



ANNUAL REPORT 2018

Solving public health
problems through
innovative scientific
research



icddr,b

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icddr,b is an international health research institute based in Bangladesh. Policymakers and practitioners utilise our evidence and expertise to improve health outcomes and prevent premature death and disability worldwide. Established more than 50 years ago, we continue to provide life-saving services to the people of Bangladesh, and to nurture the next generation of global health leaders. Our work has substantial impact here in Bangladesh and globally.

VISION

A world in which more people survive and enjoy healthy lives

MISSION

To solve public health problems through innovative scientific research

VALUES

Excellence

We are single-minded in our pursuit of scientific rigour and operational efficiency.

Integrity

We are a responsible and accountable organisation, committed to the highest standards of behaviour.

Inclusivity

We work collaboratively throughout the organisation and with our partners.

WE ARE GRATEFUL TO OUR CORE DONORS FOR THEIR LONG-TERM COMMITMENT TO OUR WORK:



Government of the People's
Republic of Bangladesh





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LETTER FROM THE **EXECUTIVE DIRECTOR**

BUILDING ON STRENGTH

*Our new Strategic Plan seeks
to build on our areas of strength
to achieve significant public
health impact.*



At the beginning of 2019, we published our latest Strategic Plan, covering the years 2019–2022. In it, we reflect on the significant progress we have made over the past three year period covered by our previous Strategic Plan, with the implementation of our focused research strategy and a major programme of organisational reform. We secured nearly USD 200m in competitive grants, complementing core support of USD 37.6m, and carried out research of considerable national and international impact (some of which is summarised on page 11). Importantly, we also updated our working practices to ensure we have a sound platform on which to build efficient and impactful programmes of research.

Our new Strategic Plan seeks to build on the foundation laid by the previous plan. We retain our key focus on the public health challenges faced by Bangladesh and other low- and middle-income countries (LMICs), as well as our commitment to high-quality research informed by the practical challenges of health care delivery in such settings. Alongside our existing scientific programmes, we have introduced a new gender-based research theme. We already have a strong track record of research in this area, and its inclusion in the Strategic Plan is designed to increase its visibility and emphasise its strategic importance to us.

Similarly, we have added a goal related to our clinical services and humanitarian responses. Again, these have long been core aspects of our work, greatly valued by the people with whom we work. Our diarrhoeal disease hospital in Dhaka is not only critical to our clinical research – it also provides much-needed and high-quality care, at no charge, to local people. Its services were in huge demand during 2018, with dedicated staff working round the clock to deliver care to those in need.

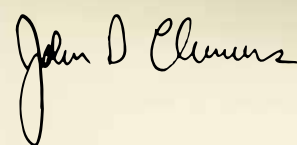
The million or so forcibly displaced Myanmar nationals have provided another major public health challenge to Bangladesh. In partnership with the Government of Bangladesh and international and national agencies, we have continued to carry out monitoring and disease

prevention studies, including a comprehensive cholera vaccination campaign that so far has successfully prevented a cholera outbreak despite significant risks of infection.

Other key aspects of our Strategic Plan include a continuing emphasis on driving research evidence into practice, including through our major Research for Decision Makers initiative. We will also maintain our focus on the development and evaluation of practical innovations, and seek to strengthen our South–South collaborations to expand uptake of these innovations in low-resource settings.

Our work on oral cholera vaccine (OCV) provided key evidence on efficacy and safety, underpinning its introduction globally as a key public health tool in both endemic and outbreak settings, accessible through a global stockpile. Increasingly, consideration is being given to the use of OCV in routine immunisation programmes, where again our research has the potential to be highly influential, not least in Bangladesh itself.

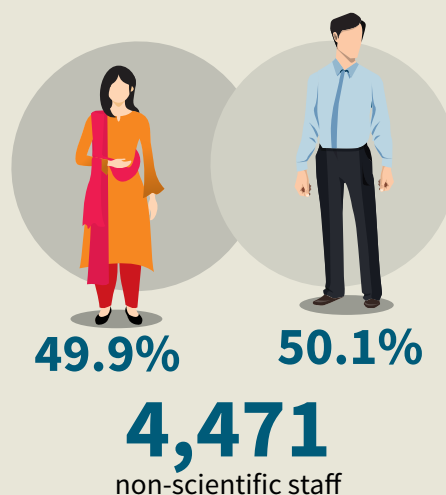
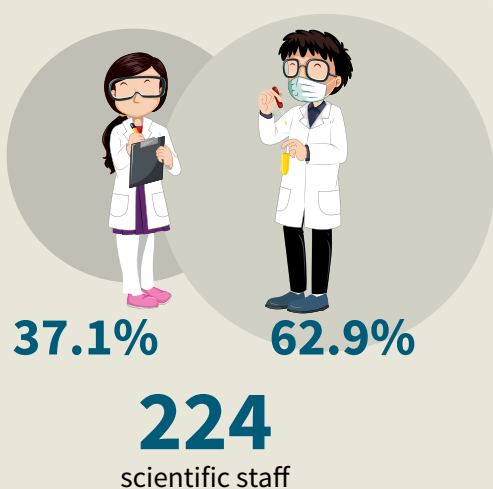
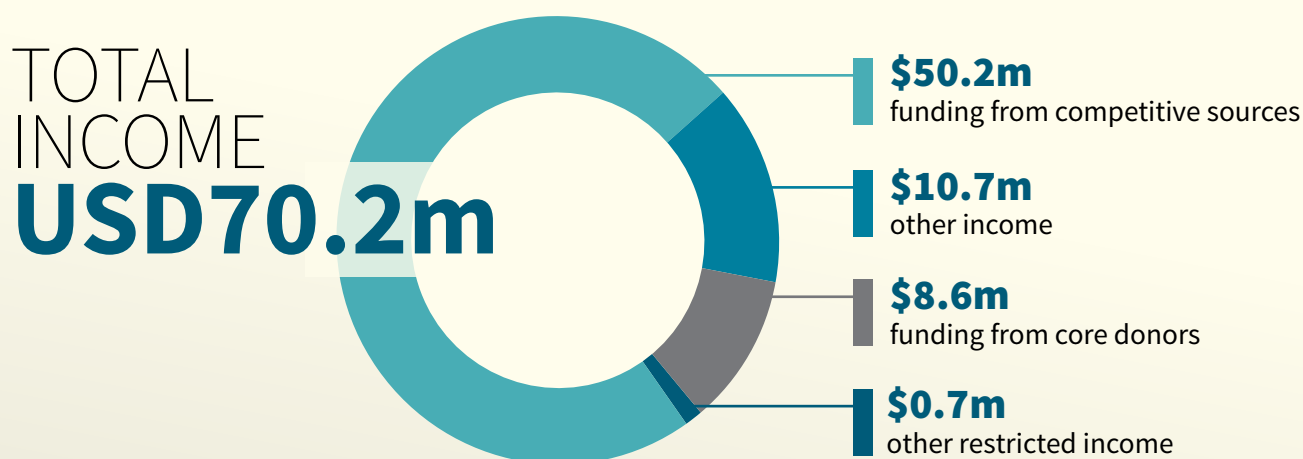
Our success in large part depends on the fruitful partnerships we have developed with donors, global research partners, national and international agencies, and bodies within the Government of Bangladesh. We look forward to working with all our partners to understand and overcome the key public health challenges facing Bangladesh and other resource-poor countries.



PROFESSOR JOHN D CLEMENS
Executive Director
May 2019

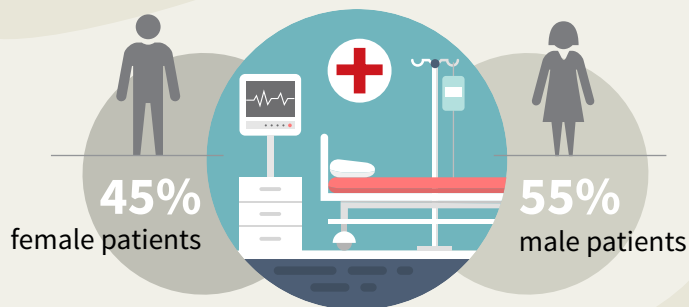
icddr,b IN NUMBERS

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



241,874

patients treated in 2 hospitals
and 1 treatment centre



120

new grants



192

national collaborations



367

original papers published*

386

ongoing projects

412

international collaborations

18,823

citations from 2015-2017

163

national policy review
committees with icddr,b
representation



666

attendees of icddr,b
training courses

462

number of laboratory
tests offered



153

international policy
review committees with
icddr,b representation

846

students hosted by
icddr,b's orientation
programme for medical
students

1,654,673

number of tests
carried out

* with icddr,b scientists as authors



SPOTLIGHT

The following stories highlight five areas – humanitarian efforts in Bangladesh, evidence-based policymaking, HIV/AIDS prevention, arsenic contamination and the impact of our last Strategic Plan – where we are having national and international impact.

AVERTING A HUMANITARIAN CATASTROPHE



Our work with national and international agencies has helped prevent a cholera outbreak among Forcibly Displaced Myanmar Nationals in Bangladesh.

With the support of icddr,b and partner organisations, the Government of Bangladesh conducted four mass oral cholera vaccine (OCV) campaigns between October 2017 and December 2018 among forcibly displaced Myanmar nationals (FDMNs) seeking refuge in Cox's Bazar in south-east Bangladesh. To date, this has successfully prevented cholera outbreaks even though the displaced population has been affected by other diarrhoeal and infectious diseases.

Since 2014, icddr,b and the Government of Bangladesh's Institute of Epidemiology and Disease Control Research (IEDCR) have been carrying out sentinel site surveillance for cholera at a government district hospital in Cox's Bazar. This revealed that cholera was circulating when FDMNs began to arrive in August and September 2017.

A request for OCV was made to the International Coordinating Group, which is responsible for granting access to the global OCV stockpile. With vaccines in short supply, release of 900,000 doses was approved, sufficient for a single-dose vaccination of people over the age of five years and two-dose vaccination for younger children – drawing on icddr,b research demonstrating the protective value of single-dose OCV in older children and adults.

The first round of vaccination began in October 2017, as part of a joint initiative between the Government of Bangladesh, international agencies, icddr,b and NGOs. The second dose of OCV was delivered to 200,000 children aged

one-five years along with oral polio vaccine in November 2017. In addition, icddr,b and IEDCR set up additional surveillance sites in facilities providing services to FDMNs.

The continuing influx of FDMNs and use of single-dose vaccination presented a continuing risk of cholera outbreaks. Two additional OCV campaigns were therefore organised in May 2018 and November/December 2018, which included local Bangladeshi communities at risk of cholera. In the fourth and final campaign, vaccines were delivered through national immunisation programme infrastructure and by 65 mobile outreach teams.

During the campaigns, more than two million OCV doses were delivered and high population coverage was achieved. icddr,b was involved at multiple points, including campaign planning, training, implementation and trouble-shooting, working closely with the Government of Bangladesh and other partners.

icddr,b also carried out studies to check that OCV was immunogenic in the FDMN population. This work showed high levels of protective antibody production in FDMNs, equivalent to that seen in Bangladeshi vaccine recipients, confirming that vaccination was probably instrumental in averting a cholera outbreak.

As well as its local success, this pioneering joint enterprise – the first time the OCV global stockpile has been used to prevent rather than respond to a cholera outbreak – could hold important global lessons for cholera control.

STRATEGIC PLAN 2015–2018: A REVIEW



Early in 2019, we launched a new Strategic Plan covering the years 2019–2022. During the course of our previous Strategic Plan, we introduced a focused research programme and overhauled our operating procedures – providing a firm foundation for future successes in 2019–2022.

During 2015–2018, our research delivered significant advances including:

ORAL CHOLERA VACCINE (OCV)

A series of landmark studies demonstrated the effectiveness of OCV and the feasibility of delivery through existing immunisation programme infrastructure.

BUBBLE CPAP

Low-cost ‘bubble CPAP’ ventilation equipment, made from locally sourced materials, was shown to be an effective treatment for severe pneumonia in seriously ill infants.

MALNUTRITION AND THE MICROBIOME

We contributed to key studies identifying links between gut microbiome abnormalities and the long-term effects of malnutrition, paving the way for new dietary interventions targeting the microbiome.

SEPSIS MANAGEMENT

We showed that management of possible serious bacterial infection among young infants with simplified antibiotics is feasible in first-level facilities in Bangladesh, informing national treatment guidelines.

THERAPEUTIC FOODS

We developed and tested ready-to-use therapeutic food stuffs based on locally sourced ingredients.

NIPAH VIRUS

Practical tools and a community engagement strategy were developed to prevent the spread of Nipah virus through consumption of contaminated date palm sap.

URBAN HEALTH ATLAS

We created an interactive digital tool mapping the location and resources of urban health facilities, to guide planning of services and to support patients’ choice.

TUBERCULOSIS (TB) DETECTION

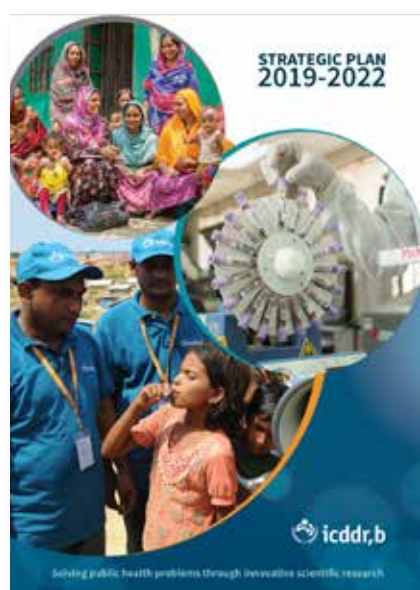
We developed an innovative social enterprise model to engage the private sector in TB detection in urban slums, which is now being scaled up across Bangladesh.

ECOSYSTEMS, HEALTH AND WELLBEING

Our work contributed to a multidisciplinary project mapping human–ecosystem relationships in the Ganges–Brahmaputra delta region of Bangladesh.

INTIMATE PARTNER VIOLENCE

We identified alarming levels of intimate partner violence in Bangladesh and developed a range of interventions to reduce violence against women.



PREVENTING AND CONTROLLING HIV



icddr,b's programme for HIV and AIDS has been conducting studies with marginalised and stigmatised populations at risk of HIV, translating evidence into actions and policy, and designing new HIV prevention services.

While Bangladesh currently has an HIV prevalence of less than 0.01% among the general population, certain groups are particularly at risk. In 2016, icddr,b and the Institute of Epidemiology, Disease Control and Research (IEDCR), on behalf of the national AIDS/STD Programme, found that the HIV prevalence among key populations collectively was 3.9%, yet prevalence varied markedly across different groups. HIV prevalence among males who have sex with males, male sex workers, transgender women (*hijra*) and female sex workers in Dhaka City remains less than 1%, illustrating the effectiveness of ongoing HIV prevention services. However, the prevalence is much higher among people who inject

drugs (PWID) in Dhaka City, where overall HIV prevalence reaches 22%.

In December 2017, we received funding of USD 8.3 million from the Global Fund to continue our work on evidence-based policy and actions for HIV prevention among key populations. icddr,b uses an implementation research framework to enhance support and HIV prevention services provided to key populations, with support of local NGOs. icddr,b has introduced HIV testing and counselling for sexual minorities through a community-led testing mechanism, which links people with positive test results to government-operated care centres, with the assistance of peer educators.

Opioid substitution therapy (OST) is a component of an essential core package of harm reduction services. At present, around 1,000 PWID are receiving services under an OST programme operated by six OST clinics (three additional clinics will be established in 2019) in collaboration with the Department of Narcotics Control and the AIDS/STD Programme. Currently, icddr,b is operating two OST clinics, offering services to 350 PWID, and provides technical assistance to four other clinics. icddr,b developed a national operational guideline, which all the partners follow. To tackle the burgeoning HIV epidemic among PWID, the AIDS/STD Programme is keen to scale up the

service in government health facilities, with technical assistance from icddr,b and other stakeholders.

New ICT-based HIV prevention services have also been launched for sexual minorities and PWID. Websites, mobile applications, SMS and voice SMS are being employed to disseminate HIV-related information to enhance knowledge, attitudes and practices.

Two important operational research studies were initiated in 2018. In one study, icddr,b is using ethnographic research methods to understand drug injecting and sharing culture, the scope and challenges of harm reduction interventions, and structural factors influencing HIV transmission among PWID in Dhaka. Findings will contribute to the redesign of HIV prevention interventions for PWID. The second study aims to develop a community-based intervention to increase tuberculosis case notification rates among sexual minority groups, which are currently low.

Recent findings from a study conducted in Dhaka in 2016–18 revealed that, despite intensive harm reduction intervention services, hepatitis C virus (HCV) infection rates have not fallen (39.6% in 2011, 42% in 2017) among PWID. The primary emphasis of the harm reduction programme was found to be on HIV and STIs; there was very little awareness of HCV among healthcare workers, PWID and their families. The findings further emphasise the need for the use of direct-acting antiviral drugs to control HCV infection in PWID.

A qualitative study found that use of methamphetamine (locally known as *yaba*) increased sexually risky behaviours. It is essential to consider the potential psychosocial and psychosexual risks associated with the use of *yaba* in Bangladesh.

LENTILS AGAINST ARSENIC



Selenium-rich lentils could offer a way to reduce the health impacts of arsenic contamination

As many as 50 million people in Bangladesh may be exposed to dangerously high levels of arsenic. The first signs of arsenic exposure are generally skin conditions, but arsenic is a carcinogen, increasing the risk of various cancers, and has multiple other effects on health. Annual treatment costs for arsenic-related conditions have been estimated at USD 77.5m.

Much of the evidence on the health impacts of arsenic in Bangladesh has come from icddr's Matlab surveillance site. Beginning in the early 2000s, more than 16,000 tubewells were mapped to identify associations between arsenic exposure and a range of health conditions.

The Matlab data revealed a clear association between arsenic exposure and risk of infant death and fetal loss (1). In adults, chronic exposure was linked to increased risk of cancer, cardiovascular disease and susceptibility to infectious disease. Risk of diabetes and hypertension

was increased threefold, and the risk of chronic lung disease was increased nine-fold (1). These studies concluded that arsenic exposure in pregnancy was contributing to 10% of infant mortality in Matlab and 250,000 infant deaths nationally every year.

Studies in rural Matlab showed that the impact of arsenic on lung function seem to be particularly significant during the prenatal period, leading to increased respiratory infections in infants (2) and impaired lung function in early and later childhood, while current arsenic exposure was related to increased airway inflammation (3, 4). A case control study identified that even low to moderate levels of bloodstream arsenic doubled the risk of pneumonia in children under five years of age (5). A 13-year follow-up in Matlab recently found that the association between arsenic exposure and risk of death from cancer, cardiovascular disease and respiratory disease persists into the teenage years (6).

Notably, the effects of arsenic are antagonised by selenium, and selenium pills are used to counter the acute effects of arsenic poisoning. However, selenium pills are expensive and not popular among the Bangladeshi population. icddr,b researchers identified a possible alternative – naturally selenium-rich strains of lentil. Lentils are widely consumed in Bangladesh and often

imported from Canada, including selenium-rich Saskatchewan lentils.

