). The zinc-supplemented children had significantly fewer mean episodes of diarrhoea (2.24 vs 3.31, p<0.05). The mean episodes of acute respiratory infection (3.55 vs 3.31, p>0.05) and fever (2.24 vs 2.34, p>0.05) were not different. **Conclusion:** Zinc supplementation children with shigellosis possibly reduces the length of the recovery period and prevents growth faltering and morbidity during hospitalization and subsequent follow-up period. A further study with a larger sample size should be conducted. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) and Swedish Agency for Research Cooperation with Developing Countries (Sida/SAREC) is acknowledged.

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Impact of Zinc Deficiency on *Vibrio cholerae* Enterotoxin-stimulated Water and Electrolyte Transport in Animal Model

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Background: The clinical genetic syndrome of zinc deficiency, acrodermatitis enteropathica (AE) manifested with skin lesions, and chronic diarrhoea improves rapidly following zinc supplementation. The permeability of the mucosal cell membrane may also be altered in zinc deficiency, and stabilization of the cell membrane is

affected in zinc deficiency, leading to defective transport of sodium. **Objective:** The study investigated the role of zinc in the transport of water and electrolytes in response to *Vibrio cholerae* enterotoxin using perfusion studies in animal models. **Methodology:** Three-week old Sprague Dawley rats weighing about 70 g were divided into 4 groups: zinc-deficient (ZD), ad libitum zinc-fed controls (ZAL), zinc weight-matched control (ZWM), and zinc-deficient acutely-repleted (ZDR). A solution of 14^{C}-labelled polyethylene glycol was used for measuring the absorption capacity of the small intestine. **Results:** Significantly lower absorption of water and sodium per cm of the intestine was observed in the ZD animals compared to the ZAL animals ($p<0.01$). A marked difference in net transport of water and electrolytes per unit length of the intestine was observed among animals of different zinc status. The ZD animals absorbed only 43% of that absorbed by the ZAL group ($p<0.0l$). In the ZDR animals, net absorption of water increased to nearly equal to that of the ZAL group ($p>0.0l$). Sodium transport followed a similar pattern of water absorption. The ZD animals absorbed less than 50% of sodium absorbed by the ZAL controls ($p<0.05$). Acute zinc supplementation resulted into an improvement of sodium absorption of the ZD group equal to that of the ZAL controls. The ZD group showed nearly 3 times higher secretion of water than that exhibited by the ZAL controls. The ZDR animals demonstrated a 40% secretion of water compared to the ZD group. The ZD group had almost 4 times greater sodium secretion than that of the ZAL group ($p<0.01$), while approximately 40% more was observed in the ZDR group. **Conclusion:** Zinc improves absorption of water and electrolytes in experimental studies. Zinc supplementation also reduces net secretion of water and electrolytes induced by cholera toxin in experimental zinc deficiency. **Acknowledgements:** The financial support of the United Nations University as fellowship grant, technical support of the London School of Hygiene & Tropical Medicine, and partial financial support of ICDDR,B: Centre for Health and Population Research are acknowledged.

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Weight Gain of Patients with Diarrhoea and Pneumonia during Hospitalization in a Diarrhoea Hospital

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Background: Weight faltering may differ in patients based on various types of diarrhoeal diseases and pneumonia. It is necessary to have specific information to identify the factors affecting growth faltering. **Objective:** The aim of the study was to make an estimate of growth faltering of different types of diarrhoea and pneumonia patients during hospitalization. **Methodology:** A hospital-based longitudinal cohort study was conducted at ICDDR,B: Centre for Health and Population Research to identify weight faltering in different types of diarrhoea and pneumonia in children and to identify the factors that affect growth faltering. Data were obtained from 58 children aged 6 months-2 years during minimal stay of 3 days. During this period, data on food intake and stool output were obtained using a follow-up questionnaire. Weight gains were compared between different types of diarrhoea (shigellosis, acute watery diarrhoea, cholera, persistent diarrhoea) and pneumonia patients. **Results:** Weight gain was significantly positive for children with shigellosis ($p<0.05$) but not for acute watery diarrhoea ($p<0.10$), persistent diarrhoea ($p<0.91$), and pneumonia ($p<0.16$). It was higher for shigellosis and acute watery diarrhoea but minimal for persistent diarrhoea and pneumonia. **Conclusion:** Net weight gain during hospitalization was significantly higher in patients with shigellosis compared to patients with acute watery diarrhoea, persistent diarrhoea, and pneumonia. **Acknowledgements:** The support of ICDDR,B: Centre for Health and Population Research and College of Home Economics is acknowledged.

180 (101)

Microbial and Physicochemical Changes in a Mixed Fruit-juice (Mango and Pineapple) during Shelf-Life

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Background: Microorganisms potentially produce cloud loss in juices. Maintaining cloud is important to eye appeal and retention of certain flavour-compounds associated with cloud matrix. **Objective:** The study was carried out to determine the effect of storage temperature on microbial growth and cloud stability of a mixed fruit-juice prepared without adding artificial colour and flavour. **Methodology:** Microbial and physicochemical comparisons were made on juices stored for 60 days at ambient temperature and at refrigeration temperature (4-7 ^{o}C) with preservative (sodium benzoate 0.01%) and without preservative, and were treated at 60 ^{o}C and 90 ^{o}C for 20 minutes. Samples were serially diluted with 0.85% of sterile saline and plated by the pour plate technique in duplicate. Cloud-stability measurement was carried out by the standard method. The study parameters were estimated after an interval of 10 days. Data were assessed using SPSS/PC+ (SPSS Win 7.5 Inc., USA). **Results:** Heating at 60 ^{o}C and 90 ^{o}C markedly reduced the level of microbial count from $6.76X10^4$ to $4X10^2$ and $6X10^3$ cfu/mL respectively. For the sample, heat treatment at 60 ^{o}C and 90 ^{o}C, without preservative, and kept at 4 ^{o}C resulted in the highest bacterial growth at 20 days ($5.1X10^3$ cfu/mL), but after this period it began to decrease and at 60 days it was $4X10^2$ cfu/mL. Yeast and mould count was nil for these 2 varieties of juices throughout the study period. Following the previous manner, plate count of the juices, treated with 60 ^{o}C, preserved in ambient temperature and with preservative increased to $3.6X10^3$ cfu/mL at 20 days and again declined to $5X10^2$ cfu/mL at 60 days. But when the juices received heat treatment at 90 ^{o}C and with preservative, the growth trend sharply decreased to 1.3X10 cfu/mL for refrigeration and to $2X10^2$ cfu/mL for ambient temperature. In contrast to microbial reduction, heat treatment at 90 ^{o}C, lower storing temperature, and preservative caused a significant increase in cloud from 0.456 to 0.892 from initial to the final period of the study ($p=0.000$). **Conclusion:** It can be concluded that heat treatment of juices at 90 ^{o}C, with preservative, and storage at 4-7 ^{o}C showed the lowest microbial growth and the highest cloud stability.

BREASTFEEDING AND INFANT HEALTH I

181 (015)

Bacteriology and Antibiotic Sensitivity Profile of Bacterial Pathogens Associated with Breastmilk and Nipples

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Background: Breastmilk is an adequate and appropriate source of carbohydrates, proteins, fats, micronutrients, vitamins, and hormones necessary for the growth and development of infants aged 0-12 month(s)). It also

provides extensive protection via valuable antibodies. Hence, the national and international support is directed to exclusive breastfeeding for infants in developing countries where nutritional problems predominate. **Objective:** Exclusive breastfeeding (baby-friendly) has been propagated and championed by the United Nations Children's Fund and governments of developing countries as vehicles for preventing malnutrition and protection against child illnesses, especially gastroenteritis. However, the prevalence of diarrhoeal diseases among children and the pressure on antibiotics locally suggest renewed vigilance on the bacteriological quality of breastmilk and the effectiveness of commonly-used antibiotics locally. **Methodology:** The study was carried out in 16 hospitals in 4 southern states in Nigeria. In total, 200 breastmilk samples and nipple swabs each were randomly collected from postnatal lactating mothers from each hospital for duration of 12 months. In total, 3,200 samples were collected and analyzed microbiologically using the pour plate technique in various selective general-purpose media. Isolation, purification, identification, and characterization for qualitative determination were carried out using colonial, morphological and biochemical characteristics and referencing with the Bergeys' Manual for Determinative Bacteriology. The pathogenicity of some isolates was determined by the rabbit ilea loop method, while the antibiotic sensitivity test was carried out using the disc-diffusion method with ATCC organisms as controls. **Results:** High total viable bacterial count was recorded for both breastmilk and nipple swabs. Seven bacterial genera (*Bacillus*, *Lactobacillus*, *Staphylococcus*, *Klebsiella*, *Streptococcus*, *Pseudomonas*, and *Escherichia coli*) were detected and isolated. The pathogenicity test showed *E. coli* and *S. aureus* to be pathogenic. All the isolates were resistant to more than 80% of antibiotics evaluated. **Conclusion:** The presence of *S. aureus*, *E. coli*, *K. pneumoniae*, and *S. viridan* in breastmilk and nipples of lactating mothers may be responsible for diarrhoea and other gastroenteritis among children in Nigeria. Attempt to treat with antibiotics individually lead to abuse which potentiates resistance.

182 (032)

Interrelationships among Nutritional Indicators, Enteropathogens, and Feeding Practices in Bangladeshi Children with Acute Diarrhoea

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Background: The nutritional status of infants primarily depends on their feeding practices. It has been reported that the severity of diarrhoea is related to type of diarrhoeal pathogens, nutritional status, feeding practices, or micronutrient status of an individual. There is little information on the interrelationship among feeding patterns, nutritional status, micronutrient levels in blood, and diarrhoeal pathogens in young children hospitalized for acute diarrhoea. **Objective:** The study was carried out to assess the interrelationship among feeding patterns, nutritional status, micronutrient levels in blood, and diarrhoeal pathogens in young children with acute diarrhoea. **Methodology:** Two hundred and nine children, aged 4-24 months, with less than 3 days of diarrhoea, were randomly selected from the Dhaka hospital of ICDDR,B: Centre for Health and Population Research on their admission day. Feeding practices were recorded by interviewing caretakers. The nutritional status was measured by standard anthropometry. Diarrhoeal pathogens were isolated by microbiological assay, and serum zinc and vitamin A were assayed by biochemical analysis. **Results:** Twelve percent of the children were exclusively breastfed, 10% were formula-fed, 37% were fed breastmilk and formula, 14% were fed rice gruel with powder milk, and 27% were fed family diet along with milk. The breastfeeding rate was 67% and 28% in infants aged less than 5 months and children aged above one year respectively. Sixteen percent of illiterate mothers exclusively breastfed their infants compared to 7% of mothers with above primary education (p=0.01) and 15% of poor mothers exclusively breastfed their infants compared to 7% of the middle-class mothers (p=0.01). Serum zinc and

retinol-binding proteins (RBP) of the exclusively breastfed babies were higher compared to those of formula-fed infants. The breastfed infants had fewer bacterial pathogens than non-breastfed subjects; on the other hand, rotavirus was more frequently isolated from the breastfed subjects. The results suggested that age of children, education of mothers, and socioeconomic status had a negative relationship with breastfeeding and nutritional status. **Conclusion:** Breastfeeding (11.2%) was associated with less bacterial pathogens. The higher level of serum zinc and retinol was found among the young infants who were exclusively breastfed. **Acknowledgements:** The financial support of the Wellcome Trust, UK and ICDDR,B is acknowledged.

183 (044)

Patterns of Seeking Medical Advice among Exclusively-breastfed Babies during the First 6 Months

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Background: Exclusively-breastfed babies usually enjoy an uneventful growth and development. They may suffer from minor ailments, such as cold, mild allergies, etc. But enteral infections, such as diarrhoea and vomiting, are virtually absence in these babies. This communication has shown that Bangladeshi babies, who are exclusively breastfed, enjoy an almost disease-free growth, and diarrhoea is virtually absent in them. **Objective:** The study was undertaken to see the patterns of medical advice sought by parents of exclusively-breastfed babies. **Methodology:** A purposive sample of 53 exclusively-breastfed newborn babies was selected from a paediatrician's surgery over 17 months. The purpose of visit was noted and categorized. They were followed up variably for up to 6 months of age (age limit for exclusive breastfeeding). **Results:** Of 239 visits, 197 (82.4%) were made for vaccination and routine follow-ups. Eleven (4.6%) visits were for follow-up only. Of 28 (11.71%) visits, 15 were made for mild respiratory complaints, and 13 were made for other illnesses. Pneumonia was diagnosed in 2 babies. Surprisingly, diarrhoea was found in none of the babies. **Conclusion:** There should be no confusion regarding the benefits of exclusive breastfeeding against infectious diseases, particularly enteral infections.

3:00 pm - 4:30 pm (Venue: Executive Director's Wing)

Poster Session 2

NUTRITIONAL PROBLEMS, GROWTH, AND DEVELOPMENT I

184 (003)

Effects of Intestinal and Respiratory Infections on Growth of Infants

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Background: Malnutrition and infections are widespread in most developing countries. The endemic nature of malnutrition and infection is probably also at the root of other health problems that impede learning among children. **Objective:** The effects of intestinal and respiratory infections on the growth of infants were studied. **Methodology:** This longitudinal study was carried out on the growth of babies, born to mothers, up to the age of 24 months in relation to intestinal and respiratory infections. In total, 250 babies were selected. Data were collected (interviewing mothers) using a questionnaire. Weights and heights of the babies were measured, and intestinal and respiratory infections followed in this period**. Results:** The results showed that the mean weight and height of the girls and boys were the same when compared with the respective NCHS standard applicable for newborns. When compared with the WHO standard, 8% and 8.9% of the newborn girls and boys were malnourished (<-2 SD of median) on the basis of weight respectively, whereas on the basis of length, 6% and 11.3% of them were malnourished (<-2 SD of median) respectively. Altogether, the mortality rate among the children was 4.9%, and it was 1.9% and 38.8% among the normal and the low-birth-weight children respectively. When compared with the NCHS standards (50th percentile), the mean weight of both boys and girls was normal up to the age of 10 months. After that the growth rates decreased, such that, at 20 months of age, the weights of the boys and girls were up to 1,000 g and 800 g below the respective standard. In the case of boys, the height was about 2 cm below the standard up to the age of 12 months. Afterwards, the trend of increase was slower, such that, at 24 months, the average height was 4.5 cm below the standard. The situation was somewhat better in the case of girls up to the standard, but, due to a slower increase afterwards, the average height at 24 months was 3.5 cm below the standard. The mean incidence of diarrhoea for children who were aged one year was 5 times for each child. The highest percentage of children with diarrhoea was in the age range of 6-12 months, and the mean of respiratory infection case at the first year of children's age was 4 times for each child. The highest percentage of respiratory infection was observed at 12 and 24 months of age. **Conclusion:** The present study is an attempt to compare the prevalence of infections and nutritional status among children. Each of these infections led to malnutrition, impaired growth and development, and abdominal obstruction. **Acknowledgements:** The financial support for the project was provided by the Secretary for Research of Tehran University, Tehran, Iran.

185 (009)

Growth Patterns of School Children of Age-group of 5-10 Years

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Background: There is an increasing trend in obesity in developed countries. This needs to be evaluated in developing countries where malnutrition is the main problem. **Objective:** The growth patterns of school children of age-group of 5-10 years were assessed to detect the prevalence of obesity and under-nutrition. **Methodology:** This cross-sectional study was conducted among 1,500 healthy school children of low- and middle-income group from 1 to 15 July 2005. The Government-aided primary schools in an urban area around the medical college were selected. The study objective and methods were explained to head teachers and class teachers prior to school opening after the long summer vacation. A pre-tested proforma was distributed to the students through the class teachers to collect family details, dietary habits, and social and environmental factors. The nutritional status was assessed by measuring height, weight, and head circumference using the standard techniques. Data were compared with the 2000 CDC growth charts. The prevalence of over-nutrition and under-nutrition was assessed. **Results:** The prevalence of obesity in the study group was 24.6 and over-weight 32.6. The prevalence of under-nutrition was 298. There was no significant difference between males and females. **Conclusion:** While under-nutrition is still the major problem in children of age-group of 5-10 years in developing countries, there is a tendency for obesity, and more elaborate studies are needed.

186 (028)

Classification and Treatment of Childhood Malnutrition in Low- and Middle-income Countries

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Background: Childhood malnutrition is a global problem. It has been estimated that malnutrition contributes to 55% of mortality of children aged less than 5 years. There are a number of different systems for classifying and treating malnutrition. The World Health Organization (WHO) has, since 1995, been advocating for a validated single standard system. It is presumed that adherence to the WHO guidelines is not uniform. **Objective:** The objective of the study was to describe and compare different classification systems and treatment models of malnutrition currently being used in literature and in practice in low- and middle-income countries. **Methodology:** A literature review based on medical publications available in the Internet and from the library of the Karolinska Institute, Sweden, was performed. Using keywords associated with malnutrition, 31 articles published during 1987-2005 were reviewed. A descriptive field study was performed in Bangladesh. Healthcare providers on different levels were interviewed regarding their knowledge and use of malnutrition classification and treatment. Literature review was performed in the Karolinska Institute during 01 August-15 October 2005. The field study was carried out in the Urban Primary Health Care Project (UPHCP), Zone 3, Dhaka, during 15-30 March 2005. Data were analyzed using SPSS 10 for Windows (Chicago, IL). **Results:** The literature review revealed that researchers used 7 classification and 4 treatment methods. The WHO classification was used in

61.2%, and the WHO-recommended treatment guidelines were used in 28.5% of the articles. The field study showed an ununiform definition of malnutrition and treatment among the healthcare providers in the study area in Bangladesh. The WHO classification and guidelines for treatment were only referred to by a minority of the healthcare providers. **Conclusion:** Despite all efforts from the WHO to advocate for a uniform classification system and treatment model of childhood malnutrition, a large number of different classification systems were used in published clinical studies. Furthermore, results of a small descriptive study from one low-income country indicated that this also is the fact in clinical practice.

187 (036)

Is Severe Malnutrition Declining in Bangladesh?

