



ANNUAL  
REPORT  
2014

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*icddr,b is an independent, non-profit health research institution dedicated to improving the lives of people living in poverty in its host country Bangladesh and globally. Through the generation of knowledge, and translation of research into treatment, training and policy advocacy, icddr,b addresses some of the most critical health concerns facing the world today.*



## RESEARCH

Over 112 research projects started in 2014, 267 peer-reviewed papers published, 200 collaborators from across the world: year-on-year icddr,b researchers generate evidence to address some of the most critical health challenges facing people living in poverty.

## TRAINING

Each year more than 1,000 healthcare professionals and students visit icddr,b to learn from the institution's collective knowledge, technical expertise and unique resources. Around the world, there are experts and emerging experts in public health whose careers have been influenced by icddr,b. In 2014, participants from 24 countries trained at icddr,b.

## SERVICES

In 2014, icddr,b cared for 218,087 patients; 56% of patients treated at Dhaka Hospital were children under 5 years of age, an increase of 1.6% from 2013.

### ICDDR,B THANKS ITS CORE DONORS FOR THEIR SUPPORT



Government of the People's  
Republic of Bangladesh



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# CONTINUING OUR TRADITION OF INNOVATION

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*Bangladesh has made excellent, even spectacular, progress towards Millennium Development Goals 4 and 5, to reduce child and maternal mortality, respectively. As we rightly celebrate these achievements and shift our attention from MDGs to SDGs – Sustainable Development Goals – we should not lose sight of the fact that, even in these areas, many complex and intractable issues still require attention.*





Professor John D Clemens

Maternal mortality in Bangladesh is still too high, at 170 deaths per 100,000 live births. Moreover, the dramatic decline in under-5 mortality (from 144 to 41 per 1000 live births) between 1990 and 2013 primarily reflects a drop in post-neonatal mortality; the decline in neonatal mortality has lagged behind, and currently accounts for almost 60% of all under-5 deaths – 37% of which occurs within the first 24 hours of life. Bangladesh also has one of the world's highest burdens of stillbirths.

In other areas, equally significant challenges remain. More than half of the country's children suffers from malnutrition, with severe acute malnutrition affecting 600,000 children. On the other end of the spectrum, childhood obesity is becoming a major public health problem. Although progress has been made in reducing infectious disease mortality, Bangladesh remains one of

ten countries with the highest burden of pneumonia, tuberculosis and diarrhoea-related deaths and illness. Research will be key to addressing these problems.

During the past year, as well as furthering our ongoing research, we have been reviewing our priorities. Since our founding, we have generated a wealth of information that has shaped healthcare policy and practice in Bangladesh, and can reasonably claim to have made significant contributions to improved health and wellbeing around the world. But we have to ask how we can best achieve impact in the future in a rapidly changing world. We want to ensure that the evidence we generate continues to contribute to improved health and wellbeing, not just in Bangladesh, but also within the region, and even beyond that in other comparable resource-poor settings globally.

We have sought input from many international experts, local policymakers and donors. We have attempted to identify what we do well, what we could do better, and what we might do differently in the future. In broad terms, our future strategy will leverage our existing strengths to focus on areas of unmet need, and reinforce our efforts to achieve impact from our research. To support this new research strategy, we will be continuing to modernise our organisation and its operations to ensure that we meet internationally recognised standards of governance, transparency and operational efficiency in all areas.

We are thus at a cusp of exciting change, with great opportunity, as an institution. We have a long and distinguished history behind us. Drawing on a real appetite for change, I am convinced that we have an equally promising future ahead of us.

**Professor John D. Clemens**  
**Executive Director**  
**May 2015**

# 2014 IN NUMBERS

A snapshot of icddr,b funding: research, training and clinical services

US\$73.5m Revenue

**\$13m**  
Unrestricted  
programme

**\$8.4m**  
Other income

**\$52.1m**  
Restricted  
programme

**5 core donors**



**112**  
new grants

**34**  
new funders

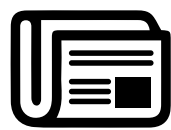


**267**

icddr,b publications  
indexed in the  
Web of Science



**405** articles  
published in the local media



**12** articles  
featured in prominent  
international media outlets

**214**

scientists:



**78**  
female



**136**  
male

**1354**

students participated in  
our training and research  
activities

**66%**



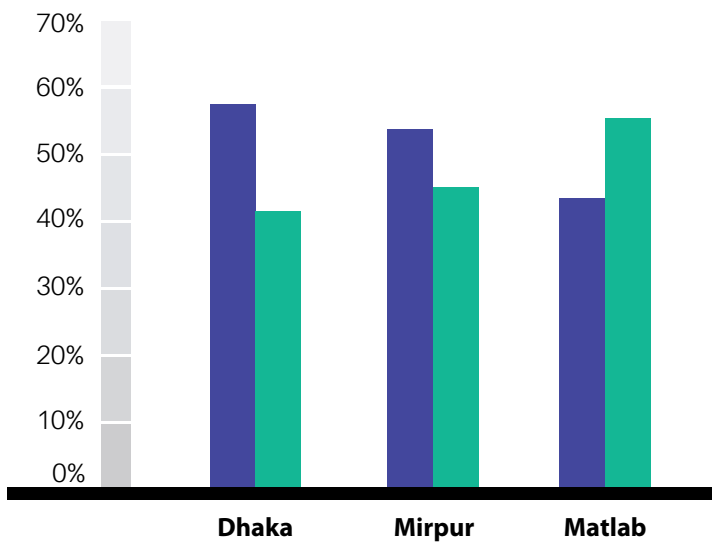
of them were  
female



In 2014,  
approximately  
**32,000**  
lives saved at  
icddr,b hospitals




**Number of patients treated in 2014**



Our hospitals  
provided care and  
treatment to  
**218,087**  
patients with a balance of

 **55%** male and  **45%** female

**57%**  
female   
treated at Matlab, reflects  
the fact that the hospital  
provides delivery facilities  
to mothers

**20%**  
of Dhaka Hospital  
patients came from  
families earning less than  
**US\$4** /day 

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# RESEARCH HIGHLIGHTS

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In 2014, our research has addressed key issues across the translational spectrum, from understanding disease processes to critiquing the effectiveness of national health systems.

2014 has seen us generate evidence on the prevalence of key diseases, provide new insight into disease processes, evaluate interventions targeting locally important health problems and analyse the organisation of health systems. In multiple ways, we have generated evidence to inform the development of health policy and practice in Bangladesh and beyond.

We have made important contributions in all our core areas of work – including maternal and neonatal health, childhood malnutrition, infectious disease and health system function. Studies have highlighted our ability to apply sophisticated laboratory techniques to address locally important issues, including metagenomic analysis

of gut microbial population dynamics in malnourished children. They also illustrate our ability to undertake large and sophisticated clinical trials, as in our continuing studies of oral cholera vaccine implementation. Our health and demographic systems and other surveillance infrastructure continue to be important sources of data.

In several areas, our work is providing a basis for the development of novel interventions. We are also generating important evidence to inform health policy in Bangladesh. For example, we have provided data on rotavirus and human papillomavirus prevalence, and on the impact of vaccine implementation.





## **MATERNAL MORTALITY - SUBSTANTIAL PROGRESS TOWARDS MDG5**

*An in-depth analysis by icddr,b researchers has identified the likely factors underpinning a sharp drop in maternal mortality in Bangladesh.*

Bangladesh is one of the few countries on course to meet Millennium Development Goal 5 - to reduce maternal mortality by 75% by 2015. Using data from two high-quality nationally representative Bangladesh Maternal Mortality Surveys and six Bangladesh Demographic and Health Surveys, icddr,b researchers and colleagues have quantified the steep decline in maternal mortality and analysed the factors associated with it.

Between 1998-2001 and 2007-10, the maternal mortality ratio - the number of maternal deaths per 100,000 live births - fell from 322 to 194, a decrease of 5.6% a year. This rate of decline would put Bangladesh on course to achieve MDG5 by 2015.

What accounts for this 40% drop in maternal mortality? Improving maternal health has been a high priority for

Bangladesh over the past decade, and the availability of services has improved markedly, particularly in the private sector. The use of clinical and public health interventions has also increased significantly. But factors outside healthcare, such as levels of female education, mobile phone use and generally improving economic circumstances, have all contributed to the fall in maternal mortality.

In 2001, an estimated 12,114 maternal deaths occurred in Bangladesh. Had birth rates by age and parity and maternal death rates within every age and parity category remained unchanged, this would have increased to 14,310 deaths in 2010. The actual estimated number was 6848 - implying that 52% of deaths had been averted. Of this number, 21% reflect a fall in the number of births, 7% changes in maternal age and numbers of births per woman and 24% the lowered risk of maternal death.

The analysis is a powerful indicator that substantial improvements in maternal health can be achieved in resource-poor countries. Internationally, it provides health officials with evidence of key factors within and outside healthcare that can have a significant impact on maternal mortality. While providing welcome good news to Bangladesh, the study also suggests that there is significant scope to reduce maternal mortality still further by enhancing access to high-quality maternal services.

El Arifeen S et al. Maternal mortality in Bangladesh: a Countdown to 2015 country case study. *Lancet*. 2014;384(9951):1366-74.

The Bangladesh case study was supported through Countdown to 2015 for Maternal and Child Survival by the Bill & Melinda Gates Foundation, the UK Department for International Development through icddr,b and by the United States Agency for International Development (USAID) through the Measure Evaluation project.

## MALNUTRITION - NOT JUST ABOUT FOOD

*A game-changing study has identified gut bacteria as important factors in recovery from malnutrition.*

Severe acute malnutrition in children is common in many low- and middle-income countries, and under-nutrition an even wider issue. Therapeutic feeding has been successful in reducing short-term mortality. However, surviving children often still fail to thrive, and moderate acute malnutrition also has long-term developmental consequences.

Working with researchers at Washington University and the University of Virginia, USA, Dr Tahmeed Ahmed and colleagues at icddr,b have found that changes in the composition of bacterial communities in the gut may be responsible for incomplete recovery from acute malnutrition.

Applying ribosomal RNA sequencing techniques, Dr Ahmed and colleagues analysed the make-up of the gut's bacterial communities using faecal samples from children with severe acute malnutrition before, during and after treatment with therapeutic foodstuffs. These were compared with the changing bacterial communities present in the guts of healthy children living in similar socioeconomic conditions. Even though malnourished children gained weight after treatment, the composition of their gut bacteria was found to revert to an 'immature' state after treatment ended.

Hence malnutrition seems to induce changes in the gut that hinder the normal evolution of bacterial communities during childhood development. The impact of malnutrition thus lasts far longer than the initial acute phase. Moreover, even less severe forms of malnutrition were also associated with abnormal gut bacterial communities.

In related work, Dr Ahmed and colleagues also characterised changing bacterial communities as adult patients recover from cholera. Notably, during recovery, certain species appeared to proliferate at the expense of cholera-causing bacteria. Inoculation of 'bacterial cocktails' into mice identified bacterial species that outcompeted cholera-causing bacteria, and revealed potential molecular mechanisms by which they may antagonise their growth.

More generally, they highlight the fact that malnutrition is a far more complex issue than simply lack of food. It shows complex interactions with factors such as gut infections and pre-natal growth (and hence maternal health). To promote this wider perspective and encourage a coordinated interdisciplinary approach, Dr Ahmed and colleagues have developed a global research agenda for childhood under-nutrition on behalf of the Sackler Institute for Nutrition Science at the New York Academy of Sciences and the WHO.

*Subramanian S et al. Persistent gut microbiota immaturity in malnourished Bangladeshi children. Nature. 2014;510(7505):417-21.*

*Hsiao A et al. Members of the human gut microbiota involved in recovery from Vibrio cholerae infection. Nature. 2014;515(7527):423-6.*

*Ahmed T et al. An evolving perspective about the origins of childhood undernutrition and nutritional interventions that includes the gut microbiome. Ann NY Acad Sci. 2014;1332:22-38.*

*Funded by the Bill & Melinda Gates Foundation, the International Atomic Energy Agency and the US National Institutes of Health.*

## ORAL CHOLERA VACCINE - SUCCESS IN PRACTICE

*A large-scale study has shown that an oral cholera vaccine delivered through the Bangladesh government's routine immunisation programme infrastructure significantly reduced the incidence of cholera hospitalisation.*



Clinical trials have provided evidence that the affordable oral cholera vaccine Shanchol can cut the incidence of cholera, but it was not clear whether it would be as effective under 'real-life' conditions, when delivered through an existing immunisation programme.

The 'Introduction of Cholera Vaccine in Bangladesh' study has addressed this issue. In a high-risk poor urban population, it compared cholera rates in groups receiving either Shanchol or vaccine plus a behaviour change intervention to promote safe water and hygienic practices, or no intervention.

Vaccine coverage was around 65% in the vaccine arms of the trial, and over two

years the incidence of severely dehydrating cholera was found to have reduced to 53% in the vaccine-only group and 58% in the vaccine plus behaviour change arm. Moreover, hospitalisation with life-threatening cholera was more than halved in both groups.

These figures are roughly in line with those from an earlier trial in India and suggest that oral cholera vaccine can have a major impact on cholera when delivered through existing mechanisms, even in highly mobile high-risk urban populations. The behaviour change intervention, by contrast, appeared to provide few additional benefits.

*Qadri F et al. Feasibility and effectiveness of the oral cholera vaccine, in an urban "cholera-endemic" setting in Bangladesh: a cluster-randomised non-blinded trial. Lancet (in press).*

*Funded by the Bill & Melinda Gates Foundation.*

## ACCELERATING ORAL CHOLERA VACCINE DEVELOPMENT

*icddr,b has joined a multinational partnership to develop a new oral cholera vaccine for low-income countries.*

More than 4 million cases of cholera occur each year, claiming at least 100,000 lives. Affordable oral cholera vaccines are providing new opportunities to reduce this death toll, and in November 2014 icddr,b entered into a partnership to offer its expertise in clinical development and clinical trials and to accelerate development of a low-cost vaccine tailored for use in low-income settings.

The new partnership brings together Hilleman Laboratories (a New Delhi-based research organisation jointly founded by Merck & Co and the Wellcome Trust), Dhaka-based vaccine manufacturers Incepta Pharmaceuticals Ltd and icddr,b. Hilleman will be responsible for pre-clinical development of the vaccine candidate, Incepta for process development and manufacturing and icddr,b for clinical trials.

Importantly, the work will be focused on application in low- and middle-income countries, addressing the issue that vaccines are typically less efficacious in such settings than in industrialised countries. A new vaccine may also allay fears that supplies of current vaccines will be insufficient to meet potentially sizeable future demand - some 30 million doses are likely to be needed to vaccinate 1-14-year-old children in high-risk areas by 2016, and demand is projected to increase to 200 million doses by 2025.





*icddr,b's Dhaka Hospital is always open to patients suffering from diarrhoeal disease or respiratory infections*

## TOWARDS UNIVERSAL HEALTH COVERAGE

*icddr,b scientists warn that Bangladesh will face daunting challenges to achieve universal health coverage.*

The ambitious goal of universal health coverage is to ensure that all citizens have access to the full spectrum of health services without undue financial hardship. While Bangladesh has made great strides in improving several aspects of national health in recent years, a review led by icddr,b researchers suggests that Bangladesh urgently needs to reduce the gap between health care need and utilisation, vastly increase the quality of health services and improve financial protection so that use of health services does not lead to hardship. The analysis also emphasises the urgent need for improved information-gathering systems to support monitoring and evaluation across the entire health sector (public and private).

Improvements are needed in access to both effective preventive and curative interventions, particularly for the highest burden conditions and interventions most likely to result in financial hardship. One priority is increased public investment in health services – public funding on healthcare as a proportion of GDP was unchanged between 1997 and 2011.

A further priority is the development of pre-payment health insurance schemes to ensure equitable access to healthcare services and to limit the potentially devastating impact of out-of-pocket expenditures – nearly 6 million people are pushed into poverty each year in Bangladesh because of healthcare costs. In 2012, with technical support from icddr,b, the Government of Bangladesh developed its first healthcare financing strategy but progress in implementation has so far been limited.

Huda T et al. Monitoring and evaluating progress towards Universal Health Coverage in Bangladesh. *PLoS Med.* 2014; 11:e1001722.

Supported by the World Health Organization.



## ROTAVIRUS – THE CASE FOR VACCINATION

*icddr,b researchers have documented the burden of rotavirus infections in Bangladesh, strengthening the case for a national rotavirus vaccine programme.*

Rotavirus is the most common cause of severe diarrhoea in young children globally, accounting for almost 40% of deaths of hospitalised infants under 5 years of age. Rotavirus vaccines exist but are not effective against all viral strains, and clinical trials in developing countries – including a major trial run by icddr,b in Bangladesh – have shown that vaccine responses are typically lower than in industrialised countries.

icddr,b's Diarrhoeal Disease Surveillance System at its Dhaka Hospital has shown that rotavirus is responsible for a growing proportion of severe diarrhoeal disease in children under 5 – up from 25% in 1993–97 to 42% in 2008–12.

More recent data from hospital surveillance and presented to national policy makers show that 67% of children under 5 admitted to hospital with diarrhoea were infected with rotavirus. Children under 18 months of age were particularly badly affected. These findings strengthen the case for introduction of rotavirus vaccines into Bangladesh's national immunisation programme.