Indeed, in a trial involving 400 participants (7), preliminary analyses results indicate that consuming high-selenium lentils is associated with significant health benefits. While efforts continue to provide safer drinking water, selenium-rich lentils could therefore provide a cost-effective and practical remedy for arsenic-exposed families across Bangladesh.

1. Yunus M *et al.* Arsenic exposure and adverse health effects: a review of recent findings from arsenic and health studies in Matlab, Bangladesh. *Kaohsiung J Med Sci.* 2011;27(9):371–6.

2. Raqib R *et al.* Effects of in utero arsenic exposure on child immunity and morbidity in rural Bangladesh. *Toxicol Lett.* 2009;185(3):197–202.

3. Smith AH *et al.* Chronic respiratory symptoms in children following in utero and early life exposure to arsenic in drinking water in Bangladesh. *Int J Epidemiol.* 2013;42(4):1077–86.

4. Ahmed S *et al.* Arsenic exposure alters lung function and airway inflammation in children: A cohort study in rural Bangladesh. *Environ Int.* 2017;101:108–116.

5. George CM *et al.* Arsenic exposure is associated with pediatric pneumonia in rural Bangladesh: a case control study. *Environ Health.* 2015;14:83.

6. Rahman M *et al.* Arsenic exposure and young adult's mortality risk: A 13-year follow-up study in Matlab, Bangladesh. *Environ Int.* 2019;123:358–367.

7. Krohn RM *et al.* A high-selenium lentil dietary intervention in Bangladesh to counteract arsenic toxicity: study protocol for a randomized controlled trial. *Trials.* 2016;17(1):218.

RESEARCH FOR DECISION MAKERS



The Research for Decision Makers project generates and disseminates findings to support evidence-based decision making in Bangladesh.

The USAID-funded Research for Decision Makers (RDM) initiative is a five-year research project. It aims to generate evidence and promote the use of evidence-based research and policy analysis for health planning and decision making.

The RDM project includes studies on a wide variety of priority issues related to maternal, newborn and child health, family planning and reproductive health, tuberculosis (TB) and nutrition, as well as cross-cutting issues such as health systems strengthening and universal health coverage.

While Bangladesh has seen impressive progress in family planning, use of long-acting reversible contraceptives/permanent methods (LARC/PM) is still very low. We are conducting a study examining whether a segmented communication approach can improve

LARC/PM use in the country. The reasons behind the discrepancy in data on LARC/PM use between routine service statistics and household surveys have also been explored, finding that around a quarter of the women listed in the routine registers were non-resident, over-aged, divorced, widowed or dead. About one in five of the women living in the area were not listed in the register. These findings were shared with government officials and stakeholders, who acknowledged the need to address the issues identified.

Since country-level information on adolescent health is limited, we are undertaking the first-ever adolescent health and wellbeing survey in Bangladesh, in collaboration with the National Institute of Population Research and Training and MEASURE Evaluation. The short-term impact of the Advancing Adolescent Health project (implemented by Plan Bangladesh and funded by USAID) on key programme outcomes has also been assessed.

To understand the factors that need to be addressed to improve the nutritional status of children, we carried out a secondary analysis, which identified maternal height and birth weight as two key determinants associated with childhood stunting.

The RDM project also studies the effectiveness of growth monitoring and promotion in improving the nutritional status of children under two years of age in rural Bangladesh.

In the area of maternal, newborn and child health, RDM is looking at the barriers hampering efforts to further lower mortality rates. To that end, we are assessing the licensing status and readiness of maternal, newborn and child health services at private facilities, which are the main sources of such services. The RDM project is also trying to identify newborn signal functions that could be used to assess the service availability and readiness of health facilities and thus assist programme planning and monitoring.

One of the key roles is to provide technical assistance to various national data-gathering exercises, such as the Bangladesh Health Facility Survey 2017, the Bangladesh Demographic and Health Survey 2017, especially on the causes of under-five deaths, and the Bangladesh Maternal Mortality and Health Care Survey 2016. Although information on maternal deaths is obtained from the latter survey, we are also testing other methods to estimate adult female mortality rates from routine information, which could provide more regular information on maternal deaths.







RESEARCH HIGHLIGHTS

In 2018, we published findings of national, regional and international significance.

Last year, icddr,b researchers and their national and international collaborators made important contributions across our focus areas, influencing both national and international policy and practice.

Our work spans critical studies on the causes of serious neonatal infections to large-scale vaccine trials, nutrition interventions and risk factors for intimate partner violence against women.

Our research addresses many of the key health concerns affecting Bangladesh and other countries in the global South.

SERIOUS NEONATAL INFECTIONS



icddr,b researchers have contributed to a landmark international study exploring the causes of serious neonatal infections.

Although the numbers of deaths of under-fives have dropped dramatically, neonatal deaths have shown much smaller declines. Some 2.6 million neonatal deaths occur globally each year, and around a third are believed to be caused by severe infections such as sepsis, pneumonia and meningitis.

However, efforts to reduce these numbers are hampered by a lack of understanding of the specific causes of death and ill-health. In low-income settings, many neonatal deaths occur at home, making it difficult to investigate potential causes. In addition, even if deaths occur within the healthcare system, inadequate clinical and laboratory facilities often make it difficult to identify the true causes of death.

The Aetiology of Neonatal Infections in South Asia (ANISA) study aimed to provide rigorous insight into the specific bacterial and viral infections leading to neonatal death. It prospectively followed five cohorts in three South Asian countries, including Bangladesh, covering a population of around 1.6 million and 30,000 births a year. In young infants (<2 months) experiencing a possible serious bacterial infection, an extensive range of diagnostic tests were used to identify the pathogens responsible.

Among more than 6,000 cases in 63,000 births, causative agents were identified in only 28% of episodes; 16% were bacterial in origin and 12% viral. Among babies who died, causative agents were identified for just under half of all possible serious bacterial infections preceding death (1).

The data provides valuable new insight into the causes of disease and death in young infants in South Asia. Of the viral infections, respiratory syncytial virus was the most common, suggesting that control of this pathogen could have a major impact on disease burden. A surprisingly large number of *Ureaplasma* infections were identified, while the high proportion of deaths linked to bacterial infections highlights opportunities to reduce neonatal deaths.

In addition, the fact that causative agents could not be identified in so many cases suggests that many may not have had an infection at all. This could potentially be leading to significant over-use of antibiotics, with important implications for the development of antibiotic resistance.

1. Saha SK *et al.* Causes and incidence of community-acquired serious infections among young children in south Asia (ANISA): an observational cohort study. *Lancet*. 2018;392(10142):145–159.

CHOLERA DIAGNOSTIC

A locally developed 'dipstick' diagnostic for cholera could provide much-needed early warning of a cholera outbreak.

It is highly advantageous to identify cholera infections rapidly. Fatality rates are often highest in the initial stages of an outbreak. Prompt detection of an outbreak can support a swift public health response to prevent its spread.

However, the acute watery diarrhoea typical of cholera could have multiple causes. Confirmation of infection requires

laboratory testing, which takes several days and depends on facilities that may not be available in low-resource settings.

Hence there is great interest in rapid point-of-care diagnostics that could provide an instant diagnosis of cholera. To meet this need, icddr,b researchers have developed a simple-to-use lateral flow assay 'dipstick' test, Cholkit, that detects the strain of cholera pathogen responsible for the overwhelming majority of current cholera outbreaks, *Vibrio cholerae* serogroup O1.

In laboratory tests, Cholkit showed excellent specificity and sensitivity, similar to those of a commercially available cholera dipstick test (1). These promising results were confirmed in a field study of nearly 8,000 samples from nationwide cholera surveillance being conducted in Bangladesh (2). Cholkit

may, therefore, be a reliable and simple to use test for rapid detection of cholera. Unlike the commercially available alternative, it does not detect the other *V. cholerae* serotype, O139, which can also cause cholera but has not triggered epidemics in the last two decades. Cholkit's sole focus on *V. cholerae* serogroup O1 is also likely to make it cheaper to manufacture.

1. Sayeed MA *et al.* Development of a new dipstick (Cholkit) for rapid detection of *Vibrio cholerae* O1 in acute watery diarrheal stools. *PLoS Negl Trop Dis.* 2018;12(3):e0006286.

2. Islam MT *et al.* Field evaluation of a locally produced rapid diagnostic test for early detection of cholera in Bangladesh. *PLoS Negl Trop Dis.* 2019;13(1):e0007124.



UNCONTROLLED HIGH BLOOD PRESSURE



The COBRA-BPS study has found that hypertension is poorly controlled in rural Bangladesh.

The COBRA-BPS trial is evaluating a package of simple measures to improve management of hypertension in rural areas of three South Asian countries, Sri Lanka, Pakistan and Bangladesh. High blood pressure is a major public health concern in the region – hypertension rates have already hit 40% in South Asia, and are projected to increase still further.

A COBRA-BPS baseline study in the three countries found that high blood pressure was not adequately controlled in 58% of people in rural areas being treated for hypertension – 53% in Bangladesh (1). Uncontrolled blood pressure was more common among those hypertensive patients who were poor, lived alone, and were not taking antihypertensive medications regularly. Blood pressure was also found to be uncontrolled among patients who had a high fasting glucose level in blood, impaired kidney function, high levels of bloodstream cholesterol, and heart disease.

Stroke and heart attacks are the top two causes of deaths from non-communicable diseases in Bangladesh. Uncontrolled hypertension contributes to both conditions. The COBRA-BPS study found that 36% participants had one or more chronic diseases associated with hypertension; heart disease and stroke are more common among hypertensive patients in Bangladesh than the other two countries. In Bangladesh, two out of three hypertensive patients do not take regular medicine and are at a higher risk of developing these fatal diseases. In addition, the COBRA-BPS study found that chronic kidney disease (CKD) affects one in three of the Bangladeshi population with hypertension and increased blood pressure is an important risk factor for developing CKD (2).

Detection of hypertension at an early stage and adopting lifestyle modifications can help to reduce blood pressure even without use of medicines. The results highlight the great potential of interventions such as those being tested in the COBRA-BPS trial to improve management of hypertension and reduce the risk of potentially deadly cardiovascular events in rural Bangladesh.

1. Jafar TH *et al.* Determinants of uncontrolled hypertension in rural communities in South Asia – Bangladesh, Pakistan, and Sri Lanka. *Am J Hypertens.* 2018;31(11):1205–1214

2. Feng L *et al.* Regional variation in chronic kidney disease and associated factors in hypertensive individuals in rural South Asia: findings from control of blood pressure and risk attenuation-Bangladesh, Pakistan and Sri Lanka. *Nephrol Dial Transplant.* 2018. doi: 10.1093/ndt/gfy184. [Epub ahead of print]



CONTROL OF ENDEMIC CHOLERA

icddr,b studies have advanced the case for use of oral cholera vaccine to control endemic cholera.

Oral cholera vaccine (OCV) has a well-recognised role in the prevention of outbreaks in emergency settings. However, cholera is a perennial threat in Bangladesh, particularly in urban centres. OCV may also be a beneficial addition to routine immunisation programmes in high-risk endemic areas.

As well as important efficacy studies, icddr,b has carried out research that could facilitate more routine use of OCV. Previously, such studies have shown that OCV retains its efficacy when stored at temperatures up to 42°C for more than a month, potentially facilitating its distribution in resource-poor settings. Recent research has now demonstrated

that a second key barrier - the need for healthcare workers to deliver a second dose - may also be surmountable.

The latest study explored the feasibility of giving vaccine recipients a second dose in a plastic zip-lock bag to administer at home. More than 90% of recipients used the second dose, and nearly all recipients supported the self-administration model (1).

Other studies have shown that the approaches used to deliver OCV in high-risk urban areas in an effectiveness trial were technically and programmatically feasible (2). icddr,b studies have also shown how tools such as geographic information systems (GIS) can be used to plan the most efficient distribution systems and to identify factors associated with non-vaccination, to inform efforts to maximise coverage (3).

Finally, a cost-effectiveness study has explored the potential impact of vaccination strategies targeting different age groups (4). There is some evidence that vaccination of young people also offers some protection to adults,

through herd immunity (5). Indeed, the cost-effectiveness study suggested that vaccination of everyone over the age of one year would prevent more cases but at great financial cost. Therefore, vaccination of 5–14-year-olds every three years, and children under-five years annually, would be the most cost-effective strategy (4).

1. Khan AI *et al.* Oral cholera vaccination strategy: Self-administration of the second dose in urban Dhaka, Bangladesh. *Vaccine*. 2019;37(6):827–832.
2. Khan IA *et al.* Organization and implementation of an oral cholera vaccination campaign in an endemic urban setting in Dhaka, Bangladesh. *Glob Health Action*. 2019;12(1):1574544.
3. Saha A *et al.* Socioeconomic drivers of vaccine uptake: An analysis of the data of a geographically defined cluster randomized cholera vaccine trial in Bangladesh. *Vaccine*. 2018;36(31):4742–4749.
4. Khan AI *et al.* The impact and cost-effectiveness of controlling cholera through the use of oral cholera vaccines in urban Bangladesh: A disease modeling and economic analysis. *PLoS Negl Trop Dis*. 2018;12(10):e0006652.
5. Ali M *et al.* Herd protection of unvaccinated adults by oral cholera vaccines in rural Bangladesh. *Int Health*. 2019;11(3):229–234.

VITAMIN D IN PREGNANCY



A large-scale trial in Bangladesh has found no evidence that vitamin D supplementation in pregnant women and during breastfeeding has any impact on infant growth.

Stunting is a major problem in Bangladesh – 36% of under-fives are stunted and 30% of newborns are small for their gestational age. Vitamin D deficiency is also common among Bangladeshi women of reproductive age, and there is some evidence that vitamin levels may affect foetal growth. However, evidence from vitamin D supplementation trials, mostly small scale, has been conflicting.

The Maternal Vitamin D for Infant Growth (MDIG) trial, led by researchers from Canada in collaboration with icddr,b, tracked more than 1,000 infants of mothers given vitamin D supplements up to one year of age. Although no safety issues were identified, vitamin D supplementation had no significant impact on birth weight or length-for-age scores (1).

The data does not suggest that vitamin D levels are affecting infant growth. They represent the strongest evidence yet in support of the WHO recommendation that vitamin D supplementation is not warranted to improve birth outcomes or infant growth, even in regions with high levels of vitamin D deficiency.

1. Roth DE *et al.* Vitamin D supplementation in pregnancy and lactation and infant growth. *N Engl J Med.* 2018;379(6):535–546.



VIOLENCE AGAINST WOMEN

Working in garment factories may actually increase women's risk of intimate partner violence.

Bangladesh has among the world's highest rates of intimate partner violence – more than half of ever-married women report having experienced physical or sexual violence at some point in their lives. Bangladesh society is highly patriarchal with rigid gender roles, and women are expected to be subservient to men.

The ready-made garment industry has grown significantly in Bangladesh, accounting for 82% of the country's exports and employing 4.2 million people, predominantly women. It has been argued that these new employment opportunities provide women with economic empowerment, reducing the risk of intimate partner violence. Conversely, some researchers have

suggested that in patriarchal contexts, where women's participation in the labour force is low, working women may challenge traditional gender roles and threaten the status of male partners, which may lead to a male backlash in the form of violence.

icddr,b researchers explored the experience of intimate partner violence among 800 female garment factory workers. Overall levels were much higher than in the general population – 34% had experienced physical violence and 43% sexual violence in the past year. However, links between economic resources and experience of intimate partner violence were complex (1). Notably, there was no evidence that greater economic resources protected women and girls against intimate partner violence – in fact, several measures of greater economic wellbeing (such as savings, ownership of gold or large household assets) were associated with a higher likelihood of intimate partner violence.

The results suggest that, in this context, working women are challenging conventional gender norms and notions of male superiority. Men may be reacting

by seeking to assert their authority through violence. The findings argue that economic empowerment will not by itself counteract intimate partner violence, which will require greater attention to social norms and male attitudes and behaviour (2).

The data came from a baseline survey as part of an evaluation of the HERrespect intervention, which is being carried out in ready-made garments factories in Dhaka (3). The multifaceted intervention, based on past icddr,b work, involves engagement with workers and managers - male and female - to address gender-related issues.

1. Naved RT *et al.* Magnitude and correlates of intimate partner violence against female garment workers from selected factories in Bangladesh. *PLoS One*. 2018;13(11):e0204725.

2. Naved R *et al.* Female garment workers' experiences of violence in their homes and workplaces in Bangladesh: A qualitative study. *Soc Sci Med*. 2018;196:150–157.

3. Al Mamun M *et al.* The HERrespect intervention to address violence against female garment workers in Bangladesh: study protocol for a quasi-experimental trial. *BMC Public Health*. 2018;18(1):512.

EFFICIENT POLIO CONTROL



A trial in Bangladesh has led to changes in the WHO's recommendations on polio control.

Although wild polio has been almost eradicated globally, low vaccination coverage with oral polio vaccine (OPV) creates conditions in which vaccine virus can reacquire the potential to spread and cause disease – so-called circulating vaccine-derived poliovirus (cVDPV).

Globally, several cVDPV outbreaks have occurred recently, mostly of type 2 poliovirus. Outbreak responses are based on repeated use of monovalent type 2 poliovirus vaccine (mOPV2) – generally two doses at least four weeks apart – and inactivated poliovirus (IPV).

However, there is little evidence to support this strategy. Furthermore, use of smaller doses at shorter intervals would be significantly easier to implement.

With colleagues at the US Centers for Disease Control and Prevention, an icddr,b research team assessed the impact of providing young infants with two doses of mOPV2 at one-week, two-week and four-week intervals, and of providing IPV in addition to mOPV2

after an interval of four weeks. The study found that immune responses were non-inferior when the second dose was provided at shorter intervals, and that the addition of IPV provided little additional benefit (1).

The results suggested that the interval between mOPV2 administration could safely be reduced from four weeks, and that IPV use was not adding to immune responses – an important finding as IPV has been in short supply globally. In light of these findings, WHO's Strategic Advisory Group of Experts on polio immunisation revised its recommendations on type 2 cVDPV outbreak responses, with shorter intervals between mOPV2 administration and more restricted use of IPV.

1. Zaman K *et al.* Immunogenicity of type 2 monovalent oral and inactivated poliovirus vaccines for type 2 poliovirus outbreak response: an open-label, randomised controlled trial. *Lancet Infect Dis.* 2018;18(6):657–665.





An aerial photograph of a small, weathered boat with a blue and brown hull, partially submerged in a vast field of green, leafy vegetation. The boat is positioned in the lower-left corner of the frame. The text 'PROGRAMME SUMMARIES' is overlaid in the center of the image.

PROGRAMME SUMMARIES

REDUCING MATERNAL, NEONATAL AND CHILD MORTALITY AND IMPROVING THE WELLBEING OF WOMEN, CHILDREN AND ADOLESCENTS



Programme lead

DR SHAMS EL ARIFEEN
Senior Director

Maternal and Child Health
Division

We develop and evaluate new interventions and carry out implementation research to enhance the coverage, quality and equity of interventions to reduce the physical and mental health burden on women, infants, children and adolescents.

