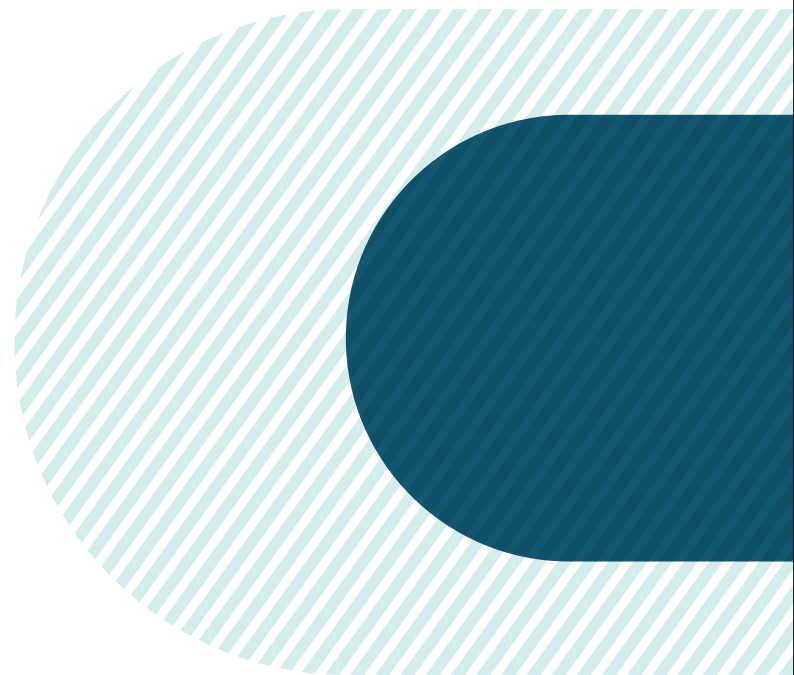




ANNUAL
REPORT

2021

Solving public health problems through
innovative scientific research

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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 60 years ago, we continue to provide life-saving services to the people of Bangladesh and nurture the next generation of global health leaders. Our work has a substantial impact in Bangladesh and worldwide.

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

Canada



ABBREVIATION

A	AdSEARCH	Advancing Sexual and Reproductive Health and Rights
	AHRI	Armauer Hansen Research Institute, Ethiopia
	AMR	Antimicrobial Resistance
	AMU	Antimicrobial Use
	ANC	Antenatal Care
	ART	Antiretroviral therapy
B	BCC	Behaviour change communication
	BDHS	Bangladesh Demographic and Health Survey
	BMEU	Bio-Medical Engineering Unit
	BMJ	British Medical Journal
	BSMMU	Bangabandhu Sheikh Mujib Medical University
C	CDC	Centers for Disease Control and Prevention, USA
	CHT	Chittagong Hill Tracts
	CI	Confidence Interval
	CIRDAP	Centre on Integrated Rural Development for Asia and the Pacific, Bangladesh
	CMS	Central Management Services
	CRVS	Civil registration and vital statistics
D	DFATD	Department of Foreign Affairs, Trade and Development, Canada
	DGFP	Directorate General of Family Planning, Bangladesh
	DGHS	Directorate General of Health Services, Bangladesh
	DHs	District Hospitals
	DLS	Department of Livestock Services, Bangladesh
	DMCH	Dhaka Medical College and Hospital, Bangladesh
	DOTS	Directly Observed Treatment, Short-course
E	ECD	Early Childhood Development
	EN-BIRTH	Every Newborn Birth Indicators Research Tracking in Hospitals
	EPTB	Extra-pulmonary Tuberculosis
	ERP	Enterprise resource planning
F	FAO	Food and Agricultural Organization
	FCDO	Foreign, Commonwealth & Development Office, UK
	FDMN	Forcibly Displaced Myanmar Nationals
G	GAC	Global Affairs Canada
	GoB	Government of the People's Republic of Bangladesh

H	HDSS	Health and Demographic Surveillance System	O	OGSB	Obstetrical and Gynecological Society of Bangladesh, Bangladesh			
	HFI	Household food insecurity		OST	Opioid Substitution Therapy			
I	IEC	Information, education, and communication	P	PPE	Personal protective equipment			
	IEDCR	Institute of Epidemiology, Disease Control and Research, Bangladesh		PS	Psychosocial stimulation			
	IMCI	Integrated management of childhood management	Q	PWID	People who inject drugs			
	INC	Immediate newborn care		QA	Quality Assurance			
	IP	Intellectual property	QMS	Quality Management System				
	IPH	Institute of Public Health, Bangladesh	R	qRT-PCR	Reverse Transcription Quantitative PCR			
	IPHN	Institute of Public Health Nutrition, Bangladesh		R&LA	Regulatory and Legal Affairs			
	IPV	Intimate partner violence		RDT	Rapid diagnostic tests			
	IRB	Institutional Review Board		RT-PCR	Real-time reverse-transcription polymerase chain reaction			
	IT	Information Technology		RUSF	Ready-to-use supplementary food			
	IV	International Vaccine Institute, South Korea	S	SAG	Scientific Advisory Group			
J	JHBSPH	Johns Hopkins Bloomberg School of Public Health		SARI ITC	Severe Acute Respiratory Infection Isolation and Treatment Centre			
				SIDA	Swedish International Development Cooperation Agency, Sweden			
L	LSHTM	London School of Hygiene and Tropical Medicine, UK		SLT	Senior Leadership Team			
				SOP	Standard Operating Procedure			
M	MAM	Moderate acute malnutrition	SRH	Sexual and reproductive health				
			MDCF	Microbiota-directed complementary food	SRHR	Sexual and reproductive health and rights		
			MSM	Men who have sex with men	T	TTU	Technical Training Unit	
			MSW	Male sex workers		U	UH&FWCs	Union Health and Family Welfare Centres
			MUAC	Mid-upper arm circumference			UHCs	Upazila Health Complexes
N	NCD	Non-communicable disease	UHC	Universal Health Coverage				
			NGO	Non-governmental organisation	UNDG		United Nations Development Group	
			NIH	National Institute of Health, USA	UNFPA		United Nations Population Fund	
			NINS	National Institute of Neurosciences and Hospital, Bangladesh	UNICEF	United Nations Children's Fund		
NMEP	National Malaria Elimination Program, Bangladesh	USAID	United States Agency for International Development	USAID's ACTB	USAID's Alliance for Combating Tuberculosis in Bangladesh			
NSVS	National SARS-CoV-2 Variant Surveillance	V	VHWS			Village health workers		
NTP	National Tuberculosis Control Programme, Bangladesh		W	WHO	World Health Organization			

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In 2021, we published findings of national, regional, and international significance.