Sarker MH et al. Changing characteristics of rotavirus diarrhea in children younger than five years in urban Bangladesh. *PLoS One*. 2014;9(8):e105978.

## JAPANESE ENCEPHALITIS VIRUS – A SUCCESSFUL VACCINE TRIAL

*Clinical studies have confirmed the safety and seroprotection of a Japanese encephalitis virus vaccine produced in new manufacturing facilities, paving the way to wider uptake.*

Vaccination is the recommended approach for control of Japanese encephalitis virus (JEV), which threatens some 3 billion people across Asia and causes up to 50,000 deaths each year. A vaccine produced by the Chengdu Institute of Biological Products in China has been widely adopted, and immunisation programmes have been shown to reduce the burden of disease, but until recently the Institute's manufacturing facilities were not compliant with WHO Good Manufacturing Practice (GMP) guidelines.

With support from PATH, the Chengdu Institute has established new GMP-compliant facilities, and icddr,b has evaluated the new JEV vaccine produced in these facilities. In studies at Dhaka and Matlab, icddr,b researchers established that the immune responses stimulated by the new vaccine matched those elicited by the original vaccine. The findings enabled the WHO to approve the vaccine for prequalification, an important step towards its use in national programmes and purchasing by international agencies such as UNICEF or the GAVI Alliance.

Zaman K et al. Lot-to-lot consistency of live attenuated SA 14-14-2 Japanese encephalitis vaccine manufactured in a good manufacturing practice facility and non-inferiority with respect to an earlier product. *Vaccine*. 2014;32(46):6061–6.

Funded by PATH.

## UNDERSTANDING NEURODEVELOPMENTAL DEFICITS

*icddr,b researchers have identified important factors affecting cognitive development in early childhood.*

Early adversity can have profound and long-lasting effects on child development. The resulting impaired cognitive development can lower educational achievements and earning potential in adulthood, perpetuating a cycle of poverty and failure to achieve full potential.

Globally, some 220 million children are affected by poverty that limits their developmental potential. Working with colleagues at University College London, icddr,b researchers have explored key factors mediating the effects of poverty on cognitive development, following nearly 2000 children whose mothers took part in a nutritional study during pregnancy.

The effects of poverty on cognitive development were seen remarkably early – even at just 7 months of age. These translated to significant differences in IQ by age 5. Three key factors – parental educational levels, birthweight and childhood growth, and degree of home stimulation – explained almost 90% of the effects of poverty on IQ. The findings highlight at-risk children as possible targets for interventions to enhance early mental development.

A second study, run in partnership with the University of Virginia, USA, has examined a further possible factor affecting early development – infection. In children living in Dhaka, clinical markers of infection (fever) and biochemical markers of inflammation (pro-inflammatory cytokines) both showed an association with impaired cognitive





abilities and motor skills at age 2. The findings highlight the potentially important but as yet unidentified role inflammation and immune responses may be playing in neurodevelopment.

*Hamadani JD et al. Cognitive deficit and poverty in the first 5 years of childhood in Bangladesh. *Pediatrics*. 2014;134(4):e1001-8.*

*Jiang NM et al. Febrile illness and pro-inflammatory cytokines are associated with lower neurodevelopmental scores in Bangladeshi infants living in poverty. *BMC Pediatr*. 2014;14:50.*

*Funded by the United Nations Children's Fund, UK Medical Research Council, Swedish Research Council, UK Department for International Development, Global Health Research Fund-Japan, Child Health and Nutrition Research Initiative, Uppsala University, USAID, the European Community, US National Institutes of Health, Bill & Melinda Gates Foundation and US Centers for Disease Control.*

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## UNDERSTANDING IMPAIRED VACCINE RESPONSES

*New studies have identified key factors underlying reduced responses to oral vaccines in resource-poor settings – and ways in which vaccine responses might be enhanced.*

Unfortunately, responses to orally administered vaccines tend to be markedly lower in low- and middle-income countries than in industrialised nations. In a study of infants in Dhaka carried out by Dr Rashidul Haque and colleagues at icddr,<sup>b</sup> and the University of Virginia, USA, malnutrition, diarrhoea and shorter duration of breastfeeding were all found to be associated with impaired antibody responses to oral polio vaccines (but did not affect responses to injected vaccines).

The findings are consistent with the idea that damage to the gut linked to malnutrition or infection limits the induction of immune responses to oral vaccines. Furthermore, they suggest that promoting breastfeeding could be a way to boost vaccine responses in infants.

Other studies, conducted by Mr Nazmul Huda and colleagues at icddr,b in collaboration with researchers at the University of California, Davis, have highlighted a further potentially important factor – the composition of the gut’s microbial ecosystem. Immune responses to a range of oral vaccines varied according to the bacterial populations present in the infant gut, with certain species being associated with enhanced vaccine responses. Manipulation of gut bacterial populations could therefore be a further way to boost vaccine responsiveness in infants.

Haque R et al. Oral polio vaccine response in breast fed infants with malnutrition and diarrhea. *Vaccine*. 2014;32(4):478–82.

Huda MN et al. Stool microbiota and vaccine responses of infants. *Pediatrics*. 2014;134(2):e362–72.

Funded by the US National Institutes of Health, US National Center for Research Resources, Bill & Melinda Gates Foundation and World Health Organization.

## HUMAN PAPILLOMAVIRUS INFECTION

*Surveys in urban and rural areas have provided the first population-based data on the prevalence of human papillomavirus in Bangladesh.*

Human papillomavirus (HPV) is a cause of cervical cancer, the second most common cancer in women in Bangladesh. A survey of nearly 2000 women in an urban and a rural setting, carried out by icddr,b researchers, has shown that the prevalence of HPV in Bangladesh is 7.7%, in line with other South Asian countries. It also identified the distribution of HPV subtypes affecting Bangladeshi women, which will inform the design of any HPV vaccine programme introduced in the country.

The survey also documented a range of risk factors associated with HPV infection, including working in the garment industry or as a housemaid – findings that could inform the targeting of preventive measures and provide important evidence for the Government of Bangladesh’s discussions about funding for pilot studies of HPV vaccine implementation.

Nahar Q et al. Genital human papillomavirus infection among women in Bangladesh: findings from a population-based survey. *PLoS One*. 2014;9(10):e107675.

Funded by Swedish International Development Cooperation Agency (Sida).

## BURDEN OF DISEASE

*icddr,b researchers have contributed to major analyses of global disease burdens.*

The landmark 2013 Global Burden of Disease study, to which icddr,b contributed, documented significant health gains in Bangladesh since 1990. Mortality from diarrhoeal diseases has dropped by 91% and deaths linked to pre-term birth

complications have fallen by 79%. Life expectancy has risen by more than 11 years – one of the 10 biggest increases globally. In common with other developing countries, however, deaths due to non-communicable diseases have soared – the incidence of stroke and ischaemic heart disease rose by 400% and 200%, respectively, between 1990 and 2013.

A 2013 Global Burden of Disease sub-study has revealed that, between 1980 and 2013, rates of overweight or obesity doubled among Bangladeshi adults but remained low among children (other studies have shown recent increases in overweight and obesity among Bangladeshi children). In 1980, 7% of adults and 3% of children were overweight or obese. In 2013, those rates had climbed to 17% for adults and 4.5% for children. Considering just obesity, rates in adults rose slightly from 2% to 4%, and rates in children and adolescents remained at about 1.5%.

icddr,b has also provided major input into one of the largest ever studies of individual mortality in the developing world. The INDEPTH network of demographic surveillance sites has published detailed analyses of causes of death based on verbal autopsy data from sites in 20 low- and middle-income countries. The data provide a detailed picture of causes of death in individual countries, and enable policy makers to see how their countries compare with others.

GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015;385(9963):117–71.

Ng M et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014;384(9945):766–81.

Streitfield PK et al. Cause-specific childhood mortality in Africa and Asia: evidence from INDEPTH health and demographic surveillance system sites. *Glob Health Action*. 2014;7:25363 [and accompanying papers].

Global Burden of Disease study funded by the Bill & Melinda Gates Foundation.

# CENTRE FOR CHILD AND ADOLESCENT HEALTH

*We aim to improve the health and wellbeing of children and adolescents in Bangladesh, through a wide-ranging programme of research in nutrition, infectious disease and child development.*

Bangladesh is a relatively young country – almost two-fifths of the population is aged 18 years or younger. Child mortality has declined significantly in recent decades, although it remains relatively high in global terms. Major health challenges include neonatal conditions, respiratory tract infections, diarrhoeal diseases, injuries and poor cognitive and physical development – more than two-fifths of children under 5 years of age show stunted growth, leading to delayed cognitive development and contributing to an intergenerational cycle of poverty.

The work of icddr,b's Centre for Child and Adolescent Health spans all areas of young people's health, particularly the control of infectious diseases through vaccination and improved diagnostics and treatment; developing and supporting the scale-up of interventions to enhance child and adolescent growth and cognitive development; implementation research to support scale-up of critical interventions and more effective use of informatics; nutritional interventions to improve newborn, infant, child and adolescent health and survival; and research to improve the health and health care of adolescents as they transition to adulthood. The centre has particular interests in the epidemiology, burden and risk factors of childhood illness in the context of rapid epidemiologic transitions.

The centre aims to improve child and adolescent health, growth and development through research that informs policy and practice. Evaluations of public sector child health services are also undertaken, generating evidence to support improved service delivery.

## RESEARCH GROUPS

- Nutritional Interventions to Improve Newborn, Infant, Child and Adolescent Health and Survival
- Immunisations for High Burden Childhood and Adolescent Conditions
- Improving Children's and Adolescents' Cognitive Development
- Adolescence and Healthy Transition to Adulthood
- Development and Evaluation of Child Health Services and Health Informatics
- Childhood Illness: Epidemiology, Burden and Risk Factors







**Director:**  
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## RESEARCH HIGHLIGHTS

### MATERNAL MORTALITY

A landmark analysis has identified factors contributing to substantial declines in maternal mortality in Bangladesh (see page 7).

### COGNITIVE DEVELOPMENT

Key factors mediating the effect of poverty on childhood development have been identified (see page 11).

### UNIVERSAL HEALTH COVERAGE

Limited progress has been made towards universal health coverage in Bangladesh (see page 10).

### PRE-TERM BIRTH

Dr Anisur Rahman has been awarded a US\$1.5m Grand Challenges in Global Health grant to investigate factors potentially contributing to pre-term birth. At Matlab, Dr Rahman will collect health and lifestyle information and biological samples from some 4,700 women in early pregnancy to identify factors associated with pre-term birth. Findings could be used to guide the development of new interventions to reduce the risk of prematurity.

### NUTRITION BY PHONE

Dr Tanvir Huda is conducting a pilot study funded by Grand Challenges Explorations to develop, test and assess the feasibility of an innovative approach integrating nutrition education and cash transfers using mobile phones to improve the nutrition of pregnant women and their babies in poor households. Inadequate knowledge and resources often lead to poor maternal diet in pregnancy and inappropriate infant and young child feeding practices. Provision of cash and nutrition education may encourage uptake of desired behaviours by women in poor households, with long-term benefits to child nutrition.

### PSYCHOSOCIAL STIMULATION

A major effectiveness trial is assessing the feasibility of integrating an evidence-based programme of nutritional care and psychosocial stimulation for malnourished children into community clinics. Under-nutrition is very common in Bangladesh and has a significant negative effect on early childhood development. The psychosocial stimulation programme, adapted for Bangladesh, has been shown to be effective in previous trials, and the latest study, supported by a US\$2m grant from Grand Challenges Canada, will assess whether it can be routinely delivered by suitably trained local staff in community clinics alongside nutritional interventions. In intervention areas, mothers of malnourished children – around 1300 in total – will be invited to visit community clinics fortnightly for a year. If it proves beneficial, the intervention could be relatively straightforward to scale up through 13,000 community clinics nationwide.

### ADOLESCENT SEXUAL AND REPRODUCTIVE HEALTH FAQs

A dataset of 6,000 frequently asked questions (FAQs) about sexual and reproductive health has been created after extensive qualitative research with male and female adolescents in rural and urban Bangladesh. Supported through the USAID-funded Translating Research into Action (TRAction) initiative, the project also compiled factual, culturally appropriate answers. The resource is feeding into the design of behaviour change communication materials for adolescent sexual and reproductive health programmes.

### KANGAROO MOTHER CARE

In-depth interviews and focus group discussions with mothers, other key family and community members and health workers have identified obstacles to use of 'kangaroo mother care' – carrying young infants next to the skin. They include practical difficulties such as combining kangaroo mother care with

housework and ideological obstacles, including a perceived lack of need for such care with apparently healthy babies (who may actually be underweight). The findings suggest that building family and community support will need to be central to interventions to enhance use of kangaroo mother care.

*Hunter EC et al. Newborn care practices in rural Bangladesh: Implications for the adaptation of kangaroo mother care for community-based interventions. Soc Sci Med. 2014;122:21–30.*

### IMCI TRAINING

As part of the Multi-Country Evaluation of Integrated Management of Childhood Illness (IMCI) initiative, healthcare workers with as little as 18 months pre-service training in IMCI were found to achieve sustained improvements in the quality of child healthcare in rural Bangladesh. With IMCI training and regular supportive supervision, improvements in the management of sick children under the age of 5 by service providers with 18 months pre-service training matched that of providers with 4 years of training. The findings demonstrate that regular supportive supervision can ensure an acceptable level of performance among IMCI service providers, and suggest that young children could be cared for successfully by lower-level providers.

*Hoque DM et al. Improving and sustaining quality of child health care through IMCI training and supervision: experience from rural Bangladesh. Health Policy Plan. 2014;29:753–62.*

### HERD IMMUNITY

A case-control study in Dhaka has shown that even low levels of *Haemophilus influenzae* type b (Hib) vaccine coverage provide significant protective herd immunity. Compared with controls, children under the age of 2 with pneumonia were less likely to live in neighbourhoods in which Hib vaccine coverage exceeded 20%. Herd protection may therefore be an important factor to consider in vaccine programme decision-making.

*Chen WJ et al. Estimation of the herd protection of *Haemophilus influenzae* type b conjugate vaccine against radiologically confirmed pneumonia in children under 2 years old in Dhaka, Bangladesh. Vaccine. 2014;32:944–8.*

# CENTRE FOR COMMUNICABLE DISEASES

*Our aim is to reduce the public health burden of communicable diseases in Bangladesh and other low- and middle-income countries by conducting multidisciplinary research on endemic and emerging infectious diseases, developing and testing new interventions and evaluating disease-control programmes.*



As well as highly prevalent diarrhoeal diseases and non-tuberculosis respiratory tract infections, Bangladesh also has one of the world's highest burdens of tuberculosis, while parasitic diseases such as malaria and leishmaniasis are endemic in parts of the country. Emerging infections, such as avian flu and Nipah virus, have potentially serious implications for Bangladesh, the South Asian region and globally.

Research in the icddr,b's Centre for Communicable Diseases covers multiple infectious diseases, including emerging and zoonotic infections, and spans surveillance and interventions. Improving hygiene practices in domestic and commercial settings is an important focus. The centre also responds to infectious disease outbreaks, in partnership with the Institute of Epidemiology, Disease Control and Research (IEDCR), Ministry of Health and Family Welfare.

By engaging with local stakeholders, the centre aims to tackle infections of greatest local and global importance. Findings are communicated to decision-makers through forums such as dissemination seminars and an open-access newsletter, the *Health and Science Bulletin*, published in English and Bengali. Centre researchers also act as technical consultants.

The centre's work has global significance, particularly that linked to emerging infections. The centre has a long-standing collaboration with the US Centers for Disease Control and Prevention (CDC) and is a key collaborating partner with CDC's Global Disease Detection Center in Bangladesh, part of a network of centres identifying and controlling emerging infections worldwide.

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## RESEARCH GROUPS

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- Water, Sanitation and Hygiene
- Tuberculosis and Leprosy
- Zoonotic Diseases
- Respiratory Viruses
- Surveillance and Outbreak Investigation
- Parasitology

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## RESEARCH HIGHLIGHTS

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### ROTAVIRUS

Rotavirus infections are responsible for an increasing proportion of cases of severe diarrhoeal disease in Bangladeshi children (see page 11).

### JAPANESE ENCEPHALITIS

Dr Emily Gurley has been awarded a CAD\$112,000 'Stars in Global Health' grant from Grand Challenges Canada for a pilot project of pig vaccination to control Japanese encephalitis virus (JEV) transmission. In north-western Bangladesh, pigs are an important JEV reservoir and pig vaccination may help to prevent the spread of the virus to humans.





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## DATE PALM SAP

Interventions to encourage use of bamboo skirts to prevent contamination of date palm sap with bat urine or saliva, an important route of transmission of Nipah virus, have had some success. More sap collectors used skirts after a high-intensity communication programme than after a lower-intensity programme. However, the programme would be costly to introduce on a large scale.