Our work spans the full spectrum of research, including epidemiological studies (e.g. on indoor air pollution), basic upstream research, clinical trials (e.g. on new interventions), health systems research, and operations and implementation research. We have recently adopted a more systematic life-course approach, expanding our research from maternal and neonatal health to include child health and development as well as adolescent health and wellbeing.

The main causes of maternal, neonatal and child mortality and morbidity are now well understood, and in many cases effective interventions have been developed. A key challenge is to promote the implementation of evidence-based approaches. We actively participate in the development of national policy and rapid translation into programmes, while continuing to seek opportunities to apply the learning gained in Bangladesh to other low- and low-middle-income countries. Reducing inequities is an overarching principle guiding all our work.

Factors affecting adolescent health need to be better understood, and there is a growing recognition of the need to safeguard mental health in this population and in women.

INFECTIONS

Many cases of serious illness in young children may be being misidentified as possible bacterial infections (see page 18).

VITAMIN D

Vitamin D supplementation in pregnancy has been found to have no impact on child growth (see page 22).

CAUSES OF DEATH

ICDDR,b has contributed to a major international study of causes of maternal and neonatal death in South Asia and sub-Saharan Africa (1). Follow up of more than 250,000 births revealed that stillbirth and neonatal mortality rates in South Asia were double those in sub-Saharan Africa. Almost half occurred during delivery, labour and within a day of delivery, with asphyxia and

severe infections accounting for three-quarters of neonatal deaths. The data will improve modelled estimates of causes of death, and highlight the critical importance of the quality of care provided during and immediately after delivery.

1. Alliance for Maternal and Newborn Health Improvement (AMANHI) mortality study group. Population-based rates, timing, and causes of maternal deaths, stillbirths, and neonatal deaths in south Asia and sub-Saharan Africa: a multi-country prospective cohort study. *Lancet Glob Health*. 2018;6(12):e1297-e1308.

CHILD MORTALITY

Nearly 50 innovative minimally invasive tissue sampling (MITS) procedures have been carried out to shed light on the causes of death of young children, as part of the global Child Health and Mortality Prevention Surveillance (CHAMPS) study. The causes of stillbirths and deaths of children under five years of age are poorly understood. As part of the



CHAMPS network, icddr,b researchers are combining MITS, demographic, healthcare seeking and other data to identify causes of death and risk factors, to inform the development of new interventions to reduce under-five death rates. The CHAMPS network currently covers seven countries with high rates of child mortality, including Bangladesh, and in 2018 it began making initial data freely available (at <https://champshealth.org/data-access/>) to promote analyses by researchers worldwide.

LABOUR SUPPORT

A package of interventions delivered during the second stage of labour has been found to have a significant impact on maternal birthing behaviour and complications. The interventions were designed to ensure women had more choice over their birthing position, encourage a spontaneous pushing technique and provide a support person. After education of healthcare providers at rural hospitals, the introduction of the interventions reduced the odds of combined maternal and neonatal complications by 46%, and significantly reduced the incidence of episiotomy, cervical tear and median blood loss (1).

1. Pervin J *et al.* Associations between improved care during the second stage of labour and maternal and neonatal health outcomes in a rural hospital in Bangladesh. *Midwifery*. 2018;66:30-35.

CAESAREAN DELIVERY

icddr,b researchers have explored some of the factors behind a marked rise in the use of caesarean sections in Bangladesh. Although a potentially life-saving procedure, caesarean delivery carries risks, and there are concerns about its growing use in Bangladesh – from 3% of births in 2000 to 24% in 2014.

An analysis of data from the 2014 Bangladesh Demographic and Health Survey (BDHS) identified a range of factors related to mothers' preferences and clinicians' behaviour, including economic drivers (1). Data from earlier BDHS rounds revealed that the proportion of institutional caesarean deliveries increased from 33% in 2000 to 63% in 2014, and accounted for 66.5% of total expenditure on deliveries (and 6.9% of national health expenditure) (2). The potential for harm and economic impacts of medically unnecessary caesarean deliveries emphasise the need for stronger regulation.

Notably, a qualitative study in rural Matlab suggests that women favour vaginal birth, but recognise the importance of caesarean delivery when required (3). Knowledge tends to be low, and women are typically reliant on the opinion of service providers.

However, clinic agents (brokers) and healthcare providers tended to promote excessive use of caesarean delivery, often for financial rather than medical reasons.

1. Rahman MM *et al.* Determinants of caesarean section in Bangladesh: Cross-sectional analysis of Bangladesh Demographic and Health Survey 2014 Data. *PLoS One*. 2018;13(9):e0202879.
2. Haider MR *et al.* Ever-increasing Caesarean section and its economic burden in Bangladesh. *PLoS One*. 2018;13(12):e0208623.
3. Begum T *et al.* A qualitative study to explore the attitudes of women and obstetricians towards caesarean delivery in rural Bangladesh. *BMC Pregnancy Childbirth*. 2018;18(1):368.

BREASTFEEDING

icddr,b has identified factors associated with early initiation of breastfeeding (1), and demonstrated that a peer counselling approach significantly improves early and continuing breastfeeding through infancy (2).

1. Karim F *et al.* Initiation of breastfeeding within one hour of birth and its determinants among normal vaginal deliveries at primary and secondary health facilities in Bangladesh: A case-observation study. *PLoS One*. 2018;13(8):e0202508
2. Ara G *et al.* Peer counselling improves breastfeeding practices: A cluster randomized controlled trial in urban Bangladesh. *Matern Child Nutr*. 2018;14(3):e12605

PREVENTING AND TREATING MATERNAL AND CHILDHOOD MALNUTRITION



Programme lead

DR TAHMEED AHMED
Senior Director

Nutrition and Clinical
Services Division

We study biological and non-biological mechanisms underpinning maternal and childhood malnutrition. We develop innovative interventions to prevent and treat these conditions, and evaluate the efficacy, feasibility and scalability of new interventions.

We undertake a wide range of research, from basic laboratory studies to evaluations of preventive and treatment programme implementation to support policy development. We focus on the main challenges facing Bangladesh and the global South, pursuing research and innovations to produce credible solutions.

Our research has already highlighted the factors responsible for and causes of under-nutrition among children and women. Collecting inputs from needs-based clinical, basic and community research, we are generating evidence to develop solutions that can be implemented at scale and disseminating information to policymakers and other stakeholders.

Our current area of concern is under-nutrition, but we work collaboratively with our non-communicable disease initiative, recognising that poor and unhealthy diets have created a dual problem of malnutrition and obesity. We benefit from cross-departmental collaboration on joint projects on water, sanitation, hygiene and nutrition; maternal nutrition; and treatment of pneumonia in public healthcare facilities.

Specific priorities include the development and evaluation of interventions for women and adolescent girls to prevent low birth weight, as well as studies to shape the design of new interventions to prevent and treat childhood wasting and stunting.

VITAMIN D

Vitamin D supplementation in pregnancy has been found to have no impact on child growth (see page 22).

MATERNAL INFLUENCE ON STUNTING

icddr,b researchers have contributed to multiple studies identifying the critical impact of mothers' nutrition on infant growth. Stunting is very common in Bangladesh – 36% of children under-five are stunted, a figure that rises to around 50% for children living in slums.

Though under-nutrition is common, stunting is a complex phenomenon not solely the result of insufficient food intake. Indeed, a

prospective study of infants in a slum area found that length at birth was a strong predictor of stunting at age two (1). Although infants' intake of micronutrients was inadequate, micronutrient intake was not associated with stunting at age two, while low birth weight was (2). In addition, results from a longitudinal study of oral vaccine efficacy identified strong associations between mothers' weight and length at birth and stunting at age two (3).

Furthermore, an analysis of data from Bangladesh Demographic and Health Surveys found a clear association between maternal height and risks of neonatal and under-five mortality (4). Offspring of the shortest women had 1.7 times greater risk of neonatal mortality compared with offspring of tall mothers.



Collectively, the findings emphasise the importance of addressing maternal as well as infant nutrition to address stunting and child health and development.

1. Islam MM *et al.* Risk factors of stunting among children living in an urban slum of Bangladesh: findings of a prospective cohort study. *BMC Public Health*. 2018;18(1):197
2. Sanin KI *et al.* Micronutrient adequacy is poor, but not associated with stunting between 12-24 months of age: A cohort study findings from a slum area of Bangladesh. *PLoS One*. 2018;13(3):e0195072.
3. Donowitz JR *et al.* Role of maternal health and infant inflammation in nutritional and neurodevelopmental outcomes of two-year-old Bangladeshi children. *PLoS Negl Trop Dis*. 2018;12(5):e0006363.
4. Khatun W *et al.* Exploring the intergenerational effects of undernutrition: association of maternal height with neonatal, infant and under-five mortality in Bangladesh. *BMJ Glob Health*. 2018;3(6):e000881.

GUT BACTERIA

icddr,b researchers are evaluating a range of potential ‘microbiota-directed complementary foods’ (MDCF) as treatments for moderate acute malnutrition. Previous work has shown that severe malnutrition leads to abnormalities in the maturation of microbial communities in the gut, leading to long-term effects on health and development even after the immediate under-nutrition has been addressed. The MDCF study is evaluating the potential of foodstuffs to stimulate the growth of age-

appropriate microbial communities. The most promising will be progressed to a large-scale trial.

INTESTINAL PATHOGENS

icddr,b researchers have contributed to a major international study examining the impact of intestinal infections on growth. The Etiology, Risk Factors, and Interactions of Enteric Infections and Malnutrition and the Consequences for Child Health and Development (MAL-ED) study has been following infant cohorts from birth to age two in seven low-income settings, exploring interactions between infection, nutrition, and child health and development.

Importantly, use of molecular diagnostics has enabled the contributions of specific infections on growth to be assessed. This has revealed a surprisingly large contribution made by sub-clinical infections with enteroaggregative *E. coli*, *Shigella*, *Campylobacter* and *Giardia*, the impact of which exceeded that associated with episodes of diarrhoea (1). *Shigella* infections had a particularly pronounced effect on growth of individuals.

The results suggest that the impact of enteric infections on growth has been underestimated by a focus only on episodes of diarrhoea. Preventing enteroaggregative *E. coli*, *Shigella*,

Campylobacter and *Giardia* infections could have a significant impact on stunting.

MAL-ED data have also been used to explore interactions between diet, infections and cognitive development. Although enteric infections were associated with reduced cognitive development, more general illness levels and dietary intake of vitamin B6 and folate also made a substantial contribution (2). The MAL-ED team has developed a model of the pathways through which dietary, infection and other factors may influence cognitive development positively or negatively.

1. Rogawski ET *et al.* Use of quantitative molecular diagnostic methods to investigate the effect of enteropathogen infections on linear growth in children in low-resource settings: longitudinal analysis of results from the MAL-ED cohort study. *Lancet Glob Health*. 2018;6(12):e1319-e1328.
2. MAL-ED Network Investigators. Early childhood cognitive development is affected by interactions among illness, diet, enteropathogens and the home environment: findings from the MAL-ED birth cohort study. *BMJ Glob Health*. 2018;3(4):e000752.

PROTEIN PLUS

Work has begun on a randomised controlled trial examining whether protein supplementation (with a protein-rich blended food or an egg) or the antibiotic azithromycin, individually or in combination, will have an impact on growth between six and 12 months of age.

DETECTING AND CONTROLLING ENTERIC AND RESPIRATORY INFECTIONS



Programme lead

DR RASHIDUL HAQUE

Emeritus Scientist

Infectious Diseases Division

We generate a better understanding of key disease-causing organisms and host immune responses to develop and evaluate low-cost potentially scalable preventive and therapeutic interventions.

Our work spans the full spectrum of infectious disease research, from basic laboratory sciences to field-based clinical trials, mathematical modelling, policy development and implementation.

Our outstanding laboratory, clinical and population-based research has enabled us to make major contributions to the fields of infectious disease epidemiology, immunology and microbial pathogenesis. We are internationally recognised for the quality of our research related to diarrhoeal diseases, including pioneering molecular-genetic studies of the cholera pathogen *Vibrio cholerae*. In addition, our clinical trial programme is conducting phase I-IV vaccine trials (e.g. for cholera, *Shigella*, enterotoxigenic *E. coli*, rotavirus, typhoid, hepatitis E and B viruses, human papillomavirus, respiratory syncytial virus (RSV), meningococcal conjugate vaccine, rabies and influenza) through well-established urban and rural field sites.



DR FIRDAUSI QADRI

Emeritus Scientist

Infectious Diseases Division

We are focusing our efforts on meeting the demands of disadvantaged populations (e.g. urban slum dwellers and the rural poor) as this is where the burden of disease is greatest. We are also expanding our research portfolio on respiratory infections (e.g. influenza, RSV vaccination of mothers, and prevention with monoclonal antibodies in infants), microbiomics, diagnostics, mathematical modelling, and integrated control strategies.

We are exploring the underlying causes of both enteric and respiratory diseases and their associated host immune responses. We are also developing cost-effective vaccines and therapeutic interventions in order to prevent and treat these pathogens in LMICs. In urban slums, vaccination and treatment will be combined with WASH, nutrition and preventive therapeutics to halt disease transmission.



PROF. ALLEN G. ROSS

Senior Director

Infectious Diseases Division

CHOLERA PREVENTION

Innovative vaccination strategies have been used to protect Forcibly Displaced Myanmar Nationals against cholera (see page 10).

OCV

icddr,b studies are paving the way towards the use of oral cholera vaccine in routine immunisation (see page 21).

VACCINES FOR WOMEN'S HEALTH

Nearly 20,000 women of reproductive age in Matlab have been recruited into

a vaccine trial against hepatitis E virus, a significant cause of maternal and neonatal mortality in Bangladesh. Through the USD 5.5m trial, technology for production of the vaccine is being transferred from its developers in China to a local manufacturing company, to support low-cost local vaccine production.

A study has also been launched on a newly developed vaccine against human papillomavirus (HPV), the key cause of cervical cancer. The safety and immunogenicity of the new vaccine will be compared with the HPV vaccine that is currently in use. Positive results would provide policymakers with the option of a more cost-effective alternative.



CHOLERA DIAGNOSTIC

A new dipstick test could provide a way to rapidly identify cholera infections (see page 19).

POLIO VACCINATION

Trial data have led to an update of WHO recommendations for control of vaccine-derived virus outbreaks (see page 24).

FLU VACCINATION

icddr,b researchers have contributed to a large international trial showing that inactivated quadrivalent influenza vaccine is protective in young children even with a high degree of vaccine mismatch. Few studies have examined influenza vaccination in children under five years of age. The study of more than 12,000 children aged between six months and three years in 13 countries found that the flu vaccine provided protective efficacy of 50% against influenza and 63% against the clinically most important moderate-to-severe influenza, even though 64% of influenza isolates did not match the vaccine strains (1).

1. Claeys C *et al.* Prevention of vaccine-matched and mismatched influenza in children aged 6-35 months: a multinational randomised trial across five influenza seasons. *Lancet Child Adolesc Health.* 2018;2(5):338-349

CHOLERA BIOFILMS

Biofilms of the cholera-causing organism, *Vibrio cholerae*, have been detected in the Bay of Bengal estuary, a key environmental reservoir of the pathogen. *V. cholerae* is responsible for two seasonal waves of cholera outbreaks in spring and autumn. Outside these times, hardly any culturable rod-shaped bacteria could be identified in environmental samples, but microscopic analysis revealed many coccoid *V. cholerae* cells embedded in biofilms (1). The transition in morphology and formation of biofilms could represent an adaptive response promoting survival of *V. cholerae* in challenging environments.

Sultana M *et al.* Biofilms comprise a component of the annual cycle of *Vibrio cholerae* in the Bay of Bengal Estuary. *MBio.* 2018;9(2). pii: e00483-18

CHOLERA ANTIBODIES

The presence of antibodies against O-specific polysaccharide, a component of the lipopolysaccharide coat of *V. cholerae*, has been found to be associated with protection against cholera infections. Household contacts of people with cholera were significantly less likely to become

infected if they carried OSP-specific plasma antibody and memory B cells (1). The findings add to the evidence that immune responses against OSP are critical to protection against *V. cholerae*.

1. Aktar A *et al.* Plasma and memory B cell responses targeting O-specific polysaccharide (OSP) are associated with protection against *Vibrio cholerae* O1 infection among household contacts of cholera patients in Bangladesh. *PLoS Negl Trop Dis.* 2018;12(4):e0006399.

RSV VACCINE

A phase III trial has begun on maternal vaccination against respiratory syncytial virus (RSV) to provide newborns and young infants with protection against infection. RSV causes an estimated 160,000 deaths a year globally, with the most severe disease seen in infants under eight months of age. Transfer of antibodies from vaccinated mothers may provide infants with protection against infection. This multicentre international trial will evaluate the safety and efficacy of an RSV nanoparticle vaccine in more than 8,500 pregnant mothers.

DETECTING AND CONTROLLING EMERGING AND RE-EMERGING INFECTIONS



Programme lead
(Acting)

DR SAYERA BANU
Senior Scientist

Infectious Diseases Division

We work with partners in Bangladesh and internationally to detect, characterise and respond to emerging and re-emerging infectious disease threats.

We have a long-standing collaboration with the US Centers for Disease Control and Protection (CDC) which has enabled us to build platforms to track infections through hospital-based surveillance and population-based surveys.

Our laboratory capacity allows us to study emerging infections and antimicrobial-resistant pathogens. We are also partnering with USAID's Emerging Pandemic Threats programme, and routinely respond to infectious disease outbreaks in partnership with the Institute of Epidemiology, Disease Control and Research of Bangladesh, and in collaboration with the local One Health initiative. As a member of the Asia Pacific Malaria Elimination Network, we are contributing to the regional elimination of malaria by 2030.

We are also forming a new partnership with the Coalition for Epidemic Preparedness Innovations in order to trial new vaccines under development for Nipah virus and to examine the immunogenetic profile of survivors.

Future priorities include developing a better understanding of antimicrobial resistance nationally, evaluating Nipah virus diagnostics, vaccines and therapeutics, and adopting a One Health approach to investigate and limit the impact of infections spanning the human-animal interface.

MAINTAINING KALA-AZAR CONTROL

icddr,b researchers are playing a key role in shaping the regional kala-azar control programme. In 2005, Bangladesh, India and Nepal accounted for 80% of global cases of kala-azar (visceral leishmaniasis, infection with the *Leishmania* parasite). Through concerted elimination efforts, infections on the subcontinent have fallen markedly, and Bangladesh achieved its control target in 2016.

However, visceral leishmaniasis has not been eliminated and outbreaks could recur. In addition, new models of disease surveillance and control are required now that the disease is comparatively rare (1). Importantly, icddr,b researchers have shown that post-kala-azar dermal leishmaniasis (PKDL), a skin disorder arising in patients months after they have supposedly been cured, is a potential source

of new infections. Sand flies feeding on blood from PKDL patients were able to acquire *Leishmania* parasites, suggesting that PKDL could be an important reservoir of parasites able to seed new outbreaks (2).

In other studies, icddr,b researchers also compared possible new approaches for detecting *Leishmania* infections and preventing further infections in communities when a new case is detected. An approach based on 'fever camps' and sand fly control was most effective at identifying linked new cases (3).