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Background: Malnutrition is a major problem in the Southeast Asian region, especially in Bangladesh. One of the causes of this poor condition is poverty, which means poverty of knowledge and poverty of food and nutrition. **Objective:** The study was undertaken to review the number of admissions of children suffering from severe malnutrition in the Community Based Medical College Hospital (CBMCH), Mymensingh, Bangladesh and related factors behind this severe malnutrition. **Methodology:** It is a retrospective study done in the paediatric unit of the CBMCH during January 2001-December 2004. Data were collected from the admission records. **Results:** Firty-seven (2.8%) of 1,650 patients were admitted with severe malnutrition in 2001, 40 (2.3%) of 1,700 in 2002, 34 (1.8%) of 1,800 in 2003, and 32 (1.8%) of 1,755 in 2004. Obviously, there was a gradual decline in the incidence of severe malnutrition, which was statistically significant (p=0.025). Ignorance, faulty diets and dietary technique, repeated attacks of diarrhoeal diseases, and following infection of measles were the causes of severe malnutrition. **Conclusion:** The gradual decline in the number of hospital admissions of children with severe malnutrition is encouraging and may be a reflection of increased awareness regarding food and nutrition, more vaccination against measles, and decrease in incidence of diarrhoeal diseases.

188 (040)

The Target-weight Zone: A Simple Tool for Follow-up of Malnourished Children

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Background: With the introduction of the new guidelines to treat severely-malnourished children, an important decrease in case-fatality rates for nutrition rehabilitation can be achieved. Hospital care is, however, expensive, and the indirect cost for parents and caretakers can be considerable. Home-based care under supervision of the first-line health services can be an alternative even for severely-affected children. Still, meticulous follow-up must be provided, and health centre staff should, at any moment, be able to trace the progress of children under their care. **Objective:** A user-friendly instrument for follow-up of malnourished children in home-based rehabilitation was developed. **Methodology:** A chart was designed to measure weight variations of children in a nutrition-rehabilitation programme. The initial line was plotted, and the target weight, defined as the median

weight-for-height of the child taking into account the growth over the average follow-up period, was set at 13 weeks. The instrument has been tested in a number of settings. The chart was tested in 3 settings--Democratic republic of Congo, Bolivia, and Chad. **Results:** The personnel, using the chart, found it, after a short training, simple and straight forward to use. However, similar problems appeared in all the 3 contexts. In Shaba, none of 95 children and in Bolivia 12% of 96 children reached the target weight. In N'Djamena, the rate was only 1% (of 256 children). Still, weight gain was usually accelerated during the first 6 weeks. Thereafter, the curves flattened, running parallel to the target line without reaching or surpassing it. **Conclusion:** The target weight-line, using the average of the international weight-for-heights reference as target, did not allow for the normal physiological variation in weight gain. This was solved by creating the target-weight zone. This not only allows a good follow-up of children but also a diagnosis of the reached potential of weight-for-height using weight only.

189 (046)

Outcome of Management of Severe Malnutrition in a Medical Institution

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Background: Mortality from severe malnutrition is still very high despite advancement of knowledge in this field. This high mortality is principally attributed to faulty case management. Recently, the World Health Organization has developed a manual for standard case management of severe malnutrition. **Objective:** Outcomes of management of severe malnutrition with 2 different treatment plans were evaluated in terms of morbidity and mortality of affected children. **Methodology:** The study was conducted at the Khulna Medical College Hospital on severely-malnourished children aged 1 month-5 years. Management of severe malnutrition with the WHO protocol was compared with that of conventional non-protocol treatment. The essential features of the WHO protocol were treatment of immediate dangers, appropriate feeding, supplementation of micronutrients, antibiotic therapy, and treatment of complications. Fifty-two children, admitted during March-October 2005, were enrolled in the WHO protocol group, while 31 children, admitted during March-October 2004, before the implementation of the WHO protocol, were taken as the non-protocol group. **Results:** General characteristics of both the groups were similar, except that female children and oedematous malnutrition cases were more common in the WHO protocol group. Associated infections, such as diarrhoea, pneumonia, and septicaemia, were almost similar in frequency. Average daily weight gain (7.7 g/kg.day) in the protocol group was significantly ($p<0.01$) higher compared to the non-protocol group (5.2 g/kg.day). Requirement of intravenous rehydration (11.5% vs 22.6%), blood transfusion (5.8% vs 38.7%), and prescription of third-generation cephalosporin (21.2% vs 32.2%) were much less in the protocol group than in the non-protocol group. The majority (63.5%) of children in the protocol group were discharged after satisfactory improvement, where it was 38.7% in the non-protocol group. Reduction in mortality was highly significant ($p<0.05$) in the WHO protocol group (5.7%) compared to the non-protocol group (22.6%). **Conclusion:** Management with the WHO protocol resulted in satisfactory weight gain and in less need of intravenous fluid, transfusion, and costly antibiotics. It had also reduced the mortality by 75%. Therefore, the WHO guidelines should be adopted in all healthcare facilities for the management of severe malnutrition. **Acknowledgements:** The technical support of ICDDR,B: Centre for Health and Population Research and Concern, Bangladesh is gratefully acknowledged.

190 (076)

Relationship between Nutritional Status and Incidence of Malaria in Children Aged Less Than 5 Years in Malaria-endemic Areas--A Case of Bushenyi District, Western Uganda

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Background: The interaction between nutritional status and malaria is complex and often controversial. Nutritional deficiencies in macro- or micronutrients are thought to lead to malnutrition with subsequent susceptibility to malaria infection. On the other hand, severe malaria or repeated malaria infections lead to malnutrition, and a large percentage of child deaths relating to malaria are attributable to under-nutrition. **Objective:** The objective of the study was to assess the nutritional status and incidence of malaria infection in children aged less than 5 years in selected sub-counties of Bushenyi district in Uganda. **Methodology:** This cross-sectional study used purposive sampling to select households with a child aged less than 59 months in the selected sub-counties. A questionnaire was designed and administered to mothers/caretakers of 126 infants and toddlers in their home setting. The health status of the children was clinically assessed using malaria parasite counts and using anthropometric measurements (weight and height). Dietary history and adequacy was assessed using a 24-hour dietary recall and food-frequency questionnaire. **Results:** Nutritional anthropometry revealed that 36.4% of the children aged less than 5 years were stunted, 24.6% were under-weight, and 10.4% were wasted. Age of the youngest child in the household was highly associated with stunting [r (n=118)=0.168, p<0.05]. In the study, 27% of the children had positive malaria parasite status. The positive parasite status was not significantly associated with poor nutritional status; however, the frequency of malaria was significantly associated with poor nutritional status (p<0.005). The study found that vulnerability to malaria infection highly increased with decrease in age of the child [$F_{1,\ 114}$=4.055, p<0.05]. Age of the youngest child in the household was also highly associated with stunting [r (n=118)=0.168, p<0.05]. Results of bivariate analysis also showed that respiratory infections and intestinal worms were significantly associated with poor nutritional status, [χ^2 (3, n=110)=7.98, p<0.05] and [$F_{1,\ 113}$=4.002, p<0.05] respectively. **Conclusion:** The risk of malaria-associated morbidity increases with the severity of malnutrition; hence, by improving child nutrition, this could prevent more malaria-related illnesses and deaths than previously thought. Integrated nutrition programmes that address growth faltering and improve the nutritional status of young children need to be included among the key priority strategies to reduce the global malaria burden.

191 (087)

Health and Nutritional Status of Young Foster Children Attending a Diarrhoea Treatment Hospital in Bangladesh

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Background: In Bangladesh, fostering of children is not uncommon, which usually occurs among children born in socially- or financially-disadvantaged families. These children frequently suffer from illnesses requiring

hospitalization, but their health problems are not well-studied. Understanding and sharing of information on their health and nutritional status may, thus, help policy-planners in formulating appropriate strategies to address their healthcare needs. **Objective:** The study was conducted to assess the health and nutritional status of young foster children presenting to the Dhaka hospital of ICDDR,B: Centre for Health and Population Research. **Methodology:** For this case-control analysis, information was extracted from the electronic database of the Surveillance System of the Dhaka hospital of ICDDR,B. In total, 151 foster children attending the hospital during 1993-2004 were identified as cases, and 353 (1:2 ratio) non-foster children of similar age randomly identified from the same database served as controls. **Results:** The mean±SD age of the foster children was 5.8±.3 months (range 13 days to 21 months), and most (87%) of their foster parents did not have a child prior to fostering. The majority (70%) of foster parents had a lower family income, and 61% of foster mothers were aged less than 30 years. Of the foster children, 84 (56%) were stunted, 93 (62%) were under-weight, and 14 (9%) were wasted. They were all non-breastfed, more often presented with dehydrating diarrhoea (40% vs 26%, p=0.002), had illiterate foster mother (56 % vs 42 %, p=0.003), less frequently received vitamin A supplementation (64% vs 77%, p=0.007), less often immunized against measles (11% vs 33%, p<0.001), and more often required a hospitalization of ≥48 hours (43% vs 26%, p<0.001) compared to the non-foster control children. Diarrhoea due to rotavirus was more common among the control children (66% vs. 22%, p=0.007). Two foster children died, but none in the non-foster group. In logistic regression, the foster children were more likely to be infants (odds ratio [OR]=3.77, 95% confidence interval [CI] 2.0-7.3, p<0.001), of female sex (OR=1.8, 95% CI 1.2-2.9, p=0.008), non-immunized against DPT (OR=2.0, 95% CI 1.3-3.1, p=0.003), and had more under-weight (<-2 z-score) (OR=1.9, 95% CI1.2-3.0, p=0.008). **Conclusion:** Because of infancy, female sex, malnutrition, and lack of immunization, the foster children are more vulnerable to poor health. Effective programmes need to be developed for improving their health and lessening morbidity and deaths. At health facilities, implementation of protocolized management is required for efficient provision of optimal care to these children. **Acknowledgements:** The study was funded by ICDDR,B: Centre for Health and Population Research and United States Agency for International Development (USAID) (collaborative agreement no. HRN-A-00-96-90005-00).

192 (124)

How Important Are the Use of Anthropometric Measurements at a Tertiary Hospital?

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Background: Anthropometry for diagnosis of clinical malnutrition is ofteen referred to as important despite the fact that it is not always used at hospital level. **Objective:** The study was conducted to validate the importance of using anthropometric measures in the assessment of nutritional status in a tertiary hospital setting with a high prevalence of malnutrition. **Methodology:** All children (n=984) aged, 1-60 month(s), admitted to the Pediatric Department, Maputo Central Hospital, Mozambique, during 16 January-15 February 2003), were included in this prospective study. Each child was investigated, weighed, and measured (study data [SD]) during the first 24 hours by one of the researchers. At discharge, data from the file (hospital data [HD] were recorded. The definitions of malnutrition used in the study were the following: low weight-for-age: WAZ <-2 (severe: WAZ <-3); stunting: height-for-age: HAZ <-2 (severe: HAZ <-3); wasting: weight-for-height: WHZ <-2 (severe: WHZ <-3); acute malnutrition: WHZ <-2 or oedema; moderate acute malnutrition: WHZ <-2 and ≥-3 without oedema; and severe acute malnutrition: WHZ <-3 or oedema. All data were analyzed using the Epi Info 6 and SPSS. **Results:** Acute

malnutrition based on anthropometric measurements was present in 30.7% (SD) of all children admitted to the hospital, but only 18.5% (HD) of these children were diagnosed with malnutrition at admission. The hospital data showed malnutrition as one of the diagnosis in 7.5% at admission, whereas 19.7% of these children were not malnourished according to the study data. Twenty-three percent of acute malnourished children are not picked up when weight-for-age was used, and 44.1% of low weight-for-age children were not wasted. **Conclusion:** Acute malnutrition is not recognized in the majority of cases due to both over- and under-diagnosis when only weight-for-age and clinical assessment were used. Anthropometric measurements are essential for making a correct nutritional diagnosis even in a tertiary setting with high prevalence of malnutrition.

HEALTH POLICY AND OTHER CHILDHOOD PROBLEMS I

193 (013)

An Epidemic of Viral Hepatitis A--Clinical Profile and Outcome of Paediatric Patients Admitted to a Teaching Hospital

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Background: A recent epidemic of viral hepatitis A occurred in Kottayam, Kerala, India. Kerala is a state in the southernmost part of India which is different from other parts of India with a high literacy rate, low infant mortality rate, and low maternal mortality rate. Kottayam is still more advanced than Kerala in health indicators. The people of Kottayam are very health conscious and are supposed to be keeping a high level of personnel hygiene. **Objective:** The study was conducted to find out the epidemiological profile and outcome of the epidemic. **Methodology:** This is a prospective, investigative clinical study for 7 months from 4 September to 5 March on children, aged 1 month-12 years, with viral hepatitis, admitted to the Medical College, Kottayam. Detailed history, followed by clinical examinations, was taken. Investigations included urine for bile pigments and bile acids, LFT, serology for viral markers, and USG of abdomen. All patients were followed up for 3-6 months. **Results:** The number of patients increased from 4 September onwards as part of an epidemic in and around Kottayam. The total number of cases during the study period was 82, of which 60 were viral hepatitis A. Forty (66.67%) cases had contact with a case of jaundice. Thirty-six (60%) cases had poor personal hygiene. Sixteen (27%) cases had no access to safe drinking-water. One child died. Fifty-one cases recovered within 2-3 weeks. Complications noted were: hepatic failure-2, ascites-3, pleural effusion-2, and ADEM-1. One child had a relapse. **Conclusion:** Hepatitis A being a benign viral infection in children usually does not produce complications or death. Mortality and complications seen in the study may be a reflection of the increased number of cases. Lack of safe drinking-water and personnel hygiene predisposes to such infections. Improper planning and lack of investment in public health is unique for any developing country, and the threat of any such infection always exists.

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194 (025)

Peutz-Jeghers Syndrome in Association with Cafe-au-lait Spots--A Case Report

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Background: Peutz-Jeghers Syndrome is an autosomal dominant disorder in which multiple hamartomous polyps in the gastrointestinal tract occur in association with distinctive mucocutaneous pigmentations. These pigmentations are characteristically different from Cafe-au-lait spots. An extensive literature search failed to show any report on coexistence of Cafe-au-lait spots with Peutz-Jeghers Syndrome. **Objective:** The objective was to report a case of Peutz-Jeghers Syndrome and Cafe-au-lait spot. **Methodology:** A case of Peutz-Jeghers Syndrome was diagnosed in 2002, who had extensive Cafe-au-lait spots all over the trunk. Since co-existence of Peutz-Jeghers Syndrome and Cafe-au-lait spots has not yet been reported anywhere in the world, the experience of the authors with professional colleagues was recorded. Detailed history was obtained from the 15-year-old patient who presented with chronic diarrhoea and failure to thrive for 12 years. Thorough physical examinations revealed presence of Cafe-au-lait spots over the trunk. Colonoscopic examination showed multiple clusters of polyps up to ileocecal junction. The patient symptomatically improved after several sessions of polypectomy. Endoscopic biopsy of the upper gastrointestinal tract showed evidence of gastritis and duodenitis. Biopsy of the skin lesion was also performed. **Results:** Routine investigations showed microcytic hypochromic anaemia. Plenty of pus cells in stool were seen. Biopsy of the polyps showed Peutz-Jeghers polyp with characteristic strand of smooth muscle and blood vessels, Skin biopsy showed increased pigmentation of basal and upper layer and dermis showed melanophage. The patient showed clinical improvement after 3 sessions of polypectomy. Diarrhoea improved, and he started to gain weight. **Conclusion:** Peutz-Jeghers Syndrome presents with pigmentation disorders but not Cafe-au-lait spots. The patient had extensive typical Peutz-Jeghers polyp in the gastrointestinal tract and extensive typical Café-au-lait spot in the body. After polypectomy, his diarrhoea improved. He has been followed up for the last 3 years. He has started to gain weight and is earning his daily wage.

195 (042)

Child-friendly Health Services Initiative: An Initiative for Collaborative Research and Action on Promoting Child Health via First-line Health Services

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Background: First-line health services have an enormous potential for improving children's health worldwide. In most domains, evidence-based guidelines exist for assisting them in this enormous task. However, there is insufficient knowledge on how to implement them, and adaptation to local conditions is often essential. Therefore, there is a need for further research and sound evaluation of actual practice. Communication and critical appraisal of results should also be promoted. **Objective:** A network of researchers and practitioners working on or in first-line child health services is being set up. The aim is to (a) develop guidelines and models for practice,

where lacking; (b) develop joint research protocols for studying implementation; (c) assist practitioners in evaluating and communicating their own solutions. **Methodology:** The network should facilitate the exchange of ideas and experience, assist in the development of joint research and evaluation protocols, and help find the necessary funds. The executives of the network, guided by a steering committee of experts, should coordinate communication aided by modern technology (email-group, website), meetings, and joint evaluation missions. **Results:** Practitioners from 5 countries (Burundi, DR Congo, Haiti, Mauritania, and Niger) started the network in June 2005. Members of the Child Health and Nutrition Unit (ITM, Belgium) provide expertise and coordination. The function of a coordinator is mandatory for re-launching the emails, for editing and translating documents, and for soliciting funds. Email is an appropriate technology for a small group, but a website should be developed to reach a wider audience. As a first joint project, a 'generic' research protocol for the ambulatory management of malnutrition at health centre level was developed and adapted to 2 specific settings (DR Congo and Haiti). And contacts with research centres are developing (Bangladesh and Ethiopia). Locally-produced guidelines (Niger) for nutrition counselling were exchanged. **Conclusion:** The network allows practitioners from different settings to exchange information and ideas on how to improve the management of child health within various health systems. It also allows a strong link between practitioners and researchers, favouring the development of multi-centric research.

196 (052)

Patterns of Use of a Growth Monitoring Clinic in an Urban Setting in Port Harcourt, Nigeria

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Background: Growth Monitoring Clinics are well-established as one of the strategies to ensure child survival. However, to be effective, the level of patronage by the target population should be high. **Objective:** This study reports the patterns of patronage by children attending a model clinic operated by the University of Port Harcourt Teaching Hospital (UPTH) in southern Nigeria. **Methodology:** Sociodemographic and anthropometric data have been collected at the 'Well Baby' Clinic at the UPTH since 2000. Records of attendance during May 2000-June 2001 were analyzed to establish the patterns of service use. **Results:** In total, 354 children, aged 0-18 month(s), attended the clinic within 13 months. The male/female ratio was about the same (49.2% males vs 50.8% females). More than half of them did not make a return visit (59.3%, n=201). The proportion of children returning for a follow-up visit drastically dropped by more than half; 144 (40.7%) recorded a second visit. This pattern of drop-out rate was similarly observed for subsequent visits; 77 (21.8%) recorded a third visit, being about half of the 'second-timers', while 37 (10.5%), 20 (5.7%), and 12 (3.4%) children returned a fourth, fifth and sixth time respectively. Only 3 children recorded a seventh visit, and one child came back an eighth and ninth time. The median age at the first visit was 5 months, but only 3 children were under 4 months. The average age of attendees differed by a month between each consecutive visit, progressively increasing from 6 to 10 months by the sixth visit. **Conclusion:** The majority of the children made only one visit and at a rather late age. A high rate of attrition was also observed between the visits. A clearer understanding of reasons for these findings will greatly enhance the patronage level of this service.