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- REDUCING MATERNAL, NEONATAL AND CHILD MORTALITY AND IMPROVING THE WELL-BEING OF WOMEN, CHILDREN AND ADOLESCENTS
 - PREVENTING AND TREATING MATERNAL AND CHILDHOOD MALNUTRITION
 - CONTROLLING ENTERIC AND RESPIRATORY INFECTIONS
 - DETECTING AND CONTROLLING EMERGING AND RE-EMERGING INFECTIONS
 - ACHIEVING UNIVERSAL HEALTH COVERAGE
 - ACHIEVING GENDER EQUALITY AND PROMOTING SEXUAL AND REPRODUCTIVE HEALTH AND RIGHTS
 - EXAMINING THE HEALTH CONSEQUENCES OF AND ADAPTATION TO CLIMATE CHANGE
 - PREVENTING AND TREATING NON-COMMUNICABLE DISEASES
-

62 CLINICAL SERVICES

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

64 LABORATORY SCIENCES AND SERVICES

The Laboratory Sciences and Services Division provides diagnostic and other laboratory services to icddr,b, and external clients. In addition, it contributes to icddr,b research in microbial genetics, genomics, environmental health, and gut-brain signalling.



66

CENTRAL MANAGEMENT SERVICES

Central Management Services (CMS) has continually improved and efficiently increased its support for research. We have strengthened the capacity of the departments and increased effectiveness by adopting policies and procedures to improve overall governance, accountability, and transparency.

74

KEY VISITORS IN 2021

Key visitors (national and international visitors) who visited icddr,b's hospital and facilities in Dhaka and Cox's Bazar in 2021.

78

PUBLICATIONS IN 2021

We are committed to the rapid and full publication of research findings in international high-impact peer-reviewed journals.

80

COLLABORATIONS

We work with multiple governments, academic institutions, and NGO partners in Bangladesh, ensuring a strong focus on local health issues, and we have long-standing ties with scientific collaborators in leading research institutions worldwide.

84

SELECTED AWARDS AND ACHIEVEMENTS

Selected awards and achievements.

86

TECHNICAL TRAINING UNIT

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

88

SENIOR LEADERSHIP TEAM

Our staff of over 4,600 are led by Executive Director Dr Tahmeed Ahmed and the Senior Leadership Team (SLT).

90

BOARD OF TRUSTEES

icddr,b's Board of Trustees comprises 15 health professionals and researchers from developed and developing countries.

92

FINANCE

icddr,b's overall revenue for 2021 amounted to USD 80.6 million compared with a total expenditure of USD 77.4 million, generating a net surplus of USD 3.2 million for the year ending 31 December 2021.

95

RECOGNISING OUR SUPPORTERS

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

MESSAGE FROM THE BOARD CHAIR



icddr,b is a global public health research institution founded at the onset of the seventh cholera pandemic in the 1960s. The pandemic caused by COVID-19 has had a significant impact on businesses and organisations all across the world. For icddr,b, the COVID-19 pandemic presented both challenges and opportunities.

As Chair of the Board of Trustees, it is my pleasure to acknowledge the achievements that icddr,b has made in 2021. Our employees in the scientific programmes showed great dedication and professionalism and often worked under difficult operating circumstances. The Centre sought and received collaboration and support from project and funding partners. While some projects had to be scaled back or delayed, we were able to proceed with most of them and made significant progress throughout the year. As you will see in the Annual Report, the Centre ended the year with remarkable scientific achievements in public health.

I am delighted to note that we secured many new research grants and published more scientific papers than even before the pandemic. In total, we generated over US\$80 million in revenue, a record-high in recent times.

The steps icddr,b took in 2020 to protect its employees from COVID-19 have proven to be highly effective and were continued in 2021. In addition to instituting preventive and protective measures for those who came to work at the Dhaka campus, we also helped our employees with other measures, like setting up a COVID-19 treatment facility for them and their family members. I am proud to note that icddr,b was able to sustain its humanitarian efforts during the year for Bangladeshis and the displaced Rohingya people. In particular, the Centre provided essential diarrhoeal hospital care free of charge. In doing so, we took great care to ensure that the quality of care was not compromised as a result of various cost-cutting measures. Looking ahead, rising inflation and the continuing Russian-Ukrainian conflict will put pressure on the global economy. Our long-standing funding partners have been reviewing and adjusting their scope and approach to international development. We will be working judiciously with them to ensure that our partnerships with them remain relevant and strong.

In closing, on behalf of the Board, I would like to thank the icddr,b leadership, our employees, and our research, funding and development partners. Without your contributions, dedication, help, and support, the Centre's achievements in 2021 would not have been possible.

Nancy Y. Cheng, FCPA, FCA
Chair, Board of Trustees
November 2022

MESSAGE FROM THE EXECUTIVE DIRECTOR



2021 has been a remarkable year for icddr,b – more work, revenue, and knowledge generation. While we were challenged by COVID-19 and operated with less than regular in-person office modalities, we thrived and generated a historical record-high amount of revenue, number of staff and a staggering 573 original paper publications in high-impact journals. Our scientists and researchers did an amazing work and made us all proud.

2021 was also a year of celebration as our very own Dr Firdausi Qadri received the Ramon Magsaysay Award, often cited as “Asia’s Nobel Prize.”

I welcome you to dive into this year’s Annual Report and learn more about the outstanding work that we did, such as understanding how wastewater can indicate COVID-19’s burden in a community, what long COVID-19

could mean, how malnutrition in children can be addressed through a game-changing food supplement, how newborns’ survival rate can be increased, the state of mental health of COVID-19 patients and healthcare providers, combatting tuberculosis, HIV and AIDS, and Nipah virus among many others.

Oral rehydration therapy, an intervention developed in large part by icddr,b, has prevented the deaths of about seventy million lives worldwide and continues to do so every day. I trust that many of the innovations and breakthroughs we are making right now will likewise significantly improve the health and well-being of people in Bangladesh, the region, and the world.

Amidst many uncertainties and challenges, we navigated icddr,b quite well and turned 2021 into a success, but again we are challenged by the war in Ukraine and a shift in the global research funding; we have no scope for complacency.