1. Rijal S *et al.* Eliminating visceral leishmaniasis in South Asia: the road ahead. *BMJ*. 2019;364:k5224.
2. Mondal D *et al.* Quantifying the infectiousness of post-kala-azar dermal leishmaniasis towards sandflies. *Clin Infect Dis*. 2018. doi: 10.1093/cid/ciy891. [Epub ahead of print]
3. Huda MM *et al.* Intervention packages for early visceral leishmaniasis case detection and sandfly control in Bangladesh: A comparative analysis. *Am J Trop Med Hyg*. 2019;100(1):97–107.



AVIAN FLU

Surveillance of domestic waterfowl and environmental samples from live bird markets in Bangladesh has identified a wide range of avian influenza type A viruses, including highly pathogenic H5 strains, throughout the year. Of more than 4,000 waterfowl tested, 4.4% were positive for avian influenza A viruses, but nearly all appeared healthy (1). These animals may be an important source of influenza A viruses in live bird markets, leading to the infection of poultry and potentially humans.

1. Khan SU *et al.* Avian influenza surveillance in domestic waterfowl and environment of live bird markets in Bangladesh, 2007–2012. *Sci Rep.* 2018;8(1):9396.

DENGUE VECTORS

Refrigerator trays and vehicles tyres have been found to be among the most productive sites for the larvae and pupae of the mosquitoes that transmit dengue virus and other infections. An entomological survey in Dhaka during three rainy seasons and one dry season found a wide range of containers holding water containing mosquito larvae and pupae (1). Proper disposal and recycling of containers could offer relatively simple ways to reduce the risk of viral transmission.

1. Paul KK *et al.* Risk factors for the presence of dengue vector mosquitoes, and determinants of their prevalence and larval site selection in Dhaka, Bangladesh. *PLoS One.* 2018;13(6):e0199457.

DIGITAL DOTS

An innovative mobile-phone-based approach is being tested as a possible alternative to the logistically challenging ‘directly observed treatment, short course’ (DOTS) strategy for tuberculosis (TB). Packaging is being designed that will reveal a new telephone number for each day’s medication. The patient will call the number having taken the medication. The call will be automatically disconnected after being logged and used to create a scorecard showing adherence to treatment to inform physician follow-up.

TB AND HEARING LOSS

Use of kanamycin to treat multidrug-resistant TB has been found to be associated with high levels of hearing loss in Bangladeshi patients. Of 36 follow-up patients, three-quarters acquired some degree of new hearing loss (1). Hearing loss was particularly severe at higher frequencies, and was likely to impact perception of conversational speech in nearly a third of patients. Patients with diabetes were at particular risk of

hearing loss. As well as suggesting that regular monitoring of hearing abilities could be implemented to inform kanamycin dosing, the findings make a case for further research into reducing kanamycin exposure and/or incorporating adjunct agents to prevent hearing loss.

1. Heysell SK *et al.* Hearing loss with kanamycin treatment for multidrug-resistant tuberculosis in Bangladesh. *Eur Respir J.* 2018;51(3). pii: 1701778

HEPATITIS B VACCINE

Vaccination against hepatitis B virus (HBV) has been found to be highly effective at preventing infection in Bangladesh even without a dose at birth. Birth and early childhood are high-risk periods for acquisition of HBV. WHO recommends vaccination at birth but this is difficult to achieve in Bangladesh, where around 70% of births occur at home. Bangladesh introduced HBV vaccination in 2003–05, and a study of more than 4,000 children has found that the prevalence of infection has dropped from 1.2% in pre-vaccine era children to just 0.05% in those born after the introduction of vaccination (1).

1. Paul RC *et al.* Hepatitis B surface antigen seroprevalence among prevaccine and vaccine era children in Bangladesh. *Am J Trop Med Hyg.* 2018;99(3):764–771.

ACHIEVING UNIVERSAL HEALTH COVERAGE



Programme lead
(Acting)

**DR MAHBUB ELAHI
CHOWDHURY**
Scientist

Health Systems and
Population Studies Division

We will help Bangladesh to achieve universal health coverage, through health system research, policy research and advocacy designed to increase accessibility, improve quality and lower financial barriers to healthcare services.

We are leveraging our expertise to strengthen the urban health service delivery system (e.g. introducing ICT-based mapping of health facilities, providing evening outdoor services in public facilities), improve health financing mechanisms (e.g. adapting learning from Chakaria micro health insurance in the national health system), develop models for efficient utilisation of the health workforce, and identify new approaches to achieve greater regulatory compliance in the private sector. We are also undertaking research on monitoring and supervision of systems for improved governance and accountability.

Our research focuses specifically on increasing service availability, improving accessibility to quality care, reducing out-of-pocket expenditure for healthcare, improving the health and social wellbeing of older people, and minimising the impact of social determinants of health. We also engage policymakers and implementers at the national and grassroots level, encouraging them to use evidence-based strategies to address health system issues. We are also developing stronger links with the global universal health coverage community.

HEALTH INSURANCE

icddr,b studies have provided valuable insights into the use of community-based health insurance schemes by informal workers. Informal workers make up 88% of the labour force in Bangladesh and are at significant risk of impoverishment due to out-of-pocket expenditure on healthcare. Community-based health insurance schemes are seen as a potentially important way of reducing these risks and improving access to healthcare.

In a study linked to a pilot insurance scheme in Chandpur, households enrolled in the insurance scheme were more likely to consult medically trained providers than those not enrolled (1). The schemes may thus help to increase use of higher-quality medical services.

A further study found that the health status of those joining the insurance scheme was significantly worse than those not joining

the scheme (2). This kind of effect could have implications for the long-term sustainability of community-based health insurance schemes.

1. Ahmed S *et al.* The impact of community-based health insurance on the utilization of medically trained healthcare providers among informal workers in Bangladesh. *PLoS One*. 2018;13(7):e0200265.
2. Ahmed S *et al.* Adverse selection in community based health insurance among informal workers in Bangladesh: An EQ-5D assessment. *Int J Environ Res Public Health*. 2018;15(2).

URBAN SURVEILLANCE

A new health and demographic surveillance system is being established in two poor urban districts of Dhaka and Gazipur. Bangladesh has a rapidly urbanising population, with population growth especially in slum settlements in Dhaka. These trends are a major challenge to the delivery of health and other services, and long-term data from 30,000 households will significantly inform policymaking.

PATIENT SATISFACTION

icddr,b studies have identified scope for improvement in the services provided at healthcare facilities. Patient exit interviews with more than 2,000 people attending a range of health facilities in Rajshahi and Sylhet found that, although 63.2% of patients were satisfied with the services they received, this fell to 52% for those attending primary care facilities (1). As well as convenient opening hours, cleanliness and privacy issues had a significant impact on satisfaction.

In a separate study, patients' satisfaction with services associated with a community-based healthcare insurance scheme was relatively high, averaging 4.17 out of 5 (2). Scores were particularly high for factors such as the facility environment, healthcare workers' behaviour towards clients and explanations of treatments. The studies provide important information about key areas that could be

strengthened to improve patient satisfaction with health services.

1. Adhikary G *et al.* Factors influencing patients' satisfaction at different levels of health facilities in Bangladesh: Results from patient exit interviews. *PLoS One*. 2018;13(5):e0196643.

2. Sarker AR *et al.* Clients' experience and satisfaction of utilizing healthcare services in a community based health insurance program in Bangladesh. *Int J Environ Res Public Health*. 2018;15(8). pii: E1637.

STAFFING LEVELS

icddr,b researchers have developed a novel index for assessing the availability of various categories of healthcare worker at facilities providing emergency obstetric and newborn care. Although Bangladesh has a reasonable facility infrastructure, it is badly affected by shortages of healthcare workers. The new index revealed wide variation in the availability of particular healthcare staff at particular times of day across different types of facility (1), and could provide a useful tool for policymakers and for advocacy.

1. Biswas TK *et al.* A newly developed tool for measuring the availability of human resources for emergency obstetric and newborn care services: prospective analytic study in two district-level public facilities in Bangladesh. *BMC Health Serv Res*. 2018;18(1):688.

PRIVATE SECTOR

In-depth interviews with 42 stakeholders involved in the contracting-out of urban primary healthcare services have identified some of the key contextual, contractual and actor-related factors that have influenced implementation of contracting-out policy in Bangladesh. Contracting-out is seen as a way of extending access and improving the quality of services, but can present practical challenges. A deeper understanding of these issues provides a basis for developing contracting-out capacities.

Islam R *et al.* Contracting-out urban primary health care in Bangladesh: a qualitative exploration of implementation processes and experience. *Int J Equity Health*. 2018;17(1):93.



ACHIEVING GENDER EQUALITY AND PROMOTING SEXUAL AND REPRODUCTIVE HEALTH AND RIGHTS



Programme lead

**DR RUCHIRA
TABASSUM NAVED**
Senior Scientist

Health Systems and
Population Studies
Division

We carry out research to address key gender-related health issues and to promote gender equality in sexual and reproductive health.

Violence against women is a major public health issue in Bangladesh. Surveys suggest that the overwhelming majority of women have experienced physical or emotional ill-treatment. Bangladesh is also characterised by high levels of child marriage. The country has multiple sexual minorities and other vulnerable populations who face significant barriers in accessing sexual and reproductive health services.

icddr,b has a long history of work on gender inequalities and on sexual and reproductive health service provision for vulnerable communities. We have explored levels of and contributors to intimate partner violence in Bangladesh and developed interventions that have significantly reduced levels of violence against young women. We have established strong links with minority populations and the groups that work with them.

Building on our existing strengths, we have a strong focus on prevention of gender-based violence, particularly intimate partner violence (e.g. the 'HERrespect' study). We also evaluate approaches for reducing child and forced marriage, and the reduction of unintended pregnancies, particularly among married adolescents. The sexual and reproductive health and rights of women in vulnerable situations is another important focus of work. We also work with colleagues across the organisation to ensure that gender parity is a consideration for all research.

FEMALE GARMENT WORKERS

The economic benefits of working in garment factories may not protect women against intimate partner violence (see page 23).

VIOLENCE AND MENTAL HEALTH OF FEMALE GARMENT WORKERS

icddr,b researchers have demonstrated how the experience of violence and mental health is interlinked. Analysis of data from 800 female garment workers showed that their experience of intimate partner violence and workplace violence increased work-related stress and led to depression. It also revealed that a worker's ability to mobilise resources in an emergency increased her self-esteem and reduced her work-related stress. The link between a women's ability to mobilise resources with self-esteem

and work-related stress indicates the need for socio-economic empowerment of women and may suggest that a combined intervention to address intimate partner violence and women's empowerment could be successful in dealing with workplace violence and mental health (1).

1. Parvin K *et al.* The pathways between female garment workers' experience of violence and development of depressive symptoms. *PLOS ONE*. 2018; 13(11) : e0207485.

GENDER NORMS

icddr,b researchers have contributed to studies examining how community-level gender norms and experience of violence in childhood affect men's attitudes and behaviour towards women.

Data on young married men in Bangladesh (aged 18–34 years) from the UN Multicountry



Study of Men and Violence suggested that more gender-equitable social norms were associated with a reduced use of controlling behaviour with spouses. Although exposure to childhood violence was not associated with use of controlling behaviour, it was linked to more negative gender equity attitudes in communities with lower overall gender equity (1).

In addition, 50% of men reported perpetrating intimate partner violence and 64% had been exposed to violence in childhood. Exposure to violence in childhood and inequitable gender norms both increased the risk of intimate partner violence (2).

The findings shed light on the interplay between exposure to violence in childhood and social norms, and suggest that interventions against both are needed to reduce violence against women and coercive behaviour by men.

1. James-Hawkins L, Cheong YF, Naved RT, Yount KM. Gender norms, violence in childhood, and men's coercive control in marriage: A multilevel analysis of young men in Bangladesh. *Psychol Violence*. 2018;8(5):580–595.

2. Yount KM, James-Hawkins L, Cheong YF, Naved RT. Men's perpetration of partner violence in Bangladesh: Community gender norms and violence in childhood. *Psychol Men Masc*. 2018;19(1):117–130.

SAFE

An intervention designed to reduce the risk of intimate partner violence in slum communities in Dhaka identified a significant reduction in physical violence against adolescent girls. The SAFE intervention included interactive group sessions, community mobilisation and service provision in women-only and mixed groups. Although overall no effects on intimate partner violence were seen, violence against adolescent girls fell by 21% for females in mixed groups (1). The results point to the importance of including both men and women in violence-reduction interventions.

1. Naved RT, Mamun MA, Mourin SA, Parvin K. A cluster randomized controlled trial to assess the impact of SAFE on spousal violence against women and girls in slums of Dhaka, Bangladesh. *PLoS One*. 2018;13(6):e0198926.

ECONOMIC COERCION

icddr,b researchers have begun a study designed to provide a clearer picture of the extent of economic coercion in Bangladesh. Economic coercion may threaten women's economic security and adversely affect health but reported levels of economic coercion in Bangladesh vary widely. After qualitative research to explore the

nature of economic coercion, a survey will be developed to evaluate women's experience of economic coercion. The study will also test whether women's participation in an economic empowerment programme has had an impact on economic coercion.

CHILD MARRIAGE

icddr,b researchers are leading an evaluation of the 'Tipping Point' intervention designed to reduce levels of child marriage. The evaluation will be carried out as a randomised controlled trial in Bangladesh and Nepal, comparing two intensities of intervention. The high-intensity intervention includes a strong emphasis on shifting social norms, which may be crucial to achieving sustainable change in child marriage practices.

GENDER-BASED VIOLENCE

icddr,b has joined the Combating Gender-Based Violence in Bangladesh project as a research partner. The UN-led project is focused on primary prevention of gender-based violence, through community-level behaviour change interventions and community empowerment to promote gender equity.

EXAMINING THE HEALTH CONSEQUENCES OF AND ADAPTATION TO CLIMATE CHANGE



Programme lead

DR QUAMRUN NAHAR
Acting Senior Director

Health Systems and
Population Studies
Division

We are evaluating the impact of climate change and migration patterns on population health in Bangladesh and ways in which populations can adapt.

Average global temperatures are projected to rise by several degrees during this century, accompanied by more intense rainfall and rising sea levels. Bangladesh is highly vulnerable to climate change. It is likely to experience floods during the wet season, and potentially droughts in the dry season as neighbouring countries limit cross-border fresh water supply. It is also likely to face more extreme weather events.

There are concerns that climate change could affect the distribution and burden of vector-borne diseases such as malaria, dengue fever, kala-azar and Japanese encephalitis virus infections. Cholera outbreaks may also become more frequent as sea surface and river temperatures rise.

Health may also be affected in other ways. Heat stress is already occurring in urban areas, while rising salinity levels in coastal districts are likely to reduce crop production and exacerbate conditions such as hypertension. Large-scale population displacements are highly likely.

We have a history of research on the links between climate and spread of infectious diseases, and in recent years we have been building our expertise in environmental science. Our interdisciplinary projects examine human-environment interactions in vulnerable coastal areas, including its impact on health and well-being.

Drawing on our long experience in health and population research in Bangladesh, we are well placed to shape and inform discussions on the appropriate response to climate change (e.g. National Health Adaption Plan, transmission of vector-borne diseases, drinking water and salinity, human migration), while also ensuring that discussions are relevant to other countries facing similar challenges.





CHOLERA AND CLIMATE

Although heat waves may have a significant impact on cholera outbreaks, icddr,b researchers have found that local rainfall levels and tree cover may influence household risk of infection. An analysis of data from Matlab has found that there is a higher risk of cholera on rainy days two days after a heat wave (1). However, this association was not seen in households with medium-dense tree cover. The findings suggest that heat waves, likely to become more common with climate change, may promote cholera outbreaks but their impacts will depend on factors such as local rainfall and tree cover.

icddr,b researchers have also contributed to a *Nature Reviews Disease Primer* on cholera and other *Vibrio* infections, highlighting the potential impact of climate change on their epidemiology (2). Of the 100 or so species of *Vibrio*, 12 cause disease in humans, including *V. cholerae*, the cause of cholera, and other species that cause food-borne disease or serious wound infections. The aquatic environment is a key reservoir of *Vibrio*, and climate change may already be changing patterns of *Vibrio* disease.

1. Wu J et al. Influences of heatwave, rainfall, and tree cover on cholera in Bangladesh. *Environ Int.* 2018;120:304–311.

2. Baker-Austin C et al. *Vibrio* spp. infections. *Nat Rev Dis Primers.* 2018;4(1):8.

CHILD MORTALITY

An analysis of data from the Matlab Health and Demographic Surveillance System has found that relatively hot months, compared with seasonal averages, are associated with reduced neonatal and child mortality (1). The findings may reflect the greater sensitivity of infants to hypothermia rather than hyperthermia in this environment.

1. Babalola O, Razzaque A, Bishai D. Temperature extremes and infant mortality in Bangladesh: Hotter months, lower mortality. *PLoS One.* 2018;13(1):e0189252.

PREVENTING AND TREATING NON-COMMUNICABLE DISEASES



Programme lead

DR ALIYA NAHEED

Head, Initiative for Non-communicable Diseases

Health Systems and
Population Studies Division

We are responding to the burden of chronic diseases in Bangladesh, documenting current care practices and health-seeking behaviours, and evaluating new interventions relevant to low-income countries, with a focus on cardiovascular disease, diabetes and mental health disorders. Our work is contributing to scalable solutions which are cost-effective in reducing the non-communicable disease (NCD) burden in Bangladesh, and can potentially be applicable elsewhere in the global South.

NCDs are a relatively new area of icddr,b work. We have witnessed the shift from communicable to non-communicable diseases using our Matlab surveillance data, and have secured competitive grants to conduct multidisciplinary research on major NCDs (cardiovascular diseases, cancers, chronic respiratory diseases and diabetes) and common mental health disorders.

Our future work will have a particular focus on cardiovascular disease, diabetes and mental health disorders. In addition to generating a deeper understanding of the disease burden and risk factors, we will develop and evaluate prevention and treatment strategies suitable for implementation in resource-poor settings (e.g. mHealth and COBRA-BPS studies for hypertension treatment, BELIEVE rural vascular health study, and National Micronutrient Survey and NCD risk). We will partner with colleagues across icddr,b and other national institutions, and collaborate with overseas partners. We will develop pragmatic solutions to tackle this rapidly growing area of health concern.

HYPERTENSION

The COBRA-BPS trial has identified high levels of poorly managed hypertension in Bangladesh (see page 20).

NCD COHORT

A cohort has been established in the Matlab Health and Demographic Surveillance System to generate new data on the risks factors and incidence of NCDs in rural Bangladesh. In the BELIEVE-Rural study, 30,000 general community-based participants will be recruited to provide health and demographic information as well as biological samples. The study will collect data relevant to cardiovascular and metabolic disease, cancer, respiratory diseases, and neurodegenerative and neurodevelopmental disorders.

KIDNEY DISEASE

One in three people with high blood pressure in rural Bangladesh have been found to be affected by chronic kidney disease. Analysis of baseline data from the COBRA-BPS trial, which is evaluating a package of measures to control hypertension in three South Asian countries, found that 38.1% of participants in Sri Lanka, Pakistan and Bangladesh as a whole and 36.4% of participants from Bangladesh had chronic kidney disease (1). The findings emphasise the importance of finding practical and effective ways of controlling hypertension in South Asia.