*Nahar N et al. Piloting the promotion of bamboo skirt barriers to prevent Nipah virus transmission through date palm sap in Bangladesh. Glob Health Promot. 2014;21(4):7-15.*

## MINIMALLY INVASIVE AUTOPSIES

A pilot study has suggested that minimally invasive autopsy – brain or lung biopsy – may be feasible in Bangladesh. Post-mortems can provide important clues to cause of death. Although they are not specifically forbidden under Islam, major procedures on dead bodies are considered objectionable. Discussions with religious leaders confirmed that needle biopsies would be acceptable, and doctors from Faridpur Medical College Hospital received training on the technique in Thailand. Of 15 families approached following death from meningo-encephalitis or respiratory illness, five (33%) gave informed consent for a biopsy to be undertaken. Further piloting is underway at Faridpur and other sites.

*Building capacity for minimally invasive autopsies in Bangladesh. icddr, b Health and Science Bulletin. 2014;12(4):1-6.*

## SOCIAL ENTERPRISE FOR TB CARE

With support from the StopTB Partnership, three tuberculosis (TB) screening centres across Dhaka have been established as social enterprises, generating revenue as well as enhancing access to TB health services. The facilities offer state-of-the-art X-ray imaging as well as gene-based diagnostic testing. In the first three months of operation, 25,000 patients were screened and 250 new cases of TB were detected, with data being fed into national surveillance systems. This novel approach is a potential sustainable and scalable model for enhancing access to TB diagnostics services.

## PARTICULATES

Infants exposed to high levels of particulate matter in their homes experience their first acute lower respiratory tract infections at early ages, a study in Dhaka has discovered. Such infections are typically more severe in early life, and are the leading cause of death in Bangladeshi children, particularly those under the age of 1. Interventions to reduce indoor particulate levels could protect vulnerable infants by increasing the age at which lower respiratory tract infections first occur. The paper reporting these findings was named one of the top 10 articles of the year in the *American Journal of Epidemiology*.

*Gurley ES et al. Indoor exposure to particulate matter and age at first acute lower respiratory infection in a low-income urban community in Bangladesh. Am J Epidemiol. 2014;179(8):967-73.*

## THE COST OF INFLUENZA

Influenza infections have been found to incur an economic cost of at least US\$169m a year in Bangladesh. Follow-up of outpatients and inpatients to identify direct medical costs and indirect costs (such as lost earnings) were used to calculate a cost-per-episode, and national statistics on influenza were used to extrapolate a national burden. Although hospitalisation incurs greater costs, the far higher number of outpatient visits means that, overall, these costs dominate. The findings will inform decision-making on introduction of influenza control measures.

*Bhuiyan MJ et al. Economic burden of influenza-associated hospitalizations and outpatient visits in Bangladesh during 2010. Influenza Other Respir Viruses. 2014;8(4):406-13.*

## A NEW HENIPAVIRUS?

A search for Nipah virus in cattle, goats and pigs revealed the presence of antibodies that bound to Nipah virus protein but did not neutralise the virus itself. The findings suggest that the animals have been exposed to another henipavirus, the family to which Nipah virus belongs, possibly through contact with bats. Further research is needed to assess whether the novel virus is a threat to human health.

*Chowdhury S et al. Serological evidence of henipavirus exposure in cattle, goats and pigs in Bangladesh. PLoS Negl Trop Dis. 2014;8(11):e3302.*

## NIPAH BELT

A study of villages in Bangladesh's 'Nipah belt' – the region affected by recurrent human Nipah virus outbreaks – has identified environmental factors potentially influencing 'spillover' from bat to human populations. As well as higher population densities, affected villages were associated with more fragmented forests and distinctive tree species. These ecological factors may increase the risk of human exposure to the virus.

*Hahn MB et al. The role of landscape composition and configuration on Pteropus giganteus roosting ecology and Nipah virus spillover risk in Bangladesh. Am J Trop Med Hyg. 2014;90(2):247-55.*

## VIRAL INFECTIONS IN INFANTS

A study of nearly 13,000 infants under the age of 5 in Matlab has provided new information on the causes of severe acute respiratory infections in this vulnerable group. The most common viral cause of infections, in both the community and in hospital, was respiratory syncytial virus (RSV). In the absence of affordable RSV-specific medications and an effective RSV vaccine, hygiene-based preventive interventions may be the best way to limit infections.

*Nasreen S et al. Population-based incidence of severe acute respiratory virus infections among children aged <5 years in rural Bangladesh, June-October 2010. PLoS One. 2014;9(2):e89978.*

# CENTRE FOR CONTROL OF CHRONIC DISEASES

*Our aim is to improve lifelong health by promoting healthy lifestyles and by contributing to the prevention and control of chronic diseases in Bangladesh.*



*A study participant using a lung function test in rural Bangladesh*

With rapid epidemiologic and demographic transitions, urbanisation and the adoption of westernised lifestyles, chronic health conditions are becoming increasingly prevalent in Bangladesh. Noncommunicable diseases such as cardiovascular diseases, diabetes, chronic obstructive pulmonary disease (COPD) and cancer now account for the major burden of disease.

icddr,b's Centre for Control of Chronic Diseases aims to provide a clear picture of the growing health and economic burden of noncommunicable diseases, and insight into their development. The centre also develops and tests interventions to reduce the burden of disease and investigates approaches for long-term management of chronic conditions.

The centre works in partnership with BRAC, Johns Hopkins Bloomberg School of Public Health, USA, the Institute of Development Studies, UK, the University of Cambridge, Duke-National University of Singapore Graduate Medical School, Imperial College London and the University of Chicago. It was founded through an initial grant from the Oxford Health Alliance and subsequently supported by the US National Heart, Lung and Blood Institute and the UnitedHealth group.

The centre works closely with national policy makers to identify key issues and to evaluate public health and health systems interventions. The centre is committed to knowledge transfer and has established a Technical Advisory Group, with representatives from the Government of Bangladesh, the WHO, clinicians, academics and researchers, which serves as a national platform for controlling chronic diseases in Bangladesh.

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## RESEARCH GROUPS

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- Chronic Disease Epidemiology and Genetics
- Chronic Diseases Systems and Society
- Chronic Diseases and Implementation
- Economics of Chronic Diseases



**Acting Director:**  
**Dr Dewan S Alam**  
Until December 2014

## RESEARCH HIGHLIGHTS

### CHILDHOOD OBESITY

A systematic review has documented levels of childhood obesity in Bangladesh (see page 13).

### MENTAL DISORDERS

Mental health disorders – such as depression, anxiety, addiction, schizophrenia and neurosis – have a serious impact on health: they contribute up to 13% to the global burden of disease. Mental health conditions are often not perceived as serious health problems in low- and middle-income countries and are not prioritised in prevention programmes and in health care delivery. Partly this is because there are often few data available on the extent of the problem.

icddr,b investigators examined the current prevalence and trends in the rates of mental health disorders in Bangladesh in order to fill the knowledge gap and to point the way towards addressing the burden associated with these conditions.

Overall the prevalence of mental disorders in Bangladesh is between 6.5 to 31% among adults, with psychiatric and psychogenic disorders such as depression, anxiety and neurosis most commonly reported. The prevalence of mental disorders was much higher in overcrowded urban communities than rural ones, and among the poor. Women were vulnerable across all settings, consistent with findings from other South Asian countries like India and Pakistan.

*Hossain MD et al. Mental disorders in Bangladesh: a systematic review. BMC Psychiatry 2014, 14:216*

### HYPERTENSION AWARENESS

Raising awareness of hypertension and encouraging people to seek help has led to increased healthcare-seeking and improved blood pressure control. Some 11% of individuals at rural Matlab and 24% at semi-urban Kamalapur were found to have high blood pressure, with only around half previously aware of their condition. Patients were advised to seek help from a qualified provider and encouraged to adopt a healthier lifestyle. At six months follow up, 83% reported visiting a provider, those visiting qualified providers showed significant falls in blood pressure. Overall, half of patients achieved target blood pressure levels

*Alam DS et al. Awareness and control of hypertension in Bangladesh: follow-up of a hypertensive cohort. BMJ Open. 2014;4(12):e004983.*

### CHRONIC KIDNEY DISEASE

A cross-sectional survey of adults in a middle-income area of Dhaka has revealed a disturbingly high prevalence of chronic kidney disease (CKD). Among more than 350 adults, one in four showed signs of CKD, often with features of insulin resistance. Growing numbers of affluent urban residents may therefore be at serious risk of kidney and cardiovascular disease.

*Anand S et al. High prevalence of chronic kidney disease in a community survey of urban Bangladeshis: a cross-sectional study. Global Health. 2014; 10:9.*

### HYPERTENSION: DIAGNOSIS AND ADHERENCE

A study of nearly 30,000 adults in rural Bangladesh has found that, of the 13.7% with hypertension, only around half were diagnosed by qualified providers; 41% were diagnosed by medically unqualified village doctors. Some 26% of patients discontinued their medicine, and were more likely to do so if they had been

diagnosed by an unqualified provider. The findings suggest that more attention needs to be placed on the hypertension care practices of unqualified providers, and on education to improve patient adherence to medicine.

*Khanam MA et al. Hypertension: adherence to treatment in rural Bangladesh – findings from a population-based study. Glob Health Action. 2014;7:25028.*

### HYPERTENSION AND COPD

A cross-sectional survey in rural and urban surveillance areas has revealed that hypertension and chronic obstructive pulmonary disease (COPD) have a significant impact on daily living and financial wellbeing. Self-treatment is common, particularly in early stages of each disease, and public health systems are poor at referring patients for specialist treatment. Hence the Bangladesh health system is poorly set up to address the growing burden of these common conditions.

*Uddin MJ et al. Consequences of hypertension and chronic obstructive pulmonary disease, healthcare-seeking behaviors of patients, and responses of the health system: a population-based cross-sectional study in Bangladesh. BMC Public Health. 2014;14:547.*

### MHEALTH FOR DIABETES

A new randomised controlled trial is assessing whether a mobile phone text messaging service improves glycaemic control in newly diagnosed patients with type 2 diabetes. More than 200 individuals are being recruited in an urban area, with around half receiving health advice and supportive messages on top of standard care. Impact on HbA1c levels will be assessed at six months.

*Islam S et al. Mobile phone intervention for increasing adherence to treatment for type 2 diabetes in an urban area of Bangladesh: protocol for a randomized controlled trial. BMC Health Serv Res. 2014;14(1):586.*

# CENTRE FOR EQUITY AND HEALTH SYSTEMS

*We generate evidence to improve health outcomes, especially for the disadvantaged in Bangladesh and other resource-poor countries, and through research and partnership we aim to develop more effective, equitable and accountable health systems.*

The guiding principle of work in the icddr,b's Centre for Equity and Health Systems is that all people, irrespective of their social and economic position, should have access to affordable, high-quality and responsive healthcare that enables them to achieve optimal physical, mental and social wellbeing. Although rooted in local issues, the centre's work has wider relevance to health systems development in resource-poor countries.

The centre has strong connections with the James P Grant School of Public Health at BRAC University in Dhaka. As well as joint appointments and collaborations, these links also include a joint fellowship programme for public health professionals. The centre also supports work on health systems, health economics, urbanisation and related areas in other icddr,b centres.

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## RESEARCH GROUPS

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- Gender and Social Determinants of Health
- Universal Health Coverage
- Human Resources
- Governance and Accountability
- Urban Health Systems
- Information Communication Technology
- Health Economics and Financing

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## 2014 RESEARCH HIGHLIGHTS

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### UNIVERSAL HEALTH COVERAGE

Centre researchers have analysed progress towards universal health coverage in Bangladesh (see page 10).

### DISEASE BURDEN

Centre researchers contributed to the 2013 Global Burden of Disease study (see page 13).

### FACILITATING BREASTFEEDING

Dr Sabrina Rasheed has been awarded a CAN\$112,000 'Stars in Global Health' grant from Grand Challenges Canada for pilot studies of an innovative method to increase the shelf life of breast milk, to enable more women working in the garment industry to continue breastfeeding. Garment workers will be given access to breast pumps and innovative low-cost equipment for pasteurisation, suitable for routine use in workplace healthcare clinics.

### PRENATAL CARE

Abdur Razzaque Sarker has been awarded a US\$100,000 Grand Challenges Explorations grant from the Bill & Melinda Gates Foundation to explore the use of group prenatal classes. Prenatal care is still underutilised in Bangladesh, and a group format may help to establish social networks and promote social interactions that encourage greater uptake.

### EMERGENCY OBSTETRIC CARE

Working with the Government of Bangladesh, centre researchers have developed a geographic information system (GIS)-based tool to map the distribution of emergency obstetric and newborn care (EmONC) facilities in 24 districts. The tool enables programme managers to compare the location of facilities with local population distributions and travel networks, and for individual facilities to be better monitored.

Using the tool, it has been shown that most study districts have at least five facilities for each 500,000 residents, in line with UN recommendations. However, facilities were reachable within one hour for just 41% of residents. Many had considerable shortfalls in staffing.

### REDUCING GENDER VIOLENCE

Preliminary analysis of data from the interdisciplinary 'Growing Up Safe and Healthy' (SAFE) project has identified major reductions in violence against women and girls in urban informal settlements following SAFE interventions. The SAFE project, spanning the health and legal sectors and run in collaboration with multiple advocacy and support organisations, combined preventive measures to address attitudes and behaviours and enhanced service provision. The project also had a positive impact on knowledge about marriage-related issues and rights.





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## EVALUATING APONJON

An evaluation of the Aponjon initiative, which provides new and expectant mothers with advice via mobile phone, has found that the service is generally well-received and has some impact on maternal behaviour. Qualitative studies in four areas of Bangladesh found that Aponjon messaging was acceptable to target audiences (although cost was a barrier to participation) and improved knowledge of recommended healthcare behaviours during pregnancy and after birth. Quantitative studies suggested the intervention led to better adherence to recommended maternal healthcare practices but had little impact on neonatal care.

## MICRO HEALTH INSURANCE

Households recruited to the *Amader Shasthya* micro health insurance scheme being run at icddr, b's Chakaria field site reached 5,000 in 2014, out of a total 16,000 households in its catchment area. Launched in 2012, *Amader Shasthya* has been designed as a risk-pooling scheme to reduce the potentially catastrophic impact of out-of-pocket expenditure on health. Notably, enrolment has been equally spread across all socioeconomic groups.

## TACKLING LEPROSY

Bangladesh has one of the world's highest burdens of leprosy, with more than 1000 new cases each year. In collaboration with LEPROA Bangladesh, the National Leprosy Elimination Programme and other partners, a comprehensive nationwide mapping of the prevalence of leprosy has been carried out, to inform leprosy elimination strategies. In two districts, a pilot project has also been implemented, under the auspices of the National Leprosy Elimination Programme, to integrate leprosy care into general health services.

## VILLAGE DOCTORS

In-depth consultations in rural Bangladesh have found that pharmaceutical company representatives are the predominant



source of information about drugs for village doctors. In remote rural areas, medically unqualified village doctors are the most common providers of health services. With little access to other information, their prescribing practices are being significantly influenced by their reliance on drug representatives.

*Rahman MH et al. What do they do? Interactions between village doctors and medical representatives in Chakaria, Bangladesh. Int Health. 2014. pii: ihu077*

## MHEALTH FOR MOTHERS

Mobile phones may be able to drive health-seeking behaviour, a step beyond use of text messages to disseminate health advice. Qualitative research has shown that despite some initial negative attitudes, most pregnant mothers used mobile phones to seek advice from community skilled birth attendants, who in turn used phones to obtain specialist clinical guidance.

*Huq NL et al. Toll free mobile communication: overcoming barriers in maternal and neonatal emergencies in rural Bangladesh. Reprod Health. 2014; 11:521*

## MHEALTH ATTITUDES

A survey of nearly 5000 people in rural Chakaria has found low awareness and

current use of mobile phone-based (mHealth) services but generally positive attitudes to its future use. With access to mobile phones increasing rapidly, mHealth has the potential to address severe shortages of trained healthcare professionals, particularly in rural areas. The survey has provided valuable information on current mHealth use and attitudes, and on obstacles to and enablers of uptake that could inform the future development of services.

*Khatun F et al. Prospects of mHealth services in Bangladesh: recent evidence from Chakaria. PLoS One. 2014;9(11):e111413.*

## INTIMATE PARTNER VIOLENCE

Women's exposure to physical or sexual violence also affects their children's development, an analysis of data from the Bangladesh Demographic and Health Survey has revealed. Nearly half of women had experienced physical violence at some point, and stunting was significantly more common in the children of such women.

*Ziaei S et al. Women's exposure to intimate partner violence and child malnutrition: findings from demographic and health surveys in Bangladesh. Matern Child Nutr. 2014;10(3):347-59.*



# CENTRE FOR FOOD AND WATERBORNE DISEASES



*We aim to reduce the burden of foodborne and waterborne diseases in Bangladesh and other developing countries by carrying out research to gain a better understanding of the biology and transmission of microbial pathogens and by testing interventions to prevent the spread of disease.*

Many infectious diseases affecting Bangladesh (and other developing countries) are primarily transmitted through contaminated water and foodstuffs. Diarrhoeal disease remains common in Bangladesh due to contamination with bacteria such as *Vibrio cholerae*, *Shigella* spp, *Salmonella* spp, diarrhoeagenic *E. coli* and other pathogens.