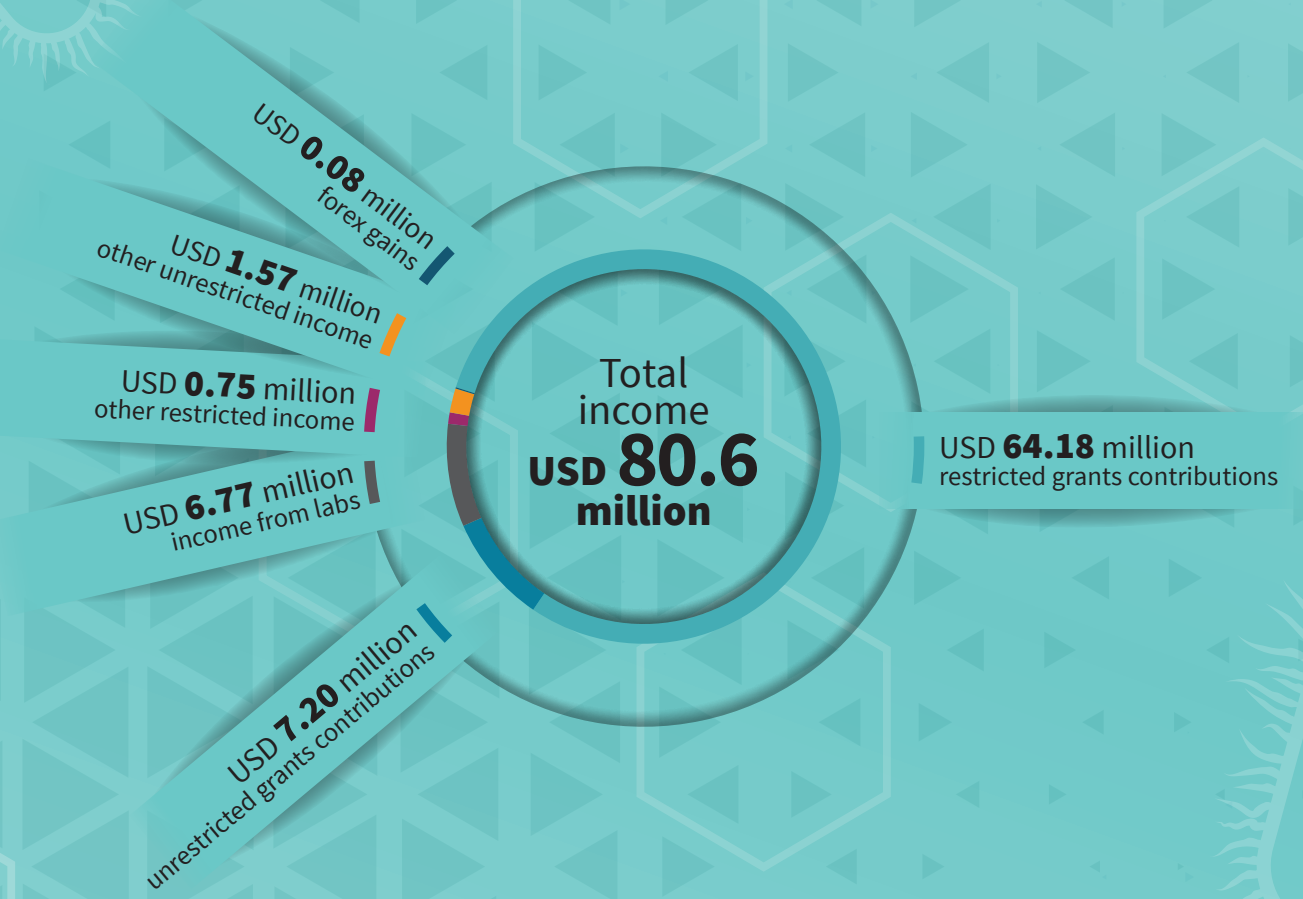
icddr,b’s life-saving research is made possible by the generosity of our funders, collaborators, and supporters. Without them, we would not be able to undertake our research initiatives that have the potential to leave a lasting impact on public health. For this, we are truly grateful.

Dr Tahmeed Ahmed
Executive Director
November 2022

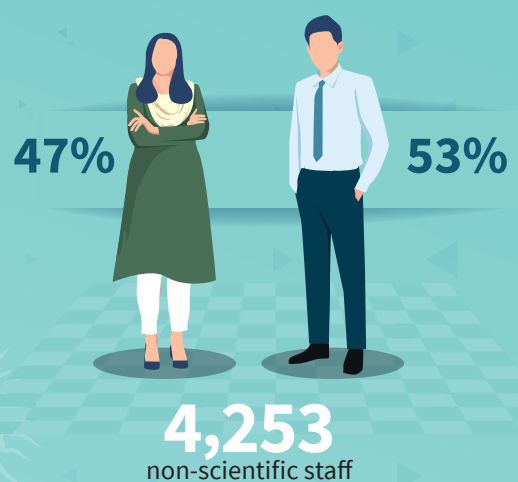
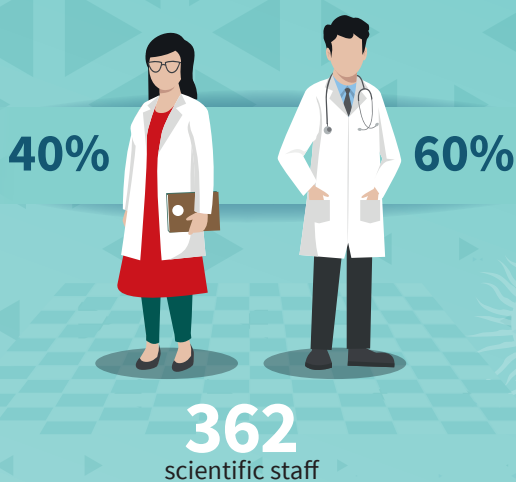


icddr,b IN NUMBERS 2021

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



Note: Restricted (research-specific grants), Unrestricted (operation and development grants)





DIARRHOEAL DISEASE TREATMENT

200,553

patients treated in 2 hospitals

46%
female



54%
male



DIAGNOSTIC CENTRE

712 tests offered



620,211

tests carried out



COVID-19 DIAGNOSIS (In 2021)

96,968

icddr,b Virology Lab

79,223

icddr,b Diagnostic Centre

4,227

USAID's ACTB^[1]
by GeneXpert



COVID-19 TREATMENT

● COVID-19 care in Dhaka

146

outpatient care

108

inpatient care

28

patients requiring oxygen supplementation

In 2021, **479** staff and **537** family members tested positive.