1. Feng L *et al.* Regional variation in chronic kidney disease and associated factors in hypertensive individuals in rural South Asia: findings from control of blood pressure and risk attenuation-Bangladesh, Pakistan and Sri Lanka. *Nephrol Dial Transplant.* 2018. doi: 10.1093/ndt/gfy184. [Epub ahead of print]

PATIENT PERCEPTIONS

The COBRA-BPS trial has explored patient perceptions of hypertension care and pathways of patient care. In structured interviews, participants identified a range of barriers to timely and high-quality care, as well as gaps in knowledge of hypertension prevention (1). Interviews in Bangladesh identified the key pathways through which people with hypertension are diagnosed and obtain care (2). The findings identified a range of possible actions to improve the availability and quality of hypertension management services in rural Bangladesh.

1. Legido-Quigley H *et al.* Patients' experiences on accessing health care services for management of hypertension in rural Bangladesh, Pakistan and Sri Lanka: A qualitative study. *PLoS One*. 2019;14(1):e0211100.

2. Naheed A *et al.* Patient pathways and perceptions of hypertension treatment, management, and control in rural Bangladesh: a qualitative study. *Patient Prefer Adherence*. 2018;12:1437-1449.

GESTATIONAL DIABETES

icddr,b researchers are contributing to the international LIVING trial, which is evaluating an integrated package of lifestyle interventions to reduce the risk of type 2 diabetes in new mothers affected by gestational diabetes (1). The interventions are designed to be culturally appropriate for South Asian countries and implementable within local health systems. Women are being recruited from 16 hospitals in Bangladesh, India and Sri Lanka.

1. Gupta Y *et al.* A lifestyle intervention programme for the prevention of type 2 diabetes mellitus among South Asian women with gestational diabetes mellitus [LIVING study]: protocol for a randomized trial. *Diabet Med*. 2019;36(2):243-251.

AUTISM INTERVENTION

icddr,b researchers are carrying out a feasibility study of an intervention designed to provide mental health and practical parenting support for mothers of children with autism (1). Previous icddr,b research has identified high levels of depression among such mothers. Centred on specialist schools for children with autism in Dhaka, psychologists have delivered mental health services while educators have provided home-based support on childcare. As well as initial evidence of psychosocial impacts, the study will provide insight into the feasibility and acceptability of the interventions and their likely costs.

1. Naheed A *et al.* Implementing a mental health care program and home-based training for mothers of children with autism spectrum disorder in an urban population in Bangladesh: Protocol for a feasibility assessment study. *JMIR Res Protoc*. 2017; 6(12): e251.



FIELD SITES

icddr,b's field sites provide detailed health and demographic data on large populations in a range of environmental settings – underpinning multiple research studies.



Longitudinal data can provide important insight into long-term trends in health and demographics, and links between environmental, demographic and other factors and health. icddr,b manages field sites gathering detailed longitudinal data from a range of environments, including rural, coastal and urban sites.

The surveillance sites have generated a wealth of data on population trends, health transitions and migrations. Such data have generated new insight into the health and demographics of Bangladesh, making important contributions to policymaking and practice.

MATLAB

Set up in 1966, the Matlab health and demographic surveillance system (HDSS) is the longest continuously running surveillance site in a low-resource setting. Located around 75 km southeast of Dhaka, the Matlab site covers a rural population of 240,000 living in 57,000 households in 142 villages.

Notably, the Matlab HDSS is divided into two areas. Health services are provided by the Government of Bangladesh in one area and by icddr,b in the other. This enables the impact of novel healthcare interventions to be evaluated, with the area receiving Government services acting as a control. Multiple service innovations in maternal and child health have been piloted and evaluated at Matlab.

All data from Matlab are made publicly available to support research. The latest data compendium, covering 2016, was published in April 2018 (1). Many of the studies reported in this Annual Report have been based on research carried out in Matlab.

CHAKARIA

The Chakaria HDSS was initiated in 1999. Located around 348 km southeast of Dhaka, it covers a population of 85,000 people, living in 17,000 households in 49 villages. Notably, the Chakaria area spans a range of environments, including hilly, plains and coastal areas. It is therefore a key site for exploring the health and other impacts of climate change, of great significance to a low-lying country such as Bangladesh. Around one in four people in Bangladesh live in coastal areas.

Chakaria is also the only HDSS in Bangladesh that routinely monitors Sustainable Development Goal (SDG) indicators using longitudinal data. Since 2015, 19 SDG indicators have been monitored using Chakaria HDSS data, seven of which are child-related. icddr,b is also evaluating a health insurance scheme in Chakaria (2), as well as innovative 'mhealth' approaches to improve health coverage (3).

URBAN FIELD SITES

Like many low-income countries, Bangladesh is experiencing rapid urbanisation. The urban population grew from 9% to 28% between 1974 and 2011, and is projected to hit 50% by 2050. Many migrants live in informal (slum) settings with poor primary healthcare delivery, and understanding and overcoming barriers to health service provision in such settings will be a major challenge.

To provide more information on the growing health challenge, in 2015 icddr,b established new HDSS in selected slum areas of north and south Dhaka and in Gazipur City Corporations, a rapidly growing city in central Bangladesh. The sites collectively cover about 30,000 households. Data are collected every three months on pregnancy outcomes, death, marriage/divorce, migration, household changes and various factors associated with maternal health.

In the future, the urban field site will be reorganised along the lines of the Matlab model, to improve monitoring of primary healthcare services and to provide a platform for testing various intervention models (e.g., to reduce caesarean delivery rates, to eliminate maternal deaths, and to evaluate urban community clinic models and health financing schemes).

1. icddr,b. Health and Demographic Surveillance System–Matlab, vol. 51. Registration of health and demographic events 2016 (icddr,b Scientific Report No. 138). 2018. Dhaka: icddr,b.
2. Mahmood SS *et al.* Who enrolls in voluntary micro health insurance schemes in low-resource settings? Experience from a rural area in Bangladesh. *Glob Health Action*. 2018;11(1):1525039.
3. Khan NUZ *et al.* How can mobile phones be used to improve nutrition service delivery in rural Bangladesh? *BMC Health Serv Res*. 2018;18(1):530.

KEY VISITORS IN 2018



Ms Saima Wazed Hossain, Chairperson, Bangladesh National Advisory Committee for Autism and Neurodevelopmental Disorders, inaugurated the project for early identification of children with disability as the Chief Guest at icddr,b.



Mr Teppo Tauriainen, Director-General for Trade, and Mr Johannes Oljelund, Director-General for International Development Cooperation, Ministry for Foreign Affairs, Sweden, with their team at icddr,b's Dhaka Hospital



Mr David Hartman, Director General, Global Affairs Canada, and Ms Phedra Moon Morris of Canadian High Commission visited the Nutrition Rehabilitation Unit (NRU) of icddr,b's Dhaka Hospital



Ms Phedra Moon Morris, Head of Aid, Ms Gabrielle Mathieu, First Secretary Development, and Ms Sylvia Islam, Senior Development Advisor of Canadian High Commission, at icddr,b's Matlab field site



Mr Javier Piedra, Deputy Assistant Administrator, USAID, and his team from Washington, DC at icddr,b's Dhaka Hospital



Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rospotrebnadzor), Russia, had a detailed visit to icddr,b's hospital and laboratory facilities



HE Ms Panpimon Suwannapongse, Ambassador, The Royal Thai Embassy of Bangladesh, handed over a donation from Her Royal Highness Princess Maha Chakri Sirindhorn of Thailand to contribute to the great purpose icddr,b has been serving in Bangladesh



Members of UN Foundation, CDC, US Congressional staffs visited icddr,b's Dhaka Hospital and discussed the new USAID Research for Decision Makers project, TB and immunisation efforts by our scientists



The Rt Hon Alistair Burt MP, Minister of State, UK, and HE Alison Blake, Ambassador, British High Commissioner to Bangladesh, accompanied by Mr Jim McAlpine, Head of DFID toured icddr,b's Dhaka Hospital and laboratory facilities and discussed icddr,b's humanitarian response in camps for forcibly displaced Myanmar nationals



Mr Derrick S Brown, Mission Director, USAID, Ms Carol Vasquez, Director, Office of Population, Health, Nutrition and Education, and Dr Samina Choudhury, Project Management Specialist, OPHN&E, visited icddr,b's Dhaka Hospital and TB laboratory facilities



HE Charlotta Schlyter, Ambassador, Embassy of Sweden, and Ms Carin Zetterlund, First Secretary/Deputy Head of Development Section, Sida visited icddr,b's Dhaka and Matlab campuses



Ms Penny Morton, Deputy High Commissioner, Australian High Commission, visited icddr,b's laboratories and Dhaka Hospital



A team from Ethiopia was at icddr,b during 3 to 6 July for a learning visit organised by Nutrition and Clinical Services Division



A team from CAPABLE, UK visited icddr,b's Dhaka Hospital and laboratories

CENTRAL MANAGEMENT SERVICES



Complementing Science

Central Management Services (CMS) has continually improved and efficiently increased its support to science. We have improved on capacity building, strengthening departments and increasing effectiveness by adopting policies and procedures to improve overall governance, accountability and transparency.

Led by Deputy Executive Director, Syed Monjurul Islam, CMS provides a proficient environment to support icddr,b's operations. CMS ensures comprehensive support to the work of our scientists and researchers through efficient and effective administrative services, which are compliant and offer a high standard of governance.

CMS has focused on improving business process automation, increasing efficiency in service delivery, monitoring donor compliance requirements, streamlining organisational practices, creating sustainable impact and further improving the visibility of icddr,b's work both nationally and globally, as well as increasing our partnership working with the Government of Bangladesh, international donors and collaborators.

Restructuring CMS has focused on delivering optimum services across the organisation. The Staff Engagement Survey conducted in 2018 indicated an increase in the percentage of staff who are satisfied working at icddr,b. They agreed that the processes and procedures in the organisation are efficient and the work environment is motivating.

COMMUNICATIONS AND CHANGE MANAGEMENT



Our success in gaining national and international media coverage was maintained, totalling over 700 news reports, which include reports in *The Economist*, *The Daily Telegraph*, CNN, BBC Online, Al Jazeera and Project Syndicate. Additional articles were published on icddr,b's website, blogs, and with our advocacy partners, such as Devex. Work started on an icddr,b corporate brochure, and an oral cholera vaccination mini-documentary was produced. Social and digital media content was viewed around 3.8 million times; the official website achieved 11.85% greater traffic and 9.31% more unique users in comparison to 2017; across social media channels we gained around 40,000 new followers.

The Hospital Appeal campaign was launched, including a new webpage for external and internal potential donors. An exciting arts and crafts exhibition produced by differently-abled children in honour of World Autism Awareness Week 2018 was organised. The Strategic Plan 2019-2022 was developed and produced in-house. The new Intranet (Shetu) was launched with added features and communications played a significant role in implementing the time management system in icddr,b.

DEVELOPMENT



The Development Unit has overseen continued positive engagement with core donors, the US Government, and the Government of Bangladesh.

An impressive array of visitors in 2018 included representatives from DFID, Global Affairs Canada, the Canadian High Commission, the Australian High Commission, The Thai High Commission, Sida and UK Parliamentary delegations. Particularly noteworthy have been visits to icddr,b by UK Secretary of State for International Development Penny Mordaunt and by the newly arrived US Ambassador Earl Miller, and the proposal by Global Affairs Canada to organise a Donors Forum to highlight icddr,b.

The Government of Bangladesh provided unrestricted funding and has continued to provide increasing funding for ongoing construction projects. A memorandum of understanding was signed with Global Affairs Canada for renewal of core funding.

New donor relationships were established with the Government of the Kingdom of Thailand. Following on the Prince Mahidol Award Ceremony, icddr,b has also established a close relationship with the Prince Mahidol Foundation and with the Government of the Kingdom of Thailand. This is already leading to a collaboration funded by the Foundation.

FINANCE



2018 has been a relatively successful year financially. The approved annual budget increased from USD 57 million to USD 70 million at the end of the year and a healthy surplus of USD 567,610 was generated.

We also achieved a successful unqualified audit report for 2018. Finance has continued to manage icddr,b resources effectively and efficiently while introducing a time management system and beginning the acquisition of a new enterprise resource planning (ERP) integrated system with implementation expected to take place in 2019 and 2020.

Full cost recovery targets have been achieved, but we continue to appreciate support from core donors which represented a significant contribution towards meeting all our costs. Achieving 100% overhead funding entirely from projects remains a formidable challenge, as many donors will not approve more than 10 to 15% overhead rates, leaving a shortfall. Supporting income generation measures, adapting and developing new recovery processes and tariffs that are acceptable to all donors should help icddr,b to be more sustainable in the future.

In addition, icddr,b was identified as a 'low risk organisation' in a recent US audit report (Single Audit under CFR 2 Part 200 Subpart, formerly known as OMB-133 Audit) for the third consecutive year.

HUMAN RESOURCES



During 2018, HR managed 34,513 applications for 263 job vacancies and recruited 2,025 staff, trained 1,737 staff on different soft skills through 57 sessions and oversaw a 98.5% completion rate on staff performance reviews. The staff engagement survey was conducted by HR, finding that

engagement increased by 22% compared to the last survey in 2016. HR provided an awareness programme on the Prevention of Sexual Exploitation and Abuse (PSEA) for 2,007 staff members.

INFORMATION TECHNOLOGY



In 2018, IT implemented efficient and effective automated solutions focusing on sustainability including 65 organisational business processes. More than 92% of IT projects were completed on time and within budget. The start of the ERP project and the sourcing and implementation of a time management system were key milestones.

Information security was enhanced significantly by increasing user awareness, automated security process implementation through security tools and implementation of IT risk management. Information security vulnerability assessment tools were introduced to prevent and detect security breaches. IT is in the process of acquiring the highly regarded security tool, SIEM, to analyse security incidents with enhanced capability of user behavioural analysis and software coding vulnerability assessment with the help of artificial intelligence.

RESEARCH ADMINISTRATION



Research Administration provided technical assistance for preparation, submission and management of research proposals and facilitated the approval process of human subjects research through the review process of icddr,b's Institutional Review Board. Wider circulation of funding opportunities was achieved in 2018. Around 250 potential funding calls were circulated. Through

a coordinated effort with stakeholders, extensive support was provided to researchers during proposal submissions. In 2018, the number of new research protocols and new grants was increased by 15% and 8% respectively. The unit also coordinated the capacity development grant for young researchers funded by one of icddr,b's core donors, Sida. Research Administration, on a regular basis, liaised with the donor agency on behalf of young scientists who are recipients of this grant.

SUPPLY CHAIN AND FACILITIES MANAGEMENT



Supply Chain and Facilities Management has achieved a reduction of annual expenditure of 14%, a reduction in inventory stock by 18% together with cost savings of over 12%. All this has been possible and a range of interventions through the implementation of a robust policy and set of procedures for supply chain management. In

addition, the department has improved fire safety and security, improved food quality in the staff cafeteria, including the introduction of healthy food options for employees, and made environmental improvements with aesthetic landscaping and functional car parking spaces. Installation of a heating, ventilation and air conditioning system provided more appropriate facilities and the specimen reception unit for the diagnostics lab was extended. Looking ahead the team has started to focus on reducing icddr,b's carbon footprint through a range of measures including the efficient use of gas, water and electricity and a review of plastic usage and recycling practices.

REGULATORY AND LEGAL AFFAIRS



A total of 716 legal documents were processed in 2018, a 20% increase over 2017. The team led the process of updating the Institutional Governance Framework of the organisation. icddr,b was represented in different quasi-judicial governmental bodies, ensuring just and equitable protection of icddr,b's and

concerned parties' interests. Preliminary negotiations on a prospective venture in clinical and health research are expected to contribute to the long-term financial sustainability of the organisation.



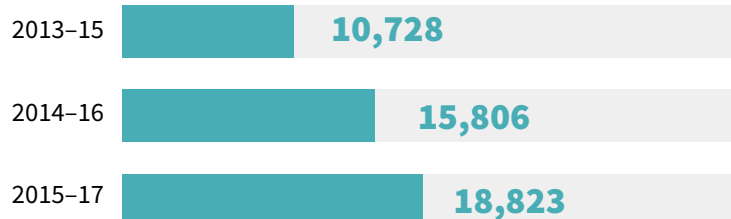
PUBLICATIONS

We are committed to the rapid and full publication of research findings in international peer-reviewed journals. Publication in the peer-reviewed scientific literature is a key indicator of quality, and an important step in the dissemination of new information to scientific, practitioner, policy and programme communities.

HIGH-PROFILE PUBLICATIONS IN 2018

In 2018, icddr,b researchers were authors on 367 original publications, and also contributed to 59 letters, editorials, book reviews and abstracts. These included outputs in leading journals, such as the *New England Journal of Medicine*, the *Lancet*, *Lancet Global Health*, *Lancet Infectious Diseases*, *PLoS Neglected Tropical Diseases*, *Clinical Infectious Diseases* and *Vaccine*. The majority of papers were co-authored with national and international colleagues. icddr,b researchers were also invited to contribute articles to leading journals including the *Lancet*.

CITATIONS



Citations of papers with icddr,b authors published in peer-reviewed journals during three-year periods, up to the end of the following year (e.g. end of 2016 for papers published in 2013–15).



367
Original papers



3
Reports/monographs



7
Book Chapters



7
Abstracts in conference
proceedings



59
Letters, editorials, etc



COLLABORATIONS

Collaboration is core to our work. We work with multiple government, academic and NGO partners in Bangladesh, ensuring a strong focus on local health issues, and have long-standing ties with scientific collaborators in leading research institutions across the world. We are also members of a range of regional networks, and work closely with partners across South Asia and in the global South.