197 (066)

Challenges in Clinical Management of Children with AIDS in Bangladesh

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Background: Lack of experience in handling paediatric AIDS cases in Bangladesh is an obstacle in the appropriate management of children with AIDS. Bangladesh is a low-prevalence country for HIV/AIDS. The number of children infected with HIV is very few. **Objective:** This communication reports the appropriate management of a child with AIDS and severe malnutrition in Dhaka. **Methodology:** A 36-month old female child with HIV was referred to the Voluntary Counselling and Testing Unit of ICDDR,B: Centre for Health and Population Research (Jagori) from an HIV-positive support group organization--Mukto Akash--for evaluation to start antiretroviral therapy (ART) in November 2004. The child had been suffering from various illnesses since she was 6 months old and had been referred to different hospitals where she received inadequate treatment. On examination, she was found to be severely malnourished, with delayed milestones of development, massive hepatosplenomegaly, generalized lymphadenopathy, chronic supporative otitis media of the left ear, and had clinical stage 3 (WHO staging) of AIDS. Laboratory investigations revealed haemoglobin at 9.4 g/dL and a CD4 cell count of 260 cell/μL. It was decided to start her on HAART, antibiotics for opportunistic infection, and nutritional rehabilitation. Paediatric formulation of antiretrovirals (ARVs) is not available in Bangladesh and, therefore, adult tablets were broken and suspensions prepared. For nutritional rehabilitation, the mother was trained in the Nutrition Rehabilitation Unit of ICDDR,B to provide an appropriate diet, and she was supplemented with micronutrients and advised for a monthly follow-up visit. **Results:** After 10 months of the intervention, the child was improving; she was in clinical stage 1 of AIDS; milestones of development were almost appropriate for age; liver and spleen have reduced in size; she was moderately malnourished, and her CD4 count rose to 490 cell/μL. Many obstacles were faced in the management of the child, including lack of availability of paediatric formula of ARVs, lack of knowledge on management of paediatric AIDS among clinicians in Bangladesh, poverty and continued financial support for food and ARVs, and regular follow-up as residence in a rural area. **Conclusion:** Training on the management of paediatric AIDS cases and better support for the provision of ART are needed in Bangladesh. **Acknowledgements:** The support of Family Health International (FHI), Bangladesh, Department of International Development (DFID), and Mukto Akash is acknowledged.

198 (215)

Community Based Therapeutic Care-Outpatient Therapeutic Program-A Pilot Project in Bangladesh

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Background: The majority of severely-acutely-malnourished children can be easily treated in the outpatient therapeutic component of a community-based therapeutic care programme. It provides home-based treatment and

rehabilitation for severely-acutely-malnourished children but who have appetite and are free of medical complications. **Objective:** The study was undertaken to develop an appropriate community-based therapeutic care-outpatient therapeutic programme (CTC-OTP) model for addressing acute malnutrition in children, aged less than 5 years, through an urban primary healthcare system in Bangladesh. **Methodology:** The CTC-OTP project is being implemented in Khulna City Corporation through 2 local NGOs-Fair Foundation (FF) and Paribar Kallayan Samity (PKS). Both these NGOs operate an urban community-based health service programme, and the CTC components are added to the existing health programme with the support of Concern and Valid International, with no additional staff. In total, 8 static clinics (4 clinics per NGO) and 12 satellite teams (5 FF, 7 PKS) have been offering the OTP through 76 service-delivery points. Children admitted to the CTC-OTP are those identified as acutely-malnourished with no major medical complications and who are able to eat the ready-to-use nutritious food (RUNF) at home, a locally-produced food product (chickpea/sesame seed/dried skimmed milk/sugar/oil/cocoa-powder fortified with minerals and vitamins). The child's medical condition was assessed by a health worker on a weekly basis to rule out complications, and RUNF is given according to weight of the child till the discharge criteria are met (=80% weight-for-height and no oedema for 2 consecutive weeks). **Results:** The CTC-OTP project has shown early signs of progress in the identification and treatment of acutely-malnourished children. The pilot phase initial findings showed that RUNF appeared to have a high level of acceptability to the children and among the discharged children, the weight gain in the case of Fair Foundation was 8.6 mg/kg.day and for PKS is 6.4 mg/kg.day, and the consecutive length of stay was 33.6 and 38.5 days. **Conclusion:** Early indications are that the CTC-OTP intervention is being successfully employed in the Bangladesh urban primary healthcare context. RUNF has appeared to prove as efficacious as the therapeutic foods used in other contexts. **Acknowledgements:** The support of the Valid International, Fair Foundation, and Paribar Kallayan Samity is acknowledged.

DAY 2: Tuesday, 7 February 2006
10:00 am - 11:30 am (Venue: Corridor Café)

Poster Session 3

DIARRHOEAL DISEASES II

199 (107)

Detection of Group B Rotavirus in Hospitalized Patients in Bangladesh

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Background: Group B rotaviruses cause diarrhoea among adults and older children. For many years, they were restricted only in China, but recently they have been isolated in India and Bangladesh. Although the viral detection rate in countries outside China has remained low, the extreme virulence potential of the virus and their dramatic appearance within a geographically-confined region prompted investigators to pursue research on the group B rotaviruses. **Objective:** The present study was undertaken to investigate the presence of group B rotaviruses in hospitalized patients. **Methodology:** During July-December 2003, about 50,000 patients were admitted to the Dhaka hospital of ICDDR,B: Centre for Health and Population Research, with a history of watery diarrhoea. As part of the surveillance, stool specimens from every 50th patient (2% sample, n=956) were tested for various common enteric pathogens, which included group A rotaviruses, *Vibrio*, *Shigella*, and *Salmonella*. In total, 611 diarrhoeal stool specimens, which were negative for group A rotaviruses, were tested for the presence of group B rotaviruses using reverse transcription-polymerase chain reaction (RT-PCR). Clinical data were available from the hospital surveillance records. The clinical features of group B rotavirus-infected patients were also analyzed. **Results:** Group B rotaviruses were detected in 13 samples (2.1% of the sub-set tested and 1.5% of the overall study) using one step RT-PCR. The age of the group B rotavirus-infected patients ranged from 9 months to 40 years; the mean age was 21.3 years, and the median age was 19 years. Three (23%) of the group B rotavirus-infected patients had bacterial co-infection with *Vibrio cholerae* O1. Fever (92.3%), abdominal pain (76.9%), and vomiting (92.3%) were common features in the patients. **Conclusion:** This is the first report of group B rotavirus in Dhaka city. The low rate of detection suggests that group B rotavirus is an uncommon cause of gastroenteritis in hospitalized patients. A community-based study would be required to investigate the true prevalence and burden of disease due to group B rotaviruses in Bangladesh. **Acknowledgements:** The study was funded by ICDDR,B: Centre for Health and Population Research and Flemish Fonds voor Wetenschappelijk (grant no. G.0288.01).

200 (128)

Enteropathogens Associated with Neonatal Diarrhoea in Bangladesh: A Hospital-based Surveillance, 1996-2004

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Background: In developing countries, diarrhoeal disease remains an important cause of morbidity and mortality among neonates. However, there is a lack of information on aetiology of neonatal diarrhoea, and it has not been systematically studied in Bangladesh. **Objective:** The study examined enteropathogens associated with diarrhoea in neonates. **Methodology:** The Dhaka hospital of ICDDR,B: Centre for Heath and Population Research operates a Diarrhoeal Disease Surveillance System, which prospectively collects sociodemographic, clinical and microbiologic information from a systematic 2% (every 50th patient) sample of patients of all ages attending the treatment facility with diarrhoeal illnesses. Data of all neonates sampled during 1996-2004 were extracted from the electronic database. Stool specimen was obtained from each neonate and was plated directly onto taurocholate tellurite gelatin agar (TTGA), Salmonella-Shigella (SS) agar, and MacConkey's agar for isolation of *Vibrio cholerae*, *Shigella*, and *Salmonella* respectively. Also, rotavirus antigen was looked for during this period. Tests for detection of enterotoxigenic *Escherichia coli* (ETEC), and *Campylobacter jejuni* were performed during 1996-2001. **Results:** In total, 90 neonates were identified, and the following enteric pathogens were isolated from them: ETEC (11), rotavirus (8), *V. cholerae* (6), *Shigella boydii* type 7-11 (1), *Salmonella* spp. (1), *Aeromonas* spp. (9), *C. jejuni* (4), and *Vibrio fluvialis* (1). Serotypes of isolated *V. cholerae* O1 El Tor included Inaba 2 and Ogawa 4. In stool microscopy, *Giardia lamblia* and *Entamoeba histolytica* were not detected. Of all the neonates, 31% were exclusively breastfed, 55% were partially breastfed, and 14% were non-breastfed. **Conclusion:** The study observed that ETEC, rotavirus, and *V. cholerae* were the common pathogens in Bangladeshi neonates with diarrhoea. Further investigations of aetiology for diarrhoea in neonates and promotion of breastfeeding are important for improved case management and developing effective control and prevention programmes. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) and Core support are acknowledged.

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Provider Diarrhoea Management Practices and Awareness of Zinc Treatment

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Background: Zinc treatment of all children, aged less than 5 years, is now included in the joint WHO/UNICEF childhood diarrhoea-management guidelines. In Bangladesh, a national scale-up effort is currently underway. **Objective:** Prior to the roll out of a dispersible zinc tablet product in Bangladesh, the study was undertaken to obtain baseline information on provider practices and knowledge of zinc as a treatment for childhood diarrhoea. **Methodology:** In one rural sub-district and urban zone, a survey for acute childhood diarrhoea was carried out. Episodes of active illness were linked to providers who provided services, and a list was created. This list was

used for locating and interviewing any provider having been consulted 5 or more times. Interviews were pre-arranged in the provider's work-setting at a time of their choice. The study was carried out from January to March 2004. **Results:** In total, 228 providers (108 rural, 120 urban) were interviewed. They were sub-grouped as licensed MBBS (19%), unlicensed allopaths (43%), drug sellers (18%), and traditional healers/homeopaths (20%). Among the licensed MBBS providers, oral rehydration solution, antibiotics, and zinc were routinely prescribed by 93%, 67%, and 18% respectively. Eighty percent of them were aware of zinc as a treatment for childhood diarrhoea; however, the knowledge about zinc and its benefits was poor. Among unlicensed allopaths and drug sellers, antibiotics and anti-helminthics were frequently prescribed (65% and 57% respectively). About one-third of them were aware of zinc as a diarrhoea treatment, but only 15% included zinc in their diarrhoea-management practices. The traditional healers and homeopaths had a minimal knowledge of zinc. Across all the providers, zinc was most frequently thought to improve the growth and development of children. **Conclusion:** Benefits of zinc as a treatment for childhood diarrhoea is already well-established among the licensed providers in Bangladesh, but is not routinely prescribed. Provider-promotion messages need to focus on behaviour change and the benefits of zinc. **Acknowledgements:** The financial support was received from the Bill and Melinda Gates Foundation.

MICRONUTRIENTS, VITAMINS, AND DIETARY INTAKE II

202 (102)

Impact of Vitamin A on Pre-school Child Mortality

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Background: A positive relationship between eye signs of vitamin A deficiency and child mortality has been reported in many observational studies. Morbidity and nutritional status are probably intermediate variables in the causal path between vitamin A deficiency and child mortality. Several studies concluded that improving vitamin A status in deficient populations was associated with an overall decrease of 23% in mortality rates for young children aged 6-72 months. **Objective:** The study assessed the impact of vitamin A on mortality of pre-school children. **Methodology:** A systemic review was performed to identify all possible studies on the selected topic. This was done by searching relevant electronic databases (MEDLINE, Cochrane, CINAHAL, AMED, PsycInfo, and EMBASE), hand search of library journals and books, Internet and reference searches. All published electronic studies were identified through a combination of systemic electronic database searching. **Results:** Results of studies showed that overall mortality in children aged less than 12 months was almost similar between the experimental and the control (18.1 and 18.3 per 1,000) group, but in the 13-72-month age-group, mortality (8.6 and 11.1) was lower by 22.7% in vitamin A-supplemented group, and dietary vitamin A intake was most beneficial to the youngest children, who were at high risk of death. Dietary vitamin A intake was associated with an apparently greater reduction in mortality among girls (multivariate relative risk 0.39) compared to boys (multivariate relative risk 0.58). There were variations in terms of types or form of vitamin A intake and child mortality. The relative risk of mortality when extreme quintiles of total dietary vitamin A intake were compared was 0.59 (95% confidence interval [CI] 0.33-1.04), of carotenoid 0.51 (95% CI 0.29-0.89), and of preformed vitamin A 1.00 (95% CI 0.61-1.62). Morbidity and nutritional status are probably intermediate variables in the

causal path between vitamin A deficiency and child mortality. Unimmunized children with vitamin A supplementation showed insignificant reduction in mortality (22.0%), whereas immunized children showed significantly reduction in mortality. **Conclusion:** Vitamin A is associated with reduced risk of morbidity and mortality, and supplementation of vitamin A reduces child mortality from 34% to 54%. **Acknowledgements:** The support of University of Southampton and Unilever in UK is acknowledged.

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Characteristics of Young Children Not Immunized against Measles and Lack High-potency Vitamin A Supplementation, and the Programmatic Implications

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Background: Morbidity and mortality associated with measles are a major public-health problem in developing countries, including Bangladesh. Measles, along with vitamin A deficiency, remains the most important cause of childhood blindness. **Objective:** The study was conducted to understand the characteristics of young children who are non-immunized against measles and also not supplemented with high-potency vitamin A. **Methodology:** This case-control study was performed on children (n=2,952) of either sex, aged 10-23 months, attending the Dhaka hospital of ICDDR,B: Centre for Health and Population Research during 1996-2001. Children who did neither receive measles vaccination nor high-potency vitamin A supplementation in the previous 6 months constituted cases (n=1,486), and those receiving them (n=1,466) constituted controls. **Results:** Of the cases, 43% were stunted, 62% were under-weight, and 31% were wasted, and the corresponding figures for the controls were nearly half in stunting and under-weight. The cases were more likely to have longer (±48 hours) hospitalization (25% vs 17%, p<0.001), have dehydrating diarrhoea (22% vs 19%, p=0.027), required intravenous fluids for their management (9% vs 6%, p=0.003), reported to the hospital >48 hours after onset of diarrhoea (35% vs 31%, p=0.008). The cases had illiterate mothers (53% vs 34%, p<0.001), had non-cemented floor of the house (55% vs 40%, p<0.001), lack of electricity at home (17% vs 11%, p<0.001), absence of cooking-gas (55% vs 46%, p<0.001), ≤2 dwelling rooms (88% vs 84% p<0.001) in their house, and a monthly income of <5,000 taka (US$ 83.00) (73% vs 60%, p<0.001). Logistic regression demonstrated that lack of immunization against measles and high-potency vitamin A supplementation was significantly associated with having an illiterate mother (odds ratio [OR]=1.76, 95% confidence interval [CI] 1.48-2.09, p<0.001), lack of sanitary toilet (OR=1.8, 95% CI 1.48-2.17, p<0.001), longer (≥48 hours) hospital stay (OR=1.46, 95% CI 1.19-1.79, p<0.001), stunting (OR=1.39, 95% CI 1.18-1.63, p<0.001), and under-weight (OR=1.25, 95% CI 1.07-1.47, p=0.006) but not wasting. **Conclusion:** Young under-weight or stunted children of illiterate mothers are not likely to be immunized against measles and to receive high-potency vitamin A supplementation and are more likely to require longer hospitalization with increased costs. The findings of the study indicate the need for developing a programme to identify such children and bring them under the measles vaccination and vitamin A supplementation programmes up to the desired level. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) is acknowledged.

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Prevalence and Outcome of Hypokalaemia among Severely-malnourished Hospitalized Children in Bangladesh

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Background: Hypokalaemia (serum potassium <3.5 mmol/L) is very common in severely-malnourished children. Under many circumstances, it is an acute medical condition warranting immediate management. **Objective:** The study was undertaken to assess the prevalence of hypokalaemia in severely-malnourished hospitalized children and its outcome and also to assess the feasibility of home-based nutritional management as an alternative approach to hospital-based nutritional management of enrolled severely-malnourished children, aged 6-59 months, in Bangladesh. **Methodology:** In total, 225 children were enrolled. Of them, 150 were discharged after a week of stabilization at the hospital, 75 followed up at home, and 75 were requested to come for follow-up till achievement of weight-for-length of 80%. The latter 75 children received conventional hospital-based nutritional management. The management of the acute phase of severe malnutrition followed the adapted guidelines of World Health Organization. Oral potassium was supplemented at a dose of 4 mmol/kg.day for 5 days in 3 divided doses. Intravenous potassium was added to intravenous fluids only if the child required infusion for correction of dehydration. **Results:** In total, 130 (58%) children were hypokalaemic (serum potassium <3.5 mmol/L), of whom 74 (57%) had severe hypokalaemia (serum potassium <2.5 mmol/L). All but 13 children with severe hypokalaemia required oral rehydration salt solution and oral potassium supplement for correction of hypokalaemia. Only one child died with a case-fatality rate of 0.8%. **Conclusion:** The results suggest that the prevalence of severe hypokalaemia is high in severely-malnourished children, and it can be treated effectively with oral potassium supplements. **Acknowledgements:** The financial support of the Swiss Agency for Development and Cooperation (SDC) and World Bank is acknowledged.