● COVID-19 care by SARI ITC^[2] in Teknaf, Cox's Bazar

1,400

COVID-19 positive patients



ARTICLES AND CITATION

573

original papers published^[3]



43,091

citations from 2017-2021



GRANTS AND PROJECTS

144

new grants



403

ongoing projects



COLLABORATION

103

national collaborations



199

international collaborations



CONTRIBUTION

273

national policy review committees with icddr,b representation



294

international policy review committees with icddr,b representation



CAPACITY BUILDING

834

attendees of icddr,b training courses



474

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

30

icddr,b staff contributing to teaching at the James P Grant School of Public Health



5

faculty positions held by icddr,b staff at the James P Grant School of Public Health (a joint venture with BRAC and BRAC university)

[1] USAID's Alliance for Combating TB in Bangladesh

[2] Severe Acute Respiratory Infection Isolation and Treatment Centre (SARI ITC)

[3] with icddr,b scientists as authors

icddr,b's MULTIFACETED RESPONSE TO THE COVID-19 PANDEMIC

icddr,b has been actively monitoring the development of the novel coronavirus disease pandemic since late December 2019, focusing on the health and well-being of the people of Bangladesh and the continuity of research and hospital operations.

SUPPORT TO THE GOVERNMENT OF BANGLADESH

icddr,b has been devoted to tracking, understanding, and combatting COVID-19 and supporting the Government of Bangladesh with technical assistance at various levels, including participating in the COVID-19 National Technical Advisory Committee. It has also helped Bangladesh ramp up testing and contact tracing, expanding diagnosis and testing services across the country by strengthening the capacities of the staff and laboratories, undertaking COVID-19 variant surveillance, strengthening infection prevention and control, strengthening hospitals and maternal, neonatal, and child health services to continue providing care, psychological support to healthcare workers, etc.

COVID-19 DIAGNOSIS

icddr,b's Bio-Medical Engineering Unit (BMEU) helped the Directorate General of Health Services (DGHS) to install, repair, certify and train about Biosafety Cabinets (BSC) in



COVID-19 labs across Bangladesh. This is supported by icddr,b led USAID's Alliance for Combating Tuberculosis in Bangladesh (ACTB) initiative. The BMEU has trained 45 doctors in operating, maintaining, and calibrating COVID-19 laboratory equipment in 29 government medical colleges.

Additionally, the Virology Laboratory of icddr,b visited 10 Government of Bangladesh (GoB) labs and trained 101 doctors and technologists on "Real-Time PCR detection of COVID-19." In addition, 86 doctors and technologists from 35 labs under the COVID-19 laboratory network of the GoB were trained in nucleic acid extraction, COVID-19 diagnosis, and equipment maintenance. Moreover, 532 professionals from various organisations involved in COVID-19 testing have completed the online RT-PCR, specimen collection, and antigen testing course.

In 2021, more than 180,000 tests were carried out by icddr,b. Among these, icddr,b's Virology lab tested more than 96,968 samples received from across the country. Additionally, icddr,b's Diagnostic Centre commercially offers COVID-19 tests to the general public and tested 79,223 samples. USAID's ACTB initiative tested 4,227 samples

following the National Tuberculosis Control Programme's (NTP) direction.

GENOMIC SURVEILLANCE OF SARS-COV-2

icddr,b initiated SARS-CoV-2 variant surveillance in December 2020 and continued to share findings with the Institute of Epidemiology, Disease Control and Research (IEDCR), DGHS, other Government agencies, and the general public. Between 1 January 2021 and 14 January 2022, a subset of COVID-19 positive samples (13,413) having Ct (cycle threshold) values <30 (n=1,259) were screened for variants by the Next Generation Sequencing at icddr,b Genomics Centre (iGC) and Virology Laboratory.

The surveillance revealed that the Alpha variant was first identified in Bangladesh in January 2021 and persisted until March 2021. The Beta variant was first detected in March 2021 and replaced almost all other variants by May 2021. The Delta variant was first identified in May 2021 and became the most dominant variant replacing all other variants by June 2021. Finally, Omicron arrived in Dhaka in December 2021 and has since emerged as the fastest-growing variant.

Additionally, in March 2021, following a significant surge in the infections in the country, icddr,b helped in founding the National SARS-CoV-2 Variant Surveillance (NSVS) consortium comprised of three other leading institutes – IEDCR, Child Health Research Foundation (CHRF), and Institute for Developing Science and Health Initiatives (ideSHi) to ramp up whole-genome sequencing of SARS-CoV-2. The outcome of variant surveillance has helped the Government formulate many important decisions, including imposing national lockdowns.

icddr,b has been contributing to global knowledge by submitting all complete sequencing to www.gisaid.org and sharing it with other collaborators.

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TREATMENT OF COVID-19

In March 2020, icddr,b management took an unprecedented decision and set up a COVID-19 isolation and treatment ward primarily for its staff and suspected COVID-19 patients at its hospital. icddr,b's Daycare Centre and later staff cafeteria were transformed into COVID-19 isolation and treatment wards, respectively. In 2021, a total of 2,951 COVID-19 tests were done, resulting in 479 staff and 537 family members testing positive. Of these individuals, 254 were treated under the COVID-19 response team at icddr,b's Dhaka Hospital. Among them, 146 were treated at the outpatient unit, 108 received treatment in either the isolation or the COVID-19 ward, and 28 patients treated in the ICU required oxygen supplementation.

With support from UNICEF, icddr,b's Severe Acute Respiratory Infection Isolation and Treatment Centre (SARI ITC) in Teknaf, Cox's Bazar provided health services to the affected Forcibly Displaced Myanmar Nationals (FDMNs) or Rohingya refugees and host communities since August 2020. In 2021, a total of 28,176 patients, including 368 FDMNs, received care for health complications, of which about 1,400 were COVID-19 patients.

COVID-19 RESEARCH AND PROJECTS

icddr,b initiated more than 35 research projects on COVID-19 in 2021 on various issues ranging from transmission dynamics, clinical spectrum and determinants of patients admitted to hospital, studies on natural infection or vaccine-induced antibody, COVID-19's impact on mental health, sewage surveillance, vaccine effectiveness, genomic analysis, therapeutic trials, among many others.

The following section highlights some of these research activities.

Wastewater surveillance of SARS-CoV-2 in Dhaka

icddr,b and the University of Virginia, USA, with support from the Bill & Melinda Gates Foundation (BMGF), have been running a sewage surveillance system covering 33 different catchment areas in eight wards of the Dhaka North City Corporation (DNCC) since June 2019. This was initially started for poliovirus (Sabin vaccine strains), antimicrobial resistance genes, and other enteric pathogens. After the COVID-19 pandemic emerged in Bangladesh in March 2020, the scope of the system was immediately expanded to test samples for the SARS-CoV-2 virus. Since then, sewage samples have been collected weekly from each catchment area, and the amount of viral pathogen in the system is quantified using reverse transcription quantitative PCR (qRT-PCR). The viral load associated with each sample collection site is then connected to its watershed through sewage and drainage line tracing and measures how many infected people are in the area. An online dashboard was developed to present all the real-time sewage surveillance and clinical case data (provided by Access to Information-a2i and IEDCR).