COLLABORATING INSTITUTIONS

BANGLADESH

- ACI Ltd
- Addiction Rehabilitation Residence (Apon)
- Alive & Thrive
- Aparajeyo Bangladesh
- Apollo Hospitals
- Ashar Alo Society
- Associates for Community and Population Research
- Autism Welfare Foundation
- Badhan Hijra Sangha
- Bandhu Social Welfare Society
- Bangabandhu Sk. Mujib Medical University and Hospital
- Bangladesh Agricultural University
- Bangladesh Association for Voluntary Sterilization
- Bangladesh Atomic Energy Commission
- Bangladesh Bureau of Statistics
- Bangladesh Center for Communication Programs
- Bangladesh Customs
- Bangladesh Forest Department
- Bangladesh Institute of Child Health (Dhaka Shishu Hospital)
- Bangladesh Institute of Development Studies
- Bangladesh Institute of Research and Rehabilitation in Diabetes
- Bangladesh Legal Aid and Services Trust
- Bangladesh Lung Foundation
- Bangladesh Medical College Hospital
- Bangladesh Population and Health Consortium
- Bangladesh University Institute of Education
- Bangladesh University of Engineering Technology
- Bangladesh University of Health Sciences
- Bangladesh Women's Health Coalition
- Bangladesh Association for Prevention of Septic Abortion
- Border Guard Bangladesh
- BRAC
- BRAC Development Institute
- BRAC University
- CARE Bangladesh
- Central Veterinary Hospital
- Centre for Injury Prevention and Research, Bangladesh
- Chattogram Maa O Shishu Medical College Hospital
- Chittagong Medical College and Hospital
- Community Based Medical College Bangladesh
- Community Health and Development Program
- CONCERN
- Concerned Women for Family Development
- Confidential Approach to AIDS Prevention
- Consumers Association of Bangladesh
- CREA (Center for Rehabilitation of Drug Addiction)
- Damien Foundation Bangladesh
- Department of Livestock Services
- Dhaka Central Jail Hospital
- Dhaka City Corporation
- Dhaka Medical College and Hospital
- Dhaka North City Corporation
- Dhaka South City Corporation
- Directorate General of Family Planning
- Directorate General of Health Services
- Durjoy Nari Sangha
- Dushtho Sasthya Kendra
- Dustha Manobatar Seba Sangstha
- East West University
- Eminence
- EngenderHealth
- Ethics Advanced Technology Ltd
- Family Health International, Bangladesh
- Family Planning Association of Bangladesh
- Faridpur Medical College Hospital
- Food and Agricultural Organization, Bangladesh
- Fred Hollows Foundation
- Gazipur District Medical Hospital
- Global Alliance for Improved Nutrition, Bangladesh
- Health and Education for Less Privileged People
- Health Economics Unit
- Hellen Keller International
- Holy Family Red Crescent Medical College and Hospital
- Home Economics College
- iDE Bangladesh
- ideSHi/CMBT (Institute for Developing Science & Health Initiatives)
- Incepta Pharmaceuticals
- Institute of Chest Diseases Hospital
- Institute of Child Health & Shishu Sasthya Foundation Hospital
- Institute of Child and Mother Health
- Institute of Epidemiology, Disease Control and Research
- Institute of Nutrition and Food Science
- Institute of Paediatric Neurodisorder and Autism
- Institute of Public Health
- Institute of Public Health Nutrition
- Institute of Water Modelling
- International Food Policy Research Institute
- International University of Business Agriculture and Technology
- Jahangirnagar University
- James P Grant School of Public Health
- JiViTA Project
- John Snow, Inc., Bangladesh
- JSI Logistics Services (Deliver)
- Khulna Medical College Hospital
- Kumudini Hospital
- Kumudini Welfare Trust of Bengal (BD) Ltd.
- Labaid Specialized Hospital
- Lepra Bangladesh
- Leprosy Control Institute and Hospital
- Light House
- Marie Stopes Clinic Society
- Masjid Council for Community Advancement
- Maternal & Child Health Training Institute
- Mattra
- Mawlana Bhashani Science and Technology University
- MBM Garments Ltd.
- mDoc LLC
- Memorial Christian Hospital
- Mohammadpur Fertility Services and Training Centre
- Micronutrient Initiative
- Ministry of Health and Family Welfare
- Ministry of Home Affairs
- Ministry of Science and Technology
- Mohammadpur Fertility Services & Training Center
- Mother and Child Health Training Institute
- Mugda General Hospital
- Mukto Akash Bangladesh
- Mymensingh Medical College and Hospital
- Nari Maitree
- Naripokkho
- National Centre for Tuberculosis and Research
- National Heart Foundation and Research Institute
- National Institute for Population Research and Training
- National Institute of Cancer Research and Hospital
- National Institute of Cardiovascular Disease
- National Institute of Diseases of Chest and Hospital
- National Institute of Mental Health
- National Institute of Neuro Science and Hospital
- National Medical College and Hospital
- National Nutrition Program
- National TB Reference Laboratory
- National Tuberculosis Control Programme
- NGO Service Delivery Program
- National Institute of Preventive and Social Medicine
- Noakhali Science and Technology University
- Nutrition Foundation of Bangladesh
- Obstetrical and Gynecological Society of Bangladesh
- Padakhep Manabik Unnayan Kendra
- Parents Forum for Differently Able
- Paricharja
- Pathfinder International



- Patuakhali Science and Technology University
- PIACT
- Plan International
- Popular Medical College Hospital
- Population Council, Bangladesh
- PRAN-RFL Group
- Primeasia University
- Progoti Samaj Kallyan Protisthan
- Quality Improvement Partnership
- Radda MCH-FP Centre
- Rajabashor
- Rajshahi Medical College and Hospital
- Rangpur Medical College Hospital
- Reproductive Health Services Training and Education Program
- Research, Training, and Management International
- Revitalization of Community Health Care Initiative in Bangladesh
- Rural Service Delivery Partnership
- Salvation Army, Bangladesh
- Save the Children, Bangladesh
- Shaheed Suhrawardy Medical College
- Shimantik
- Shyamoli TB Clinic
- Sightsavers, Bangladesh
- Sir Salimullah Medical College and Hospital
- Smiling Sun Franchise Program
- Social Assistance and Rehabilitation for the Physically Vulnerable
- Social Marketing Company
- Society for Education, Action and Research in Community Health

- Society for the Welfare of Autistic Children
- Society for the Welfare of Intellectually Disabled, Bangladesh
- SurjaKanta Infectious Disease Hospital
- Sylhet MAG Osmani Medical College and Hospital
- Tauri Foundation (School for Gifted Children)
- Terre de Homes
- TREE Foundation Ltd
- UChicago Research Bangladesh
- United Nations Children's Fund (UNICEF), Bangladesh
- United Nations Population Fund, Bangladesh
- University of Chittagong
- University of Dhaka
- University of Rajshahi
- University Research Corporation
- University of Science and Technology Chittagong Hospital
- Urban Family Health Partnership
- Urban Primary Health Care Project
- Water Aid Bangladesh
- We Can Campaign
- World Food Programme, Bangladesh
- World Health Organization, Bangladesh
- World Vision Bangladesh

AFRICA

- Ardhi University, Tanzania
- Armauer Hansen Research Institute, Ethiopia
- Cuttington University Graduate School, Liberia
- INDEPTH Network, Ghana
- International Institute of Primary Health Care, Ethiopia
- KEMRI-Wellcome Trust Research Programme, Kenya
- Kilimanjaro Christian Medical Centre, Tanzania
- Makerere University, Uganda
- Ministry of Health, Mozambique
- MO Resources Ltd, Tanzania
- Njala University, Sierra Leone
- School of Public health, Moi University, Kenya
- Sokoine University of Agriculture, Tanzania
- South African Medical Research Council
- University of Cape Town, South Africa
- University of Global Health Equity, Rwanda
- University of Harare, Zimbabwe
- University of Natal, South Africa
- University of Natal Medical School, South Africa
- University of Venda, South Africa

AUSTRALIA

- Australian National University
- Central Queensland University
- Charles Sturt University
- CSIRO Human Nutrition
- Curtin University of Technology
- Edith Cowan University
- Griffith University
- La Trobe University
- Liverpool Hospital
- Macfarlane Burnet Institute for Medical Research and Public Health
- Menzies School of Health Research
- North Field Laboratories Pvt. Ltd
- Royal Children's Hospital
- University of Adelaide
- University of Melbourne
- University of New England
- University of New South Wales
- University of Queensland
- University of Sydney

SOUTH AND CENTRAL AMERICA

- Institute of Nutrition of Central America and Panama, Guatemala
- Instituto de Investigacion Nutricional, Peru
- National Autonomous University of Mexico
- PRISMA, Peru
- Universidad Peruana Cayetano Heredia, Peru

NORTH AMERICA

- Academy of Educational Development, Washington DC, USA
- Albany Medical Centre, USA
- Albany Medical College, USA
- Albert Einstein College of Medicine, USA
- Aquaya Institute, USA
- Arnold School of Public Health, USA
- Barnard College, USA
- Baylor College, USA
- Binghamton University, USA
- BioScale, Inc., USA
- Boston Children's Hospital, USA
- Boston University School of Public Health, USA
- Brigham and Women's Hospital, USA
- British Columbia Centre for Disease Control, Canada
- Broad Institute, USA
- Brown University, USA
- Centers for Disease Control and Prevention, USA
- Children's and Women's Hospital, Canada
- Children's Hospital Oakland Research Institute, USA
- Children's Hospital of Eastern Ontario, Canada
- Children's Hospital of Richmond at VCU, USA
- Christian Reformed World Relief Committee, USA
- Cincinnati Children's Hospital Medical Centre, USA
- Columbia University, USA
- Consortium for Conservation Medicine, USA
- Cornell University, USA
- Dartmouth Medical College, USA
- Duke Global Health Institute, USA
- Duke University Medical Center, USA
- EcoHealth Alliance, USA
- Emory University, USA
- Emory University Rollins School of Public Health, USA
- Evolve BioSystems, Inc., USA
- Family Health International, USA
- Fenway Institute, USA
- FHI360, USA
- Food and Nutrition Technical Assistance III Project (FANTA III), USA
- Forsyth Institute, USA
- Freeman Spogli Institute, USA
- Georgetown University, USA
- Global Alliance for Improved Nutrition, USA
- Gynuity Health Projects, USA
- Harvard Medical School, USA
- Harvard School of Public Health, USA
- Harvard University, USA
- Hospital for Sick Children, Canada
- Indiana University, USA
- Infectious Disease Research Institute, USA
- Institute for Disease Modeling, USA
- Institute of Health Metrics Evaluation, University of Washington, USA
- International Centre for Research on Women, USA
- International Nutrition Foundation, USA
- Jhpiego, USA
- Jibon Health Technologies, Inc., USA
- Johns Hopkins Bloomberg School of Public Health, USA
- Johns Hopkins University School of Medicine, USA
- Massachusetts General Hospital, USA
- McGill University, Canada
- Medgar Evers College, City University of New York, USA
- National Academy of Sciences, USA
- National Institute of Allergy and Infection Diseases, USA
- National Institutes of Health, USA
- National Vaccine Program, USA
- Nationwide Children's Hospital, USA
- Naval Undersea Warfare Center, USA
- New England Medical Centre, USA
- Northeastern University, USA
- Northwestern University, USA
- Novavax, Inc., USA
- Nutrition International, Canada
- Ohio State University, USA
- Oklahoma State University, USA
- Oregon State University, USA
- Ottawa Hospital Research Institute, Canada
- Pace University, USA
- Pan American Health Organization, USA
- PATH, USA
- PATH Vaccine Solutions, USA
- Pennsylvania State University, USA
- Peter Gilgan Centre for Research and Learning, Canada
- Pfizer, USA
- Population Council, USA
- Portland State University, USA
- PREVENT, USA
- Public Health Agency of Canada
- Pure Earth, USA
- Reckitt Benckiser Inc., USA
- Rhode Island Hospital, USA
- Robert Wood Johnson Medical School, USA
- RTI International, USA

- Salix Pharmaceuticals, USA
- Salu Design, Canada
- Save the Children, USA
- Seattle Biomedical Research Institute, USA
- Smart World Apps, USA
- St Michael's Hospital, Canada
- Stanford University, USA
- Stanford University School of Medicine, USA
- TechLab Inc., USA
- Texas Medical Center Campus, USA
- Tufts University School of Medicine, USA
- Tulane University, USA
- United Nations Children's Fund (UNICEF), USA
- United States Agency for International Development
- United States Army Medical Research Institute for Infectious Diseases
- United States Department of Agriculture
- University of Alabama at Birmingham, USA
- University of Alberta, Canada
- University of Arkansas Medical School, USA
- University of British Columbia, Canada
- University at Buffalo, USA
- University of Calgary, Canada
- University of California, Berkeley, USA
- University of California, Davis, USA
- University of California, Los Angeles, USA
- University of California, San Diego, USA
- University of California, San Francisco, USA
- University of California, Santa Cruz, USA
- University of Central Florida, USA
- University of Chicago, USA
- University of Cincinnati, USA
- University of Colorado, USA
- University of Denver, USA
- University of Florida, USA
- University of Georgia College of Veterinary Medicine, USA
- University of Houston College of Pharmacy, USA
- University of Kentucky College of Medicine, USA
- University of Manitoba, Canada
- University of Maryland Biotechnology Institute, USA
- University of Maryland School of Medicine, USA
- University of Michigan, USA
- University of Minnesota, USA
- University of Missouri, USA
- University of Montreal, Canada
- University of North Carolina, USA
- University of North Carolina School of Medicine, USA
- University of Notre Dame, USA
- University of Pennsylvania, USA
- University of Pittsburgh, USA
- University of Richmond, USA
- University of Saskatchewan, Canada
- University of South Carolina, USA
- University of Southern California, USA
- University of Tennessee, USA
- University of Texas at Galveston, USA
- University of Toronto, Canada
- University of Utah, USA
- University of Vermont, USA
- University of Virginia, USA
- University of Virginia Health System, USA
- University of Washington, USA
- University of Waterloo, Canada
- Vanderbilt University, USA
- Virginia Commonwealth University, USA
- Walter Reed Army Institute of Research, USA
- Warren Alpert Medical School of Brown University, USA
- Washington University School of Medicine, USA
- Western Human Nutrition Research Center, USA
- Wyeth-Lederle Vaccines, USA
- Yale School of Medicine, USA

EUROPE

- Academic Medical Center, Amsterdam, The Netherlands
- Antoni van Leeuwenhoek Hospital/ The Netherlands Cancer Institute
- Bangor University, UK
- Barts and The London School of Medicine and Dentistry, UK
- Bilthoven Biologicals, The Netherlands
- Children's Investment Fund Foundation, UK
- Conservatoire Nationale des Arts et Metiers, France
- Department for International Development, UK
- Drugs for Neglected Diseases initiative, Switzerland
- Dundee University, UK
- Eawag, Switzerland
- Ecole Polytechnique Fédérale de Lausanne, Switzerland
- Eidgenössische Technische Hochschule, Switzerland
- Enfants du Monde, Switzerland
- Erasmus MC University Medical Centre, The Netherlands
- European Centre for Disease Prevention and Control, Sweden
- European Molecular Biology Laboratory, Germany
- Fondation Mérieux, France
- Foundation for Innovative New Diagnostics, Switzerland

- Geneva University Hospital, Switzerland
- GlaxoSmithKline, UK
- GSK Medicines Research Centre, UK
- Huddinge University Hospital, Sweden
- Imperial College London, UK
- Institut Pasteur, France
- Institute of Development Studies, University of Sussex, UK
- Institute of Social Sciences, The Netherlands
- Institute of Tropical Medicine, Belgium
- Institute of Water and Land, Sweden
- International Atomic Energy Agency, Austria
- International Organization for Migration, Switzerland
- Karolinska Institute, Sweden
- Karolinska University Hospital, Sweden
- King Edward VII Hospital, UK
- KNCV Tuberculosis Foundation, The Netherlands
- KU Leuven, Belgium
- Laboratorio de Referencia de Leishmaniasis, Spain
- Leiden University Medical Center, The Netherlands
- LIONEX Diagnostics & Therapeutics, Germany
- Liverpool School of Tropical Medicine, UK
- London School of Hygiene and Tropical Medicine, UK
- Loughborough University, UK
- Ludwig-Maximilians University of Munich, Germany
- Marie Stopes International, UK
- Max Planck Institute for Evolutionary Anthropology, Germany
- Medical Research Council, UK
- Medical University of Vienna, Austria
- Ministry for Social Affairs and Health, Finland
- Nestlé Research Centre, Switzerland
- Nestlé Nutrition Institute, Switzerland
- Netherlands Interdisciplinary Demographic Institute
- Northumbria University, UK
- Norwegian Institute of Public Health, Norway
- Novartis Consumer Health, Switzerland
- Nutriset S A S, France
- Overseas Development Institute, UK
- Population Research Centre, The Netherlands
- REGA Institute, Belgium
- Royal Institute of Technology, Sweden
- Royal Institute of Tropical Research, The Netherlands
- Royal Veterinary and Agriculture University, Denmark
- Sahlgrenska Academy of University of Gothenburg, Sweden

- Sanofi Pasteur, France
- Sheffield Hallam University, UK
- Sint Antonius Ziekenhuis, The Netherlands
- Statens Serum Institut, Denmark
- Stockholm University, Sweden
- Swedish Institute for Infectious Disease Control
- Swiss Agency for Development and Cooperation, Switzerland
- Swiss Federal Institute of Technology
- Swiss Red Cross
- Swiss Tropical and Public health Institute
- TDR, WHO, Switzerland
- Trinity College Dublin, Republic of Ireland
- UCB Osmotics Limited, UK
- Umea University, Sweden
- Unilever Health Institute, The Netherlands
- Unilever Nederland Holdings BV, The Netherlands
- Universitat de Barcelona, Spain
- University College London, UK
- University College London, Institute of Child Health, UK
- University of Aberdeen, UK
- University of Amsterdam, The Netherlands
- University of Basel, Switzerland
- University of Bath, UK
- University of Birmingham, UK
- University of Bristol, UK
- University of Cambridge, UK
- University of Copenhagen, Denmark
- University of Durham, UK
- University of Edinburgh, UK
- University of Exeter, UK
- University of Glasgow, UK
- University of Gothenburg, Sweden
- University of Groningen, The Netherlands
- University of Heidelberg, Germany
- University Hospital of Basel, Switzerland
- University Hospital, Liestal, Switzerland
- University of Iceland
- University of London, UK
- University of Manchester, UK
- University of Newcastle upon Tyne, UK
- University of Oslo, Norway
- University of Oxford, UK
- University of Paris, France
- University of Portsmouth, UK
- University of Sheffield, UK
- University of Southampton, UK
- University of Southampton General Hospital, UK
- University of St Andrews, UK
- University of Stirling, UK
- University of Sussex, UK
- University of Warwick, UK
- University of York, UK

- Uppsala University, Sweden
- Wageningen University, The Netherlands
- Weg door Jonkerbos, The Netherlands
- Wellcome Trust, UK
- Wellcome Trust Sanger Institute, UK
- Wildlife Trust, UK
- World Health Organization, Switzerland

OTHER ASIA

- Action Research & Training for Health, India
- Aga Khan University, Pakistan
- Aichi Medical University, Japan
- Armed Forces Research Institute of Medical Science, Thailand
- AXIS Clinicals Ltd, India
- Banaras Hindu University, India
- BP Koirala Institute of Health Sciences, Nepal
- Centre for Development Studies, India
- Chengdu Institute of Biological Products, China
- China National Health Development Research Center
- Chinese Center for Disease Control and Prevention, China
- Christian Medical College, Vellore, India
- Chulalongkorn University, Thailand
- Clinogent, India
- Drug Monitoring Research Institute, India
- Duke-NUS Graduate Medical School Singapore
- EPI Headquarters, China
- Family Health International, Nepal
- Family Health International, Pakistan
- Family Planning Associations of India
- Foundation for Research in Health Systems, India
- Futures Group International India Pvt. Ltd, India
- Greentech Knowledge Solutions Pvt. Ltd, India
- Indian Institute of Health Management Research, India
- India Development Service
- Indian Institute of Management, India
- Institute for Human Development, India
- Institute for Health Management Pachod, India
- Institute of Social and Economic Change, India
- Interactive Research and Development, Pakistan
- International Institute for Population Studies, India
- International Medical Center of Japan
- International Vaccine Institute, South Korea
- Jissen Women's University, Japan
- Kagawa University, Japan
- Kanagawa University of Human Services, Japan
- Karnatak University, India
- Kyoto University, Japan
- Mahidol University, Thailand
- Malaria Consortium, Thailand
- Matsutani Chemical Industry Co. Ltd, Japan
- Ministry of Health & Sports, Myanmar
- Ministry of Health and Welfare, South Korea
- MSD Wellcome Trust Hilleman Laboratories (P) Ltd, India
- National Council of Maternal and Child Health, Pakistan
- National Institute for Cholera and Enteric Diseases, India
- National Institute of Health, Japan
- National Institute of Infectious Diseases, Japan
- Nay Pyi Taw, Myanmar
- Okayama University, Japan
- Pakistan Institute of Medical Sciences
- PATH India
- Public Health Foundation, India
- Rajendra Memorial Research Institute, India
- Rajiv Gandhi Centre for Biotechnology, India
- Research and Training Center for Community Development, Vietnam
- Research Institute for Humanity and Nature, Japan
- Research Institute of Tuberculosis, Japan
- Sagamihara National Hospital, Japan
- Sanjay Gandhi Postgraduate Institute of Medical Sciences, India
- Sanofi Pasteur, Singapore
- Serum Institute of India Ltd
- Siebold University of Nagasaki, Japan
- SK Bioscience, South Korea
- South Asia Network for Chronic Disease, India
- Sree Chitra Tirunal Institute for Medical Science and Technology, India
- Standard Diagnostics Inc., South Korea
- SUI Associates Co., Ltd, Japan
- Taiyo Kagaku Company Ltd, Japan
- Tokyo University Hospital, Japan
- Tokyo-Kasei University, Japan
- Tuberculosis Research Centre, India
- University of Colombo, Sri Lanka
- University of Kelaniya, Sri Lanka
- University of Kerala, India
- University of Nagasaki, Japan
- University of Nagasaki Institute of Tropical Medicine, Japan
- University of Tokyo, Japan
- University of Tsukuba, Japan
- World Health Organization, Philippines
- Xiamen Innovax Biotech Co. Ltd, China
- Xiamen University School of Public Health, China
- Yamaguchi University Graduate School of Medicine, Japan

SELECTED AWARDS AND ACHIEVEMENTS

PRINCE MAHIDOL AWARD 2018

PROFESSOR JOHN D CLEMENS

icddr,b's Executive Director Professor John D Clemens has received the 2018 Prince Mahidol Award jointly with Swedish immunologist and former icddr,b Scientific Advisory Group Chair Professor Jan Holmgren. Established under the Royal Patronage of the Kingdom of Thailand, the Prince Mahidol Award Foundation annually confers two awards in recognition of outstanding contributions to the advancement of the world's medical and public health services.