Research in the icddr,b's Centre for Food and Waterborne Diseases focuses on the clinical and environmental monitoring and characterisation of microbial pathogens, to shed light on disease burden and microbial ecology and to support the development of strategies for blocking disease transmission. The centre also develops and tests locally applicable interventions to improve water safety and hygiene practices.

In its food safety work, the centre characterises routes of disease transmission through the food chain. The centre also works with commercial partners to analyse and prevent contamination of foodstuffs.

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## RESEARCH GROUPS

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- Enteric Bacteriology and Epidemiology
- Food Safety
- Water and Environment
- Molecular Microbiology and Ecology
- New Diagnostics and Therapeutics
- Emerging Diseases and Immunobiology
- Diagnostics and Drug Resistance



**Director:**  
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## RESEARCH HIGHLIGHTS

### WELLCOME TRUST INVESTIGATOR AWARD

Dr Shah M Faruque has become the first Bangladeshi scientist to receive a prestigious Wellcome Trust Senior Investigator Award, worth around US\$2.7m over five years. The Award will enable Dr Faruque, a world-leading expert on the genetics of *Vibrio cholerae*, to further his studies on *V. cholerae* and control of cholera.

### BANGLADESH ACADEMY OF SCIENCES GOLD MEDAL

Dr Md Sirajul Islam has been awarded the Bangladesh Academy of Sciences Gold Medal in recognition of his scientific contributions over a 35-year period. Dr Islam is an environmental microbiologist particularly known for his work on environmental reservoirs of *Vibrio cholerae*. He received the medal from the Honourable Prime Minister of Bangladesh Sheikh Hasina in a ceremony at the Bangladesh Academy of Sciences.

### FELLOWSHIPS AND TRAINING GRANTS

Dr M Aminul Islam received a Fogarty Fellowship to work on antibiotic resistance. Dr Zhahirul Islam has been appointed country coordinator for Bangladesh of a new joint programme initiated with the University of Sydney called 'Leadership and Advocacy in Infectious Diseases, Microbiology and Infection Control,' which is aimed at young researchers who are potential future leaders in their field. Dr Islam will identify suitable candidates for the programme within Bangladesh.

### CHOLERA STRAIN EVOLUTION

A bacterial virus, or phage, known as RS1 may play an important role in generating new pathogenic strains of *Vibrio cholerae*. Infection with the RS1 phage can lead to the loss of genetic material coding for cholera toxin, generating non-toxicogenic strains. However, this genetic material can subsequently be reacquired, generating novel pathogen variants. The findings shed important new light on the role of phage in *V. cholerae* evolution and the emergence of novel toxigenic strains associated with devastating epidemics – new understanding that will ultimately inform global cholera control efforts.

*Kamruzzaman M et al. RS1 satellite phage promotes diversity of toxigenic Vibrio cholerae by driving CTX prophage loss and elimination of lysogenic immunity. Infect Immun. 2014;82(9):3636–43.*

### CAMPYLOBACTER JEJUNI POPULATION STRUCTURE

Poultry are an important reservoir of *Campylobacter jejuni*, which causes fever, abdominal cramps and bloody diarrhoea in humans, and is associated with the development of the neurological disorders Guillain-Barré syndrome and Miller Fisher syndrome. Genotyping of *Campylobacter jejuni* isolates from poultry and patients has revealed a diverse population structure, with little overlap between human and poultry isolates. Hence sources other than poultry may be contributing to human *Campylobacter* infections in Bangladesh. The findings will shape future infection-control strategies.

*Islam Z et al. Comparative population structure analysis of Campylobacter jejuni from human and poultry origin in Bangladesh. Eur J Clin Microbiol Infect Dis. 2014;33(12):2173–81.*

### SHIGELLA DRUG RESISTANCE

New research has shed light on the explosive growth of antibiotic resistance in *Shigella*, the cause of dysentery, in Bangladesh. Resistance to ciprofloxacin, for example, leapt from 0% in 2004 to 44% in 2010. Resistance was associated with both target site mutations and upregulation of drug efflux pumps. In addition, resistance to trimethoprim-sulfamethoxazole was found to be associated with a 4.3 MDa plasmid carrying the *sul2* resistance gene. The findings provide insight into the extent and mechanisms of antibiotic resistance in *Shigella* in Bangladesh, and emphasise the need for ongoing monitoring to support effective clinical treatment.

*Azmi IJ et al. Fluoroquinolone resistance mechanisms of Shigella flexneri isolated in Bangladesh. PLoS One. 2014;9(7):e102533.*

*Iqbal MS et al. Plasmid-mediated sulfamethoxazole resistance encoded by the *sul2* gene in the multidrug-resistant Shigella flexneri 2a isolated from patients with acute diarrhea in Dhaka, Bangladesh. PLoS One. 2014;9(1):e85338.*

### ESBL E. COLI

Globally, production of enzymes known as 'extended spectrum beta-lactamases' (ESBL) by gut bacteria such as *E. coli* is an important cause of antibiotic resistance, but little is known about ESBL-producing bacteria in Bangladesh. Of 339 *E. coli* isolates from urinary tract and wound infections in three different Bangladeshi hospitals, 40 showed evidence of ESBL production and were resistant to multiple antibiotics. The high prevalence of ESBL-producing *E. coli* probably reflects overuse and misuse of antibiotics in Bangladesh, emphasising the need for effective antibiotic stewardship.

*Lina TT et al. Phenotypic and molecular characterization of extended-spectrum beta-lactamase-producing Escherichia coli in Bangladesh. PLoS One. 2014;9(10):e108735.*

# CENTRE FOR HIV AND AIDS



*Our aim is to reduce the spread and impact of HIV and AIDS in Bangladesh, particularly among vulnerable and marginalised groups.*

Although Bangladesh is a low HIV-prevalence country, prevention efforts are still essential to limit spread of the virus. Certain key populations, such as people who inject drugs, show a significantly higher prevalence of HIV while other groups, including men who have sex with men, female sex workers and transgender individuals, are highly vulnerable and important targets for interventions.

The key aim of the icddr,b's Centre for HIV and AIDS is to support government efforts to control the spread of HIV and AIDS. This includes the development of nationwide surveillance systems as well as molecular epidemiological studies to understand HIV transmission within Bangladesh and the introduction of strains from other countries.

The centre has long-standing programmes of work with vulnerable communities, and icddr,b is a principal recipient of a large grant from the Global Fund to Fight AIDS, Tuberculosis and Malaria to improve access of such groups to HIV prevention services. The centre also evaluates HIV prevention interventions, provides training in HIV counselling and management of sexually transmitted infections, and carries out studies on the impact of HIV infection.



**Director:**  
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## RESEARCH GROUPS

- HIV Vulnerability and Marginalisation
- Surveillance, Monitoring and Evaluation
- Sexually Transmitted Infections

## RESEARCH HIGHLIGHTS

### STIs IN HIGH-RISK GROUPS

A cross-sectional survey in Dhaka has generated laboratory-based diagnostic data on sexually transmitted infections (STIs) in key populations – females who inject drugs, female sex workers (street and home-based), male sex workers and *hijra* (transgender people). STI prevalence was as high as 21.3%, with oral gonorrhoea particularly prevalent among male sex workers and *hijra*. The study also identified high levels of resistance to front-line drugs for gonorrhoea, well above thresholds at which the WHO recommends discontinuing use of individual antibiotics. The data provide a clearer picture of the STI burden among key populations, arguing for programmes to address issues such as oral STIs and highlighting the need to update national guidelines on antibiotic management of STIs.

### HIV VULNERABILITY IN STREET CHILDREN

There are almost half a million street children in Bangladesh, three-quarters of them living in Dhaka. An innovative qualitative and ethnographic study of street children in Dhaka has found that they engage in behaviours that expose them to increased risk of HIV and other STIs and have little knowledge about sexual health and HIV infection. Group discussions and in-depth interviews revealed that street dwellers experience high levels of sexual abuse and exploitation and drug use. However, street children show a marked reluctance to use existing sexual health or other healthcare services. There is an urgent need to improve uptake of sexual health services by these children, as well as targeted interventions to reduce drug use and wider policy shifts to address the dire living conditions of this vulnerable group.

*Uddin MJ et al. Vulnerability of Bangladeshi street-children to HIV/AIDS: a qualitative study. BMC Public Health. 2014; 14:1151*

### MAPPING HIV CASES AND SERVICES

A new geographic information system (GIS)-based approach has been developed to collect national data on HIV infection rates and access to services. The web-based tool enables drop-in clinics and service delivery centres to submit regular information, allowing service providers to map the geographical distribution of services and interventions, and helping to ensure that supply meets demand.

Data will be held in national information management systems, and will support service planning and policy-making as well as research.

### PREDICTORS OF DEATH

Research at the specialist Jagori Ward at Dhaka Hospital has provided the first data on predictors of death in adult patients in Bangladesh with HIV. As well as low CD4 cell counts, opportunistic fungal and bacterial infections were associated with increased risk of death. These AIDS-related deaths could have been averted by earlier diagnosis and management of opportunistic infections, supporting the case for enhanced screening to facilitate early identification of HIV infections.

*Shahrin L et al. Characteristics and predictors of death among hospitalized HIV-infected patients in a low HIV prevalence country, Bangladesh. PLoS One. 2014;9(12):e113095.*

### HIV IN CHILDREN

Most children with HIV in Bangladesh are infected through vertical transmission and their parents often have a history of external migration, research at Dhaka Hospital has shown. The study also identified the most common symptoms associated with HIV infection in children and factors associated with low CD4 cells counts, particularly under-nutrition.

*Shahrin L et al. Clinical profile of hospitalized HIV-infected children in Bangladesh, a low-HIV-prevalence country. Paediatr Int Child Health. 2014;34(2):133-7.*



# CENTRE FOR NUTRITION AND FOOD SECURITY

*We aim to reduce the burden of nutritional disorders in Bangladesh, particularly for vulnerable groups such as children and pregnant women, and with a focus on evaluation of interventions to prevent stunting.*



Malnutrition and food insecurity remain critical concerns in Bangladesh. Some 41% of children under 5 years of age suffer from chronic malnutrition, while several million children are acutely malnourished. More than one-third of young children have nutritional anaemia, increasing the risk of intellectual impairment, while 26% of women are anaemic.

icddr,b's Centre for Nutrition and Food Security carries out research across the translational spectrum. Discovery research includes work on biomarkers to identify environmental enteropathy, which leads to stunting. The centre develops new interventions, including ready-to-use foods from locally available ingredients that would transform treatment of childhood malnutrition in resource-poor settings. It is involved in the delivery of interventions and in the evaluation of maternal and infant nutrition interventions run by the Government of Bangladesh and non-governmental organisations. It also investigates the impact of malnutrition on infectious diseases, such as kala azar (leishmaniasis) and tuberculosis.

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## RESEARCH GROUPS

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- Maternal and Child Nutrition
- Nutrition-Infection Interactions
- Food Security and Monitoring and Evaluation
- Diet and Drugs in Diarrhoeal Disease Management
- Micronutrients
- Food Safety
- Nutrition and Metagenomics
- Food Fortification and Biofortification
- Infant and Young Child Feeding
- Supplementary and Therapeutic Feeding
- Implementation and Training

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## RESEARCH HIGHLIGHTS

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### **RECOVERY FROM MALNUTRITION**

The composition of the gut's microbial ecosystem has been implicated in delayed recovery from malnutrition (see page 8).

### **INFANT DEVELOPMENT**

Gulshan Ara has received a CAD\$112,000 'Stars in Global Health' award from Grand Challenges Canada to pilot a novel intervention to improve child development. Mothers of young infants in informal urban settlements will receive visits from trained female counsellors from the local community, to promote infant feeding and positive parenting practices, deficiencies in which are known to affect child development.



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## DEWORMING

Dr Prasenjit Mondal has secured a US\$100,000 Grand Challenges Explorations award from the Bill & Melinda Gates Foundation to test whether supplying deworming drugs to women of child-bearing age reduces the incidence of helminth infection and anaemia. While Bangladesh has a deworming programme targeting school children, no equivalent programme exists for women of reproductive age.

## MAL-ED

Centre researchers have begun analysing data from eight international sites, as part of a major collaboration examining the interplay between malnutrition and enteric infections, and their impact on childhood growth and development, in Bangladesh and seven other low- and middle-income countries. The MAL-ED initiative, funded by the Bill & Melinda Gates Foundation, is following cohorts of children from birth to 24 months of age, with data being collected on risk factors for malnutrition and enteric diseases, as well as on their growth, development, gut function and response to vaccines.

*MAL-ED Network Investigators. The MAL-ED study: a multinational and multidisciplinary approach to understand the relationship between enteric pathogens, malnutrition, gut physiology, physical growth, cognitive development, and immune responses in infants and children up to 2 years of age in resource-poor environments. Clin Infect Dis. 2014;59 Suppl 4:S193-206 [and associated papers].*

## RECOVERY DIETS

Data collection has been completed on a randomised controlled trial comparing three recovery diets for severely malnourished infants under 6 months of age. Although management protocols for malnourished children are well-defined, they have been developed for infants older than 6 months, and younger infants may have different requirements. The trial, funded by the UK Department for International Development (DFID) and the Government of Bangladesh,

is comparing infant formula, the therapeutic milk product F-100 and diluted F-100.

## ZINC BIOAVAILABILITY

In collaboration with the Bangladesh Rice Research Institute and with support from HarvestPlus, the bioavailability of zinc in children given high-zinc biofortified rice (developed through conventional plant breeding procedures) is being assessed. Many children in Bangladesh are zinc-deficient, and although zinc supplementation can reduce the incidence of childhood diarrhoea and pneumonia and improve growth, large-scale zinc supplementation is highly challenging. Use of biofortified foodstuffs could be a more practical alternative.

## EVALUATING HOME FORTIFICATION

The initial findings of an evaluation of a maternal, infant and young child nutrition home fortification project being undertaken by the Global Alliance for Improved Nutrition (GAIN) in collaboration with BRAC have been reported. The project is using a network of community health volunteers managed by BRAC to promote complementary feeding by increasing the use of micronutrient powder, with the aim of preventing anaemia in children under 5 years of age. Preliminary findings from a baseline survey suggest that awareness is low, with only 45% of mothers having heard of the product and 24% having used it.

## MAINSTREAMING NUTRITION SERVICES

Qualitative and quantitative research have identified operational challenges and staffing requirements associated with the introduction of nutrition services at community clinics. Since 2011, the Government of Bangladesh has begun integrating nutrition services into its

health systems infrastructure. USAID-funded research in two upazilas, in collaboration with the National Nutrition Service Directorate and Community Clinic Project Directorate, identified practical implementation challenges within community clinics and the estimated workload of clinic staff. The study's findings are enabling policy-makers to fine-tune the programme.

## ELEVATED SODIUM

A new observational study is investigating the prevalence, health consequences and treatment of elevated levels of circulating sodium ions (hypernatraemia) in childhood diarrhoeal diseases. Hypernatraemia can have devastating and potentially lethal effects on the brain, and survivors are at risk of convulsions or other cognitive, motor or behavioural problems in later life. The study is exploring the prevalence of hypernatraemia, its neurological sequelae and its longer-term developmental outcomes, as well as evaluating currently used treatment protocols.

## DEPRESSION IN OLDER PEOPLE

A study of physically healthy adults aged 40 years and older in rural Bangladesh has found a high prevalence of depression, and links between depression and poor diet. Some 42% of individuals were found to have mild depression and 17% were severely depressed. Women and those aged over 60 were at particular risk of depression, which was also associated with poverty and consumption of a nutrient-poor vegetable diet.

*Das J et al. Factors associated with elderly depression among rural Bangladeshi individuals. Am J Psychiatr Neurosci. 2014; 2(1): 1-7.*

# CENTRE FOR POPULATION, URBANISATION AND CLIMATE CHANGE

*We are studying the health impacts of demographic and population changes including urbanisation and the likely social and health impacts of climate change in Bangladesh and beyond.*



Bangladesh is experiencing major demographic shifts. With more than 160 million citizens, it is the world's eighth most populous country but annual population growth has slowed significantly to 1.4%. Meanwhile, the proportion of people living in cities has risen to 28%. As a low-lying country, Bangladesh is also vulnerable to climate change and sea-level rise.

Research in icddr,b's Centre for Population, Urbanisation and Climate Change aims to capture the key climate changes affecting the population of Bangladesh and their likely implications for health and health systems around the world. Changes will have impact in multiple areas including food security, the spread of infectious diseases, rise of noncommunicable diseases and demands on health system infrastructure.

The centre is generating evidence to support longer-term decision-making in Bangladesh. It is developing a series of 'big picture' projections to 2050 to capture likely changes in demand for resources (e.g. schools, hospitals, jobs); health issues affected by ageing (e.g. noncommunicable diseases); migration and urbanisation (especially slums); and climate change and adaptation by relocation.

The Matlab demographic surveillance system is also being used to explore various aspects of family life and health including fertility, family support and infant and child health and development.