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A Study of Iodine Nutrition Status in Consumed Household Salt and Urinary Iodine of Adolescent College Girls

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Background: In most previous surveys or studies, iodine nutrition status has been assessed on school-age children and also on men and women of childbearing age. But no study has been done specifically on adolescent girls aged 12-18 years, a large percentage of whom get married and enter into pregnancy, thus perpetuating malnutrition through generations. **Objective:** The study was carried out to assess the iodine nutrition status of college girls aged 16-18 years. This was done by determining the level of salt iodine, which they were consuming

in their households, and also their urinary iodine excretion (UIE), which is an indicator of biochemical iodine deficiency. **Methodology:** In total, 459 students, randomly selected from 3 girls colleges, were surveyed. One day before the survey, the students were provided with small polythene packets to bring salt from their homes. Next day, salt and a random urine sample were collected from each student. The salt and urine samples were analyzed in the laboratory of the Institute of Nutrition and Food Science (ICCIDD). Salt iodine was determined by the titrimetric method, and urinary iodine was estimated by the ammonium per aulfate digestion on micro plate (APDM) method. **Results:** The median urinary iodine (MUI) level was 269 mcg/L, and distribution analysis showed that 15.3% of the students had biochemical iodine deficiency (urinary iodine <100 mcg/L). The highest percentage (16.2%) of deficiency was observed among girls aged 16 years. The mean iodine value of salts consumed in the household level was 49 ppm (as per law, 15 ppm iodine should be present at household level). However, some salt samples contained no iodine. Only 8.1% of the salt samples contained iodine in the range of 10 to 20 ppm. More than 34% of the salt samples contained iodine greater than the standard factory level (45 to 50 ppm). Iodine in salt was reflected by a urinary iodine excretion. The average level of iodine was found 3 times higher than it should be, which is reflected in the MUI. **Conclusion:** The findings suggest that a large percentage of the study population was not consuming the standard level of iodine from their household salt intake. The salt factories should be more careful and sincere about mixing iodine properly in household salts. Higher salt iodine corresponds to higher urinary iodine. **Acknowledgements:** The study was supported by the International Council for Control of Iodine Deficiency Disorders, Bangladesh, Institute of Nutrition and Food Science, University of Dhaka, and Department of Biochemistry and Molecular Biology, University of Dhaka, Dhaka.

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Calorie Restriction Enhances T Cell-mediated Immune Response in Over-weight Men and Women

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Background: It is well-known that dietary energy restriction prolongs life-span and enhances immune responsiveness in a wide range of laboratory animals. However, information on the applicability of these results to humans is limited **Objective:** The effects of calorie restriction on T cell-mediated function in human was examined. **Methodology:** Forty-six over-weight (body mass index [BMI], mean±SD=27.9±1.2) men and women aged 25-45 years (mean±SD=34.86±4.2) were randomly assigned to a 30% or 10% (control) calorie-restricted group. Delayed type hypersensitivity skin test (DTH), lymphocyte proliferation, prostaglandin E_2, and cytokine productions were determined at baseline and after 6 months of calorie restriction (CR). **Results:** The DTH responses (p=<0.05) and ConA and phytohaemagglutinin (PHA)-stimulated lymphocyte proliferation were significantly increased in both the calorie-restriction groups compared to baseline [M0 vs M6, mean±SEM: 30% CR, ConA, 26,455±2,726 vs 44,448±4,580, p=<0.001; PHA, 36,657±2,341 vs 48,452±4,248, p=0.003; 10% CR, ConA, 30,530±3,485 vs 56,390±10,556, p=0.018; PHA, 41,348±4,162 vs 63,498±8,083, p=0.012]. However, proliferative response to anti-CD3 was increased significantly only in 30% of the CR group [M0 vs M6, mean±SEM: 6,919±989 vs 11,423±1,814, p=0.008]. Lipopolysaccharide (LPS)-stimulated PGE_2 production was reduced in both the groups, but reached statistical significance only in 30% of the CR group [M0 vs M6, mean±SEM: 1,263.73±196.0 vs 857.2±1,19.5; 33% decrease, p<0.05]. **Conclusion:** These results, for the first

time, show that 6-month calorie restriction in humans improves T cell-mediated function. This effect of calorie restriction is, at least in part, due to decrease in PGE_2 production, which has been shown to suppress T cell function. **Acknowledgements:** The study was supported by the Ellison Medical Foundation-International Nutrition Foundation Fellowship Program, NIA, and USDA.

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Health and Social Life of Adolescents Girls in Bangladesh: Evidence from a Large Survey

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Background: Little is published or known about health, nutrition, and social life of never-married adolescent girls in rural Bangladesh. **Objective:** The study examined the prevalence of reported morbidity, intake of iron supplements, nutritional status, food security, access to media, and mobility in public place in rural areas. **Methodology:** Two-stage cluster sampling was used for selecting 5,106 never-married adolescent girls, aged 13-19 years, in 113 sub-districts. Female workers interviewed the adolescents at their homes using a structured questionnaire. They were asked for morbidity in the preceding 2 weeks, source of medical care, ever-use of iron supplement, and knowledge of nutrition and common diseases. Questions were also asked whether they were disturbed (or harassed) on their way to school or social visits, listened to radio and television, had food security, and menstruation problem. Data were analyzed using bivariate and multivariate techniques. **Results:** The 2-weekly prevalence of morbidity was 35%; symptoms in order of prevalence were fever (18%), cough and/or cold (9%), stomachache (4%), diarrhoea (3%), and skin infections (1%). Their usual sources of care were village quacks (50%), pharmacies (15%), private doctors (17%), homeopaths (6%), and public-sector doctors (6%). One in 9 adolescents had irregular menstruation, 12% avoided some food during menstruation, and 23% passed white foul-smelling vaginal discharge. Food avoidance during menstruation and foul-smelling vaginal discharge were common among the girls of food-deficit households. Sixty-four percent had knowledge of the needs for extra nutrients, but only 7% used iron supplements. Both knowledge and use increased with increase in levels of education and household economic status. Chronic energy deficiency (thin) was prevalent in 9% of the cases, and 7% had skipped meals for shortage of food in the last 2 weeks, and it was higher in food-deficit households. The adolescents had limited scope to listen radio (37%) and watch television (42%) once a week or more. Two of 5 adolescents read newspapers occasionally. Forty-three percent of the adolescents feared travelling in public, and it was higher among educated and better-off households. **Conclusion:** The high prevalence of symptomatic reproductive morbidity (23%) and insecurity in mobility (43%) among unmarried adolescent girls is of great concern and needs to be addressed for their better growth and development.

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Iodine Content of Salt Consumed in Restaurants in Different Parts of Dhaka City

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Background: Several studies have been done on the level of iodine intake at different levels, such as households, hostels, salt factories, and garment factories. But the iodine content of salt consumed in restaurants that cater millions of people everyday has not been investigated. **Objective:** The study evaluated the iodine content of salt used in restaurants in different parts of Dhaka city. **Methodology:** The study was conducted during October 2004-January 2005 in different parts of Dhaka city, such as Dhanmondi, Mohammadpur, riverside, and slum area. A simple random sampling was used for selecting 25 restaurants from each area. A structured questionnaire was employed to study behavioural aspects of restaurant owners/managers towards iodized salt. Iodine content of the salt samples was determined using the titrimetric method at the Institute of Nutrition and Food Science, Dhaka. **Results:** The levels (92-96%) of iodine in salt used in restaurants located in Dhanmondi, Mohammadpur, and slum area were as per the law ($\geq$15 ppm), whereas 28% of restaurents from riverside was not (<15 ppm) (χ^2= 10.11; p=0.0). All the restaurant owners in Dhanmondi, Mohammadpur, and riverside and 80% in slum area heard about iodized salt. Sixty-four percent of the restaurant owners in Dhanmondi had knowledge about the benefits, mainly prevention of goitre, 52% in Mohammadpur, 56% in riverside, and 56% in slum area. 40-60% of the restaurent owners in Dhanmondi, Mohammadpur, and riverside, and 28% in the slum area knew how to test iodine by the home-based method; none knew about the kit method (χ^2=21.17; p=0.0). All the respondents in Dhanmondi and Mohammadpur heard about iodized salt from TV and newspapers, while 32% from the slum area learnt about iodized salt from radio (χ^2=48.23; p=0.0). Packet salt was used in all the restaurants in Dhanmondi, and Mohammadpur, 72% in riverside, 68% in slum area (χ^2=71.22; p=0.0). Awareness about the salt law among the restaurant owners was 48% in Dhanmondi, 80% in Mohammadpur, 56% in riverside, and 48% in slum area (χ^2=28.24; p=0.0). **Conclusion:** More promotional campaigns through TV and radio directed towards the riverside restaurants should be conducted for using iodized salt. In addition, sale of open salt should be strictly prohibited. **Acknowledgements:** The authors thank Professor Quazi Salamatullah and M. Mohiduzzaman, Institute of Nutrition and Food Science, University of Dhaka for their kind help in analyzing the iodine content of the salt samples by titrimetric method in their laboratory.

[*]Students of 1989-1999 and Rsearch Fellow

3:00 pm - 4:30 pm (Venue: Executive Director's Wing)

Poster Session 4

BREASTFEEDING AND INFANT HEALTH II

209 (118)

Infant-feeding Patterns at the Provincial General Hospital, Nakuru, Kenya

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Background: Childhood malnutrition is prevalent worldwide. In sub-Saharan Africa, 1 in 3 children, aged less than 5 years, is under-nourished. Factors that significantly increase the risk of malnutrition, during childhood, include low birth-weight, inappropriate feeding practices, repeated infections, and inadequate time set aside for infant feeding (World Health Organization, 2000). The international guidelines recommend exclusive breastfeeding for the first 6 months. Complementary feeding is the introduction of solid foods to the diet of the infant, but most infants are introduced to these foods early in life. **Objective:** The study investigated the feeding patterns of infants from birth to 14 weeks. **Methodology:** The observational study was conducted among mothers attending the Maternal and Child Health Clinic in Provincial General Hospital, Nakuru, Kenya, from February 2004 to July 2005. Permission to carry out the study was obtained from the hospital administration. Informed consent was also obtained from mothers. Feeding patterns were determined by interviewing mothers during the 6-, 10- and 14-week immunization-scheduled visits. This was done using a detailed structured questionnaire adapted from the WHO "Breastfeeding and replacement feeding practices in the context of mother-to-child transmission of HIV." Descriptive statistics were used. **Results:** In total, 175 infants completed the study. Before breastfeeding was initiated immediately after birth, 20.9% of the infants were given water and 2.9% cow's milk. In the first week of life, 61.4% of the infants were being exclusively breastfed compared to 18.9% by the sixth week, 11.2% by the tenth week, and 6.3% by the fourteenth week. Other mothers were practising predominantly breastfeeding but also giving water, 30.7% in the first week, 42.7% by the sixth week, 35.5% by the tenth week, and 25.1% by the fourteenth week. Solid foods were introduced by the sixth week, with cereals being given to 14.1% of the infants by the sixth week, 15.0% by the tenth week, and 16.0% by the fourteenth week. Fruits and vegetables were also introduced by the sixth week. **Conclusion:** Exclusive breastfeeding is not being practised as recommended by the WHO. Complementary feeding is being introduced early in life. This has implications for the growth and development of infants. More emphasis needs to be put on infant feeding in developing countries. **Acknowledgements:** The financial support of the Austrian Academic Exchange is acknowledged, with the infrastructural support of Egerton University and Provincial General Hospital, Nakuru, Kenya.

210 (125)

Effects of Education Level of Father and Mother on Perception of Breastfeeding

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Background: Exclusive breastfeeding in developing countries like Bangladesh is recommended as a valuable and cost-effective public-health measure to promote early childhood growth. Despite enormous benefits of breastfeeding, practice in Bangladesh is not at satisfactory level. Research on breastfeeding has found that many socioeconomic and cultural factors act as the determinants of breastfeeding practice. However, effects of education level of fathers and mothers on perception regarding breastfeeding are not well-evaluated. **Objective:** The specific objectives of the study were to observe the effects of parent's education on breastfeeding, to assess the patterns of breastfeeding for children, aged 0-2 year(s), and to assess awareness and beliefs of fathers and mothers about breastfeeding. **Methodology:** The study was conducted during July-October 2005 in northern area of Dhaka city. It was a descriptive cross-sectional study; sample size was 101. The data-collection method was face-to-face interview using a questionnaire. After the completion of data collection, data were checked, edited, and coded. Data analysis was done in computer using SPSS/PC+ (version 11.5). **Results:** The study examined the net effects of education of parents on the breastfeeding practice. Lower education had a significant association with low breastfeeding practice, especially knowledge about breastmilk, colostrum, exclusive breastfeeding, and breastfeeding. In this study, the most important finding was that there was a significant association between knowledge about breastfeeding and education of father and mother. Many illiterate mothers were found to practise breastfeeding without knowing the advantages of breastmilk. A positive association was found between breastfeeding practice and education of parents. **Conclusion:** The findings suggest that, to maximize the breastfeeding practice, the Government should continue to improve the level of schooling for women. The breastfeeding promotion programme should be expanded more widely in the whole country to let all mothers have the same opportunity to access the new information and benefits from the programme, especially for less-educated mothers in the country. **Acknowledgements:** The financial support of the Bangladesh Breastfeeding Foundation (BBF) is acknowledged.

NUTRITIONAL PROBLEMS, GROWTH, AND DEVELOPMENT II

211 (088)

Changes in Morbidity Pattern and Nutritional Status of Children, Aged Less Than 5 years, Presenting at Dhaka Hospital of ICDDR,B, After a Decade (2004 vs 1993)

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Background: Diarrhoeal diseases remain a leading cause of childhood morbidity and mortality in developing countries, especially among malnourished children. Periodic comparison of data is important to assess the direction and magnitude of changes and impact of specific interventions, which are necessary for health planning. **Objective:** The study compared a set of health and nutritional characteristics of children, aged less than 5 years, attending the Dhaka hospital of ICDDR,B: Centre for Health and Population Research, with diarrhoeal diseases in 1993 and 2004. **Methodology:** In this retrospective analysis, the study population included children, aged 0-59 month(s), of either sex, who were included in the Diarrhoeal Disease Surveillance System of the Dhaka hospital of ICDDR,B. Their health and nutritional status (n=1,114) in 2004 were compared with that of 1993 (n=2,499). **Results:** The male-to-female ratio remained unchanged at 1:0.6. In 2004, the proportion of children with watery stool, vomiting, and clinical dehydration, hospitalization for >24 hours, and chest infections were significantly ($p<0.001$) greater. However, the proportion of children with higher (>15/24 hour) stool frequency, persistent (±14 days) diarrhoea, and requirement of intravenous fluids were significantly less. *Vibrio cholerae* 01 (13% vs 4%) and rotavirus (40% vs 20%) were more frequently isolated in 2004, but *Shigella* (6% vs 11%) and *V. cholerae* O139 (0% vs 8%) were less frequently isolated in 2004 ($p<0.001$ for all comparisons). Similarly, the proportion of children with stunting and severe stunting (46% vs 31%, $p<0.001$ and 20% vs 10%, $p<0.001$ respectively), under-weight, and severe under-weight (58% vs 47%, $p<0.001$ and 26% vs 17%, $p<0.001$ respectively) were less in 2004. Several factors, indicative of socioeconomic status (SES), such as illiteracy (no formal schooling) of mothers (39% vs 53%), use of non-sanitary latrine (47% vs 59%), less use of unboiled water (70% vs 88%), lack of cooking-gas (40% vs 54%), <4 household assets (55% vs 69%), and monthly family income <3,300 taka (US$ 55.00) (31% vs 67%) were significantly ($p<0.001$ for all comparisons) less frequent in 2004. Immunization against EPI diseases, such as polio, BCG, DPT, and measles, and coverage of high-potency vitamin A supplementation were significantly (<0.001) higher in 2004. **Conclusion:** A substantial improvement in the selected health parameters, including nutritional status and taking preventive health services, has occurred between 1993 and 2004 after adjusting for socioeconomic covariates. However, the finding on increasing prevalence of cholera, indicative of deteriorating water supply and sanitation, and personal hygiene, is a matter of concern and needs to be addressed in future programmes. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) and ICDDR,B core fund is acknowledged.

212 (092)

Over-weight in Children, Aged 2-10 Years, in Bangladesh: Experience from a Hospital-based Study

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Background: At the other end of the malnutrition scale, over-weight is one of today's growing yet less-understood public-health problems of many developing countries. **Objective:** The aim of the study was to estimate the prevalence of over-weight among children aged 2-10 years and to examine characteristics of over-weight children presenting to a large diarrhoeal disease treatment facility in Dhaka, Bangladesh. **Methodology:** From the electronic database of the Surveillance System (systematic sampling of 2% of all patients) of the Dhaka hospital of ICDDR,B: Centre for Health and Population Research, 5,123 children, aged 2-10 years, who were enrolled during 1993-2003, were identified to constitute the study population. Over-weight was defined as a weight-for-height of >2 SD of the NCHS median, and 18 children meeting the criteria were identified as cases, and another 72 children having no over-weight were randomly selected as controls (case to unmatched concurrent control ratio of 1:4). **Results:** Only 18 (<1%) of the 5,123 children aged 2-10 years were over-weight. Both the groups (case and control) were similar with regard to age, sex, parental education, monthly family income, and housing and environmental conditions. Their medical history, presenting characteristics, and enteric pathogens were also similar. However, the mean age of fathers of the over-weight children was significantly higher than the control children (46±20 vs 38±11 years, p=0.030). Expectedly, weight, and body mass index of the over-weight children were significantly (p<0.001) higher. **Conclusion:** The findings of this study are similar to those of other studies conducted in Bangladesh. With this small sample size, the study identified characteristics that were significantly associated with over-weight in children aged 2-10 years. The prevalence of over-weight may likely to be higher in the urban affluent population. Therefore, community-based study among the urban higher socioeconomic background population is important for better understanding of the problem of over-weight in Bangladesh. **Acknowledgements:** The financial support of the United States Agency for International Development (USAID) and ICDDR,B core fund is acknowledged.