ISLAMIC DEVELOPMENT BANK

DR TAHMEED AHMED

icddr,b Senior Director Dr Tahmeed Ahmed and his colleagues Dr Munirul Islam and Dr Azharul Islam Khan received the second Islamic Development Bank (IsDB) Transformers Roadshow 2018 award for development of ready-to-use therapeutic food and plans to address severe acute malnutrition among forcibly displaced Myanmar nationals. The Honourable Prime Minister of the People's Republic of Bangladesh, Sheikh Hasina, presented the award in the presence of the IsDB president HE Dr Bandar MH Hajjar.



BANGLADESH ACADEMY OF SCIENCES

DR SHAMS EL ARIFEEN

icddr,b Senior Director Dr Shams El Arifeen was awarded the prestigious Bangladesh Academy of Sciences Sultan Ahmed Choudhury Science and Technology Gold Medal Award 2017. The Academy confers this award on distinguished scientists involved in research and development in medical sciences.



DR MD. IQBAL HOSSAIN

Dr Hossain was awarded the 'AMAH Siddiqui Memorial Award 2017' in recognition of his contribution to paediatric research and the publication of his paper in American Journal of Clinical Nutrition on assessing acute malnutrition in Bangladeshi children aged 6-60 months.



DR SHEHRIN SHAILA MAHMOOD

Dr Shehrin Shaila Mahmood won the Best Poster award at the Fifth Global Symposium on Health Systems Research in Liverpool, UK. Dr Mahmood's poster highlighted the effect of the Government of Bangladesh's maternal health voucher schemes on ensuring the continuum of maternal and newborn care.



DR SYED M SATTER

Dr Satter was selected from a field of highly qualified candidates as an ICEID 2018 Leader at the International Conference on Emerging Infectious Diseases (ICEID) in Atlanta, USA. This conference brings together more than 1,500 public health professionals from around the world.



DR SHAHANA PARVEEN

Dr Shahana Parveen was awarded the Best International Abstract Award at APIC 2018 (Association for Professionals in Infection Control and Epidemiology) in Minneapolis, USA. Dr Parveen also attended the WHO R&D Blueprint Roadmap Taskforce Meeting for Nipah, one of the priority diseases listed by WHO, as a newly selected taskforce member, in July 2018 in London, UK.

TECHNICAL TRAINING UNIT

icddr,b provides a wealth of training opportunities for researchers, practitioners, policymakers and others, from Bangladesh and globally.

icddr,b offers a rich learning environment for the next generation of researchers, clinicians and practitioners. Participants in training programmes have 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 low-income setting.

During 2018, more than 1,500 public health researchers, programme staff and allied health professionals, students, interns and fellows from 21 countries participated in icddr,b scientific technical training, public health orientations, and field experience programme activities.

In terms of scientific technical training, we organised 30 events and trained 666 professionals (47% men and 53% women; 94% national and 6% international) from 14 countries. During 2018, icddr,b's scientific staff development was a high priority; icddr,b scientific staff accounted for 271 (43%) of the 627 nationals who received training. Most importantly, with support from Sida, training was provided to 182 early-career and mid-level researchers.

We provided public health orientation to 698 students from 10 institutions, including medical colleges in Bangladesh and beyond. Through the field experience programme, we received 154 students/interns/fellows from 42 national and 25 international institutions spanning 11 countries, including Bangladesh, who become goodwill ambassadors for icddr,b.

Locally, collaboration between icddr,b and the BRAC James P Grant School of Public Health helped strengthen institutional capacities, especially in the domains of implementation research and health systems reviews. Globally, we benefited from collaborations with universities, including Uppsala University in Sweden, with the potential for greater collaboration in the future.

The new training and development strategy, part of icddr,b's Strategic Plan 2019-2022, will oversee learning and capacity building better aligned with the needs of the local health workforce, including icddr,b, with training focused on the areas in which icddr,b excels.



Countries represented by students attending icddr,b training courses, and field experience and orientation programmes:

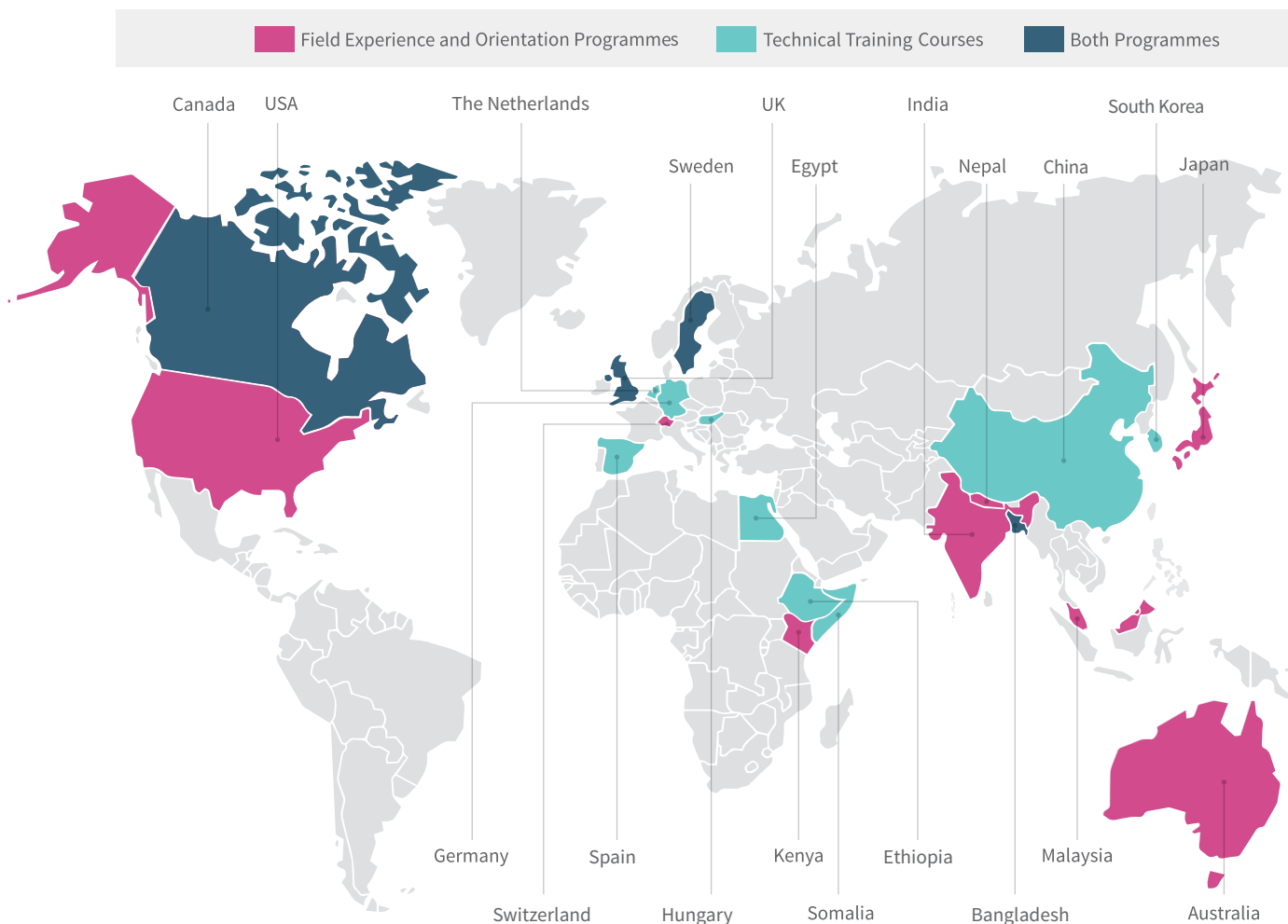
FIELD EXPERIENCE AND ORIENTATION PROGRAMMES

Orientation: Australia, Bangladesh, India, Nepal

Field experience: Australia, Canada, India, Japan, Kenya, Malaysia, Sweden, Switzerland, UK, USA

TECHNICAL TRAINING COURSES

Bangladesh, Canada, China, Egypt, Ethiopia, Germany, Hungary, The Netherlands, Somalia, South Korea, Spain, Sweden, UK



Technical Training Unit

30 training events
666 participants

James P Grant School of Public Health

(a collaboration with BRAC and BRAC University)

11 (9 male and 2 female) icddr,b staff are
faculty or adjunct faculty members

Field experience programme

Aimed at master's and PhD students seeking practical insights
into, and experience of, public health in a low-resource setting

148 students hosted:
105 national, 33 international

Orientation programme

Tailored to meet specific curricular needs, primarily for medical
students interested in research and humanitarian activities

698 students hosted:
559 national, 139 international

CLINICAL SERVICES

Our hospitals in Dhaka and Matlab provide free care to those in need, and provide a basis for an extensive programme of clinical research and training.

For decades, as part of our 'social contract' with the communities with whom we work, we have provided high-quality clinical care through our hospitals in Dhaka and Matlab and at the Mirpur Treatment Centre. In 2018, our clinicians treated more than 240,000 patients, principally at the Dhaka Hospital – a 10% increase over 2017, following a surge of cases of diarrhoeal disease. More than half of these patients were infants under five years of age.

Being intimately involved in the delivery of care ensures that our clinical researchers have a deep understanding of the key health issues facing local populations, and identify appropriate interventions with the potential to be implemented locally or in similar facilities if they are shown to be effective. The hospitals train doctors and nurses in clinical care, and provide a platform for them to take part in clinical research. Our clinical facilities also provide a showcase of what can be achieved in a resource-constrained environment in a low-income country.

Our hospital facilities are important sites for surveillance, clinical training and the testing of new interventions. We also have a duty of care to the

local communities who make such an important contribution to public health research.

We also offer paid-for clinical laboratory testing services, including X-ray, ultrasonography and gastrointestinal endoscopy, the income from which supports provision of care in our hospitals.

Our hospitals in Dhaka and Matlab cost USD 5 million a year to operate, placing a considerable strain on resources. Our Hospital Appeal (<http://donate.icddr.org>) is intended to raise funds to cover the cost of our hospitals. Donations help to support the doctors, nurses, support staff, in-patient and out-patient wards, intensive care unit and nutrition rehabilitation unit that save the lives of thousands of children every year.

Internationally, we provide advice to low-income countries on the set up of health facilities and also contribute to international disease control efforts in crisis situations. Over the past two years, our efforts have been focused on humanitarian emergencies within Bangladesh, and we have played a pivotal role in protecting the health of forcibly displaced Myanmar nationals.



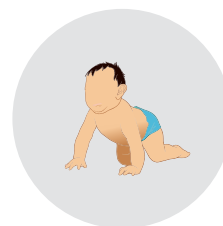
241,874

Patients treated



140,789 (58%)

Number of children <5 years





DHAKA HOSPITAL

● Total patients

166,624

● By gender



58%



42%

● By age



**<5 years:
59%**



**>5 years:
41%**

MATLAB HOSPITAL

● Total patients

59,122

● By gender



45%



55%

● By age



**<5 years:
60%**



**>5 years:
40%**

MIRPUR TREATMENT CENTRE

● Total patients

16,128

● By gender



56%



44%

● By age



**<5 years:
41%**



**>5 years:
59%**

LABORATORY SCIENCES AND SERVICES



Dr Niyaz Ahmed
Senior Director

The Laboratory Sciences and Services Division provides diagnostic and other laboratory services to icddr,b and external clients, and contributes to icddr,b research in microbial genetics and genomics.

The Laboratory Sciences and Services Division brings together all icddr,b's research laboratories and services arms under one umbrella, providing a strategic framework for the development of laboratory sciences and services.

As well as its flagship diagnostic laboratories, the division carries out and supports field-based and clinical research programmes and trials through its laboratory-based activities and platforms. In addition to providing essential laboratory support for projects and outbreak investigations within Bangladesh and abroad, the division also carries out pioneering research in the areas of bacterial genetics and evolution, pathogen survival mechanisms, molecular epidemiology and diagnostic development.

All the service facilities of the division are 100% self-sustaining and generate surplus revenues to cover operational expenses of the division and to support icddr,b's humanitarian projects.

In 2018, the division and its facilities were managed by 224 scientific and technical staff, five research teams, five clinical services groups, four support teams and two regulatory teams.



CONSTITUENT LABORATORIES

The division hosts outstanding research laboratories, and its clinical diagnostic laboratories serve as reference laboratories for the analysis of human disease cohorts and control subjects. The diagnostic laboratories are the only accredited labs in Bangladesh achieving ISO15189 (quality) and ISO15190 (safety) standards for up to 160 tests and parameters. Approximately 1,400 patients and individuals use diagnostic services each day, in addition to in-patients and patients referred from the icddr,b staff clinic.

RESEARCH SUPPORT FACILITIES

The division also operates other research support facilities such as the Genomics Centre, which provides services in the areas of genomics, metagenomics, exon sequencing and microRNA sequencing. A state-of-the-art animal house and a bacteriological media facility also caters to the needs of researchers from within icddr,b and outside collaborators. The division also hosts a biorepository of archived biological materials.

REGULATORY SERVICES GROUPS

The division is responsible for regulatory oversight related to biosafety and biosecurity as well as for laboratory quality monitoring and quality assurance services. Regulatory oversight groups operate in-house quality assurance procedures and also prepare laboratories and research groups for external quality assurance programmes, internal and external audits, and ISO accreditation audits. They also provide vigilance and oversight related to biohazard mitigation, as well as safe and ethical disposal of biological waste.



SENIOR LEADERSHIP TEAM

Our staff of over 4,000 are led by Executive Director Professor John D Clemens and the Senior Leadership Team. Together they are responsible for the day-to-day running of the organisation and are accountable to the Board of Trustees.

SENIOR LEADERSHIP TEAM

AS OF 1 MAY 2019



Professor John D Clemens
Executive Director



Mr Syed Monjurul Islam
Deputy Executive Director



Dr Firdausi Qadri
Acting Senior Director,
Infectious Diseases Division



Dr Shams El Arifeen
Senior Director, Maternal and
Child Health Division



Dr Tahmeed Ahmed
Senior Director, Nutrition and
Clinical Services Division



Dr Niyaz Ahmed
Senior Director, Laboratory
Sciences and Services Division

SENIOR LEADERSHIP TEAM



Professor Allen G Ross
Senior Director, Infectious
Diseases Division
(From August 2018)



Dr Quamrun Nahar
Acting Senior Director, Health
Systems and Population
Studies Division



Ms Catherine Spencer
Director, Communications
and Change Management



**Mr Mohammad Noushad
Chowdhury**
Director, Supply Chain and
Facilities Management



Mr Thomas Barry
Director, Finance



Mr Anthony Flynn
Director, Development



Mr Hugues Bello
Director, Human Resources



Ms Armana Ahmed
Head, Research
Administration

OBSERVERS



Mr Nagarajan Nagarajan
Director, Internal Oversight

SECRETARIAT



Ms Loretta Saldanha
Executive Assistant to the Executive
Director

BOARD OF TRUSTEES

AS OF NOVEMBER 2018

icddr,b's Board of Trustees comprises 16 health professionals and researchers representing both developed and developing countries.

The Board was created by an Ordinance of the Government of the People's Republic of Bangladesh. Three members are nominated by the People's Republic of the Government of Bangladesh, with the WHO and UNICEF nominating one member each. icddr,b's Executive Director serves as the Member Secretary.

The Board operates under the icddr,b Ordinance and the accompanying Board of Trustees Bylaws. The Board of Trustees' roles and responsibilities include fund oversight; approving and monitoring the budget; setting broad institution-wide policies, monitoring adherence to the Strategic Plan; employing, evaluating and supporting the Executive Director; maintaining the line between governance and management; and evaluating the Board's own performance.