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## RESEARCH GROUPS

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- Climate Change and Infectious Diseases
- Epidemiological Transition
- Demographic Surveillance Research
- Migration and Urbanisation
- Fertility and Family Planning

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## RESEARCH HIGHLIGHTS

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### URBAN HEALTH

The 2013 Bangladesh Urban Health Survey, carried out by the National Institute of Population Research and Training with technical input from icddr,b and MEASURE Evaluation, found that most indicators of health had improved since the last survey in 2006. Almost all urban residents live within 2 km of a health facility and use of contraceptives is high. However, while inequalities between informal settlements and other urban areas have lessened, residents of the informal settings including slums are still highly disadvantaged. The range of healthcare providers has increased, spanning public, NGO and private services, with NGO and private care being the preferred choice of urban residents.



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## MIGRATION AND MORTALITY

Sex-selective migration to urban areas is having a significant impact on sex differences in mortality in rural Bangladesh. Typically, healthy males migrate in search of work, which not only skews the sex ratio of rural populations but also means that the remaining male population is less healthy, affecting sex differences in mortality. Such factors need to be borne in mind when interpreting data on sex differences in mortality in rural populations.

## SAND FLY SURVEILLANCE

Bangladesh's first sand fly surveillance site, launched with UK Department for International Development (DFID) funding in 2013 in Mymensingh, has begun to generate data. Sand flies transmit the *Leishmania* parasite, and control of sand flies is central to the national and regional kala-azar elimination programmes. Surveillance has shown that sand fly numbers peak twice during the year, and are higher in households experiencing kala-azar than in those free of disease. The findings will inform vector control activities such as insecticide spraying in houses.

## SALT CONSUMPTION IN COASTAL AREAS

Population-based research in coastal areas of Bangladesh has identified alarmingly high salt levels in tube-well water, an issue that is likely to worsen as climate change and rising sea levels exacerbate saltwater intrusion. Salt consumption is a well-known risk factor for high blood pressure, and large numbers of local people were found to have early-stage hypertension. The ongoing work will provide important data on salt consumption and its impact on health in coastal areas.

## ESPA DELTA

Evidence is accumulating of the environmental degradation linked to human activities in the Bengal delta region, particularly deteriorating water quality. The centre is contributing to a major international initiative – Assessing Health, Livelihoods, Ecosystem Services and Poverty Alleviation in Populous Deltas (ESPA Delta) – which is mapping ecosystem services and documenting the demographic and socioeconomic characteristics of river delta populations, to better understand links between ecosystem service use and wellbeing. Modelling through to mid-century will project how services and wellbeing could be affected by climate change, feeding into policy making in Bangladesh and other delta regions.

## 'SLASH AND BURN' FARMING AND MALARIA

Individuals practising the traditional 'slash and burn' *jhum* form of agriculture in remote steep hillsides in Chittagong Hill Districts are at increased risk of malaria infection, compared with other residents. People living with *jhum* cultivators are also at increased risk of malaria. In light of the findings, three Hill District Councils have launched interventions targeting *jhum* cultivators and their families.

Galagan SR et al. The practice of *jhum* cultivation and its relationship to *Plasmodium falciparum* infection in the Chittagong Hill Districts of Bangladesh. *Am J Trop Med Hyg.* 2014;91(2):374–83.

## ASYMPTOMATIC MALARIA

Two recent studies have identified significant levels of asymptomatic malaria infections in malaria-endemic regions of Bangladesh. The findings suggest that a large reservoir of malaria parasites capable of sustaining transmission may exist, and that malaria control may not be as effective as previously thought.

While national control efforts have focused on identifying and treating symptomatic cases of malaria, a cross-sectional survey in the malaria-endemic Chittagong Hill Districts found that in 77% of cases where malaria parasites were detected, infected individuals showed no symptoms of disease. Furthermore, pregnant women were at significantly increased risk of having an asymptomatic infection, and infected but asymptomatic pregnant women had reduced haemoglobin levels. The findings have important implications for malaria control programmes and possible plans for eradication, and suggest that wider screening for malaria infections and early treatment should be considered in pregnant women.

Starzengruber P et al. High prevalence of asymptomatic malaria in south-eastern Bangladesh. *Malar J.* 2014;13:16.

Khan WA et al. Asymptomatic *Plasmodium falciparum* malaria in pregnant women in the Chittagong Hill Districts of Bangladesh. *PLoS One.* 2014;9(5):e98442.



# CENTRE FOR REPRODUCTIVE HEALTH



*We aim to promote universal access to comprehensive reproductive health in Bangladesh and beyond, by developing and facilitating the uptake of innovative, sustainable and equitable reproductive health services.*

Maternal mortality rates in Bangladesh have declined significantly and are approaching Millennium Development Goal targets but remain high in global terms. The ultimate goal of icddr,b's Centre for Reproductive Health is to reduce maternal and neonatal mortality still further, through a wide-ranging programme of research encompassing biomedical and social approaches to reproductive health and wellbeing. Much evidence now exists on ways to ensure healthy pregnancies, childbirth and neonatal care. The centre's work therefore focuses not just on the development or testing of novel interventions, but particularly on implementation of evidence-based practices in local or other developing world settings.

A key role is played by the Matlab demographic surveillance site. Here, icddr,b organises reproductive health services in around half the surveillance area, allowing interventions to be compared with standard government-provided services.

The centre has particular interests in the management of pre-eclampsia/eclampsia in the community and in excessive blood loss after delivery – the most common cause of maternal mortality. Family planning services are another priority. The centre also works on topics such as maternal nutrition and cervical cancer.

The centre works closely with the Government of Bangladesh on the implementation and evaluation of reproductive health services. As well as disseminating information on evidence-based practice, the centre studies factors accelerating or inhibiting the uptake of evidence-based practice.

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## RESEARCH GROUPS

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- Family Planning, Menstrual Regulation and Post-abortion Care
- Fetal and Neonatal Health Research
- Maternal and Reproductive Nutrition
- Maternal Health
- Health System and Reproductive Health
- Reproductive Infection and Cancer



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## RESEARCH HIGHLIGHTS

### HPV

Population surveys have provided the first reliable data on the prevalence of human papillomavirus in Bangladesh (see page 13).

### POST-PARTUM HAEMORRHAGE

icddr,b has been awarded a US\$250,000 grant from Grand Challenges Canada to trial Tampostat, a low-cost, self-regulating tamponade for managing post-partum haemorrhage. The emergency obstetric device is designed for use by a skilled birth attendant, with minimal training. With collaborators from the USA and elsewhere, icddr,b will run a clinical trial to assess Tampostat's efficacy, safety and feasibility.

### MATERNAL HEALTH TASK FORCE

icddr,b and the Maternal Health Task Force (MHTF), based at the Harvard School of Public Health, have jointly developed a research agenda and funding mechanism for studies aiming to improve the quality of maternal health care during the critical period from the third trimester to 7 days after birth. The MHTF Innovation Fund supports high-quality and policy-relevant research and tools development in Bangladesh and other South Asian countries, with results feeding into a parallel series of discussions with policy-makers and relevant stakeholders.

### PREVENTING PRE-ECLAMPSIA

A controlled implementation trial has examined the potential for community maternal healthcare workers to identify severe pre-eclampsia and eclampsia, administer an early loading dose of magnesium sulphate (an effective and affordable treatment) and refer mothers to hospital. The trial was run in collaboration with Save the Children's USAID-funded MaMoni project, which trained local community health providers. The intervention area showed higher diagnosis of pre-eclampsia and eclampsia, greater referral to hospital and fewer maternal deaths. The findings suggest it would be feasible to deliver the programme through existing systems, although there is still scope to improve diagnosis and referral rates.

### PRE-TERM BIRTH

The long-running Projahnamo (Project for Advancing the Health of Newborns and Mothers) study has generated more important information on pre-term birth, responsible globally for more than a million deaths a year – more than a third of all neonatal deaths.

Data from more than 32,000 live births revealed that 22.3% were pre-term, with just over half being late pre-term. Risk of pre-term birth was lower in better-educated women, those who had sought antenatal care and those who had completed a birth preparedness course. Risks were higher in those who had experienced a previous child death, were undernourished or had reported an antenatal complication.

In this cohort, nearly half of all neonatal deaths were associated with pre-term birth. Risk factors for mortality included first birth and household poverty, while birth and

newborn care preparedness was linked to lower risk of death. Some 87% of pre-term babies received a visit from a community health worker within three days, suggesting that opportunities exist to deliver care packages to lower the risk of mortality.

The study has also examined the care-seeking behaviours of mothers of pre-term babies. In general, mothers were reluctant to seek medical help, and when they did they more frequently turned to non-medically qualified providers (such as homeopathic practitioners). Less than a third sought help from qualified providers. Involving community-favoured providers in health education and including postnatal care education in antenatal counselling could help to enhance care seeking after pre-term birth.

*Shah R et al. Incidence and risk factors of preterm birth in a rural Bangladeshi cohort. BMC Pediatr. 2014;14:112.*

*Shah R et al. Neonatal mortality risks among preterm births in a rural Bangladeshi cohort. Paediatr Perinat Epidemiol. 2014;28(6):510–20.*

*Shah R et al. Determinants and pattern of care seeking for preterm newborns in a rural Bangladeshi cohort. BMC Health Serv Res. 2014;14:417.*

### MATERNAL IODINE

Research on mothers taking part in the MINIMat (Maternal and Infant Nutrition Interventions in Matlab) has found that maternal urinary iodine levels significantly affect prenatal development. Below 1.0 mg/L, increasing maternal urinary iodine levels were associated with higher birth weight and length, though only in boys. The findings suggest that treating iodine deficiency in pregnant women is likely to outweigh the risks of excess exposure.

*Rydbeck F et al. Maternal urinary iodine concentration up to 1.0 mg/L is positively associated with birthweight, length, and head circumference of male offspring. J Nutr. 2014;144(9):1438–44.*

# CENTRE FOR VACCINE SCIENCES



Senior Research Officers Md Rasheduzzaman Rashu, (left) and Md Abu Sayeed evaluate cellular immune responses in cholera and typhoid patients (Immunology laboratory, Centre for Vaccine Sciences)

*Our aim is to improve health locally and globally through research, development and implementation of vaccines and other methods of infectious disease control.*

Although Bangladesh has a well-established vaccination programme, there is potential for additional vaccines and immunoprophylactic agents to be studied and introduced. Moreover, a significant burden of infectious disease remains unaddressed, making new vaccine development an urgent priority.

For various reasons, vaccine responses in resource-poor, high-risk settings are typically lower than in industrialised countries. Understanding why is important for the development of the best approaches to boost vaccine responses and to inform decision-making on vaccine implementation.

As well as assessing efficacy and feasibility in large pragmatic trials, the icddr,b's Centre for Vaccine Sciences works closely with health authorities in Bangladesh to address practical implementation. The centre also works with private enterprises and public-private consortia to develop new vaccines.

Current priorities include vaccines to control diarrhoeal diseases, including major trials of oral cholera and rotavirus vaccines, and vaccines to prevent respiratory tract infections, the biggest global killer of children. The centre actively supports the WHO's BRaVe (Battle Against Respiratory Viruses) initiative and oral cholera vaccine stockpile initiative, as well as the Global Task Force on Cholera Control and Prevention. The centre is receiving major support from the Bill & Melinda Gates Foundation to develop surveillance systems for respiratory and other diseases across Bangladesh.



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## RESEARCH GROUPS

- Enteric Vaccines
- Systems Vaccinology
- Emerging Vaccines
- Vaccine Surveillance
- Respiratory Vaccines
- Economics of Vaccines

## RESEARCH HIGHLIGHTS

### ORAL CHOLERA VACCINE

Encouraging levels of protection have been achieved in a feasibility and effectiveness study of the oral cholera vaccine Shanchol delivered through Bangladesh's national immunisation infrastructure (see page 8).

### VACCINE PARTNERSHIP

icddr,b is working with Hilleman Laboratories and Incepta Pharmaceuticals Ltd to accelerate development of a new oral cholera vaccine (see page 9).

### JAPANESE ENCEPHALITIS

A locally produced Good Manufacturing Practices-compliant version of a Japanese encephalitis virus vaccine has been found to be as effective as the original vaccine (see page 11).



### VACCINE RESPONSES

Malnutrition, diarrhoea and shorter duration of breastfeeding have been found to be associated with reduced responses to oral vaccines in infants (see page 12).

### PROVIDE STUDY

The Performance of Rotavirus and Oral Polio Vaccines in Developing Countries (PROVIDE) Study was completed in 2014. Initial analysis of data from 700 children and their mothers living in urban slums suggests that rotavirus vaccine efficacy was 64% for severe rotavirus diarrhoea and 41% for all rotavirus, with zinc deficiency associated with a greater risk of rotavirus diarrhoea. Data on an injectable polio vaccine are being analysed. The study also collected data on concurrent infections, gut damage and other factors that could explain why oral vaccines are typically less effective in the developing world.

Kirkpatrick BD et al. The "Performance of Rotavirus and Oral Polio Vaccines in Developing Countries" (PROVIDE) Study. Description of Methods of an Interventional Study Designed to Explore Complex Biologic Problems. *Am J Trop Med Hyg.* 2015. pii: 14D0518.

### LIVE ATTENUATED INFLUENZA VACCINE

A phase III study has been completed of a live attenuated influenza vaccine (LAIV) that has been used for many years in Russia and is now manufactured in India. The vaccine may be a suitable alternative

to the existing FluMist LAIV, which is not recommended for children under 2 years of age. In the largest study yet of this vaccine in a low-income setting, nearly 2000 children were vaccinated in urban and rural sites, and data are currently being analysed to assess efficacy and safety.

### SHIGELLA VACCINE

In a phase I dose-escalation trial, initially in adults and subsequently in children, a live attenuated *Shigella sonnei* vaccine, WRSS1, was found to be safe at all dose levels. No serious adverse events occurred in either adults or children. *S. sonnei*, a major cause of dysentery, is a growing public health threat in Bangladesh.

### HEAT STABILITY OF SHANCHOL

Clinical studies in Dhaka have shown that storage of the oral cholera vaccine Shanchol at ambient temperatures of up to 42°C has no significant impact on its safety and or ability to stimulate immune responses. The findings suggest that refrigeration of Shanchol may not be necessary, which would make the vaccine significantly easier to distribute and administer.

### TPTEST FOR ENTERIC FEVER

As well as being adopted by doctors and researchers, the TPTest (typhoid/paratyphoid test) – an accurate and rapid test for typhoid and paratyphoid fever developed at icddr,b – has been utilised in a surveillance study for enteric diseases being undertaken by icddr,b and the Institute of Epidemiology and Disease Control Research (IEDCR). The test, which is highly sensitive and provides results within 24 hours, detects antibodies against specific *Salmonella* species. Discussions are being held with industrial partners with a view to producing a rapid dipstick commercial version of the test.



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# OUR PUBLICATIONS

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## COMMITMENT TO PUBLICATION

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Ensuring the visibility and impact of icddr,b's research depends upon its wide dissemination to scientific, clinical and policy communities. A key method of dissemination is publication in peer-reviewed journals, which makes icddr,b research accessible in the scientific literature and adds to the global public health debate so that icddr,b research can be built upon and implemented.

In 2014, icddr,b maintained its commitment to publishing its findings widely and in reputable journals known for their prestige, quality and reach. An in-depth analysis for the last decade (see next page) has shown that the volume and impact of icddr,b publications are steadily increasing. icddr,b actively publishes in areas of traditional strength – predominantly public health, microbiology and infectious disease – and publications demonstrate the international and collaborative nature of our research.

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## HIGH-PROFILE PUBLICATIONS IN 2014

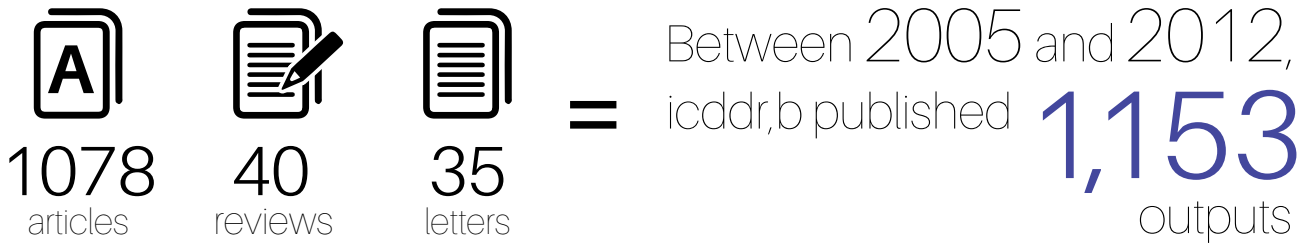
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In 2014, 267 icddr,b publications were indexed in the Web of Science, a database of the leading journals in all areas of science. icddr,b authors published across 124 general and specialist titles, including high-impact journals such as *The BMJ*, *The Lancet*, *Nature*, *PLOS Medicine*, *Proceedings of the National Academy of Sciences of the USA* and *Vaccine*. Some 82 articles were in fully open-access journals.

A full list of all publications can be found at: [www.icddrb.org/AR2014\\_Publications](http://www.icddrb.org/AR2014_Publications).