213 (111)

Influence of Infection on Iron Profile in Severely-malnourished Children

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Background: Protein-energy malnutrition is an important underlying cause in two-thirds of deaths from infectious diseases in Bangladesh. Each year, 240,000 deaths of children, aged less than 5 years, can be attributed to malnutrition in the country. Poverty, illiteracy, and infections are the major risk factors for malnutrition. Both iron deficiency and infections are known to be associated with poverty, lack of education, and probably also with crowded housing and contaminated water supplies. It has long been known that malnutrition and infectious diseases frequently occur together because nutritional status of the host can alter the functional activity of the

immune system, thereby affecting the host's response to infections. Malnutrition leads to infection and vice versa. Infection or inflammation is a common cause of mild iron deficiency, especially in respiratory tract infections, diarrhoea, urinary tract infections, and parasitic infestations. **Objective:** Currently-available confirmatory tests for iron deficiency include the serum iron, ferritin, total iron-binding capacity (TIBC), transferrin saturation, and the free erythrocyte protoporphyrin or a therapeutic trial of iron. However, infection or inflammation can influence iron status and, thus, complicate the accurate detection of iron deficiency and may decrease the effect of additional dietary iron by reducing the body's ability to absorb and use it. Therapeutic trial of iron also has the disadvantage of a three-month delay for satisfactory response, and free erythrocyte protoporphyrin is not yet in extensive use. Serum ferritin is a new tool which appeared to be the most reliable test. It is depressed only in iron deficiency, but infection or inflammation raised serum ferritin concentration. The aim of this study was to estimate the iron profile and to evaluate the influence of infection on iron status in severely-malnourished children. **Methodology:** This prospective study was carried out on 108 children aged 12-71 months in the Department of Pediatrics, Dhaka Medical College Hospital (DMCH), Bangabandhu Sheikh Mujib Medical University (BSMMU), and Ad-din Hospital during July 2003-December 2004. Biochemical analysis was done at the Biochemistry Department of BSMMU. Children were broadly divided into two groups. Severely-malnourished children, according to the World Health Organization, with or without infection, aged 12-71 months, with symmetrical oedema involving at least the feet, were selected as the case. The apparently healthy male and female children aged 12-71 months with weight-for-height z-score (WHZ) >-2 and height-for-age z-score (HAZ) >-2 of the median NCHS/WHO reference values without any systemic disease or pallor were selected as control. Children aged 12-71 months having anaemia due to other causes, e.g. haemolytic anaemia, leukemia, bleeding disorders, and other malignant diseases, and having history of intake of iron were excluded from the study. **Results:** The mean serum iron level in the non-infected severely-malnourished children (35.91±0.70 µg/dL) was significantly lower than normal healthy children (63.50±0.97 µg/dL) ($p<0.001$). On the other hand, the non-infected group had a significant higher level than the infected group (32.8±0.91 µg/dL) ($p<0.05$). In the infected group of severely-malnourished children, the mean serum ferritin level (20.22±1.24 ng /mL) was significantly higher than the non-infected malnourished children (7.02±0.30 ng/mL) ($p<0.001$). The mean serum TIBC level was reduced in severely-malnourished children than normal healthy children but only the non-infected group (230.00±1.16 µg/dL) had a significantly lower level than normal children (330.86±2.43 µg/dL). There was a significant reduction of mean serum transferrin saturation level in the non-infected malnourished children (15.65 %) than in normal children (19.35%) and also reduced in the infected malnourished children than in the non-infected peers ($p<0.001$). The mean serum iron level was lower in parasitic infestation than in other infections and non-infected malnourished children. **Conclusion:** Malnourished children had reduced the mean serum iron level. Infection influenced the reduction of mean serum iron level and transferrin saturation level, but a marked reduction was observed in parasitic infestation. The elevated mean serum ferritin level was observed in all types of infection probably as acute phase protein. The mean serum TIBC level was reduced in malnourished children, but no significant difference was observed between the infected and the non-infected groups.

214 (116)

Nutritional and Developmental Status in Children with Cerebral Palsy

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Background: The nutritional and developmental aspects of cerebral palsy are not well-known. Both these conditions are certainly influenced by social background, clinical types, and their degree of severity. A child with

cerebral palsy may suffer from different grades of malnutrition due to oromotor dysfunction. However, what determines these extreme diversities of nutritional aspect is not known. Again, to what extent the nutritional aspect is influenced by developmental stage is also not known. **Objective:** The study was conducted (a) to assess the nutritional status and causes of malnutrition in children with cerebral palsy, (b) to categorize the developmental status of children with cerebral palsy, which will help develop an appropriate rehabilitation programme for such children, and (c) to develop a guideline for proper feeding of these disabled children. **Methodology:** This is a retrospective study conducted in a child development centre of Chittagong Maa-Shishu O General Hospital (Chittagong Mother-Children and General Hospital) during June 2003-June 2005. In total, 177 children, having neuro-development problems and clinically diagnosed as cerebral palsy, aged 9 months-5 years, were selected and compared with a similar number of normal control children matched for age and sex. The nutritional status was assessed by Gomez and Wellcome classification. Neuro-developmental and mental status was assessed using appropriate classification of disabilities. **Results:** In this study, a significant number of children with cerebral palsy had grade II (36.75%) and grade III (28.81%) malnutrition. 48.02% of the bCP cases were under-nourished, 31.07% were marasmic, and 0.56% with marasmic kwashiorkor. All of them had their mean weight and height much below the 3rd centile of the standard growth chart. Gross and fine motor functions were severely affected in 72.88% and 46.32% of the cases respectively. Cognitive functions were severely affected in 52.71% of the cases. The majority (64.35%) of the cases had mental retardation. **Conclusion:** A multidisciplinary approach in evaluating the feeding of children with cerebral palsy is recommended, in which paediatrician, occupational and physiotherapist, clinical psychologist, and dietitian will work together along their parents to provide a comprehensive service to these families.

215 (120)

Use of a Scoring System for Identification and Management of Severe Malnutrition by Paramedical Clinicians in Rural Bangladesh

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Background: In resource-poor settings, initial outpatient assessment of children is usually done by paramedical clinicians/medical assistants (MAs). There is a high prevalence of severe malnutrition in rural Bangladesh. The MAs at LAMB, a 75-bed hospital and health and development project in Northwest Bangladesh, correctly identified and managed few of these children, particularly those with severe complicated malnutrition. **Objective:** The study was conducted to improve the identification and management of severe malnutrition using two different assessment tools. **Methodology:** All children presenting to the Under-5 Clinic (n=692) at the LAMB Hospital during June-August 2005 were weighed and those who were moderately (<-2 SD) or severely (-3 SD) under-weight (n=156) were included in the study. Initially, the MAs assessed the severity of malnutrition using an algorithm which was implemented for the first 6 weeks. This was replaced, after training, with a scoring system for the remainder of the study. These assessment tools were based on the following clinical features: severity of under-weight, danger signs, trend of weight gain/loss, age, presence of wasting, and peripheral oedema. Children were identified as being not severely malnourished (requiring reassurance) or severely malnourished with or without complications (requiring education and follow-up or referral for inpatient care respectively). Outcome measures were: accuracy of completion of assessment tools, accuracy of subsequent diagnosis, and appropriateness of management (including number referred for admission and number actually admitted). **Results:** Of the 156 children, 18 (11.5%) were not severely malnourished, 73 (47%) had

uncomplicated severe malnutrition, and 63 (40.4%) had severe complicated malnutrition. 83/105 (79%) of score sheets were correctly completed compared to 31/51 (61%) of the algorithms. Using the score sheet only 11/105 (10%) were given an incorrectly low score compared to 12/51 (23%) using the algorithm. 95/105 (90%) of the children were appropriately managed using the scoring system compared to 19/51 (37%) of those with the algorithm. 49/156 patients were identified as having severe complicated malnutrition and were referred, and of them, 18 refused admission. **Conclusion:** A simple scoring system can be employed to aid paramedical clinicians, and it appears preferable to an algorithm in accurately assessing children for severe malnutrition. Despite this, there are difficulties in convincing parents of the need for inpatient treatment.

216 (130)

Oedematous Malnutrition in Neonate—A Case Report

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Background: Oedematus malnutrition is common in 1 to 4 year(s) of life. It may occur in infancy even in a breastfed baby but never reported in the neonatal period of life. **Objective:** To re-establish full and exclusive breastfeeding of a quality that allows for catch-up growth. **Methodology:** An 11-day old male child was admitted to the Ad-din Hospital in May 2004 with generalized oedema. The diagnosis was confirmed mainly from history of feeding mismanagement, poor socioeconomic status, and clinical findings. Laboratory investigations were done to exclude other causes of oedema. The baby was mildly pale, oedematous, with weight of 2.8 kg and length of 47 cm without diarrhoea, hepatomegaly and respiratory distress, and no evidence of heart failure. Urine output was good. Investigations excluded congenital nephrotic syndrome or hepatic disorder. The baby was treated with injection gentamycin and amoxicillin for 7 days with breastfeeding on demand according to the standardized protocol. The mother was given vitamin A (200,000 IU) and micronutrients and were also encouraged to drink at least 2 litre of fluids per day and eat enough at least 2500 kcal/day with regular assurance to the mother. **Results:** Although the baby was fed sugar, misri water, mustard oil, and mainly burly, which was boiled with water and mixed with sugar from birth, breastfeeding was actively established with sufficient urine output on the day of admission. Baby's weight was taken every morning at 9 am. Weight of the baby was reduced to 2.1 kg on the 9th day after admission, when clinically oedema was resolved. On the 10th day, the baby began to gain weight and, on the 25th day, his weight was 2.9 kg. Daily average weight gain was 15 g/kg.day. The baby was discharged at the age of 36 days with good sucking and having sufficient breastmilk. **Conclusion:** Oedematous malnutrition can occur below 6 months of age, yet not reported in neonates, which can be managed exclusively by breastfeeding and also by nutritional and micronutrient supplementation and time-to-time assurance to the mother.

217 (147)

A Study of Nourished vs Severely-malnourished Children Admitted to a Hospital: Their Feeding Patterns and Contributing Factors

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Background: Malnutrition in children, aged less than 5 years, is a national problem in Bangladesh. Only 6% of children could be classified as having normal weight-for-age in 2 national surveys. A vast number of severely-

malnourished children are admitted to different hospitals in Bangladesh. The World Bank reported that inadequate child-caring practices, including sub-optimal breastfeeding, are probably the most important causes of protein-energy malnutrition (PEM). Proper feeding of infants and children is the most important part of caring practices. **Objective:** The study was conducted to compare the effect of wrong breastfeeding and feeding practices among hospitalized malnourished and well-nourished children and extent of other contributing factors of malnutrition. **Methodology:** A prospective study was conducted on 196 hospitalized severely-malnourished children (marasmus 43%, kwashiorkor 11%, marasmic kwashiorkor 46%) admitted to the Nutrition Unit of a Dhaka-based Hospital during April-November 2002. A group of well-nourished children admitted to the same hospital for medical problems other than malnutrition was selected for comparison of findings. Their mothers were interviewed using a pre-tested questionnaire to record relevant information. **Results:** The results revealed that, of 196 severely-malnourished children (male: female 1:1.4), 79% were aged less than 3 years. There were maximum marasmic kwashiorkor (46%) and kwashiorkor (11%). A large number (45%) of malnourished children were from urban slum, and well-nourished children (80%) were from urban area. Colostrum was rejected by 33% of mothers of the study group compared to 12% in the control group. Bottle feeding was very high in both the groups of children (55% in malnourished group vs 80% in well-nourished group). About 50% and 70% of the children in the study group and control group were found to continue breastfeeding up to 12 months, but 37.5% of the malnourished children continued breastfeeding up to 24 months compared to only 2% in the well-nourished group. A significantly higher percentage (86%) of well-nourished control children received semi-solid weaning foods of appropriate kind (khichuri, eggs, etc.) at appropriate time (4-6 months) compared to the study group (32%). The incidence of various diseases, especially infection, was noticeably higher among the study children. Diarrhoea (41% vs 14%), acute respiratory infection (42% vs 24%), vitamin A deficiency (35% vs 0%), and anaemia (73% vs 0%) were the common associated problems observed among the study children. **Conclusion:** The study concluded that improper feeding practices were quite evident among the study children. Colostrum rejections, inadequate breastfeeding, early supplementation with adult formula, or cow's milk in the form of bottle feeding, early or delayed introduction of semi-solid weaning foods, and inadequate intake of protein were the important risk factors of malnutrition among the study children.

218 (166)

Effect of Nutrition on Snack Choices in 10-11 Year Old Children

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Background: Nutrition education has a great impact on food choices in children. **Objective:** The aim of the study was to evaluate the effect of nutrition education on snack choices in 10-11-year old children. **Methodology:** Sixty students from a primary school were chosen by random sampling for an hour nutrition-education course. Subjects of the course included: importance of having snacks, definition of healthful and unhealthful snacks, benefits of healthful snacks, and disadvantages of unhealthful snacks. Effect of nutrition education was evaluated by comparing percentage of correct answers to 11 open questions before and after the course. **Results:** Nutrition education had a positive effect on the knowledge of students and percentage of correct answers changed significantly (from 70% in pre-test to 97% in post-test). **Conclusion:** Nutrition-education programmes, when adequately implemented, provide an opportunity to learn to make responsible food choices.

HEALTH POLICY AND OTHER CHILDHOOD PROBLEMS II

219 (069)

Seven Hundred Children Die Every Day Due to Malnutrition in Bangladesh: The Role of Public Health Administration in Improving the Quality of Healthcare Services for the Poor People of Bangladesh

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Background: Malnutrition is a major public-health problem resulting in morbidity and mortality among a vast majority of people, especially children of the lower socioeconomic class. Improvements in health status in the intervention areas show evidence that the role of public health administration in improving the quality of healthcare services for the poor people of Bangladesh is important. **Objective:** The study explored the susceptibility of children of Bangladesh to malnutrition and, based on the findings, it recommends measures to be adopted to prevent malnutrition among the children. **Methodology:** The study was carried out by the latest Internet search and review of literature, journals, and seminar papers on the national, regional and global prevalence of malnutrition. **Results:** Malnutrition is a serious public-health problem in Bangladesh. It is reducing the development potential of the country. The factors affecting the nutritional status of children are not only ignorance, illiteracy, superstition, poverty, joblessness, low income, food availability, and accessibility to or availability of health services but also perhaps most importantly gender disparity. Behavioural patterns and caring practices at the household level have also been shown to be responsible for this vulnerability. According to a World Bank report, nearly 700 Bangladeshi children die of hunger or of other nutrition-related cases every day. A 1998 review showed that severe malnutrition among children aged less than 2 years in the project area had dropped from 13% to 2%. The number of under-weight babies had decreased by 30%. **Conclusion:** The paper strongly warns against the danger of 'denial' and complacence. Despite various steps taken by the Government to increase the nutrition status of children, the malnutrition level in the country still remains highest in the world, affecting health and education of children and productivity of its adult population. Both street children and primary school children in Bangladesh are malnourished. The importance of appropriate education at all levels, including household, school and out-of-school education and counselling, offering nutrition services, child growth monitoring, and food supplementation, using media materials is emphasized. Public awareness about food fortification and nutrition, reduction/alleviation of micronutrient deficiencies, increased resistance to diseases, increased intelligence, income and productivity and better opportunities for survival, and participation in development work is urgently required to overcome this catastrophic uncertainty. Above all, Bangladesh should immediately translate its health policies into action to benefit the poor under-nourished people.

220 (091)

Improving Child Nutrition by Nutrition Education through Urban Primary Healthcare

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Background: The infant and child mortality rates in Bangladesh are highest in South Asia, and the synergistic relationship between malnutrition and infection is primarily responsible for this. Despite the high prevalence of child malnutrition and its effect on child morbidity and mortality, only a few of the existing primary healthcare clinics in Dhaka city address child malnutrition. The Marie Stopes Clinic Society (MSCS) has taken an initiative to address child malnutrition. An intervention was given to caregivers to improve the nutritional status of children in the urban primary healthcare set-up. **Objective:** The study was undertaken to improve the nutritional status of children in an urban area. **Methodology:** A longitudinal intervention study was conducted on children aged 6-59 months in Lalmatia, Dhaka, Bangladesh. An equal number of subjects (n=90 each) were allocated to the intervention and comparison groups. Mothers of the intervention group were counselled on food security, disease control, and caring practices. Nutrition information materials (Behaviour Change Communication) were demonstrated to the mothers to successfully practise the education. The intervention was continued for 4 months. The results were statistically analyzed and studied. **Results:** Twenty percent of the children were severely underweight in the intervention group compared to 21% in the comparison group. After the intervention, the proportion decreased to 6.7% in the intervention group and 8.9% in the comparison group ($p<0.001$). The proportion of severe and moderately-malnourished children reduced by 17.8% in the intervention group and by 2.3% in the comparison group ($p<0.008$). Baseline data indicated that 15.6% of mothers in the intervention group and 17.8% in comparison group prepared child's food with oil. At the end, 53.3% of mothers in the intervention group prepared child's food with more oil compared to 22.2% in the comparison group. At the baseline, about 36% of women cooked vegetables for 4-5 days per week in the intervention group, and after the intervention, it increased to 64.4% compared to 37.8% of the comparison group mothers. About 13% of children in the intervention group used soap for bathing, which increased to 40.0% compared to 8.9% in the comparison group. **Conclusion:** The intervention group improved in nutritional status with change in behaviour, which was possible due to nutrition education using intensive counselling to mothers with the nutritional triangle concept.

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Effect of a Nutrition Intervention on Changing the Perception on Child-caring Practices in Rural Bangladesh

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Background: Child nutrition is determined by level of caring practices, food security, and disease control. To improve infant-caring practices on disease control or better infant feeding, it is necessary to understand the perceptions of mothers regulating their behaviour. A qualitative study was undertaken on child caregivers to assess food and nutrition-related behaviour. **Objective:** The study explored the attitudes, beliefs on child-feeding and caring practices of mothers at pre-intervention period, and changes of their perceptions and practices after the intervention. **Methodology:** In total, 48 focus-group discussions (FGDs) were conducted before and after the intervention, among mothers and caregivers of well-nourished and moderately-malnourished children, aged 6-24 months, from 4 divisions of Bangladesh, during 1999-2001. They were selected to intervene through 6-10 mothers in each session which continued for one and half hours, either with frequent nutrition education (FNE) twice weekly and less frequent nutrition education (LFNE), weekly and another group served as control. Intervention with nutrition education was developed on the basis of the baseline FGD results and prior to improving practice on complementary feeding, food preparation (*khichuri*), caring practices, and home management of common childhood diseases. Recording with audio systems was done besides written documents. **Results:** Before the intervention, mothers used different colloquials with wrong perceptions to explain malnutrition. After three months of the intervention, ability of mothers to identify malnutrition significantly improved as an indicator of improved knowledge and, in the post-intervention/observation session, it was very clear. They had misconception of different energy-dense foods and had taboos on treatment of disease. After the intervention, significant change was seen in feeding practices, e.g. giving *khichuri* as main complementary food and addition of oil and eggs in home-made complementary food. In the control group, practice of giving a complementary food was not established. They changed their healthcare-seeking behaviours by going to local health service providers instead of going to local *hekim* or traditional healers. Fathers were convinced to purchase ingredients for the preparation of complementary food. **Conclusion:** It can be concluded that both FNE and LFNE can significantly improve the perceptions and practices on feeding and child-caring behaviour of mothers, and involving family heads for childcare would lead to sustainable behaviour change to achieve good nutrition for children. **Acknowledgements:** The financial support of the World Bank through the BINP (Ministry of Health and Family Welfare, Government of Bangladesh) is acknowledged.

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Five Nations Assessments on HIV and Infant Feeding

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Background: IBFAN Asia Pacific and WABA, as part of the work of the International Task force on HIV and IF, jointly proposed a rapid assessment on the issue at country level to find out how HIV and infant feeding are being addressed in the PMTCT programmes as part of HIV/AIDS programmes, specifically to list the processes being followed by a country. The countries selected for the study were: Afghanistan, Bangladesh, Nepal, Malaysia, and Indonesia. **Objective:** The study was carried out to learn the countrywide situation on HIV and infant feeding to take AFAAS measures for combating the situation. **Methodology:** The study was conducted with 2 methods: (a) Interview of key stakeholders in HIV and IF and (b) Descriptive study through a semi-structured qustionnaire, (c) and self-explanatory process. **Results:** Position of 5 countries on HIV and IF are as given below.