A summary report depicting COVID-19 status in the sewage network from all these areas is also sent to the National COVID-19 Task Force and IEDCR every week. Accordingly, public health officials take necessary containment measures in those areas.

Link for the dashboard: <https://dhakaesforsars-cov-2.research.virginia.edu/>

Seroprevalence of SARS-CoV-2 and associated risk factors

In Bangladesh, the perception prevailed that slum dwellers or people of lower socioeconomic status do not get COVID-19. icddr,b conducted a serosurveillance study that estimated antibody levels against SARS-CoV-2. The study enrolled 3,220 participants who were inhabitants of slums and surrounding non-slum areas in Dhaka and Chattogram cities between October 2020 and February 2021, before vaccination against COVID-19 commenced in the country. The study revealed that 67.3% of the study population had antibodies against SARS-CoV-2. Interestingly, the estimated seroprevalence was more prominent in the slum (71%) than in non-slum (62.2%) areas, disproving the commonly perceived belief.



Furthermore, most seropositive individuals showed very mild or no symptoms of COVID-19 at the time of contact. Only four slum dwellers and 18 non-slum participants were hospitalised with moderate to severe COVID-19 disease in the past six months.

The study concluded that the risk of SARS-CoV-2 infection was higher in people with lower income, lower education status, overweight, presence of non-communicable diseases such as diabetes and heart disease, and lower in people who wore masks regularly, frequently washed hands with soap and had prior BCG vaccination. Estimated infection rate by serosurvey and factors associated with the prevalence of SARS-CoV-2 infection in the poor and middle-class communities may support the imposition of various public health measures.

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Study on side effects of Oxford-AstraZeneca's COVID-19 vaccine

icddr,b evaluated the side effects of the Oxford-AstraZeneca's Covishield vaccine (ChAdOx1 nCoV-19) from March to April 2021, involving 474 participants who received the first COVID-19 vaccine administered in Bangladesh.

Pain at the injection site, fever, myalgia, fatigue, and headache were the most commonly reported symptoms. The overall side effects



were more prevalent in the younger population ($p \leq 0.05$). These findings were consistent with the clinical trial results of ChAdOx1 nCoV-19. Logistic regression analysis further revealed that compared to people aged 70 years or above, the incidence of reported side effects was significantly higher in younger people. In addition, a significantly higher percentage of female participants suffered from post-vaccination side effects than males (OR = 1.51). It was concluded that the Covishield vaccine was well-tolerated among people of different age groups.

Studying COVID-19 vaccines' effectiveness

Post-vaccination effectiveness studies are critical to understanding protection by vaccines as the pandemic progresses, especially because vaccines have been challenged by different variants

that have emerged and become the dominant infecting pathogens.

icddr,b scientists have carried out an effectiveness study of the COVID-19 vaccines against the circulating variants of SARS-CoV-2 among the Bangladeshi population aged 18 years or above using the test-negative design. The patients with COVID-19-like symptoms who were admitted to four healthcare facilities in Dhaka city (Dhaka Medical College Hospital, Kurmitola General Hospital, Mugda Medical College and Hospital, and Bangabandhu Sheikh Mujib Medical University Hospital) from 8 September 2021 to 29 December 2021 were enrolled. They were tested for COVID-19 with RT-PCR and divided into positive cases and matched controls. A total of 313 cases were matched to 1,196 controls. Genome sequencing of the virus of the positive patients revealed that 99.6% of the infections were due to the Delta variant of SARS-CoV-2.

The study revealed that among the three vaccines for which protection was evaluated (Moderna (mRNA-1273); Sinopharm (Vero Cell-inactivated); Serum Institute of India (ChAdOx1 nCoV-19), only the Moderna vaccine was associated with significant (64%) protection (95% CI: 10 to 86, $p=0.029$) against symptomatic COVID-19 disease. Protection by receipt of any vaccine against severe disease was 85% (95% CI: 27 to 97, $p=0.019$), with protection ranging from 75% to 100% by the three vaccines studied.

Understanding the long-term effects of COVID-19

While most people with COVID-19 get better within a few days or weeks of their first symptoms and recover, for some people, symptoms can last longer. The emerging evidence suggests that the after-effects of COVID-19 can affect multiple organ systems and persist for many months. icddr,b began a prospective



longitudinal study in collaboration with Bangabandhu Sheikh Mujib Medical University Hospital (BSMMU) in 2021. The study aims to assess the prevalence of symptoms and clinical and laboratory findings among COVID-19 survivors after clinical recovery for up to 24 months to capture the evolution of clinical characteristics over time.

A preliminary analysis revealed that COVID-19 survivors reported a wide array of symptoms during the baseline visit, including fatigue (81%), sleeping difficulty (50%), headache (38%), cough (36%), foggy thinking (33%), body ache (33%), dizziness (31%), palpitation (31%), and joint pain (31%). Additionally, 61% of participants had depression and anxiety disorder, and 19% had post-traumatic stress disorder. Even after 12 months of initial infection, suffering remained remarkably high.

The new occurrence of neurological, respiratory, cardiovascular, and psychiatric findings was higher among COVID-19 survivors. The incidence rate of new-onset diabetes mellitus among hospitalised survivors was 9 of 1,000 person-month compared to none among survivors in the non-hospitalised group. The incidence rate of worsening blood glucose control, as evident by the new requirement of insulin therapy, was higher among hospital survivors than in the non-hospitalised group.

Validation and clinical evaluation of COVID-19 rapid diagnostic test kits

In 2021, the active COVID-19 infection detection method was a real-time RT-PCR assay using a nasopharyngeal swab, a gold standard for diagnosing COVID-19. However, the RT-PCR test is expensive and needs proper technical expertise; thus, not suitable for mass-level screening.

icddr,b supported the GoB for evaluating the rapid diagnostic test (RDT) kit in different settings for its widespread application and incorporation in the testing algorithm of COVID-19 diagnosis and RT-PCR assays. As a result, it was found that in expediting the diagnostic process and onward COVID-19 management in the country, SARS-CoV-2 antigen-based RDT is highly effective compared to the RT-PCR test [1].