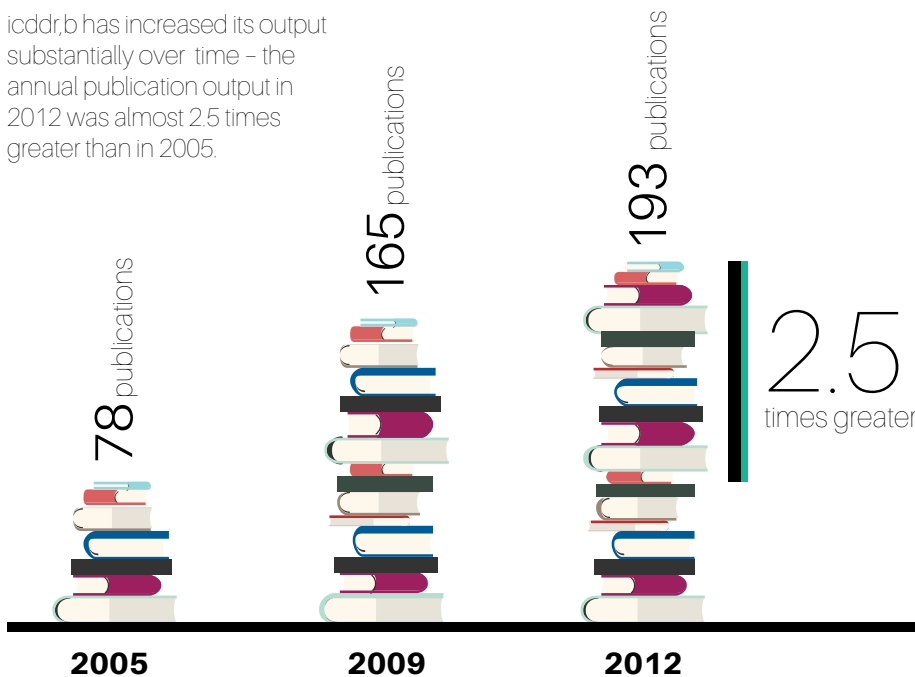
## icddr,b's increasing output and impact over time

An in-depth bibliometric analysis of icddr,b publications in the Web of Science database, conducted by Leiden University in The Netherlands, revealed increasing output and impact over time.



These outputs were weighted to give letters less importance in the bibliometric analysis.

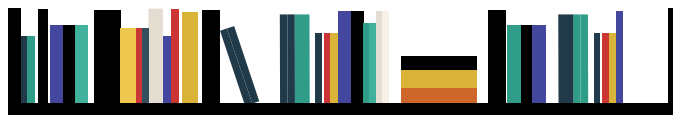
icddr,b has increased its output substantially over time - the annual publication output in 2012 was almost 2.5 times greater than in 2005.



Up to 2013, icddr,b publications received an average of 11 citations, a slightly above average impact compared to others in the database. In addition, 11% of icddr,b publications were among the 10% mostly cited publications.

Between 2005 and 2012, icddr,b mostly contributed publications in the areas of public and environmental health, microbiology, and infectious disease. icddr,b researchers were lead authors on 40-50% of papers.

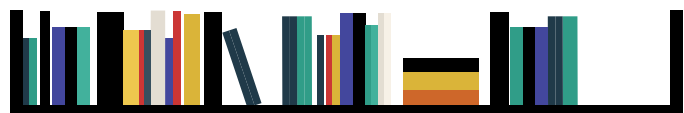
92%



of all icddr,b publications involved collaboration with national or international research partners

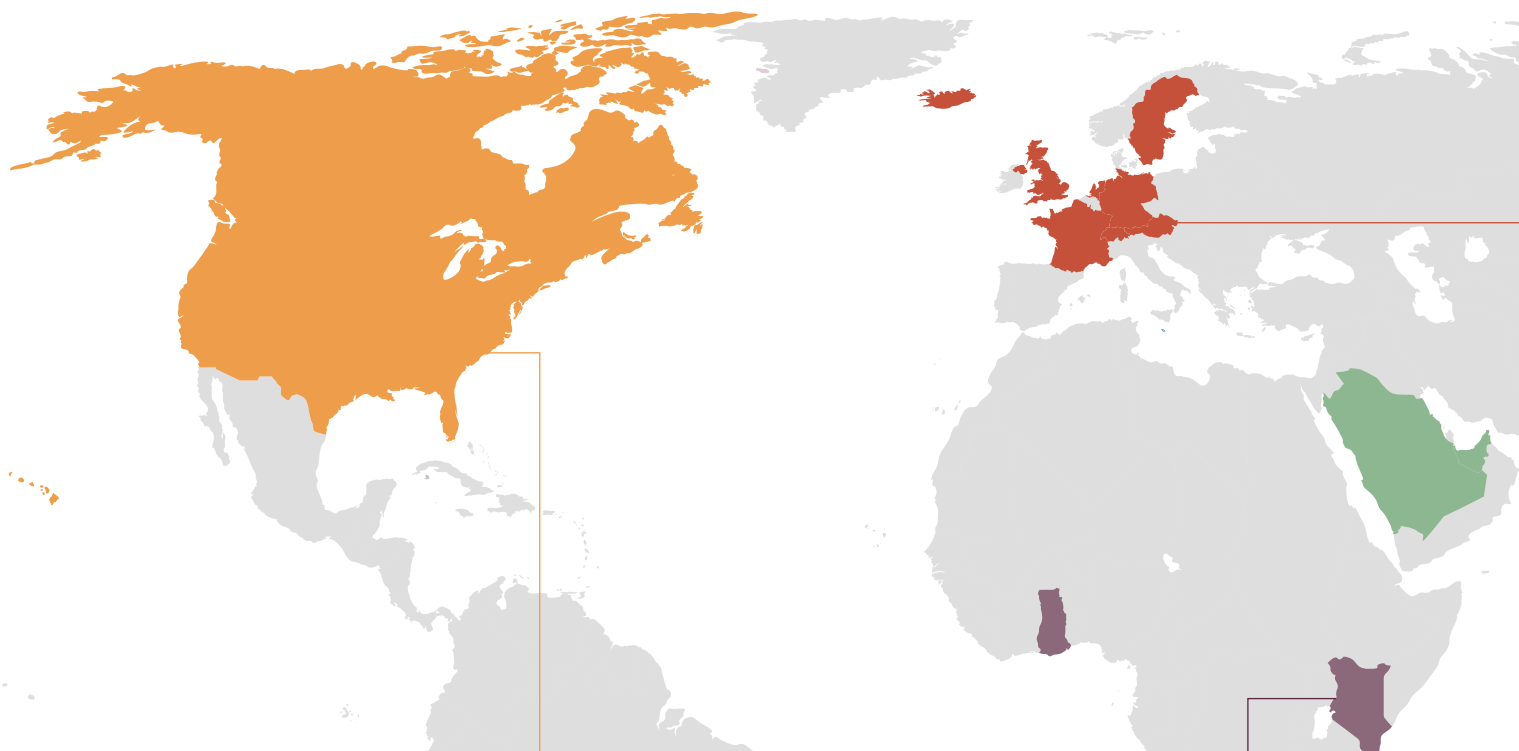
more than 85%

of our papers resulted from collaborative efforts with international partners



Collaboration has the highest citation impact for icddr,b, reflecting our commitment to partnerships to ensure our work is relevant globally.

# COLLABORATING INSTITUTIONS 2014



## NORTH AMERICA

- Academy of Educational Development
- Brigham and Women's Hospital, USA
- Centers for Disease Control and Prevention
- Christian Reformed World Relief Committee (CRWRC)
- Columbia University
- Dartmouth Medical College
- EcoHealth Alliance
- Emory University
- Gynuity Health Projects
- Harvard Medical School
- Harvard University
- Infectious Disease Research Institute
- Institute of Nutrition of Central America and Panama (INCAP)
- Johns Hopkins Bloomberg School of Public Health (JHBSPH)
- Johns Hopkins University School of Medicine
- Massachusetts General Hospital (MGH)
- McGill University
- National Institutes of Health (NIH)
- Naval Undersea Warfare Center
- Oklahoma State University
- Pan American Health Organization (PAHO)
- PATH
- Pennsylvania State University
- Pfizer
- Population Council
- PREVENT
- Public Health Agency of Canada
- Rhode Island Hospital (A Lifespan Partner)
- Rollins School of Public Health
- Save the Children
- Seattle Biomedical Research Institute (SBRI)
- Smart World APPs
- Stanford University
- The Consortium for Conservation Medicine
- The Fenway Institute
- The Hospital for Sick Children
- The Peter Gilgan Centre for Research and Learning
- University of Buffalo
- University of Alberta
- University of British Columbia
- University of California
- University of Colorado
- University of Denver
- University of Florida
- University of Texas at Galveston
- University of Manitoba
- University of Maryland
- University of Michigan
- University of Missouri
- University of Montreal
- University of North Carolina School of Medicine
- University of Pittsburgh

## AFRICA

- Ardhi University
- MO Resource Limited
- School of Public Health, Moi University
- Sokoine University of Agriculture
- University of Cape Town
- University of Venda

## EUROPE

- Ecole Polytechnique Fédérale de Lausanne (EPFL)
- Enfants du Monde
- Erasmus MC University Medical Ctr Rotterdam
- Imperial College London
- Institute of Child Health
- International Atomic Energy Agency (IAEA)
- Karolinska Institute
- Karolinska University Hospital
- Leiden University Medical Center (LUMC)
- London School of Hygiene and Tropical Medicine (LSHTM), United Kingdom

## ASIA

- Aga Khan University
- Aichi Medical University
- Ashar Alo Society
- Bandhu Social Welfare Society
- Bangladesh Institute of Child Health (Dhaka Shishu Hospital)
- Bangladesh Institute of Research and Rehabilitation in Diabetes
- Bangladesh Legal Aid and Services Trust (BLAST)
- Bangladesh Lung Foundation
- Bangladesh University of Engineering Technology (BUET)
- Bangladesh University of Health Sciences (BUHS)
- BP Koirala Institute of Health Sciences

- BRAC Development Institute
- BRAC University
- BRAC
- CARE-Bangladesh
- Centre for Injury Prevention and Research, Bangladesh (CIPRB)
- Chengdu Institute of Biological Products
- Chittagong Maa O Shishu Medical College Hospital
- Chittagong Medical College and Hospital
- Chittagong USTC Hospital
- Community Based Medical College Bangladesh
- Confidential Approach to AIDS Prevention (CAAP)
- Consumer Association of Bangladesh
- Damien Foundation Bangladesh
- Department of Livestock Services (DLS)
- Dhaka City Corporation
- Dhaka Medical College and Hospital (DMCH)
- Directorate General of Health Services (DGHS), Bangladesh
- Duke-NUS Graduate Medical School Singapore
- EngenderHealth
- Faridpur Medical College Hospital, Bangladesh
- Food and Agricultural Organization (FAO)
- Gazipur District Medical Hospital
- Global Alliance for Improved Nutrition (GAIN)
- Holy Family Red Crescent Medical College and Hospital
- Institute of Chest Diseases Hospital
- Institute of Child Health & Shishu Sasthya Foundation Hospital

- Institute of Epidemiology Disease Control and Research (IEDCR)
- Institute of Public Health Nutrition (IPHN)
- Institute of Water Modelling (IWM)
- Interactive Research and Development (IRD)
- International Food Policy Research Institute (IFPRI)
- International Vaccine Institute (IVI)
- James P Grant School of Public Health
- Kumudini Hospital
- Lepra Bangladesh
- Leprosy Control Institute and Hospital
- Light House
- Marie Stopes Clinic Society (MSCS)
- Mawlana Bhashani Science and Technology University
- MCH, DGFP, MoHFW
- Mukto Akash Bangladesh
- Nagasaki University Institute of Tropical Medicine
- National Centre for Tuberculosis and Research
- National Institute for Cholera and Enteric Diseases, (NICED)
- National Institute for Population Research and Training (NIPORT)
- National Institute of Diseases of Chest and Hospital (NIDCH)
- National Institute of Infectious Diseases
- National Tuberculosis Control Programme (NTP)
- NICVD
- NIDCH
- NIPSOM
- Nutrition Foundation of Bangladesh
- Obstetrical and Gynecological Society of Bangladesh (OGSB)
- PATH, India
- Popular Medical College Hospital
- PRAN-RFL Group
- Radda MCH-FP Centre
- Rajabashor
- Rajendra Memorial Research Institute
- Sanjay Gandhi Postgraduate Institute of Medical Sciences
- Sanofi Pasteur
- Shaheed Suhrawardy Medical College (SSMC)
- SHIMANTIK
- Shyamoli TB Clinic
- Sightsavers, Bangladesh
- Sir Salimullah Medical College and Hospital
- Smiling Sun Franchise Program (SSFP)
- SUI Associates Co., Ltd.
- SurjaKanta Infectious Disease Hospital
- Terre de Homes
- The Salvation Army, Bangladesh
- Tokyo University Hospital, Japan
- United Nations Children's Fund (UNICEF)
- University of Dhaka
- University of Kelaniya
- University of Nagasaki
- University of Tsukuba
- University of Tokyo
- University of Tsukuba
- Urban Primary Health Care Project (UPHCP)
- Water Aid Bangladesh
- We Can Campaign
- World Food Programme
- World Health Organization
- Xiamen University School of Public Health

## AUSTRALIA

- Ludwig-Maximilians University of Munich
- Medical University of Vienna
- Nestle Research Center
- Nutriset S A S
- Sint Antonius Ziekenhuis
- Stockholm University
- The Children Investment Fund Foundation
- University Hospital
- University of Amsterdam
- University of Basel
- University of Cambridge
- University of Copenhagen
- University of Exeter
- University of Gothenburg

- Charles Sturt University
- Griffith University
- Menzies School of Health Research
- The Macfarlane Burnet Institute for Medical Research and Public Health
- The Royal Children's Hospital
- The University of Melbourne
- University of Queensland
- University of Sydney



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# AWARDS AND OTHER RECOGNITION

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## **WELLCOME TRUST INVESTIGATOR AWARD**

Dr Shah M Faruque has become the first Bangladeshi scientist to receive a prestigious Wellcome Trust Senior Investigator Award, worth around US\$2.7m over five years. The award will enable Dr Faruque, a world-leading expert on the genetics of *Vibrio cholerae*, to further his studies on *V. cholerae* and control of cholera.



## **ASIA PACIFIC OBSERVATORY FELLOWSHIP**

Dr Aliya Naheed has been awarded one of the first fellowships of the Asia Pacific Observatory (APO) for health systems and policies, following a joint application from icddr,b and the Nossal Institute for Global Health, University of Melbourne, Australia. The awards are designed to strengthen the capacity of fellows to link research with decision-makers, promoting evidence-based national health care policies. Hosted by the WHO Regional Office for the Western Pacific, the APO is a partnership of governments, development organisations and the research community aiming to inform and strengthen national health policy development in the Asia-Pacific region.



### **BANGLADESH ACADEMY OF SCIENCES GOLD MEDAL**

Dr Md Sirajul Islam has been awarded the Bangladesh Academy of Sciences Gold Medal in recognition of his scientific contributions over a 35-year period. Dr Islam is an environmental microbiologist particularly known for his work on environmental reservoirs of *Vibrio cholerae*. He received the medal from the Honourable Prime Minister of Bangladesh Sheikh Hasina in a ceremony at the Bangladesh Academy of Sciences.



### **UNITED NATIONS APPOINTMENT**

Dr Firdausi Qadri has been appointed to the United Nation’s High-level Panel on Technology Bank for the Least Developed Countries by the UN Secretary-General. The Panel will advise on the organisational and operational aspects of a proposed Technology Bank and Science, Technology and Innovation Supporting Mechanism dedicated to developing countries. The Panel will produce practical recommendations, to accelerate structural transformation and promote sustainable development in the developing world.



### **BRUCE SQUIRES AWARD**

An icddr,b team led by Dr K Zaman and international collaborators has won the 2014 Bruce Squires Award for an article demonstrating the benefits of influenza immunisation on mothers, fetuses and infants. Made annually by the Canadian Medical Association Journal, the award recognises work of particular importance to evidence-based medical practice.

Steinhoff MC *et al.* Neonatal outcomes after influenza immunization during pregnancy: a randomized controlled trial. *CMAJ*. 2012;184(6):645–53

### **CHARLES C. SHEPARD SCIENCE AWARD**

A paper on the impact of Hib vaccination in Bangladesh, published by an international team including icddr,b researchers, received the prestigious Charles C. Shepard Science Award in 2014. The award is presented each year by the US Centers for Disease Control and Prevention (CDC) to recognise work of particular scientific excellence and originality.