Chair:



Dr Richard S W Smith
Adjunct Professor
Imperial College Institute of
Global Health Innovation, UK
(Until June 2018)



Professor Maxine Anne Whittaker
Dean, College of Public Health, Medical and
Veterinary Sciences and Deputy Director of the
Australian Institute of Tropical Health and Medicine,
James Cook University, Australia
(Board Chair from November 2018)

Member Secretary:



Professor John D Clemens
Executive Director
icddr,b



Syed Monjurul Islam
Deputy Executive Director
icddr,b
(Observer)

REPRESENTING THE GOVERNMENT OF BANGLADESH



Kazi Shofiqul Azam
Secretary, Economic
Relations Division
Ministry of Finance



Monowar Ahmed
Secretary in Charge, Economic Relations Division,
Ministry of Finance



Dr Abbas Bhuiya
Chief Editor, *International Journal
for Population, Development and
Health*, Partners in Population and
Development
Former Deputy Executive Director,
icddr,b



Md. Sirazul Islam
Secretary, Health Services Division
Ministry of Health & Family Welfare



Md. Ashadul Islam
Secretary, Health Services Division,
Ministry of Health & Family Welfare

REPRESENTING UNICEF



Dr Therese Dooley
Senior Adviser (water, sanitation and hygiene)
UNICEF Regional Office for South Asia

INDEPENDENT MEMBERS



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Professor, Department of
International Health
Director, International Center for
Maternal and Newborn Health,
Johns Hopkins Bloomberg School of
Public Health, USA



Nancy Y Cheng
Assistant Auditor General, Canada



Kenneth M Dye
International Development
Consultant on Governance and
Accountability
Former Auditor General of Canada



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Former Deputy Minister for Health
Senior Public Health Advisor
University Research Co., Myanmar



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Professor, Infectious Diseases
Helsinki University, Finland



Dr G B Nair
Former Director of National Institute of
Cholera and Enteric Diseases, India, and the
Translational Health Science and Technology
Institute, India.



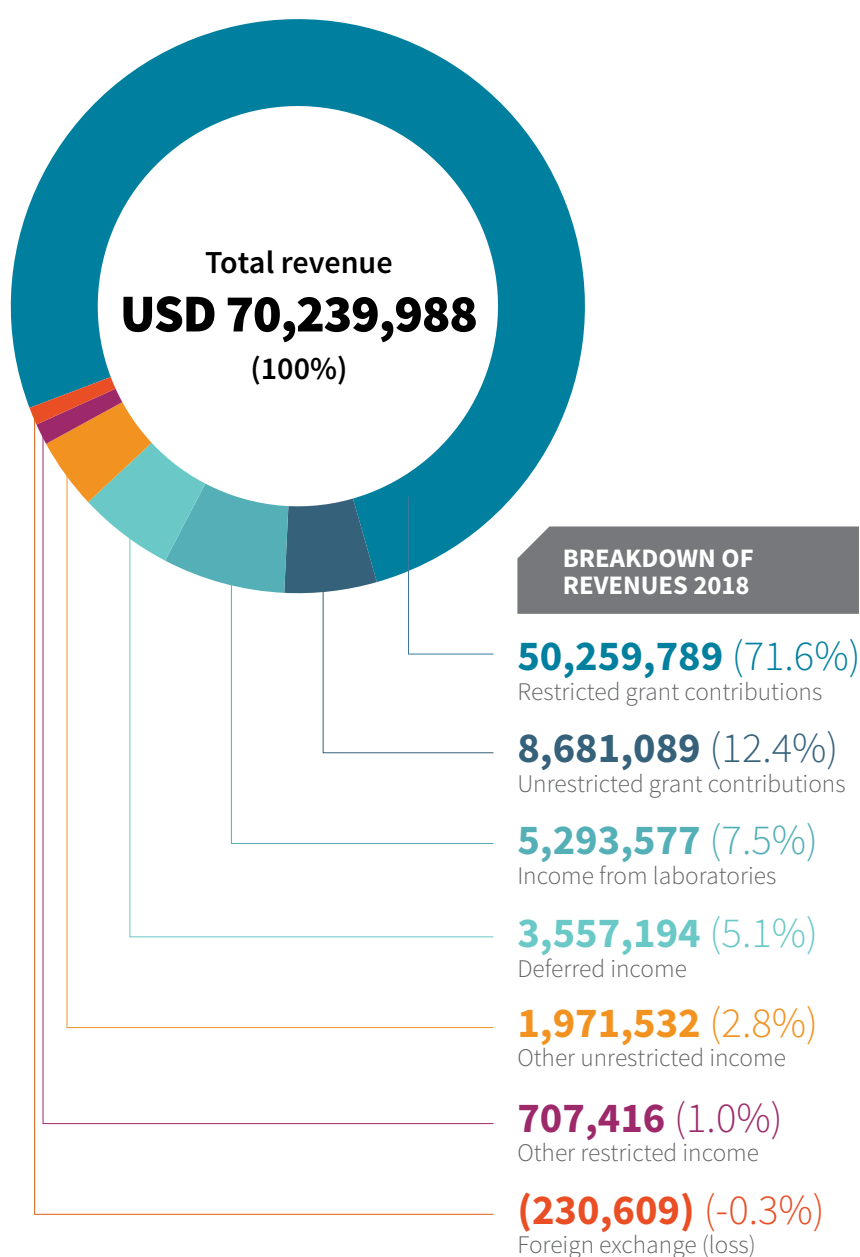
Dr Ogutu Bernhards Ragama
Chief Research Officer, Kenya
Medical Research Institute

FINANCE

icddr,b's overall revenue for 2018 amounted to **USD 70.23 million** compared with a total expenditure of USD 69.67 million, generating a net surplus for the year of USD 568k.

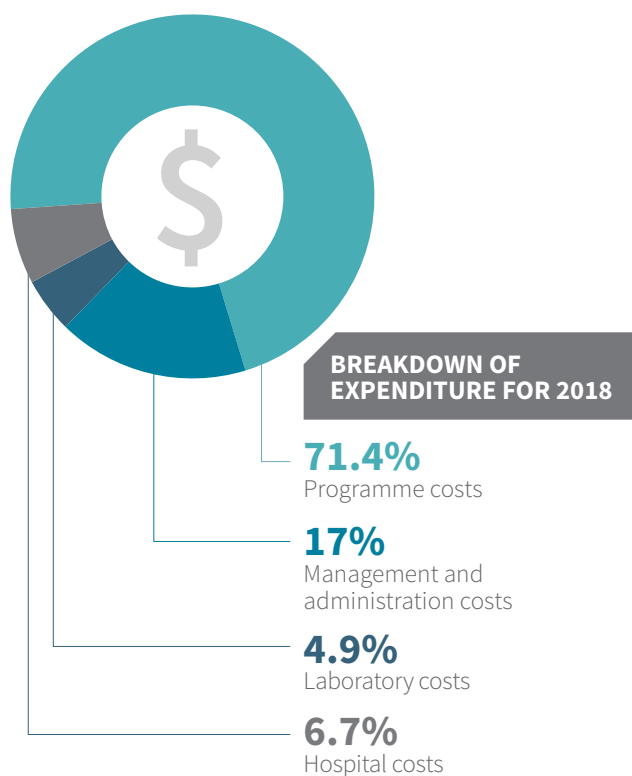
REVENUE

Our overall revenue for 2018 of USD 70.23m (see below) represented an increase of USD 4.32m compared with 2017. Research grant income for 2018 decreased slightly, by USD 97k or 0.2% compared to 2017. Unrestricted funding rose by USD 5.28m or 155%, thanks to increased funding from Global Affairs Canada (USD 1.6m), Government of Bangladesh (USD 553k), DFID (USD 2.5m) and Sida's (USD 700k) full year contribution in 2018.



EXPENDITURE

- Total expenditure for 2018 amounted to USD 69.67m, representing an increase of USD 3.86m compared with 2017.
- The majority of expenditure (71.4%) was related to programme-specific activities, with only 17% related to management and administration; 11.6% of total expenditure related to hospital and laboratory costs.



DETAILED EXPENDITURE FOR 2018:

National staff	USD 32,872,707
International staff	USD 5,521,654
Emeritus staff	USD 882,639
Supplies and materials	USD 7,643,180
Collaborative partnership costs	USD 4,150,861
Travel and vehicle hire charges	USD 3,508,350
Consultancy fees	USD 983,189
Rent, communication and utilities	USD 1,815,190
Training, dissemination and staff development	USD 1,525,402
Other operational costs	USD 10,769,206
Overall expenditure	USD 69,672,378

OTHER KEY FINANCIAL STATISTICS FOR 2018

1. At the end of the year, icddr,b had USD 67.7m in net assets.
2. Cash and cash equivalents amounted to USD 33.2m at the end of the year.
3. Accounts receivables (debtors) increased by 7% because of a rise in final donor contracts being signed later in the year.
4. Accounts payable decreased by 5.5% as a result of reduced supplier and investment liabilities.
5. Provisions increased by 32% primarily due to making provisions for project supplies, project staff costs and to partially doubtful debts.
6. The current ratio (liquidity) has declined from 1.24 in 2017 to 1.19 in 2018.
7. Stock inventories have decreased by 8.4%. In terms of volume, there was a marginal decrease in inventories.
8. Investments decreased by 4.5% due to lower market valuations resulting in increased unrealised gains.
9. Loans and advances decreased by 34% due to lower staff provident fund liabilities and a reduction in security deposits.
10. The workforce increased from 3,341 in 2017 to 3,536 in 2018 (5.8% increase). The total number of scientific staff at the end of the year was 224.
11. Indirect costs (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) rose from 29% to 33.2%; this figure includes central management, hospital and administrative costs.

icddr,b received an unqualified (healthy) audit opinion from ACNABIN chartered accountants in respect of its financial statements for 2018.

Financial statements are available at www.icddrb.org/about-us/reports/financial-reports.

RECOGNISING OUR SUPPORTERS

We are indebted to the foundations, institutions, corporations, development agencies, NGOs and multilateral bodies that support our work.

TOP 10 DONORS DURING 2018

	Donor partners	Restricted ('000 USD)	Unrestricted ('000 USD)	Total ('000 USD)
1	Bill & Melinda Gates Foundation	14,583		14,583
2	US Government – United States Agency for International Development (USAID)	6,300		6,300
3	UK Government – Department for International Development (DFID)	1,313	3,243	4,556
4	US Government – Centers for Disease Control and Prevention (CDC)	3,976		3,976
5	Global Fund to Fight AIDS, Tuberculosis and Malaria	2,719		2,719
6	United Nations Development Group	2,581		2,581
7	US Government – National Institutes of Health (NIH)	2,520		2,520
8	Government of the People's Republic of Bangladesh	415	1,954	2,369
9	Global Affairs Canada	15	2,279	2,294
10	Swedish International Development Cooperation Agency (Sida)	1,041	1,205	2,246

A complete list of donors is provided in Note 20 to the financial statements:
www.icddrb.org/about-us/reports/financial-reports

CORE DONOR FUNDING

We are grateful for the core support provided by the governments of Bangladesh, Canada, Sweden and the UK.

The core donors provide funding that:

1. Enables us to focus on and pursue strategic research objectives, aligned with the new global development agenda, including increased capacity building, advocacy and policy development activities
2. Enhances our financial stability, reducing our vulnerability to changes in the volatile research-funding environment, giving us more independence to prioritise our research agenda and to support worthwhile activities that are not funded by other donors
3. Facilitates our investment in maintaining and improving our infrastructure and research platforms essential to scientific advances, such as disease surveillance networks, state-of-the-art laboratories, and humanitarian services at icddr,b hospitals and clinics, which provide care free of charge to the poorest communities
4. Allows us to continue to modernise our operations – financial, human resources, communications, supply chain and facilities management, and monitoring and evaluation – to improve our organisational efficiency and cost-effectiveness.

Together, these and future investments will ensure that icddr,b continues to generate high-quality research knowledge.



Canada



OUR DONORS

IN 2018

A

Action Against Hunger/Action Contre la Faim Bangladesh (ACF), Bangladesh

Advanced Chemical Industries Limited (ACI), Bangladesh

Annexon, Inc, USA

AXIS Clinicals Ltd., India

B

Bangladesh Agricultural University Research System (BAURES), Bangladesh

Bangor University, UK

Bill & Melinda Gates Foundation, USA

Bilthoven Biologicals B.V., Netherlands

BIOCEPTIVE, INC.(Bioceptive), USA

Boston Children's Hospital, USA

BRAC, Bangladesh

C

CARE Bangladesh

CARE, USA

CDC Foundation, USA

Centers for Disease Control and Prevention, USA

Central Queensland University, Australia

Chevron Bangladesh Blocks Thirteen and Fourteen, Ltd., Bangladesh

Child Health Foundation, USA

Children's Hospital & Research Center at Oakland (CHRCO), USA

D

Department for International Development (DFID), Bangladesh

Department for International Development (DFID), UK

Department of Foreign Affairs, Trade and Development (DFATD), Canada

Dhaka Shishu Hospital, Bangladesh

Directorate General of Family Planning (DGFP), Government of Bangladesh (GoB)

Dr. Abdullah Hel Baqui

Drugs for Neglected Diseases Initiative (DNDi), Switzerland

Duke University, USA

E

EAWAG, Switzerland

EcoHealth Alliance, USA

ELRHA, UK

Emory University, USA

Enfants du Monde, Geneva

Erasmus University, Rotterdam, The Netherlands

F

fhi360, USA

Fogarty International Center/NIEHS/NIH, USA

Food and Agriculture Organization of the United Nations (FAO), Italy

Foundation for Innovative New Diagnostics (FIND), Switzerland

Foundation Merieux, France

Fundacao Faculdade de Medicina, Brazil

G

Gastroliver Foundation, Bangladesh

Gavi Alliance, Switzerland

GFATM, Switzerland

GlaxoSmithKline (gsk), UK

Glenmark Pharmaceuticals Ltd., India

Global Alliance for Clean Cookstoves, USA

Global Alliance for Improved Nutrition (GAIN), Switzerland

Global Alliances to Preventing Prematurity and Stillbirth (GAPPS), USA

Global One (GO), UK

Government of the People's Republic of Bangladesh (GoB)

Grand Challenges Canada (GCC), Toronto, Ontario, Canada

Green Tree International, Korea

Gynuity Health Projects, USA

H

Harvard Medical School, USA

HarvestPlus, USA

Healthcare Pharmaceuticals Limited (HPL), Bangladesh

Heidelberg University Hospital, Germany

Helen Keller International (HKI), Bangladesh

Hilton Foundation, USA

HKG epi THERAPEUTICS Ltd., Hong Kong

I

IHSD - Institute for Health Sector Development Limited, UK

Incepta Pharmaceuticals Ltd. Bangladesh

INDEPTH Network, Ghana

Infectious Disease Research Institute (IDRI), USA

Institute for Developing Science and Health Initiatives (ideSHi), Bangladesh

Institute of Epidemiology, Disease Control and Research (IEDCR), Bangladesh

International Atomic Energy Agency (IAEA), Austria

International Development Research Centre, Canada

International Planned Parenthood Federation, UK

Islami Bank Bangladesh Limited (IBBL)

ITO Supporting Comity, Japan

J

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

Johns Hopkins Bloomberg School of Public Health, USA

Johns Hopkins University (JHU)

K

Karolinska Institute, Sweden

Katholieke Universiteit Leuven (KU LEUVEN RESEARCH & DEVELOPMENT), Belgium

Kenya Medical Research Institute (KEMRI), Kenya

Korea International Cooperation Agency

Kuwaiti Women Philanthropic Team, Kuwait

L

Leland Stanford Junior University, USA

London School of Hygiene & Tropical Medicine, UK

Loughborough University, UK

M

Makerere University School of Public Health (MakSPH), Uganda

Management Sciences for Health, Inc. (MSH), USA

Massachusetts General Hospital (MGH), USA

Matsutani Chemical Industry Co., Ltd, Japan

Max-Planck-Gesellschaft, Germany

Medical Research Council (MRC), UK

Menzies School of Health Research, Australia

Ministry of Local Government, Rural Development & Cooperatives, GoB, Bangladesh

Mott MacDonald Limited, UK

MSD Wellcome Trust Hilleman Laboratories Pvt. Ltd, India

N

National Academy of Sciences (The National Academies), USA

National Institute of Infectious Diseases (NIID), Japan

National Institutes of Health (NIH), USA

National Nutrition Services (NNS), Government of Bangladesh (GoB)

National Tuberculosis Control Programme (NTP), DGHS, MoHFW, Bangladesh

National University of Singapore, Singapore

Nestec Ltd., Switzerland

Nestle Foundation, Switzerland

Non Communicable Disease Control (NCDC) Programme, DGHS, MoHFW, GoB

Northwestern University, USA

Norwegian Institute of Public Health (NIPH)

NUTRITION INTERNATIONAL (NI), Canada

O

Ottawa Hospital Research Institute (OHRI), Canada

OXFAM, Bangladesh

P

Palladium, USA

Partners in Health, USA

PATH, USA

Plan International, Bangladesh

Population Council, USA

PPD Development, LP, USA

Pure Earth, USA

Q

Queensland University of Technology, Australia

R

Rhode Island Hospital, USA

S

S K Bioscience, Republic of Korea
SAJIDA Foundation, Bangladesh
Save the Children International Inc., Dhaka, Bangladesh
Seattle Children's Hospital Foundation, USA
Servier Affaires Medicales, France
SOTER BioConsulting, Inc. USA
South African Medical Research Council, South Africa
Stanford University, USA
Sun Yat-sen University, China
Swedish International Development Cooperation Agency (Sida), Bangladesh
Swedish International Development Cooperation Agency (Sida), Sweden
Swiss Red Cross (SRC), Switzerland

T

TechLab, Inc., Virginia, USA
Tetra Tech, Burlington, USA
The Brigham and Women's Hospital, Inc, USA
The Chancellor, masters and Scholars of the University of Cambridge, UK
The Children's Investment Fund Foundation, UK
The Commission of the European Communities, Belgium
The Fred Hollows Foundation, Australia
The George Institute for Global Health, Australia
The Global Good Fund I, LLC, USA
The Hospital for Sick Children, Canada
The Korea International Cooperation Agency (KOICA), South Korea
The National Institute for Health and Welfare (THL), Finland
The Ohio State University, USA

The Pennsylvania State University, USA
The Regents of the University of California, USA
The Rockefeller Foundation, USA
The Swiss Tropical and Public Health Institute, Switzerland
The United Nations Educational, Scientific and Cultural Organization (UNESCO), France
The United Nations Entity for Gender Equality and the Empowerment of Women, USA
The University Court of the University of Edinburgh, UK
The University of Birmingham, UK
The University of Central Florida, USA
The University of Melbourne, Australia
The University of North Carolina at Chapel Hill, USA
The University of Sheffield, UK
The University of York, UK
The Walter and Eliza Hall institute of Medical research, Australia
The Waterloo Foundation, UK
The Wellcome Trust, UK
Thrasher Research Fund, USA
Tokyo Kasei University and The University of Tokyo, Japan
Tufts University, USA
U
U.S. Agency for International Development (USAID), Dhaka
UBS Optimus Foundation, Switzerland
UNICEF, Bangladesh
UNICEF, USA
United Nations Population Fund (UNFPA), Bangladesh
United States Department of Agriculture (USDA), USA

University College London, UK
University College London Institute of Child Health, London, UK
University of Alberta, Canada
University of California, Berkeley, USA
University of California, San Diego, USA
University of Florida, USA
University of Heidelberg, Germany
University of Maryland, USA
University of Newcastle upon Tyne, UK
University of North Carolina at Chapel Hill, USA
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University of Oxford, UK
University of Saskatchewan, Canada
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University of Tsukuba, Japan
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University of Washington, USA
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Uppsala University, Sweden
USAMC-AFRIMS, Thailand
W
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WELLS BIO, Republic of Korea
World Bank, Washington, USA
World Health Organization (WHO), Bangladesh
World Health Organization (WHO), Malaysia
World Vision, Bangladesh

ANNUAL REPORT 2018



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