Additionally, icddr,b scientists have evaluated the clinical performance of the OnSite® COVID-19 Rapid Test involving 380 symptomatic patients. Overall sensitivity and specificity were found to be 91% (95% CI: 84.8–95.3%) and 99.2% (95% CI: 97.1–99.9%) compared to RT-PCR. The RDT can also detect patients six days after the onset of symptoms to a maximised performance with an average of Ct ≤ 26.48. Based on the results, the kit received Emergency Use Authorization by the World Health Organization (WHO) [3].

1. Rahman MM, Hoque AF, Karim Y, Kawser Z, Siddik AB, Sumiya MK, Siddika A, Alam MS, Alam AN, Alam M, Hossain ME, Banu S, Qadri F, Shirin T, Rahman M, Rahman MZ. 2021. Clinical evaluation of SARS-CoV-2 antigen-based rapid diagnostic test kit for detection of COVID-19 cases in Bangladesh. *Heliyon*. 2021 Nov;7(11):e08455. doi: 10.1016/j.heliyon.2021.e08455.

2. Sazed SA, Kibria MG, Hossain MS, Zamil MF, Adhikary PC, Hossain ME, Ahmed D, Haque R, Alam MS. Clinical evaluation of a new antigen-based COVID-19 rapid diagnostic test from symptomatic patients. *Diagnostics*. 2021 Dec 8;11(12):2300. doi:10.3390/diagnostics11122300

Studying knowledge and practices of hygiene among migrant workers

In Bangladesh, migrant workers' remittance represents the second largest foreign currency earnings, and they are one of the worst victims of COVID-19. icddr,b researchers conducted a study to explore hygiene

practices and COVID-19 vaccine efficacy among migrant workers in Bangladesh in collaboration with International SOS in Singapore and the Ministry of Expatriates' Welfare and Overseas Employment, Bangladesh.

The study revealed that only one-third of the workers had handwashing knowledge and followed those, and half had knowledge about respiratory hygiene and practised those. The study also found that although Pfizer and mixed vaccines (Moderna/Pfizer/Sinopharm) showed the highest antibody for Anti-SARS-CoV-2-N and Anti-SARS-CoV-2-S in their blood, the antibody titers declined significantly after five months of vaccination.

The study concluded that the Government should have efforts to raise awareness of hand and respiratory hygiene among migrant workers through developing information, health education, and communication (IEC) and behaviour change communication (BCC) materials. Training on hygiene should be incorporated in the Bureau of Manpower Employment and Training (BMET) pre-departure mandatory training courses. Migrant workers also should get the full course of the COVID-19 vaccine and should be covered by regular serosurvey from respective experts as the antibody level wanes over time.

The longitudinal immune response of COVID-19

(Please see page 29).

Estimating excess mortality during COVID-19

(Please see page 30).





SPOTLIGHT

The following stories highlight five areas – malnutrition, mental health, combatting tuberculosis, HIV/AIDS care and prevention, and Forcibly Displaced Myanmar Nationals (FDMNs) health protection – where we have a national and international impact.

THE DEVELOPMENT OF MDCF, A POTENTIAL GAME CHANGER IN THE FIGHT AGAINST CHILDHOOD MALNUTRITION

Regrettably, in 2020 an estimated 5 million children under the age of 5 years died worldwide, mostly from preventable and treatable causes. About one in five of these deaths are attributed to severe wasting (too thin for their height), which is caused by a lack of nutritious food and repeated bouts of diseases, which in turn compromise their immunity. Globally, about 45 million under-5 children are wasted, of which more than a half live in South-East Asia (about 25 million), and more than one-fifth live in Africa (about 10 million). Bangladesh has a high rate of child undernutrition, contributing to about 1.4 million children being affected by wasting, commonly known as moderate acute malnutrition (MAM).

There is a lack of evidence-informed recommendations on the composition of supplementary foods used to treat children with MAM. Children suffering from malnutrition often fail to grow even after eating enough. Consequently, their brains do not develop properly and remain susceptible to diseases many years after. This is due to their immature gut microbes, resulting in poor growth of the child. Not all foods are equally effective in solving this global problem. Scientists from icddr,^b and Washington University, USA, have studied the major types of bacteria in children's healthy guts. They also tested which sets of foods boost these beneficial bacterial colonies in animal models. Based on the findings, they developed the Microbiota Directed Complementary Food (MDCF), made up of locally available food ingredients that not only repair the gut microbiota but also stimulate its proliferation of beneficial growth potential bacteria leading to restoring the healthy

growth and mental development of the children.

A Microbiota Directed Complementary Food prototype (MDCF-2) or a ready-to-use supplementary food (RUSF) was given to 123 slum-dwelling Bangladeshi children aged between 12 and 18 months with moderate acute malnutrition. The supplementation was given twice daily for three months, followed by one month of monitoring. Weight-for-length, weight-for-age, and length-for-age z scores and mid-upper-arm circumference values were collected at baseline and every two weeks during the intervention period and at four months. The study compared the rate of changes in the related phenotypes between baseline and three months and between baseline and four months. It also measured levels of 4,977 proteins in plasma and 209 bacterial taxa in faecal samples.

The study finds that the rates of change in the weight-for-length



and weight-for-age z scores were consistent with a benefit of MDCF-2 on growth throughout the study. In addition, the receipt of MDCF-2 was found to be linked to the magnitude of change in levels of 70 plasma proteins and 21 associated bacterial taxa that were positively correlated with the weight-for-length z score ($P < 0.001$ for comparisons of both proteins and bacterial taxa). These proteins included mediators of bone growth and neurodevelopment. The findings support MDCF-2 as a dietary supplement for young children with moderate acute malnutrition and provide necessary insights into its effectiveness. It also demonstrated that MDCF-2 could repair immature microbiota, promote weight gain and increase plasma biomarkers related to bone formation, neurodevelopment, and immune function.

This food preparation is culturally acceptable and affordable by local communities and is considered a sustainable approach to treating undernutrition. Further studies are under consideration, including a Pre-Proof of Concept trial to develop a shelf-stable, bio-similar formulation of MDCF-2 and a larger multi-country trial.

Chen RY, Mostafa I, Hibberd MC, Das S, Mahfuz M, Naila NN, Islam MM, Huq S, Alam MA, Zaman MU, Raman AS, Webber D, Zhou C, Sundaresan V, Ahsan K, Meier MF, Barratt MJ, Ahmed T, Gordon JI. A microbiota-directed food intervention for undernourished children. *N Engl J Med.* 2021 Apr 22;384(16):1517-1528. doi: 10.1056/NEJMoa2023294.