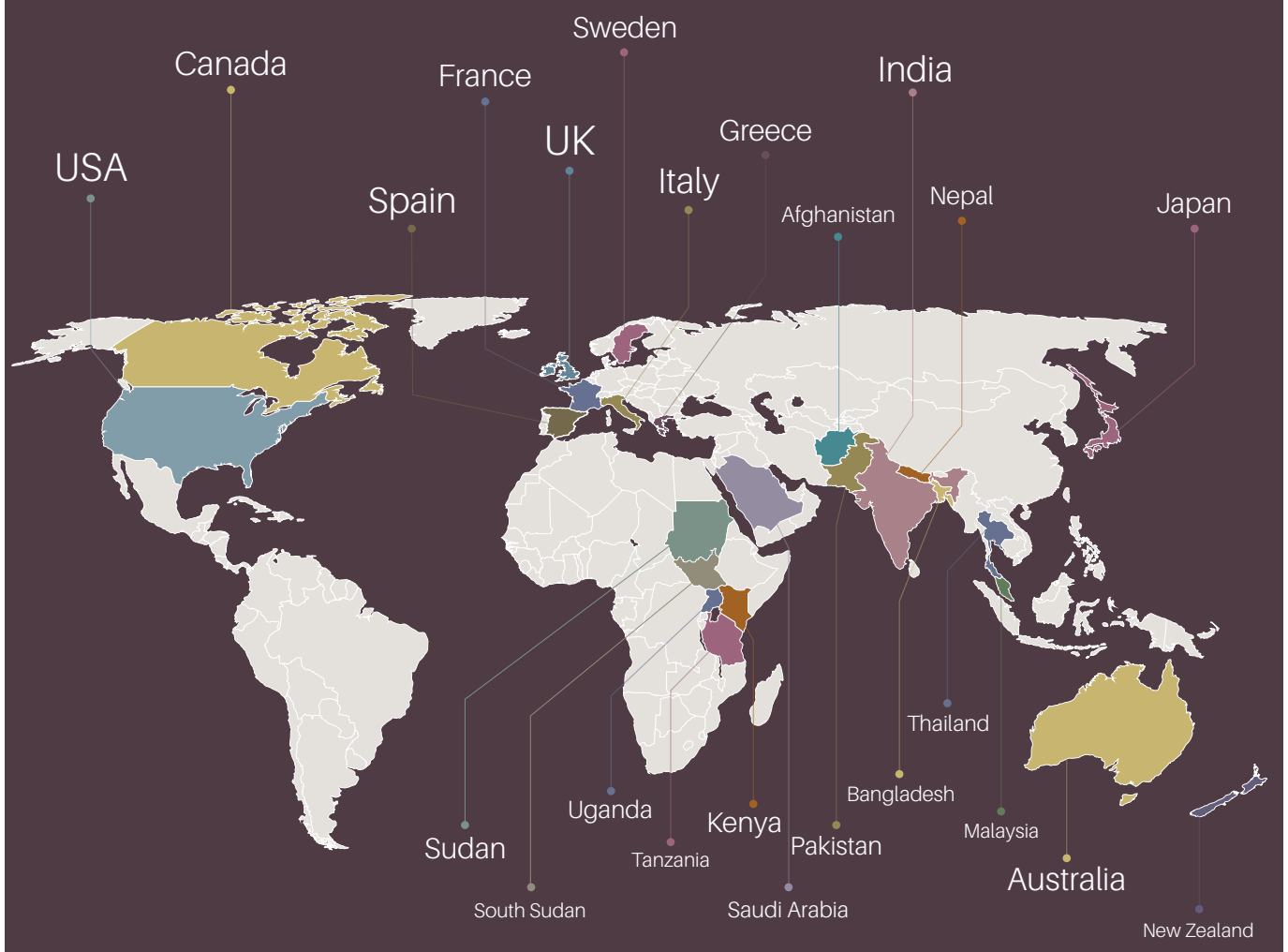
Sultana NK *et al.* Impact of introduction of the *Haemophilus influenzae* type b conjugate vaccine into childhood immunization on meningitis in Bangladeshi infants. *J Pediatr*. 2013;163(1 Suppl):S73–8.

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# OUR TRAINING

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In 2014, icddr,b maintained academic/training collaboration with 31 institutions in 24 countries, including new partnerships with Ethics Advanced Training Limited, and WHO-TDR.



*icddr,b has a long history of offering researchers and healthcare professionals exposure to the public health challenges affecting people living in poverty, and the low-cost interventions that icddr,b has developed to meet them.*

icddr,b scientists, clinicians and research facilities, including field sites, offer a rich wealth of learning resources for the next generation of researchers, clinicians and practitioners. Participants in training programmes are provided the opportunity to learn from leading experts, gain valuable field experience and see first-hand how low-cost interventions are developed and implemented in a resource poor setting.

In addition to specialist training provided by icddr,b's Technical Training Unit, icddr,b's research centres also provide needs-based training and technical assistance in Bangladesh, the region and globally.

**Building health workforce capacity in Bangladesh.** As part of a three-year project to train 1800 Rural Medical Practitioners (RMPs), funded by Advanced Chemical Industries Limited, 539 RMPs were trained in 10 months, against a target of 400. This project is helping to address the crisis of human resources for health in Bangladesh

**Capacity building through USAID-URC supported TRAction Project.**

A draft E-learning/distance learning strategy for implementation science/ implementation research (IS/IR) has been developed. As well as key icddr,b staff, 145 public sector participants (policy-makers, health managers, health care providers, researchers) have been trained in IS/IR in collaboration with the Directorate General of Health Services (DGHS) and the National Institute of Preventive and Social Medicine (NIPSOM); this collaboration has added value to the TRAction project, through cost-sharing and engagement of stakeholders to build capacity in the public sector health workforce. In collaboration with the WHO-TDR programme, IS/IR 'master trainers' have been developed at icddr,b

**Training the next generation of international enteric disease scientists.** Led by icddr,b's Centre for Vaccine Sciences, the training attracted participants from India, Italy, Sweden, France, Norway, Thailand, Bolivia and Bangladesh and was funded by icddr,b and a European Union-funded project called STOPENTERICS. The participants received training in the epidemiological and clinical aspects of enteric infections and their prevention and control.

<http://www.icddr.org/media-centre/news?id=652&task=view>

**Training on childhood malnutrition and diarrhoeal diseases for post-graduate medical students.**

icddr,b's Centre for Nutrition and Food Security has entered into a partnership with Bangabandhu Sheikh Mujib Medical University, one of the top post-graduate medical institutions in Bangladesh, to offer specialized training on management of severe malnutrition and diarrhoeal diseases. Acute malnutrition and diarrhoeal diseases are two of the greatest health challenges for children in Bangladesh and other developing countries. This training for post-graduate medical students is aimed at building capacity among young health professionals in Bangladesh to tackle these challenges.

<http://www.icddr.org/media-centre/news?id=645&task=view>

**Specialised Technical Training Unit:** Courses aimed at building capacity in the health workforce

48 training events

1,131 participants

**James P Grant School of Public Health, BRAC University**

11 senior icddr,b scientists are on the faculty and remained highly engaged in teaching activities.

**Field Experience Programme:** Aimed at Masters and PhD students seeking practical insights into, and experience of, public health in a low-resource setting

110 national participants

74 international participants

**Orientation Programme:** Tailored to meet specific curricular needs, primarily for medics interested in research and humanitarian activities

18 institutions represented

1,354 students trained:

34% male 66% female

1,190 Bangladeshi 164 international



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# OUR SERVICES

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*In support of its research mission, icddr,b provides high-quality clinical services in Dhaka and Matlab. In addition, icddr,b scientists, doctors and nurses share their technical expertise to help manage cholera outbreaks during humanitarian emergencies around the world.*

An essential part of icddr,b's work includes providing a range of health services in three locations in Bangladesh - Dhaka Hospital, Mirpur Treatment Centre and Matlab Hospital. In 2014, icddr,b cared for 218,087 patients; 67% of patients were treated at Dhaka Hospital, and the number of patients treated at each location increased from 2013. The number of patients at the Mirpur Treatment Centre, in particular, increased by more than 20%, compared to 2013.

icddr,b health facilities continue to offer life-saving services, such as diagnostics, and treatment for diarrhoeal and respiratory diseases and other clinical services, free of charge. In collaboration with the Government of Bangladesh, it supports the distribution of contraception at the community level and as part of the government's Extended Programme for Immunization it offers vaccination services. These interventions directly benefit Bangladesh's most vulnerable citizens, while the facilities also provide a platform for disease surveillance, clinical training, and extensive research and clinical trials.

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## EMERGENCY RESPONSE

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icddr,b is a founding member of the World Health Organization's Global Outbreak and Response Network (GORAN) and continues to offer its assistance and expertise to deal with cholera outbreaks during humanitarian crises. In 2014, icddr,b responded to requests from the WHO to provide technical expertise in the risk assessment and management of cholera outbreaks in Northern Iraq and South Sudan.

Both countries are providing shelter to thousands of people displaced by armed conflict.

icddr,b experts conducted surveillance and analysis to provide rapid risk assessment of cholera and other diarrhoeal diseases. They worked with local government officials to develop cholera response plans and provided training to government and private

health workers on outbreak control and prevention, surveillance methods, case management, social mobilization and management of water and sanitation systems. icddr,b experts also helped to set up cholera treatment centres and strengthened the local capacity for laboratory diagnosis to detect and distinguish specific diarrhoeal diseases.



218,087  
**patients treated**

.....

No. of children <5 yrs  
**122,444 (56%)**

.....

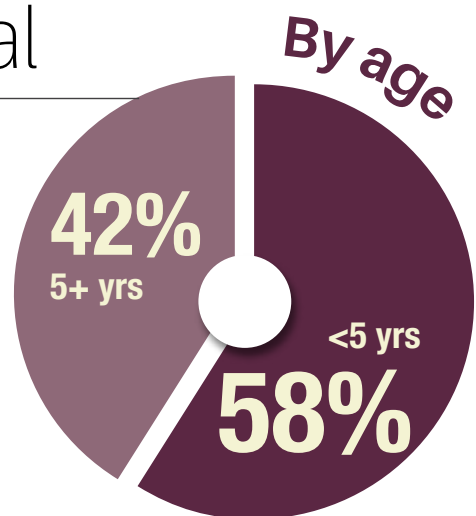
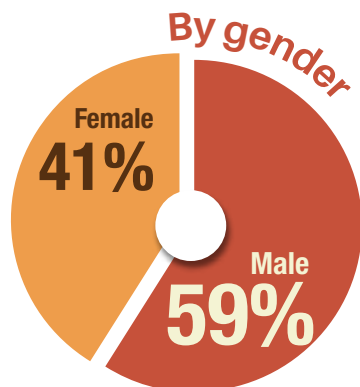


**67%**

of icddr,b's patients were treated at its Dhaka Hospital

## Dhaka Hospital

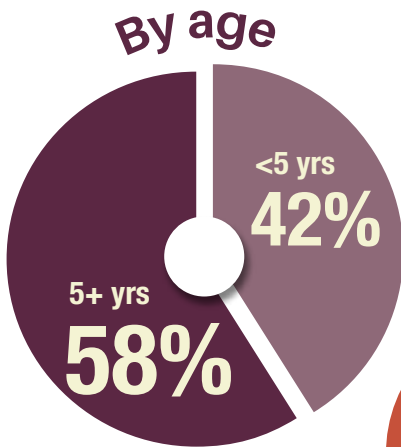
Patient total **146,699**





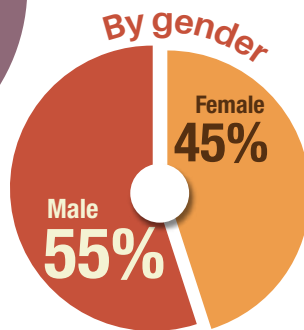
At the Mirpur Treatment Centre, number of patients treated increased by more than

**20%** compared to 2013



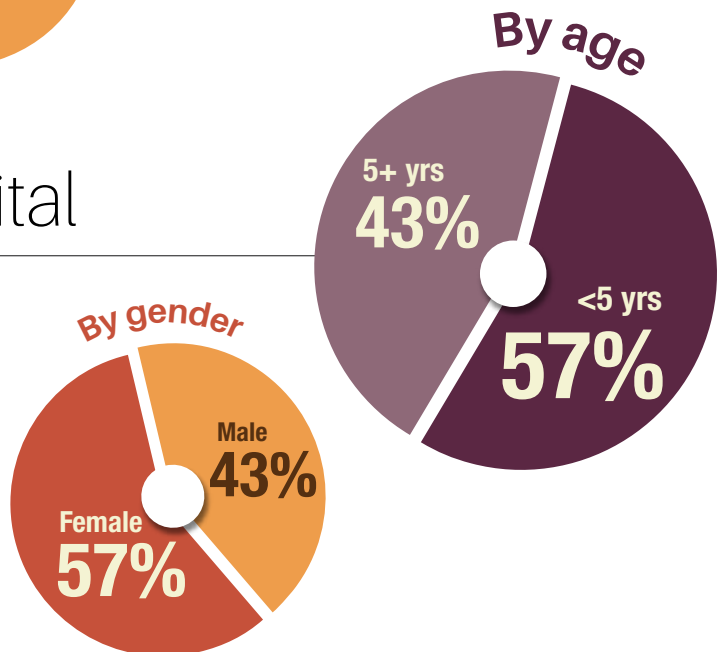
## Mirpur Treatment Centre

Patient total **25,054**



## Matlab Hospital

Patient total **46,334**



icddr,b would like to thank the individuals and companies who supported the Dhaka Hospital in 2014.



If you would like to support our life-saving work, please visit: [www.icddrb.org/donate](http://www.icddrb.org/donate)



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# OUR CORPORATE SERVICES

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*2014 saw a number of considerable achievements by icddr,b's corporate services, accomplished as a result of the dedication and efforts of our staff.*

As icddr,b began to review its strategic research priorities, we initiated a process to modernise our organisation and its operations to ensure that we meet internationally recognised standards of governance, compliance, transparency and efficiency in all areas.

We strengthened our operational structure by recruiting a Chief Operating Officer, and have begun to revise our operational services and leadership in order to support the highest standards of business and ethical behaviour, and to fulfil our responsibilities to our donors and extended audiences.

Benchmarking our financial, procurement, IT and human resources services against world-class peer organisations has been key to ensuring we meet international standards in all operational areas. To achieve long-term financial sustainability, we have focused on cutting costs, and have introduced a plan to recover the full costs of all projects. In addition, we have implemented a governance process to ensure organisational regulatory and legal compliance, and to ensure the delivery of operational excellence to all our stakeholders.



Ingrid Renaud  
Chief Operating Officer

Our aim is to create a workplace that ensures people are always treated with dignity and respect. We believe that different ways of thinking complement each other, and that diverse teams are more creative and inclusive, better reflecting the communities we serve. We aim to recruit and nurture the best qualified people to ensure the sustainability of icddr,b into the future, and continue to embed a culture that affirms equal opportunities for all staff, regardless of gender, race, religion, marital or family status, sexual orientation or disability.

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# OUR PEOPLE

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## SENIOR LEADERSHIP TEAM

As of 31 December 2014

**Executive Director, Professor John D Clemens** is an international expert in vaccine development and evaluation in developing countries. He led the development of the world's only WHO-recommended, low cost oral cholera vaccine, which is now being used in a global stockpile. He has authored over 350 original scientific papers and also is a Professor of Epidemiology at UCLA. A graduate of Stanford (B.S.) and Yale (M.D.) Universities, he was awarded the 2010 Sabin Gold Medal for excellence in vaccine sciences.

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**Deputy Executive Director and Director of the Centre for Equity and Health Systems, Dr Abbas Bhuiya** has more than 30 years' experience in the field of community health research with special focus on health services for the poor/vulnerable and equity issues, behaviour change, and facilitation of community initiatives for the improvement of health, especially of the poor. He has academic training in Statistics and Demography from Chittagong University, Bangladesh, and from the Australian National University, Canberra, Australia.

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**Chief Operating Officer, Ingrid Renaud** has extensive global experience managing the operations of non-profit organisations. She is especially skilled in developing, leading and supervising cross-functional areas including finance, human resources, information technology, and administration. Ingrid received a Master of Science degree in Applied Behavioural Science and Organizational Development from Johns Hopkins University, and a Bachelor of Arts degree in Fine Arts with a minor in Psychology from Southampton College. Before joining icddr,b she was COO at Global Rights, an international human rights organisation.

**Director of the Centre for Nutrition and Food Security, Dr Tahmeed Ahmed** has extensive experience of treatment and public health measures to address undernutrition, childhood tuberculosis and diarrheal diseases. He is also a Professor of Public Health Nutrition at the James P Grant School of Public Health, BRAC University, Bangladesh, and an Honorary Professor at the University of Queensland, Australia. He is currently serving as Chair of the sub-committee formed by the Government of Bangladesh to formulate the National Nutrition Policy.

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**Acting Director, Centre for Control of Chronic Diseases Dr Dewan S Alam** has a medical degree from the University of Dhaka, master's degrees in nutrition and epidemiology from the University of Queensland, and a PhD degree from Wageningen University, The Netherlands. He holds an adjunct professor position at North South University, Dhaka. His major research interests include developing and testing preventive interventions and management of non-communicable diseases at primary care level in resource-poor settings.

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**Director of the Centre for Child and Adolescent Health, Dr Shams El Arifeen** has nearly 25 years' experience in child and neonatal health, health services and health systems research. He specialises in community-based randomised trials, with a focus on health interventions for developing world populations. He is also an Adjunct Professor at the James P Grant School of Public Health at the BRAC University in Bangladesh, where he teaches epidemiology.

**Director of the Centre for HIV and AIDS, Dr Tasnim Azim** qualified in medicine at the University of Dhaka, Bangladesh, and undertook a PhD in immunology and virology at the University of London, UK. She is a member of numerous national and international committees, including the Reference Group to the United Nations on HIV and injecting drug use and the regional advisory group on the regional project on cross-border mobility (EMPHASIS) under CARE, UK.