Issue	Afghanistan	Bangladesh	Indonesia	Malaysia	Nepal
National Programme on HIV/AIDS	No	Yes	Yes	Yes	No
Nodal agency on HIV	No	Yes	Yes	Yes	No
National policy on HIV and IF	No	no	Yes recommends artificial feeding	Yes, recommends artificial feeding	No
Policy on PPTCT	No	Yes	Draft ready	Yes	No
Capacity-building in infant-feeding counselling	Absent	Absent	Lack of training program	Needs strengthening	Absent

Acknowledgements: The technical and financial support of IBFAN AP and WABA is acknowledged.

Adverse Events Following Immunization in a Selected Peri-urban Area of Dhaka City

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Background: For the last few years, adverse events following immunization (AEFI) has become a major obstacle in the field of immunization, and the magnitude of AEFI, especially in the peri-urban area, is virtually unknown. **Objective:** The status of AEFI and the problems relating to immunization in a peri-urban area of Dhaka city was investigated. **Methodology:** A cross-sectional study was conducted in Satarkul union under Badda thana, Dhaka, Bangladesh to find out the common AEFI among infants after vaccination during February-June 2005. In total, 112 caretakers of infants were interviewed using a structured questionnaire. The study was endorsed by the National Institute of Preventive and Social Medicine, Dhaka. **Results:** Minor reactions, i.e. pain, swelling, redness, fever, irritability, and incessant cry, were very common. All (100%) caretakers replied that they faced neither serious reaction nor any major problem after the vaccination. There was no complaint of any major AEFI. More than three-fourths (77.7%) stated that the babies had local pain after the vaccination. The mean duration of starting of pain was 2.21±2.82 hours, and the mean duration of the local pain was 2 days (45.70±22.02 hours). More than two-thirds (67.9%) stated that the babies had reddening locally after vaccination. More than three-fifths (62.5%) complained of fever. One-fifth (20.5%) of the babies had a problem of excessive irritation, and one in 10 (11.6%) complained of vomiting. Fifty percent of the babies had problem of long incessant crying. More than two-thirds (71.4%) of the respondents complained that their babies faced local swelling at the site of vaccination. However, there was no complaint of any episode of convulsion or unconsciousness, floppiness of the limbs, any severe reaction in 24 hours following the vaccination, nor any shivering of the body. Again, there was no complaint of lymphadenitis nor any boil at the site of vaccination. There was no event of paralysis of the limbs or any episode of diarrhoea. The problems that came out as ill events after the vaccination were minor and, in some cases, just a common inflammatory reaction. **Conclusion:** It is necessary to create awareness among mothers regarding the AEFI and to advise not to get afraid of common reactions and side-effects after vaccination.

*MPH (Epidemiology) Student

DAY 3: Wednesday, 8 February 2006

10:00 am - 11:30 am (Venue: Corridor Café)

Poster Session 5

DIARRHOEAL DISEASES III

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Relationship between Food Intake and Weight Gain during Hospital Stay of Acute Diarrhoeal Patients in a Diarrhoea Hospital in Dhaka

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Background: Diarrhoea causes nutritional decline because, during diarrhoea, the patient's food intake is reduced and absorption of nutrients is also reduced, but nutritional requirements are increased. **Objective:** The study was conducted to assess the nutritional status and growth of patients and to find out the relationship between food intake and weight gain during hospital stay of acute diarrhoeal patients. **Methodology:** A hospital-based cross-sectional study was conducted among 118 patients, aged 6-59 months, with acute diarrhoea, who required treatment for at least 3 days at the patients wards in the Dhaka hospital of ICDDR,B: Centre for Health and Population Research. Daily food intake was reassured, and anthropometric measurements of weight and height/length were taken for assessing nutritional status. Stool weight was measured. Data were analyzed using SPSS/PC+ version 10 and EPI STAT version 3.2.2. **Results:** During hospitalization, weight-for-age z-score was better at discharge among patients than at admission (-3.06±1.4 vs 3.16±1.4, p=0.000). Weight-for-height z-score was also better at discharge than at admission (-1.87±1.2 vs -2.01±1.1, p=0. 000). WAZ and HAZ scores were significantly lower in patients with a higher calorie gap (>50%) from recommended dietary allowances (RDA) than patients with less calorie gap (<50%) from RDA, whereas there was no significant difference by WHZ score. Stool weight per kg of body weight positively correlated significantly with the duration of hospitalization. There was a significant difference in the mean gap of energy intake from RDA between the above groups and below the mean duration of stay in hospital. **Conclusion:** The study reflected that the hospitalized children had reduced food intake due to severe illness. Patients' weight deficientcy during hospitalization were associated with deficiency in dietary intake during treatment in the hospital.

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Monitoring of Diarrhoea in Weaning Malnourished Infants of Tribals by Introducing Indigenous Semi-solid Diet

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Background: Early marriages of girls, inadequate breastfeeding to newborns, and then shifting babies directly on plain solid dry bread are the traditional practices among the tribals inhabited in western part of India which

force early trigger of malnutrition and mortality among infants where maximum deaths are due to diarrhoea only. **Objective:** The effect of introduction of semi-solid indigenous diet in powder form was studied in weaning babies before shifting them on solid diet. **Methodology:** The study was conducted during May 2004-December 2004 in 2 hamlets located in inaccessible interior area in western part of India where there was an alarming rate of grade III and IV malnutrition and mortality due to diarrhoea in the monsoon season. Two groups of subjects, constituting control and experimental, aged 2-6 months, were selected. Their pre-weaning weight and malnutrition status was recorded. On the onset of the weaning process, semi-solid diet was introduced thrice a day under perfect hygienic conditions for 6 months till babies shifted to normal solid diet. The semi-solid food was constituted with all 6 essential components of nutrition providing 1,800 cal/day. Health of babies was monitored regularly. **Results:** The introduction of semi-solid food in the diet of tribal infants, after discontinuation of breastfeeding, had decreased the number of malnutrition and diarrhoeal cases almost to nil compared to the control group; where most babies were in grade III, malnutrition marginally inclined to grade IV stage of malnutrition. Diarrhoeal symptoms were observed in all the subjects. Results were statistically analyzed and were found to be strongly correlated. **Conclusion:** The introduction of semi-solid diet had definitely helped reduce malnutrition-related diarrhoea among the tribal infants where this concept was totally missing, and every year thousands of malnourished tribal infants become the true victims of diarrhoea. The results of this experiment were observed and confirmed by tribals on the experiment site itself. This observation has given boost to the Government's community nutritional programme for tribal children aged 2-36 months to eradicate malnutrition and diarrhoea in the tribal belt. **Acknowledgements:** The author thanks Sankalp, an organization of Indian students of IOWA State University, USA, for funding the research project.

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Association of ETEC-associated Diarrhoea with Malnutrition in Children, Aged Less Than 2 Years, in Bangladesh

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Background: Diarrhoeal diseases are a major cause of childhood mortality and morbidity in developing countries like Bangladesh, and enterotoxigenic *Escherichia coli* (ETEC) is an important cause of diarrhoea. Diarrhoeal diseases as a frequent cause of illness could exacerbate nutritional faltering, thereby increasing the subsequent risk of death. **Objective:** The study was carried out to determine the association between infection due to ETEC and nutritional status in children in the first 2 years of life in an urban, low-income setting in Dhaka city in Bangladesh. **Methodology:** A cohort of 321 children was followed from birth to 2 years of age in an urban setting in Mirpur, Dhaka. Anthropometric measurements were taken at birth and at 3-month interval of every child. Nutritional status of those who were under-weight (weight-for-age [WAZ]) or stunted (height-for-age [HAZ]) was assessed. History of diarrhoea was obtained by direct surveillance at homes and by attendants at the field clinic. All diarrhoeal stools and healthy stools (monthly collections) were assessed for ETEC which included testing for toxins and 13 colonization factors. Children with diarrhoea due to ETEC (ETEC group) were compared with those who did not have any episode of ETEC-associated diarrhoea (non-ETEC group). Analysis of data was carried out using the Epi Info software. **Results:** ETEC was a cause of diarrhoea in 50% of the children during the 2-year follow-up period. Stunting was more common in the ETEC group than in the non-ETEC group. Diarrhoeal episodes were higher in children who were stunted (62% vs 46%, $p<0.047$). Isolation of ETEC was

9% in the well-nourished group compared to 20% in the stunted group (9% vs 20%, p<0.001). Children who had at least one episode of diarrhoea due to ETEC were compared with those with no episodes over the 2-year study period. Of these two groups, 45% were stunted in the ETEC group (45% vs 31%, p<0.058) over the same period of follow-up. No relationship was found between asymptomatic ETEC-associated infection and nutritional status. An association was also not found between WAZ scores and diarrhoea due to ETEC. **Conclusion:** In children followed up from birth to 2 years of age, ETEC was a common cause of diarrhoea and was associated with stunting. **Acknowledgements:** The study was supported by Sida-SAREC funds.

MICRONUTRIENTS, VITAMINS, AND DIETARY INTAKE III

227 (181)

Potential Effects of Socioeconomic Status and Seasonality on Consumption of Vitamin A and Pro-vitamin A-rich Foods by Pregnant Women in Northwest Bangladesh

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Background: In Bangladesh, maternal vitamin A (VA) deficiency is common, reflected by low levels of serum retinol and nightblindness during pregnancy. It is important to understand how socioeconomic status (SES), home production of VA-rich foods, and seasonality affect maternal intake of foods rich in VA or pro-vitamin A. **Objective:** The study was undertaken to examine the association between consumption of VA or carotenoid-rich foods and household SES/ownership of VA-productive assets that may affect access to these foods and to describe the seasonality in consumption of VA-rich foods. **Methodology:** This analysis draws from 1st trimester SES and 7-day food recall data from 34,974 pregnant women enrolled in the JiVitA Project's maternal nutrition community trial. The odds of increased consumption of VA-rich foods by ownership of fruit trees, home gardens, cattle, poultry, and fish ponds were analyzed. The impact of owning TV/radio and other SES indicators was also assessed. Food intake was evaluated for 3 seasons: winter (November-February), summer (March-June), and monsoon (July-October). **Results:** Ownerships of livestock, poultry, fish ponds, and fruit-bearing trees were individually associated with increased likelihood of consumption of milk, eggs, mango, jackfruit, and fish (odds ratio [OR])=1.34-1.97). Multiple regression analysis showed that SES indicators (ownership of poultry, respondent's or husband's literacy, microcredit participation, and better house construction) were associated with consumption of eggs. Although egg intake was positively associated with chicken ownership, consumption of dark-green leafy vegetables (DGLVs) decreased. Ownership of radio was associated with increased consumption of DGLVs, fruits, and pumpkin, but not with eggs. Few women consumed >1 egg per week across the 3 seasons (28%, 40%, and 19%). Most women ate meat or fish at least twice a week in each season (82%, 70%, and 84%), the median consumption being 4, 3, and 6 times respectively. DGLVs were eaten throughout the year, but consumption was least in the monsoon season (69%, 72%, and 57%). Consumption of mango showed an expected summer peak (0%, 16%, and 2%) respectively. Intake of cheap and available pro-vitamin A-rich foods, such as ripe papaya, carrot, and jackfruit, was uncommon. **Conclusion:** These findings support the hypothesis that the household ownership of productive resources is directly associated with improved maternal dietary quality.

Microcredit participation and ownership of radio also contributed to the increased consumption of VA-rich foods. There is a marked seasonal variation in the consumption of VA-rich foods, with the lowest consumption in the monsoon and the consequent increase in nightblindness during pregnancy (unpublished data). Programmes which include strategies to improve rural access to VA-rich foods year-round may be warranted. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and Bill and Melinda Gates Foundation.

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A Survey of Micronutrient Supplement Availability in Rural Northwest Bangladesh

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Background: Over the past 2 decades, Bangladesh has seen a sharp rise in the number of domestic pharmaceutical companies. At present, over 240 separate companies produce and supply drugs and nutritional supplements to urban and rural markets across Bangladesh. Many social marketing and health-promotion campaigns have also served to increase the awareness of proper nutrition and the need for nutrient sufficiency in the diet. Over the past few years, companies have begun to market a wide range of micronutrient and mineral supplements in both urban and rural Bangladesh. **Objective:** The study was carried out to explore and describe the range of dietary and pharmacologic micronutrient supplements available to rural populations in Northwest Bangladesh and to conduct an exploratory survey of the most popular types of supplements and formulations. **Methodology:** A random cross-sectional survey of available micronutrient supplements was conducted across 650 km^2 of Gaibandha, a northwestern rural district of Bangladesh. A geographic information system (GIS) was used for randomly selecting 17 medicine shops. Six research physicians visited each shop and administered a structured questionnaire to list availability of supplements, current stock, intended future procurement, and other data. Data were analyzed to identify the most popular products and formulations. **Results:** In total, 57 different pharmaceutical companies supplied these rural vendors with a range of 26 unique combinations of micronutrients. At least 205 distinct products (a specific composition from one company) were available in 5 different formulations (e.g. tablet, syrup, capsules, liquid, and injectables). The best-selling products (based on monthly transaction volume) were vitamin B complex, vitamin C, and calcium supplements. These products ranged in cost from Tk 6 to 40, depending on the formulation, composition, and brand. Multi-vitamin and mineral combinations were the fourth most active products in terms of market volume, ranging in price from Tk 30 to 150. The average sales volume for these products among the 17 shops was in excess of Tk 15,000 (US$230) in the last month. **Conclusion:** These preliminary findings suggest that market production and consumption of micronutrients in rural Bangladesh are notable and that epidemiologic studies are warranted to ensure that these nutritional products marketed as dietary supplements or pharmacologic regimens are appropriate in this rural population. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development (USAID) and Bill and Melinda Gates Foundation.

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all-E Lutein and 3′-epilutein in Epidermis of Chronic Arsenic Poisoning

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Methodology: Identification and quantification of carotenoids in the epidermis of 9 patients of chronic arsenic poisoning were done using isocratic reverse phase high-performance liquid chromatography (HPLC). **Results:** The major carotenoids in all the skin biopsies were all-E lutein and 3′-epilutein. A small amount of 2′,3′-anhydrolutein, all-E zeaxanthin, and 13-Z zeaxanthin was also present in some biopsy samples. α-carotene, β-carotene, and lycopene were not detected in any sample. The mean (±SD) concentration of all-E lutein in arsenic non-exposed normal skin was 1.09±0.26 μg/g of wet tissue, whereas it was only 0.29±0.10 mg/g in the diffuse dark-brown spots of chronic arsenic poisoning. In raindrop-shaped discoloration spots of skin, the mean (±SD) concentration of all-E lutein was 0.86±0.29 μg/g of wet tissue. **Conclusion:** The results suggest that arsenic exposure reduces the number and concentrations of carotenoids in the skin, and raindrop-shaped discoloration of the skin may be due to higher accumulation of all-E lutein and its metabolite 3′-epilutein compared to diffuse dark brown spots. **Acknowledgements:** The study was supported by a grant from the World Health Organization, Bangladesh (project no. PHE BAN 003).

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Reduction of Micronutrient Malnutrition of Children Aged Less Than 5 Years by Introducing 2-month Mother's Guidelines about NutritionAspects in Urban Dhaka

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Background: Childhood micronutrient malnutrition affects health, survival, and future economic productivity and is related with insufficient dietary intake of vitamin A, iodine, iron, and other vitamins and minerals. **Objective:** The study was undertaken to identify awareness and feeding practices of urban intervention mothers and its association with micronutrient deficiencies among children aged less than 5 years and to compare it with non-intervention group. **Methodology:** The study was conducted during July 2004-June 2005. Mothers with children, aged less than 5 years, from 270 intervention and 269 non-intervention households were selected from 4 thanas of Dhaka city by the simple random-sampling procedure, covering all socioeconomic criteria. Mother's guidelines as nutrition and micronutrition education were for the intervention group of mothers for creation of awareness about deterioration of children's micronutrient malnutrition. Two-monthly weight monitoring of children and appropriate management were done. After completion of the 2-month intervention, information was

collected. **Results:** The findings revealed that over-weight (45.2%) babies were predominant in the non-intervention group. Contrasting result (52.5%) was found in the intervention group. The findings were statistically significant. 10.7% and 7.3% of moderate malnutrition were observed in the non-intervention and the intervention group respectively. All the intervention children had more normal nutritional status by mid-upper arm circumference. Vitamin A deficiency was found in 7.1% and 11.4% (χ^2=0.334), iron deficiency in 16.6% and 35% (χ^2=0.000), and iodine deficiency in 1.9% and 2.3% (χ^2=0.053) of children in the intervention and non-intervention groups respectively. Eighty percent of mothers in the non-intervention group and 96% of mothers in the intervention group were aware that colostrum feeding should be started within half an hour after child birth. The understanding level about child micronutrients was 78% and 85% among the respondents of the intervention and the non-intervention group respectively. Perceptions about prevention of diarrhoea to feed vitamin A-rich foods were indicated by 69% and 2.5% of the mothers respectively (t=0.00). **Conclusion:** The findings on the awareness of proper feeding practices for reduction of micronutrient deficiency are of great importance among the intervention groups. The programme should be implemented nationally for better national productivity. **Acknowledgements:** The financial and technical support of the Bangladesh National Nutrition Council is acknowledged.