ADDRESSING MENTAL HEALTH AND WELLBEING OF COVID-19 PATIENTS AND HEALTH WORKERS

The COVID-19 epidemic was stressful for everyone, especially those infected and engaged in providing treatment. Uncertainty about one's own health

and the health of loved ones creates the most stress. Due to their increased workload, fear of infection, and separation from family and friends, health workers are under significant psychological stress during COVID-19.

icddr,b created a web-based platform for virtual mental health therapy for healthcare providers and COVID-19 patients. It engaged clinical psychologists from the University of Dhaka to hold virtual lectures and disseminate mental health-related information. In addition, clinical psychology graduates formed a pool of counsellors. Young psychologists under this pool were guided by the senior professors of the university. Through the web-based platform, 2,814 COVID-19 patients and 2,586 healthcare workers from 34 facilities in 16 districts received counselling. This effort was financed by the United Nations Population Fund (UNFPA) and USAID, with technical support from the University of Dhaka's Department of Clinical and Counselling Psychology. icddr,b also delivered 360 mental health and COVID-19 guidebooks developed by the Non-communicable Diseases Control (NCDC), DGHS. About 1,600 posters and 20,000 pamphlets were provided to 16 hospitals to promote awareness among patients,

healthcare personnel, attendants, and the general public.

Following its success and subsequent request from the NCDC, icddr,b initiated a project to build "Well-being corners" at the district and sub-district level health facilities integrated into their routine health services to provide online mental health counselling.

RESPONSE TO THE FORCIBLY DISPLACED MYANMAR NATIONALS

More than 700,000 FDMNs, commonly known as Rohingyas, arrived in the Cox's Bazar region of Bangladesh in 2017, bringing the total displaced people to more than a million. icddr,b continues to play a key role in protecting the health of FDMNs in Bangladesh through surveillance of diseases, pre-emptive vaccination and providing treatment for diarrhoea and COVID-19.

icddr,b has been supporting the GoB in undertaking regular diarrhoeal surveillance in nine sentinel sites in the camps and two in host communities. Every month, around 300 rapid cholera tests are carried out, and those samples are then sent to Dhaka for a laboratory



culture test. Regular testing of water samples and disease surveillance have significantly checked outbreaks of waterborne diseases, including diarrhoea in the camps, when an outbreak could create a large-scale disaster.

Islam MT, Khan AI, Khan ZH, Tanvir NA, Ahmmed F, Afrad MMH, Begum YA, Kim M, Hasan ASMM, Vandenant M, Uzzaman MS, Shirin T, Clemens JD, Qadri F. Acute Watery Diarrhea Surveillance During the Rohingya Crisis 2017–2019 in Cox's Bazar, Bangladesh. *J Infect Dis.* 2021 Dec 20;224(12 Suppl 2):S717-S724. doi: 10.1093/infdis/jiab453

Studying Menstrual Hygiene Practices among Rohingya Adolescent Girls

Menstrual Hygiene Management (MHM) is a health concern and challenge, especially in humanitarian crises. icddr,b scientists conducted a study to assess knowledge, practice, and factors for healthy MHM practices among Rohingya adolescent girls between 14 to 18 years. It was found that about 51% of adolescent girls learned about menstruation from their mothers and older sisters after the first occurrence of menstruation or menarche at the mean age of 12 years. About 75% of them used sanitary pads as absorbents, which they receive mostly as relief material or bought from local stores (83%); the rest used cloths and

other materials (25%). About 57% of the respondents disposed of their absorbents by burying them. Those who used reusable absorbents washed them with soap and water (40%) and mostly dried them indoors (17%). Factors influencing healthy MHM practice included using absorbents, privacy, disposal, washing and drying clothes, physical activities, hygiene, and pain management. Adolescents with secondary or higher education were four times more likely to have better MHM practice (odds ratio=4.27; confidence interval=1.19–15.31) than those without schooling.

Rakhshanda S, Ahmed S, Saidu S, Nderitu C, Thapa B, Awal A, Farnaz N, Rahman A, Aktar B, Faruque ASG. Knowledge and practice regarding menstrual hygiene management among the Rohingya refugee adolescent girls in Cox's Bazar, Bangladesh: a mixed method study. *Int J Hum Rights Healthc* 2021 May 15; 14(4):311-326. doi: 10.1108/IJHRH-10-2020-0096.

SARI ITC in Teknaf, Cox's Bazar

icddr,b, with support from UNICEF, has been operating a 75-bed SARI ITC at Teknaf, Cox's Bazar, since 31 August 2020 to provide COVID-19 care to affected Rohingya refugees and host communities. SARI ITC is staffed with 155 employees, including

trained doctors, nurses, medical technologists, patient care attendants, biomedical engineers, infection prevention-control officers, data, IT, and logistic officers. The facility is well-equipped with essential supplies, including Personal protective equipment (PPE), medicines, central oxygen supply, cylinder oxygen, concentrators, and high-flow nasal cannulas. It also has a 10-bed High Dependency Unit, Laboratory, X-ray, and ECG unit to support patient care.

All services are free of charge, including diagnosis, treatment, meals for inpatients, and referral to Cox's Bazar public hospital. Alongside the management of COVID-19, the facility provides treatment for the chronic obstructive pulmonary disease (COPD), asthma, diarrhoea, hypertension, diabetes, pneumonia, and malnutrition.

In 2021, SARI ITC treated 28,176 patients, including 368 FDMNs, for health complications, of which about 1,400 were COVID-19 positive and received treatment accordingly. The majority of the COVID-19 patients were clinically mild (47%), followed by moderate (28%), severe (22%), and about 3% were critically ill.

SARI ITC inaugurated a nutrition corner in July 2021 to provide services to visiting patients at the outpatient department. Many patients who received treatment at the SARI ITC commended the care, and some of them took to social media to share their overwhelming experiences.



COMBATTING TUBERCULOSIS

In Bangladesh, tuberculosis remains a significant cause of illness, with an estimated 986 individuals getting it every day, accounting for about 120 lives per day¹. The COVID-19 pandemic has exacerbated this situation.

Since March 2020, icddr,b has been implementing USAID's Alliance for Combatting TB in Bangladesh (ACTB) initiative. It strives to increase the TB case detection rate to 90% and sustain the treatment success rate to over 90% within the next four years.

icddr,b led USAID's ACTB has been supporting the National Tuberculosis Control Programme (NTP), DGHS, and the Ministry of Health and Family Welfare to accelerate their efforts to end TB through a comprehensive series of activities.

One Stop Solution for TB at the Heart of Dhaka

To manage and treat all forms of TB at one facility, USAID's ACTB opened the country's first One Stop TB Service Centre in Shyamoli, Dhaka. The Center has a state-of-the-art clinical facility for safe and effective TB treatment and a multidisciplinary team approach to addressing complex clinical and social aspects of TB.