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**Director, Human Resources, Christine Dennehy** has over 30 years of human resources and change management experience in both the commercial and non-profit sector. She was previously Director of Human Resources with MSD, the Irish subsidiary of Merck and Co. She has a track record in operational leadership and strategy development and realization, and has implemented six sigma and other change management methodologies. She gained her MSc in Human Resource Strategic Leadership from Sheffield Hallam University, UK. She was the first HR recipient of the Merck Fellowship Award for Global Health, an innovative corporate social responsibility initiative that aligns Merck expertise with the non-profit sector globally.

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**Director of the Centre for Food and Water-Borne Diseases, Dr Shah M Faruque** has a master's degree from the University of Dhaka, Bangladesh, and a PhD from the University of Reading, UK. After holding positions at the University of Dhaka, he joined icddr,b in 1989. From 1996 to 2007 he was also Senior Associate in the Department of International Health at Johns Hopkins University, USA. A world expert on *Vibrio cholerae* and other enteropathogens, he was awarded the World Academy of Sciences Prize in Medical Sciences in 2005, and elected a fellow of the World Academy of Sciences in 2007.

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**Acting Director of the Centre for Communicable Diseases, Dr Emily S Gurley**

is an infectious disease epidemiologist who has been involved in research on emerging infectious diseases in Bangladesh since 2003. She studied for a Master's in Public Health at Emory University, Atlanta, USA, and undertook a PhD in Epidemiology at Johns Hopkins University, Baltimore, USA. She is also an Adjunct Assistant Professor at Johns Hopkins Bloomberg School of Public Health.

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**Director of Communications and Development, Graham Judd**

is a communication specialist with extensive knowledge of the development sector. He brings to his position experience gained from a career in broadcast media, having spent 25 years working for the BBC in the UK, and for public television in the USA. Graham holds a Bachelor of Science degree from the University of Sheffield, UK. He joined icddr,b in 2010.

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**Director of Finance, Dr Simba Mandizvidza**

CA, CPA, MBA, DPA has over 25 years of demonstrated strategy, financial and operational management in public accounting firms, governmental, nonprofit and commercial organisations. Since joining icddr,b in 2011, Dr Mandizvidza has made significant impact in the areas of cash flow, budgeting, cost management and management information. He has also enhanced icddr,b's ability to address growing policy and compliance requirements. As Senior Auditor of a national accounting and management consulting firm in the USA, Dr. Mandizvidza gained significant experience in US GAAP, regulatory and compliance requirements. His diverse experience includes full-scope financial statements, performance and compliance audits with clients across many industries including nonprofit organizations, federal, state & local and quasi-government corporations.

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**Acting Director, Population, Urbanisation and Climate Change, Dr Quamrun Nahar**

is the Acting Director of the Centre for Population, Urbanisation and Climate Change at icddr,b. She has worked extensively in the field of adolescent health, maternal health, and health systems research, especially in improving reproductive health services for adolescents and young people in Bangladesh. Dr Nahar has more than 20

years of working experience in icddr,b. Dr Nahar is also an associate professor at the James P. Grant School of Public Health, BRAC University, Dhaka. She obtained her medical degree from the University of Dhaka and Postgraduate Diploma in Primary Health Care and Master in Medical Science degree from the University of Western Australia. Dr Nahar also holds a PhD in Sociology from the University of Hawaii, USA.

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**Director of the Centre for Vaccine Sciences, Dr Firdausi Qadri**

has worked in the field of infectious disease and vaccines for more than 25 years. She obtained her PhD in biochemistry from the University of Liverpool, UK, and worked as an Assistant Professor at the University of Dhaka before joining icddr,b in 1986. The accolades she has received include the 2006 Gold Medal for Outstanding Research in Biological Sciences by the Bangladesh Academy of Science, and the Christophe and Rodolphe Mérieux Foundation Grand Prize in 2012 and the C.N.R Rao prize from TWAS in 2013. She is Adjunct Professor at the BRAC University and actively involved with the Dhaka University in mentoring MS and PhD students.

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**Acting Director of the Centre for Reproductive Health, Dr Md Anisur Rahman**

qualified in medicine at Chittagong University, Bangladesh, and obtained his PhD from Uppsala University, Sweden. He is also Head of the Matlab Health Research Centre. His main areas of research are arsenic exposure and reproductive health, pre-term and stillbirth issues, quality of care during pregnancy, delivery and post-partum periods, and also implementation research related to improving perinatal health.

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**Director, Supply Chain Management and Facilities Management, Samuel L Rose**

was the vice president of Integrated Supply Chain for Raytheon Integrated Defense Systems reporting directly to the President based out of the Boston, Massachusetts area. Sam has also held executive operational, commercial, finance, procurement and supply chain positions with other large multinational companies such as British Telecom (UK), Huawei (China) and General Electric (USA) in their respective corporate headquarters. He holds a Masters in Business Administration from University of West Florida and earned

a BSc in Electrical Engineering from the United States Air Force Academy through a Presidential appointment. Sam is a certified procurement professional holding CPM and MCIPS qualifications from ISM (USA) and CIPS (UK), respectively.

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**Director, Research Clinical Administration and Strategy, Dr Md Abdus Salam**

is responsible for overseeing research support functions, such as exploring research funding and assisting researchers in writing grant applications, grants agreements, grants management, institutional review board, and dissemination of research findings. Dr Salam formerly served as Director, Clinical Sciences Division (CSD), icddr,b. Dr Salam is a graduate of Dhaka Medical College, University of Dhaka, Bangladesh. He received training in paediatric medicine and surgery and served Dhaka Hospital of ICDDR,B. He then served at the Sebha Army Hospital in Libya before rejoining icddr,b. Dr Salam has published over 100 original articles and review papers and is a regular reviewer of several peer-reviewed international journals. He has chaired several committees, is a life-member of the Bangladesh Medical Association and the advisory board for ONE World Health.

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**OBSERVER****Head, Information Technology, Tanvir Azad Chowdhury**

received his Masters in Computational Engineering from Ruhr University Bochum, Germany. Tanvir's experience includes directing the design and delivery of advanced technology solutions with strong innovation, transformation and turnaround leadership. At icddr,b, Tanvir is accountable for applications and infrastructure supporting all icddr,b functions, including enterprise systems, networks, servers and data centres.

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# BOARD OF TRUSTEES

## CHAIRPERSON

### Dr Richard S W Smith

Director, UnitedHealth Chronic Disease Initiative

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## MEMBER SECRETARY (EX-OFFICIO)

### Professor John D Clemens

Executive Director, icddr,b

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## REPRESENTING GOVERNMENT OF BANGLADESH

### Mr Mohammad Mejbahuddin

Senior Secretary, Economic Relations Division, Ministry of Finance.

### Mr Syed Monjurul Islam

Secretary, Ministry of Health and Family Welfare (Since November 2014)

### Professor (Dr) Md Suhrab Ali

Professor of Biochemistry, Northern International Medical College, Bangladesh

### Mr M M Neazuddin

Secretary, Ministry of Health and Family Welfare, Bangladesh (until November 2014)

## REPRESENTING UNICEF

### Mr Sanjay Wijesekera

Associate Director of Programmes and Chief of Water, Sanitation and Hygiene, New York, USA

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## REPRESENTING WHO

### Dr Prakin Suchaxaya

Coordinator Gender, Equity and Human Rights, World Health Organization-SEARO (Since May 2014)

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## INDEPENDENT MEMBERS

### Professor Zulfiqar Ahmed Bhutta

Husein Laljee Dewraj Professor and Chairman of the Department of Paediatrics and Child Health at the Aga Khan University Medical Center, Karachi, Pakistan

### Dr Norma Binsztein

Microbiologist, Instituto Nacional de Enfermedades Infecciosas, National Ministry of Health, Buenos Aires, Argentina

### Dr Somsak Chunharas (until June 2014)

Senior Public Health Advisor and Secretary General of the National Health Foundation, Bangkok, Thailand

### Mr Kenneth M Dye

International Development Consultant on governance and accountability. Former Auditor General of Canada

### Professor Nirmal K Ganguly

Distinguished Biotechnology Professor and Advisor, Translational Health Science and Technology Institute, New Delhi, India

### Professor Ann Marie Svennerholm

Professor of Infection and Immunity at the University of Gothenburg, Sweden

### Dr Jeannette Vega

Director of Fondo Nacional de Salud, Chile

### Dr Mary Elizabeth Wilson

Associate Professor of Global Health and Population, Harvard School of Public Health, USA Associate Clinical Professor of Medicine, Harvard Medical School, USA

### Professor Zhongwei Zhao

Professor, Australian Demographic and Social Research Institute, the Australian National University, Australia

### Dr Maxine Whittaker

Professor of International and Tropical Health and Director of the Australian Centre for International and Tropical Health at the University of Queensland, Australia

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## OBSERVERS

### Dr Abbas Bhuiya

Deputy Executive Director, icddr,b

### Mr Rajesh Agrawal

Assistant Director General of Finance (Chief Finance Officer) at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India



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# OUR FINANCES

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## OVERVIEW

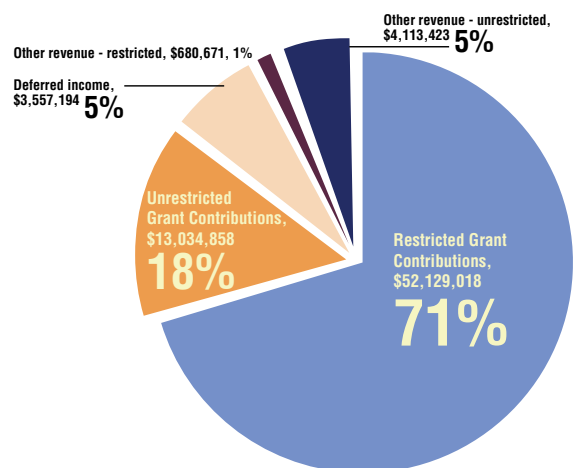
icddr,b finished 2014 with a surplus of just over US\$4.05 million representing an improvement on last year of \$666K and well above the forecast surplus of US\$458K. This was made possible by improved grant contributions, expenditure control and closer monitoring of salary allocation to projects.

We received an unqualified (healthy) audit opinion from KPMG in respect of its financial statements for 2014.

## REVENUE

Revenue for 2014 amounted to US\$73.5 million which was an increase of US\$6.2m or 9% compared to 2013. This was made of US\$52.1 million for restricted funds, US\$13 million for unrestricted, deferred income of US\$3.5 million, other revenue restricted-\$4.1 million and other revenue unrestricted of \$680K. Research Grants have improved by US\$1.68 million or by 3% compared to 2013. Unrestricted funding is expected to decrease in 2015 and measures have been taken to address this through cost recovery processes and cost savings plans.

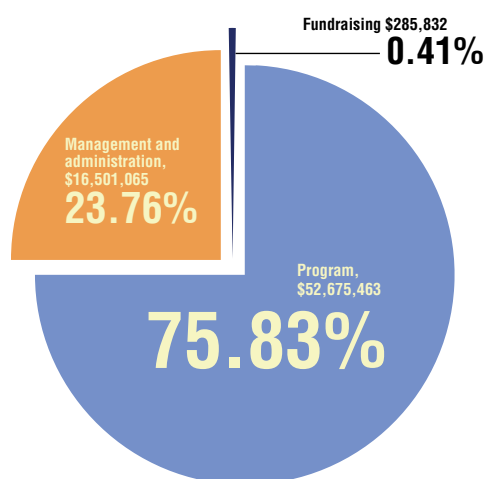
### REVENUE FOR 2014



# EXPENDITURE

Total expenditure for 2014 amounted to US\$69.4 million, which was an increase of US\$5.6 million or 9% compared with 2013. Programme expenditure accounted for US\$ 52,765,463 or 75.8%, fundraising was US\$285K or 0.4% and management and administration was \$16.5million or 23.7%. Programme expenditure has improved from 72% to 76% of total expenditure. Despite the increase in funding, overall staffing levels have reduced by 116.

## 2014 EXPENDITURE SUMMARY



## THESE OVERALL EXPENSES ARE BROKEN DOWN BELOW AS FOLLOWS:

Salaries & benefits	\$35,594,100
Supplies and materials	\$9,639,402
Depreciation and amortisation	\$6,061,615
Collaborative partnership cost	\$5,998,541
Travel and vehicle hire charges	\$3,670,795
Consultancy fees	\$2,374,453
Rent, communication and utilities	\$1,804,375
Training, dissemination and staff development	\$1,325,653
Cleaning & security expenses	\$709,372
Repair and maintenance	\$636,587
Other operational costs	\$619,235
Printing and publications	\$582,531
Hospital patient expenses	\$445,701

## OTHER 2014 KEY FINANCIAL STATISTICS

### NET ASSETS

	Amount (in US\$ '000s)	
	2014	2013
Current and Other Assets	85,448	78,042
Capital Assets	59,526	72,079
Current and Other Liabilities (including ESPF)	(63,152)	(60,228)
<b>Net Assets</b>	<b>81,823</b>	<b>89,893</b>
<b>Net Assets (ignoring transfer of CWIP)</b>	<b>91,559</b>	<b>90,050</b>
Restricted	56,667	69,443
Unrestricted	25,156	20,450
<b>Total Net Assets</b>	<b>81,823</b>	<b>89,893</b>

- icddr,b's balance sheet continued to be strong with US\$81.8 million in Net Assets, although the decrease we saw this year was due to a transfer of Capital Work in Progress relating to restricted assets as these costs were previously charged as expenses in prior year accounts.
- Unrestricted net assets represent the part of net assets that is used to finance day to-day operations without constraints established by donors or other requirements. These assets have increased by \$4.7 million, mainly due to an end-of-year surplus of US\$4.05 million and the increase in the Hospital Endowment Fund (\$337K) and Centre Endowment Fund Endowments (\$248K).

- Closing cash and cash equivalents amounted to US\$32,387,626 at the end of the year, representing an improvement of US\$6,102,659 compared to 2013.
- Current and other assets increased by US\$7.4 million, mainly due to an increase in investments, loans and advances and particularly cash and cash equivalents.
- The workforce decreased from 4,554 in 2013 to 4,438 in 2014, a reduction of 116 staff. Most of the contract employees were hired for specific projects. As of December 31, 2014, the total number of scientific staff was 218.
- Indirect costs (i.e., representing the expenses that are not readily identified with a particular grant, contract, project function or activity, but are necessary for the general operations of the organisation) have reduced from 37% to 34% but this rate is expected to be much lower in 2015.
- Forecast expenditure in 2015 will be less than 2014 as a result of reduction in unrestricted funding and that cost recovery mechanisms will be operationalised including other measures to ensure the sustainability of icddr,b.

For our audited financial statements, please go to:  
[www.icddrb.org/2014\\_financial\\_statements](http://www.icddrb.org/2014_financial_statements)

# RECOGNISING OUR SUPPORTERS

*icddr,b thanks the foundations, institutions, corporations, development agencies, NGOs, and multilateral bodies that support its work. A full list is included in the financial report at [www.icddr.org/2014\\_financial\\_statements](http://www.icddr.org/2014_financial_statements)*

## THE TOP 10 REVENUE SOURCES FOR RESTRICTED AND UNRESTRICTED GRANTS FOR 2014 WERE:

		Amount in US\$	
		Restricted	Unrestricted
1	Bill & Melinda Gates Foundation	9,697,180	
2	DFID, United Kingdom	2,576,467	4,089,875
3	National Institutes of Health (USA)	5,138,457	
4	Centers for Disease Control and Prevention (USA)	4,884,057	
5	Johns Hopkins University (USA)*	4,268,793	
6	Global Fund for AIDS, TB and Malaria	4,197,110	
7	University Research Co., LLC (USAID)	4,190,496	
8	DFATD, Canada		3,552,236
9	DFAT, Australia		3,116,340
10	Sida, Sweden	585,511	1,375,330
<b>Total</b>		<b>35,538,071</b>	<b>12,133,781</b>

\*JHU is the prime donor for icddr,b while receiving funding from other sources

We are especially grateful to our core donors, the governments of Australia, Bangladesh, Canada, Sweden and the United Kingdom who—in keeping with the Paris Declaration on Aid Effectiveness—provide long-term core funds to icddr,b to support the advancement of its Strategic Plan. Representatives from each of the development agencies meet regularly with icddr,b to monitor progress and discuss emerging research priorities and outputs of note. Every year, icddr,b reports performance against an agreed log-frame, and a joint donor report is commissioned to monitor progress. It is the application of icddr,b's research and its continued contribution to the global public health agenda that has attracted and retained investments by the world's leading development agencies.

## CORE DONOR FUNDING HAS

1. Enabled icddr,b to focus on and pursue its strategic research objectives rather than chase adhoc research funds
2. Increased the institution's financial stability, making it less vulnerable to changes in the external supply-led science research-funding environment
3. Enabled icddr,b to invest in maintaining and improving core infrastructure essential to scientific advances but for which project grants rarely provide, e.g. disease surveillance networks, laboratory upgrades, humanitarian services at icddr,b hospitals and clinics
4. Enabled icddr,b to develop and modernise its business processes—financial, HR, communications, and M&E—which are fundamental to the institution being able to operate to international standards.

Together these and future investments and advances ensure that icddr,b can continue to generate high-quality research knowledge, and attract funds in a highly-competitive global environment.



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