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Follow-up Baby-friendly Activities Plus Awareness of Micronutrient Malnutrition of Healthcare Providers

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Background: Baby-friendly Hospital is the movement of converting hospitals and maternities where all its policies and procedures are supportive to help mothers for successful breastfeeding. **Objective:** The study evaluated the follow-up activities of the Bangladesh Breastfeeding Foundation (BBF) relating to successful breastfeeding (SBF) at the Baby-friendly Hospital Initiative (BFHI) centres located in urban Dhaka. **Methodology:** A cross-sectional universal sampling procedure for follow-up study was initiated from all 21 BFHI centres from October 2003 to October 2004. In total, 303 healthcare providers (doctors, matrons, and nurses) from gynaecology, paediatrics, and labour ward, including antenatal clinics and postnatal clinics, were selected. Pre-coded structured questionnaires were used employing the required variables. **Results:** Around 54.0% (n=164) of the healthcare providers were trained on successful breastfeeding, and comparing with the remaining respondents, the finding was significant (χ^2=15.253, p=0.000). Overall, idea about the breastfeeding policy was ascertained by 56.0% only (χ^2=2.020, p=0.000). Significantly more nurses (48%) than doctors (25.4%) and matrons (9.6%)) had knowledge on correct techniques of breastfeeding position (p=0.005), and 47.5% (p=0.000) could educate mothers about correct attachment of the baby for breastfeeding. 7.9% of professionals opined that various types of information, education, and communication/promotional materials were displayed in the BFHI centres. More than 98.0% (p=0.003) of the mothers suggested introduction of breastfeeding just after child birth, and 49.5% (p=0.000) agreed that routine health-education session on successful breastfeeding was organized. 99.7% discouraged using any prelacteal feeds to babies, and 97.0% (p=0.000) had knowledge about exclusive breastfeeding. About 29.0% of the healthcare providers stated that, overall, the BBF was monitoring their activities but not up to the level. More than 76% of the respondents reported that colostrum is the best food security up to 6 months of age of a child, whereas only 12.2% (p=0.000) knew about the idea of food and nutrition; 9.9% (p=0.000) were aware of any difference between nutrition and micronutrients. 13.5% (p=0.000)

of the healthcare providers had the understandability about the name of some micronutrient-rich foods for children. **Conclusion:** Re-vitalization is to be initiated from the BBF for extensive monitoring of successful breastfeeding. Policy issues may be adopted for introducing micronutrient awareness among the healthcare providers for nutrition development and child survival. **Acknowledgements:** The financial support and sponsorship of the Bangladesh National Nutrition Council are acknowledged.

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Effect of Zinc Supplementation in Immune Response to *Vibrio cholerae* Antigens Using Different Routes of Immunization

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Background: Zinc plays a critical role in the normal functioning of the immune system. Recent data suggest that zinc has a role to play in infectious diseases, such as shigellosis and cholera, and on the immune response to enteric vaccines. There is a need to better understand the mechanism by which zinc enhances the immune response and prevent and protect from recurrent infections. **Objective:** The aim of the study was to determine the role of zinc in modulating the cellular and humoral immune responses to *Vibrio cholerae*-specific antigens using different routes of immunization. **Methodology:** The study was carried out in sets of BALB/c mice, aged 4-6 weeks, using key *V. cholerae* virulence antigens, lipopolysaccharide (LPS), toxin-coregulated pilus (TcpA), mannose-sensitive haemagglutinin (MSHA), and cholera toxin (CT). Mice were supplemented with 25.0 mg zinc/kg diet for zinc-adequate (ZnA) group and 2.0 mg zinc/kg diet for zinc-deficient group (ZnD) in a zinc-free diet (Altromin), 14 days prior to immunization, and continued up to 77 days through the oral (ORI), subcutaneous (SCI) or transcutaneous (TCI) routes. The study focused on determining the immune responses using (a) flow cytometric analyses for assessing the phenotypic changes of the immune cells, (b) functional assays for determining the antibody responses in the circulation, and (c) humoral immune responses to determine the magnitude of response and isotype patterns. **Results:** Increased expression of CD3, CD4 and CD19-expressing cells were seen in ZnA mice compared to the ZnD and control groups ($p<0.05$) when any of the 3 routes of immunization was used. LPS, TcpA, MSHA, and CT-specific antibody responses were elevated in the IgG and IgM isotypes. The magnitude of vibriocidal antibodies was higher in groups receiving LPS and MSHA in the ZnA group ($p<0.001$). Increased migration of immune cells from skin-associated lymphoid tissue (SALT) to the gut was observed in the TCI/ ZnA group, whereas gut-homing receptor was elevated in the ORI group. **Conclusion:** Supplementation with zinc has positive immunomodulating effects on the cellular and humoral immune responses to *V. cholerae* antigens. These studies also showed that, in addition to the SCI and ORI procedures, the newer, needle-free TCI route is also positively influenced by increased levels of zinc. Zinc, therefore, acts not only as a mucosal adjuvant but also as a positive modulator for *V. cholerae* antigens under different immunization schedules and routes. Further studies are needed to understand the implications of this in protection from infections due to *V. cholerae* in humans. **Acknowledgements:** The study was supported by ICIDR/NIH funds.

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Comparison of Efficacy of a Semi-solid Ready-to-use Therapeutic Food with a Liquid Milk-based Diet for Rehabilitation of Severely-malnourished Children in Mulago Hospital

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Background: Case fatality of severe malnutrition in developing countries remains high. In Uganda, rehabilitation of severely-malnourished children is based on high-energy milk (HEM), a liquid diet containing 100 kilocalories per 100 mL. Recently, a semi-solid ready-to-use therapeutic food (RUTF) whose nutrition composition is similar to HEM has been designed. **Objective:** The study was undertaken to determine whether giving daily RUTF in rehabilitation of severely-malnourished children results in a higher weight gain and a shorter hospital stay than giving them HEM. **Methods:** One hundred and thirty severely-malnourished children were randomized to either RUTF or HEM. Daily weights were taken, and patients were followed up until they attained 85% of WFH. Time to attain 85% WFH from time of enrollment was recorded. Data were analyzed using the SPSS package (version 11), by intention to treat. **Results:** The mean weight gain in the RUTF children was 11.96 (SD 9.42) g/kg.day vs 8.05 (SD 12.12) g/kg.day in the HEM group (p=0.042). The duration of stay in rehabilitation was 12.28 (SD 7.81) days and 12.68 (SD 7.80) days in the HEM group (p=0.77). **Conclusion:** In the rehabilitation of severely-malnourished children, use of RUTF resulted in a higher weight gain than use of HEM. However, the duration of stay in rehabilitation was similar in both the dietary groups.

BREASTFEEDING AND INFANT HEALTH III

234 (164)

BFHI Model Project in Bangladesh: Experiences on Sustainability

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Background: Since 1992, more than 400 maternity facilities have been designated as baby-friendly in Bangladesh as per the Baby-friendly Hospital Initiative (BFHI) international guidelines. But questions are often raised on their sustainability. Following a national assessment of representative samples of baby-friendly hospitals, a model project has been undertaken in 4 big hospitals in Dhaka and Chittagong to strengthen their baby-friendly activities. **Objective:** The objective of the project was to analyze the barriers to sustainability of BFHI, to assess the improvement following a model of changes in the BFHI activities, and to identify the key improvement factors transferable to other hospitals. **Methodology:** Following baseline qualitative and quantitative assessment of 4 big national hospitals, a package of improved BFHI activities was formulated after consultation with all the relevant stakeholders. This included activation of a BFHI committee, training to all-level staff, including *ayas* and wardboys, provision of a simple service manual, communiation materials, take-away

print materials for mothers, record-keeping of breastfeeding indicators and reporting, internal and external monitoring involving government functionaries, integrating with other maternal and child health services of hospitals, such as EPI, CDD, etc., and establishing lactation-management services. After one year, follow-up assessment was done to see the changes and identify the positive elements of the package. **Results:** Activation of the BFHI committee is critical for sustaining the BFHI. Short-term low-cost refresher training by local faculties, reader-friendly manuals, involvement of *ayas* and wordboys have beneficial effect. Mothers liked to take away pictorial-print materials. Record-keeping and reporting were difficult to implement. Monitoring of any intensity has a positive effect on running the programme. Antenatal counselling and lactation-management centre are vital to the BFHI programme. Reassessment of the BFHI process may be helpful. **Conclusion:** The BFHI can be sustained through its need-based improvement. Key elements are: BFHI committee, refresher training, antenatal care, lactation-management centre, record-keeping, and monitoring. Involvement of the government functionaries has no alternative in sustaining the BFHI. A sustainable BFHI programme has great effect on infant and young child-feeding practices in the community. **Acknowledgements:** The support of United Nations Children's Fund, Bangladesh Breastfeeding Foundation, Directorate General of Health Services, and Director-General of Family Planning is acknowledged.

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Infant Growth in Rural South India and Its Association with Feeding Practices and Diarrhoeal Morbidity--Evaluation of a Community Intervention

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Background: Over half of under-weight children in the world live in India, where approximately 47% of children, aged less than 3 years, are under-weight, and 46% are stunted. Growth faltering normally begins at around 6 months of age, the time when a diet based predominantly on breastmilk begins to include complementary foods, which when delivered inappropriately results in growth faltering. Infants in Karnataka, South India, display this pattern of malnutrition with those aged less than 6 months having a low prevalence of under-weight compared to those having a much higher prevalence of under-weight (39%) aged 6-11 months. **Objective:** The specific aims of the study were (a) to understand specific feeding practices, such as type and frequency of complimentary feeding, duration of breastfeeding, nature of care provider, morbidity, and healthcare-seeking behaviour, and (b) to explore the differences in weight velocity between infants whose families received nutrition counselling and those who did not, using a rich dataset that includes breastfeeding, timing and nature of complimentary feeding, and morbidity data for over 24 months of age for almost 250 infants. **Methodology:** Families were administered a monthly questionnaire on feeding and childcare behaviour, and the study infants were weighed at this time, using the SECA solar scales, developed for the United Nations Children's Fund. Logistic and linear regression was used for examining the differences between intervention and non-intervention infants. **Results:** There was statistically significant improvement in weight velocity for female infants in the intervention group, which has already been reported (Indian Paediatrics 2005). Girls in the intervention group showed a positive association between key feeding practices and weight velocity analyzed between 6 and 11 months of age, with higher odds ratios for positive behaviour on key measures. Currently, analysis is underway to explore the association between growth and feeding practices with duration of breastfeeding and morbidity. **Conclusion:** Nutrition education and counselling was significantly associated with increased weight velocity among girls and improved feeding behaviour among both boys and girls. These results

provide further evidence that community-based nutrition programmes that emphasize appropriate feeding and care behaviour can be effective in preventing early childhood malnutrition in poor households. Further analyses will explore the link among duration of breastfeeding, growth, and morbidity (in particular diarrhoea) which requires longitudinal data to better understand the interaction of these variables and which cross-sectional data may belie.

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3:00 pm - 4:30 pm (Venue: Executive Director's Wing)

Poster Session 6

NUTRITIONAL PROBLEMS, GROWTH, AND DEVELOPMENT III

236 (149)

Nutritional Status of Children, Aged Less than 5 Years, of Vulnerable Women

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Background: The Food Security for Vulnerable Group Development (FSVGD) Project is a component of the nationwide vulnerable development (VGD) programme. Its main purpose is to increase the food security of VGD women and their dependants. Along with other interventions, the FSVGD distributes wheat-flour fortified with essential micronutrients, including vitamin A, zinc, and iron which is expected to increase the nutritional status of VGD women and their dependants. **Objective:** The study was carried out to see the baseline (before distributing fortified food aid) nutritional status of children, aged less than 5 years, of FSVGD Project beneficiaries. **Methodology:** A pilot study was conducted on children, aged less than 5 years, of VGD women from the cycle 2003-2004 in 2 of 7 project districts. In total, 158 children were assessed for their nutritional status that included anthropometrical measurements, such as weight, height/length, mid-upper arm circumference (MUAC), blood haemoglobin concentration, and dietary consumption. Their raw anthropometric data were compared with the NCHS reference values, and age- and sex-adjusted anthropometric indices were calculated. Anaemia was defined using haemoglobin thresholds recommended by the World Health Organization and United Nations Children's Fund, and dietary intakes of selected nutrients were compared with the recommended daily allowance (RDA). **Results:** 51.3%, 42.4%, and 12.1% of the study children were under-weight (WAZ <-2 SD), stunted (HAZ <-2 SD), and wasted (WHZ <-2 SD). Anaemia was present in 59% of the children. The prevalence of malnutrition was significantly higher among children aged 12-23 months and also among female children. The use of hygienic sanitary latrines tended to be positively associated with the WHZ scores, and deworming in the last 6 months was significantly associated with the decreased risk of wasting in children. **Conclusion:** Widespread malnutrition is prevalent among all FSVGD women and their children aged less than 5 years. A higher prevalence of malnutrition in 12-23-month age-group is probably attributable to inadequate feeding practice from birth, and the poorer nutritional status of female children might be due to gender discrimination in that community. **Acknowledgements:** The financial support of the European Commission (EC) is acknowledged.

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Levels and Determinants of Nutritional Status of Lactating and Non-lactating Mothers in Bangladesh: Does Nutrition Intervention Make a Difference?

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Background: Maternal malnutrition continues to be high among pregnant and lactating women in Bangladesh. Breastfeeding ensures child nutrition but at cost of maternal nutrition. The National Nutrition Programme (NNP) of the Government of Bangladesh targets nutrition interventions to pregnant and lactating women to combat deterioration of nutritional status. **Objective:** The study examined the level and determinants of malnutrition of lactating and non-lactating women living in the NNP and the non-NNP areas. **Methodology:** The baseline survey of National Nutrition Programme in 2004 interviewed and measured the nutritional status of 8,819 mothers of children aged less than 2 years (called lactating mothers) and 4,828 mothers of children aged 2-4 years (called non-lactating and non-pregnant mothers) in 113 sub-districts. They were asked about their education, household durable assets, food security, morbidity, antenatal-care visits, intake of iron supplement, health and nutrition knowledge, and exposure to media. The health and nutritional status was analyzed using SPSS, including logistic regression. **Results:** The prevalence of chronic energy deficiency (BMI <18.5) of mothers of children aged less than 2 years was 38% compared to 33% of mothers of children aged 2-4 years. Iron supplementation was 25% in both the groups. Antenatal visit was 50.5% among the lactating mothers and 58.2% among the non-lactating mothers. In both the groups, use of TT vaccine was almost similar (16% and 13.7% respectively). Both the groups were similar in landlessness (52%), not listening to radio (62% vs 60.8%), or watching television (56% vs 57.5%). Malnutrition of lactating and non-lactating mothers negatively correlated with their education (p=002), wealth index (p=0.00), and household food deficit (p=0.006). There was no relationship between their NGO memberships, rest during pregnancy, and NNP area and their nutritional status. **Conclusion:** Lactating mothers were more malnourished compared to non-lactating mothers, and the factors determining their nutrition were similar. Programmes in Bangladesh should be highly prioritized with increase in female education, food security, and poverty alleviation. **Acknowledgements:** The financial support of the World Bank and CIDA through the NNP of Ministry of Health and Family Welfare, Government of Bangladesh and technical support of the Institute of Public Health, National Institute of Population Research and Training, Institute of Nutrition and Food Science, and Mitra and Associates are acknowledged.

Qualitative and Quantitative Findings on Micronutrient Malnutrition of Children Aged Less Than 5 Years and Mothers of Two Groups

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Background: Urban key informants, focus-group discussants (FGDs), and mothers of children, aged less than 5 years, are quite unaware of children's micronutrient malnutrition, related consequences, and micronutrient-rich foods. **Objective:** The study investigated the effects of behaviour change communication of mothers on micronutrient deficiencies of children between two groups. **Methodology:** A qualitative and quantitative study was conducted in 4 different urban areas of Dhaka in 2003. A checklist on micronutrient malnutrition was used for collecting data. Eight key informants (2 from each location) for in-depth interview and 69 mothers of reference categories from 8 FGD sessions (8-9 mothers from each session) were included for the qualitative purpose. Two hundred twenty-two from intervention and 210 from non-intervention mothers with children were selected for quantitative study. A 3-hour lesson at a time was organized for mothers. A monthly GMP (promotion of growth monitoring) session was organized for mothers with children continuously in the intervention groups for 3 months. A complete guideline on micronutrients was given to mothers. A structured questionnaire was used for data collection after 3 months. **Results:** Half of the key informants had no awareness about nutrition and child growth, and some had a good knowledge on micronutrient deficiencies but had no practice to reduce it. One-third of the respondents understood child's micronutrient malnutrition. Some FGD mothers could understand similarly, but had no practice. In quantitative findings, severe, moderate and mild nutrition indicated by weight-for-age median was found in 37% of children in the intervention and 58% in the non-intervention group ($t=0.081$, $p<0.003$). Vitamin A deficiency was found in 7.2% and 12.4% ($t=0.789$), iron deficiency in 13.1%, and 13.8% ($t=0.320$), and iodine deficiency in 1.6% and 0.5% ($t=0.602$) of the children in the intervention and non-intervention group respectively. Mothers' understanding of micronutrient malnutrition was good in 65% and 22%, and to prevent diarrhoea by feeding vitamin A-rich foods in 54.4% and 4.8% of the intervention and non-intervention group respectively. While for iron deficiency, it was 73.0% and 33.8% and iodine deficiency 71.2% and 14.8% of mothers of the intervention and non-intervention group respectively. **Conclusion:** Comparatively, the non-intervention mothers had no better understanding of micronutrient-rich food choices and practices to prevent deficiencies. Introduction of micronutrient lessons by any media might be useful. **Acknowledgements:** The financial assistance of the Ministry of Science and Information and Communication Technology and Bangladesh National Nutrition Council (BNNC) is acknowledged.

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Factors Affecting Anaemia during Pregnancy in Women of Different Socioeconomic Status

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Background: Anaemia is a major nutritional problem leading to high maternal morbidity and mortality, neonatal mortality, and a high proportion of low birth-weight. The national survey of anaemia has shown that about 46% of pregnant women are anaemic who are at high risk of pregnancy outcome. Studies on determinants of anaemia during pregnancy in women reporting to large maternity centres in Dhaka could provide some meaningful insights to understand the causes and help initiate appropriate remedial measures. **Objective:** The study was undertaken to determine the factors underlying nutritional anaemia in pregnant women in different gestational periods in Dhaka city of Bangladesh. **Methodology:** In total, 200 pregnant women, aged 18-23 years, of different parities were randomly selected for a cross-sectional study from 3 large maternity hospitals in Dhaka city. Data were collected by direct interviews using a structured questionnaire on socioeconomic status, income, education, body-weight, height, vitamin supplementation, iron intake, and food-related conception. Data were cleaned, edited, and analyzed in a microcomputer using the SPSS/PC+ package. The factors were compared between the anaemic and the non-anaemic group. The statistical significance was accepted at 5% level. **Results:** Of the 200 pregnant women, 59% had haemoglobin below 11 g/dL. Thirty-five percent of the women had less than 5 years of schooling. Women who received any vitamin supplementation were less anaemic than who did not take vitamins (50.7% vs 78.3%, $p<0.00$). Women who had any iron intake during pregnancy were less anaemic than those who did not take iron (55.8% vs 74.3%, $p<0.04$). Income, education, profession, water source, and slum dwelling did not have any significant role for anaemia in pregnancy. Food taboos during pregnancy were found for *boal*, *mrigel*, *baiin*, *poa*, *kholsha*, coconut, melon, and dry food causing harm to the mother and the foetus. **Conclusion:** Of the pregnant women, anaemic women had a significantly less intake of vitamins and iron and had a significantly high proportion of superstitions on fish items. Programmes should be expanded to intensify supplementation of vitamin and iron in pregnancy and to advise on appropriate feeding during pregnancy.

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Nutritional Status of Infants Aged Less Than 5 Months of Employed and Non-employed Mothers

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Background: Infant care and working outside the home are both incompatible activities and having inverse relationship with each other. **Objective:** The study was conducted to assess the nutritional status of infants, aged less than 6 months, of employed and non-employed mothers. **Methodology:** The study was conducted at RADDA MCH-FP, Mirpur 10, Dhaka, Bangladesh, during January-June 2005. For a cross-sectional study, the national survey estimated that infants constituted around 10% of the whole population. For this study, the sample included 200 mothers (100 working and 100 non-working mothers). **Results:** The nutritional status of infants of the employed mothers had much more deterioration than infants of the non-employed mothers. Ninety-five

percent of employed mothers had no facility to take infants to their working place. Sixty percent of the employed mothers' infants were stunted, and 66% of the employed mothers' infants were under-weight and wasted. **Conclusion:** There is an urgent need to establish day-care centre in every work place so that mothers can breastfeed their infants; duration of maternity leave should be increased. **Acknowledgements:** The financial support of the Bangladesh Breastfeeding Foundation is acknowledged.

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Survey of Nutritional Status and Comparison of the Intake of Energy and Nutrients with DRI in Semnan Girls Secondary School, Spring 2004

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Background: Malnutrition among children and adolescents is not only an important health problem but also an economic development problem in developing countries. **Objective:** The study was conducted to determine the nutritional status and to compare the intake of energy and nutrients with dietary reference intakes in the Semnan Girls Secondary School. **Methodology:** In a cross-sectional study in spring 2004, using 2-stage cluster-random sampling, 256 students, aged 14.5-18.5 years, were selected from the Semnan Girls Secondary School. Weight and height were measured and body mass index (BMI) was calculated. Nutritional status was defined by index BMI-for-age from CDC 2000 reference, data on intake of energy and nutrients by 24-hour recall and food record questionnaire were collected. Statistical analysis was one sample t-test for comparing energy and nutrients with reference. **Results:** In this survey, a high percentage of students [5.7% (expected 5%) and 11.7% (expected 10%)] were thin and over-weight. The intake of energy and vitamin B12, folate, calcium, zinc, and fibre was less than dietary reference intakes) ($p<0.0001$). **Conclusion:** The findings suggest that thinness and over-weight rate sin Semnan students of secondary school are higher than expected. **Acknowledgements:** The financial support of the School of Public Health and Institute of Public Health Research, Tehran University of Medical Science, is acknowledged.

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Prevalence of Childhood Obesity and Its Correlated Factors among Students of Junior High School at Jakarta, Indonesia, 2004

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Background: Childhood obesity is becoming a health problem also in developing countries. Obesity that begins in early childhood persists highly and continue to adulthood. Furthermore, obesity is a risk factor of several diseases. **Objective:** The aim of the study was to establish the prevalence of childhood obesity and its correlated factors among the students of a junior high school. **Methodology:** This was a cross-sectional study. Using convenient sampling method, the status of obesity of 105 subjects (51 boys, 54 girls), aged 11-15 years, was

evaluated. These children who had been measured for height and weight were also asked to fill the questionnaire. **Results:** The prevalence of childhood obesity was 6.7%. The average age was 13.12±0.97 years. 48.6% were boys, and 51.4% were girls. The majority (65.7%) of them were not active for physical activity. Most parents of subjects were graduated from senior high school. 67.6% came from a low-income family. Anthropometric data revealed that 6.7% of the subjects were obese. A greater number of subjects had a moderate knowledge but poor attitude and practice. There was a significant correlation among age, self-perception, and status of obesity ($p<0.05$). There was no significant correlation among knowledge, attitude, practices, and family income of the subjects, educational status of parents, and status of obesity ($p>0.05$). **Conclusion:** The prevalence of obesity was 6.7%. Some subjects who are actually not obese had an obesity-supporting behaviour. Parents were the main source of information on obesity. Most subjects had a good self-perception about their obesity.

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Experiences in Institutional Management of Severe malnutrition among Children, Aged Less than 5 Years, Through Collaborative Approach

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Background: Chittagong Medical College Hospital, in partnership with Concern Worldwide Bangladesh and ICDDR,B: Centre for Health and Population Research, initiated a collaborative approach from June 2005 to demonstrate best practices for management of severe malnutrition among children, aged less than 5 years, in a government tertiary-level health facility. **Objective:** The aim of the study was to ensure protocolized management of severely-malnourished children admitted to the Paediatric Department of Chittagong Medical College Hospital. **Methodology:** During June-December 2005, 104 severely-malnourished children (based on severe wasting and/or oedema) were admitted to the Nutrition Block of Chittagong Medical College Hospital's Paediatric Department. Case histories were obtained from mothers/caregivers, and the children were examined daily by a physician. The standard protocols of the World Health Organization were followed to manage the admitted children. **Results:** The results showed that the majority of the severely-malnourished children were in the age-groups of 6-12 months (n=28, 26.9%) and 13-24 months (n=37, 35.6%). Sixty-three of the 104 children gained enough weight to recover completely and were successfully discharged (recovery rate of 60.6%). Of the successfully-discharged children, 28 (44.4%) showed weight gain more than 10 g/kg.day, while 22 (34.9%) showed moderate weight gain (5-10 g/kg.day). However, 13 (20.6%) of the successfully-discharged children showed poor weight gain <5 g/kg.day. Length of stay varied from 10 days or less for 39 (37.5%) children to 10-20 days for 45 (43.3%) children. Only 4 (3.8%) children were admitted for more than 30 days. Seven children died in the Nutrition Block (case fatality rate 6.7%). Of those who did not recover, 12 (11.5%) defaulted from the Block. **Conclusion:** The government tertiary-level health facility could demonstrate the best practices for management of severely-malnourished children through developing skills and appropriate logistics supply. **Acknowledgements:** The collaborative approach for institutional management of severe malnutrition is being implemented through financial and technical support from Concern Worldwide Bangladesh and ICDDR,B.

HEALTH POLICY AND OTHER CHILDHOOD PROBLEMS III

245 (151)

Health and Nutrition Pilot Project of Rural Maintenance Programme, CARE Bangladesh

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Background: The Rural Maintenance Program (RMP) is one of the largest poverty-alleviation programmes implemented by CARE Bangladesh. To improve the nutritional status of women in RMP and their children, CARE Canada recommended a Nutrition Pilot Project to provide a health and nutrition training package to RMP beneficiaries. **Objective:** The study was undertaken to observe the changes of nutritional status of women in RMP by adapting the health and nutrition intervention package with RMP ongoing activities. **Methodology:** A case-control study was undertaken in 17 districts under 2 field offices: Mymensingh and Jessore field offices of CARE Bangladesh. The respondents were divided into 3 groups: intervention, comparison, and control. The intervention group received a nutrition intervention package 30 minutes weekly over one year, in addition to their routine training. The comparison group received routine RMP training. The control group was similar but unlucky to be selected as RMP women. Anthropometric data were compared between baseline and endline with difference between the groups. **Results:** Anthropometric indicators of the 3 groups showed that, at the endline, the means of weight, MUAC, and body mass index (BMI) increased significantly in the intervention group. There was a mean decrease of body-weight of 150 g in the comparison group ($p=0.19$) and about 350 g in the control group ($p<0.008$). The mean body-weight of the intervention group increased at the endline by 1.4 kg ($p<0.000$). The group had an average increase of 0.5 cm of MUAC at the endline ($p<0.001$). The mean BMI reduced in the control group ($p=0.008$) and comparison group ($p=0.19$). Women of the intervention group increased about 0.63 ($p<0.000$) in their mean BMI from the baseline At the endline, there was a significant increase in iodized salt intake and immunization coverage in all the groups. Intake of vitamin A capsule increased significantly more (97%) in the intervention group at the endline. **Conclusion:** The nutrition pilot intervention was highly effective in improving the nutritional status of women in RMP, and it should be incorporated in the entire RMP. **Acknowledgements:** The financial support by CARE Canada and technical support of ICDDR,B: Centre for Health and Population Research are acknowledged.

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Impact of Training on Service Use of Depot-holders: Relevance to Scaling-up Zinc Programme

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Background: Bangladesh is the first country to take initiative for scaling up of zinc treatment for all diarrhoeal episodes in children in accordance with the joint WHO/UNICEF childhood diarrhoea-management guidelines. Involvement of all health sectors, i.e. public, private, and NGO, is crucial in this scaling-up programme. The NGO Service Delivery Program (NSDP) is one of the largest NGOs of the country that provides child healthcare. **Objective:** The study aimed at determining the role of healthcare provider training and supply of zinc on zinc scale-up programme through the NSDP facilities. **Methodology:** The NSDP healthcare providers and caretakers of children in 2 rural sub-districts were interviewed at baseline regarding their knowledge and practices in managing diarrhoea. Then, in one site, the providers were trained and supplied with zinc. The community leaders of the site were also sensitized about the treatment. The providers and caretakers of the 2 sites were interviewed after 3 months. **Results:** In total, 607 caretakers at baseline and 612 after the intervention were interviewed from the intervention site. Forty-eight percent of the children at baseline and 44% after the intervention did not visit any healthcare provider for diarrhoeal illness. Although the pattern of care-seeking remained same, the number of visits to the NSDP providers increased after the intervention (17 at baseline vs 40 after the intervention). **Conclusion:** Although visits to the NSDP providers increased after the intervention, it was not sufficient for a scaling-up programme. The findings suggest that provider training alone will not significantly benefit the zinc scaling-up programme. **Acknowledgements:** The financial support was received from the Bill and Melinda Gates Foundation.

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Systematic Evaluation of the Nutritional Rehabilitation Service of Cusco Regional Hospital

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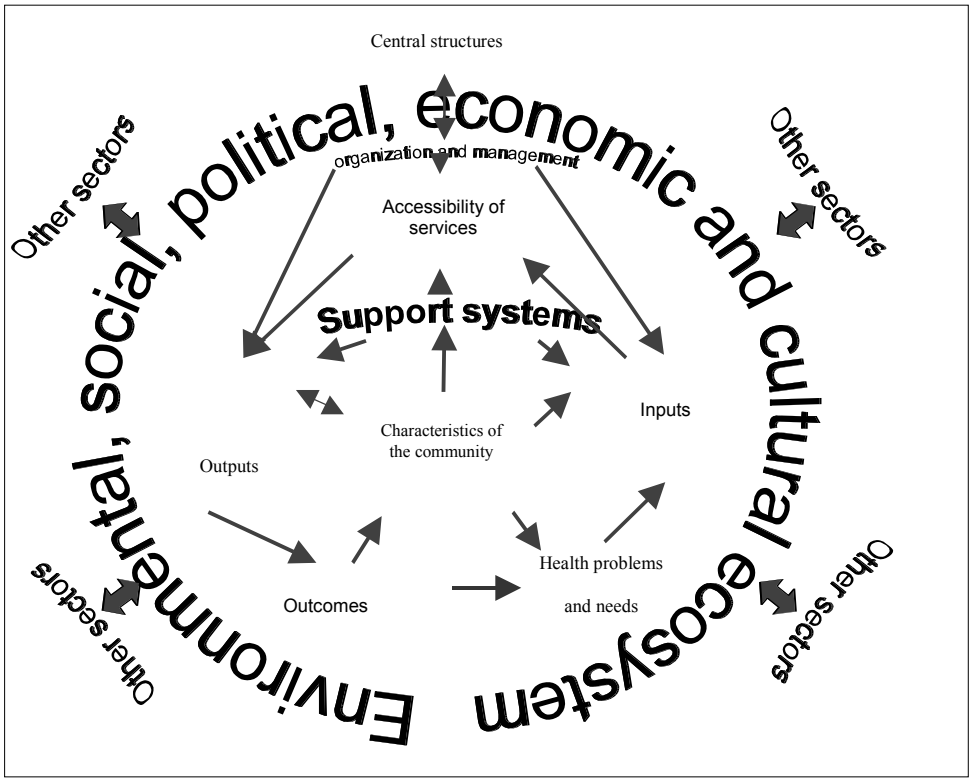
Background: Severe malnutrition is a major cause of infant mortality in various regions, including case fatality among patients admitted to hospitals. According to the World Health Organization (WHO), it is possible to reduce these case-fatalities with proper case management described in a guideline. **Objective:** The study was conducted to establish the gap between management in nutritional rehabilitation service at the Regional Hospital of Cusco and the WHO protocol. **Methodology:** The evaluation was conducted at the nutritional rehabilitation service of the paediatric area in the Regional Hospital of Cusco-Peru in April 2004, with the permission of the regional Ministry of Health. The evaluation was based on a health system research model. First, the essential components of the system were identified for the rehabilitation of severely-malnourished children. Then the tools needed to evaluate each of these components were identified. Sixty-four clinic histories and the local protocol were reviewed, 3 direct observations were made, and 6 in-depth interviews were conducted. **Results:** Feeding was

differentiated for severe wasting and oedematous malnutrition. In both the cases, macro- and micronutrients were too high or not enough (particularly protein was double of that recommended, and energy was insufficient for oedematous children). Personnel suspended the dietary regimen to 'very ill' patients. Neither hypothermia nor hypoglycaemia was taken into account. The protocol for dehydration was the same as suggested by the WHO, but personnel gave common fluids; dehydration with shock was treated with excessive sodium and volume. Oedematous children received furosemide. Not all children received antibiotics. Mothers were used to eat their children's food. Personnel were motivated since the recent appointment of a nutritionist, but not all were trained in the local protocol. Oedema disappeared in 11 days. The average stay was 26 days, and the discharge criteria were different as WHO suggested. There was an under-use of the services by the rural patients. The regional Ministry of Health was interested in treatment. However, the national guideline had serious deficiencies for treating severe malnutrition. **Conclusion:** This systematic evaluation identified appropriately the differences between management of severe malnutrition at Cusco and that suggested by the WHO, highlighting the issues that must be adopted for implementation and serving as a basis for future monitoring.

Health System Model (A.A. KIELMANN)



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Optimizing the Verbal Autopsy Process for Community Trial or Programme Use

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Background: In resource-poor rural settings, estimation of causes of newborn and child death is challenging. The World Health Organization (WHO) recommends the use of verbal autopsy as a reliable means of capturing events prior to death and classifying infant mortality by cause in these settings. The process is time- and personnel-intensive, emphasizing the need to streamline event capture, data collection, review, and consensus methods. **Objective:** The study was conducted to develop a review and consensus system for the rapid and reliable ascertainment of causes of infant death by physician-reviewers, using data collected by trained lay interviewers using verbal autopsies. **Methodology:** From a population of ~500,000 undergoing demographic surveillance in the JiVitA Health Research Project area, 70-90 reports of infant deaths have been received every month since September 2001. Over the first 4 years of implementation, JiVitA has streamlined a process whereby pairs of research physicians meet once a week to independently review and then agree on proximal and underlying causes of infant death. Gradually, the process of review and consensus has been streamlined using internal/external training sessions, consultations with specialists, and by developing new tools (e.g. data extraction, standard abbreviations, COD coding, standard case definitions, and confidence scores). The review process has now reached a stable, peak efficiency and continued for the past 10 months. **Results:** Initially, one team of 4 physician-reviewers was able to complete only 14 reviews in an 8-hour review session. After 28 weeks of experience in applying clinical and epidemiologic constructs to the review process--and 3 rounds of training by external neonatologists--the team was split into 2 pairs, doubling performance to 26 per session. An optimization of review practices and the introduction of standard definitions, abbreviations, clinical confidence scores, and process improvements increased the reviews to 25 per team (~nearly 75 per session for 3 pairs of physicians). These also reduced the weekly proportion of 'pending' and 'uncertain' causes of death. To date, the JiVitA research physicians have reviewed and assigned a cause of death for over 2,500 infant deaths. **Conclusion:** The physician-review and consensus process is a flexible and efficient means of estimating the proximal and underlying causes of death in resource-poor settings. By carefully monitoring the process and by developing (or adapting) tools to increase efficiency, a high rate of processing can be achieved. The use of standardized methods and definitions helps maintain consistency over time. Formalizing 'clinical judgements' with use of case definitions improves the efficiency and reliability with which physicians can assign causes of death, while maintaining many of the strengths of an algorithm-based approach. **Acknowledgements:** The JiVitA Project is supported by the United States Agency for International Development and Bill and Melinda Gates Foundation.

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T- and B-cell Responses in *Helicobacter pylori*-infected Duodenal Ulcer Patients and Asymptomatic Subjects in Bangladesh

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Background: Available evidence indicates that the prevalence of *Helicobacter pylori*-associated infection among the Bangladeshi population is over 80%, although the majority of infected individuals remain asymptomatic with only about 15% developing peptic ulcers and a smaller proportion gastric malignancies. Although *H. pylori* induces a vigorous immune response, it is not protective and the host fails to clear the infection. **Objective:** To better understand the factors that predispose symptomatic illness, the B- and T-cell responses in blood and in the gastric and duodenal mucosa of duodenal ulcer patients and asymptomatic carriers of *H. pylori*-associated infection were analyzed. **Methodology:** Mucosal biopsies were collected from adult Bangladeshi males. The study included both asymptomatic carriers (n=10) of the infection and patients with duodenal ulcers (n=6). All volunteers were positive for *H. pylori*-associated infection in serology and in stool antigen test. Intra-epithelial lymphocytes were removed from the biopsies by EDTA/DTT treatment. Lamina propria lymphocytes were isolated by subsequent collagenase digestion. The expression of different T- and B-cell markers on lamina propria cells were determined by flow cytometry. **Results:** Decreased frequencies of CD19+ B cells were found in the blood of duodenal ulcer patients than in asymptomatic carrier individuals. The numbers of CD4+CD25 high regulatory T cells were decreased in the antrum and duodenum in duodenal ulcer patients compared to asymptomatic carrier individuals, although the differences were not significant. CD4+ and CD8+ lamina propria T cells from the antrum and duodenum of duodenal ulcer patients expressed decreased levels of the chemokine receptors--CXCR3 and CCR4--compared to cells from asymptomatic carrier individuals. Antral T cells from duodenal ulcer patients also expressed the homing receptor L-selectin to a lower extent than T cells from asymptomatic carrier individuals. **Conclusion:** These preliminary results suggest that different T- and B-cell populations may be recruited to and accumulate in the gastrointestinal mucosa of duodenal ulcer patients compared to asymptomatic carrier individuals and that this may be of importance for development of duodenal ulcer disease. **Acknowledgements:** The study was supported by Sida-SAREC funds.