Rolling out all Oral Shorter Treatments for DR-TB

Reducing the DR-TB regimen is a milestone in treating patients who used to be managed by long-term and painful injectables. USAID's ACTB, in partnership with NTP, devised an expansion plan for all oral shorter DR-TB regimen in Bangladesh; developed a training package for healthcare providers; trained physicians and healthcare personnel;

and scaled up all oral DR-TB regimen in Dhaka, Rajshahi, Mymensingh, and Sylhet divisions. In 2021, 650 DR-TB patients were enrolled under this regimen. Additionally, USAID's ACTB deployed six medical officers who ensured the treatment and management of 6,353 DR-TB patients in six Programmatic Management of DR-TB (PMDT) sites.

Launch of TB Preventive Treatment

It is estimated that 27% of the population of high TB endemic countries like Bangladesh may have latent TB infection. Tuberculosis preventive treatment or TPT can reduce rates of progression from infection to active TB disease by about 60 to 90%. USAID's ACTB, in partnership with the NTP, launched TPT in Bangladesh in May 2021. Under this initiative, free of charge TPT is offered to people who are infected or are at risk of developing active TB. Following the successful implementation of the initiative at all the seven Upazilas of Moulvibazar

district, it is gradually being scaled up across Bangladesh.

Countering Adult and Childhood TB

To increase adult and childhood TB diagnosis in Bangladesh, in 2021, USAID's ACTB carried out facility-based active case finding for TB in secondary and tertiary healthcare facilities across four divisions of Bangladesh. Additionally, USAID's ACTB conducted training and orientations on childhood TB for physicians and healthcare providers to improve their clinical diagnostic capacity. To increase knowledge and awareness and reduce the stigma about childhood TB, USAID's ACTB established childhood TB corners in selected health facilities. To provide infection prevention control support and to ease TB service seekers' visits to Directly Observed Treatment, Short-course (DOTS) corners, facility readiness activities were also carried out at 119 DOTS corners of Rajshahi and Sylhet divisions.



¹ Global Tuberculosis Report 2021, World Health Organization



Public-Private Mix (PPM) Approach to Controlling TB

One of the major challenges to controlling TB is the missing number of people with TB who are seeking services in the private sector. icddr,b TB Screening and Treatment Centres (TBSTCs) – operating under an innovative social enterprise model – have successfully contributed to an increase in TB diagnosis and management through private sector engagement. In 2021, ten icddr,b TBSTCs detected a total of 6,671 TB cases (all forms).

Since people with diabetes are three times more likely to get TB, as a PPM initiative, USAID's ACTB collaborated with the Diabetic Association of Bangladesh (BADAS) and has been screening people with diabetes for TB. When found positive, they are referred to the nearest DOTS centres

for TB treatment. This initiative helped detect 3,213 TB cases in 2021. USAID's ACTB also partnered with the Social Marketing Company (SMC) to engage their vast network of informal healthcare providers to ramp up TB detection, improving their quality of service and establishing a referral mechanism.

Additionally, to address the existing gaps in extra-pulmonary tuberculosis (EPTB) diagnosis and treatment, USAID's ACTB included free of charge EPTB services in the TBSTC at Mirpur, Dhaka, and in two other private diagnostic centres in Dhaka.

Preparing Next Generation Public Health Professionals

To attract the next generation of public health professionals and bio-medical researchers to the TB programme, USAID's ACTB partnered

with BSMMU and the National Institute of Preventive and Social Medicine (NIPSOM), and provided fellowships to post-graduate doctors/students conducting research/thesis on TB. In 2021, four students were awarded this fellowship.

HIV/AIDS CARE AND PREVENTION

icddr,b's Programme for HIV and AIDS is quite unique as it conducts research to generate evidence and then implements interventions within the framework of implementation science to facilitate national scale-up by the Government and non-governmental organisations (NGOs). The Programme addresses the needs of the most vulnerable, marginalised, and service access-compromised

populations, such as men who have sex with men (MSM), including male sex workers (MSW); transgender women (hijra), and people who inject drugs (PWID) through the Opioid Substitution Therapy (OST) programme. In addition to providing preventive, testing, and care within the HIV prevention interventions, icddr,b undertakes many evidence-based approaches as follows:

Strengthening HIV Prevention by Piloting a Biomedical Breakthrough

The HIV intervention modality historically adopted behavioural approaches (e.g., condom distribution, BCC, etc.). However, this may not suffice in the context of the increase in HIV infection among MSM and hijra. Thus, this needs to be complemented by a scientifically proven biomedical intervention. In Bangladesh, icddr,b has pioneered pre-exposure prophylaxis (PrEP) for these populations, considering their sexual risk behaviours. PrEP is an antiretroviral medication taken by HIV-negative people who are at substantial risk of HIV infection. Following successful clinical trials and interventions in other countries, the approach is underway as a pilot. If it succeeds, the Government may consider scaling up PrEP across the country.

Virtual HIV Prevention Intervention for Hidden MSM

Service access has always been challenging for identified MSM in Bangladesh, as societal discrimination makes them hard to reach. Moreover, MSM from higher socioeconomic strata do not visit HIV Service Centres due to the fear of identity disclosure and reluctance to associate with other service recipients. Against this backdrop, icddr,b is piloting an intervention for these MSM groups consisting of virtual education and

communication services, condom distribution, and HIV self-testing with linkage support. If successful, this could lay the foundation for a low-cost, sustainable approach that opens avenues to reach these groups and potentially other key populations at risk of HIV.

Optimising HIV Testing Coverage through HIV Self-Testing (HIVST)

A recent study of oral fluid-based HIV self-testing among MSM, hijra, and their partners revealed high feasibility and acceptability rates of 92% and 99%, respectively, thus marking its inclusion in the national HIV testing guidelines. Subsequently, this testing approach was introduced into the existing intervention modality. It will potentially be scaled up to the national HIV program, which works with FDMNs and other key populations. icddr,b is also currently working with the government bodies to develop a standard operating procedure (SOP) to guide this large-scale implementation.

Gender-Responsive Interventions for MSM

icddr,b is exploring options for serving the unmet needs of unserved, vulnerable and at-risk population groups, such as MSM's female partners. Accordingly, the Programme has been sensitising service providers on human sexuality, sexual and gender diversity, etc. This piloting is ongoing in several districts and has the potential to scale up in other districts.

Government Ownership of the OST Program

Pioneered and piloted by icddr,b since 2010, the OST program has gradually grown due to its success and demand. icddr,b has also provided

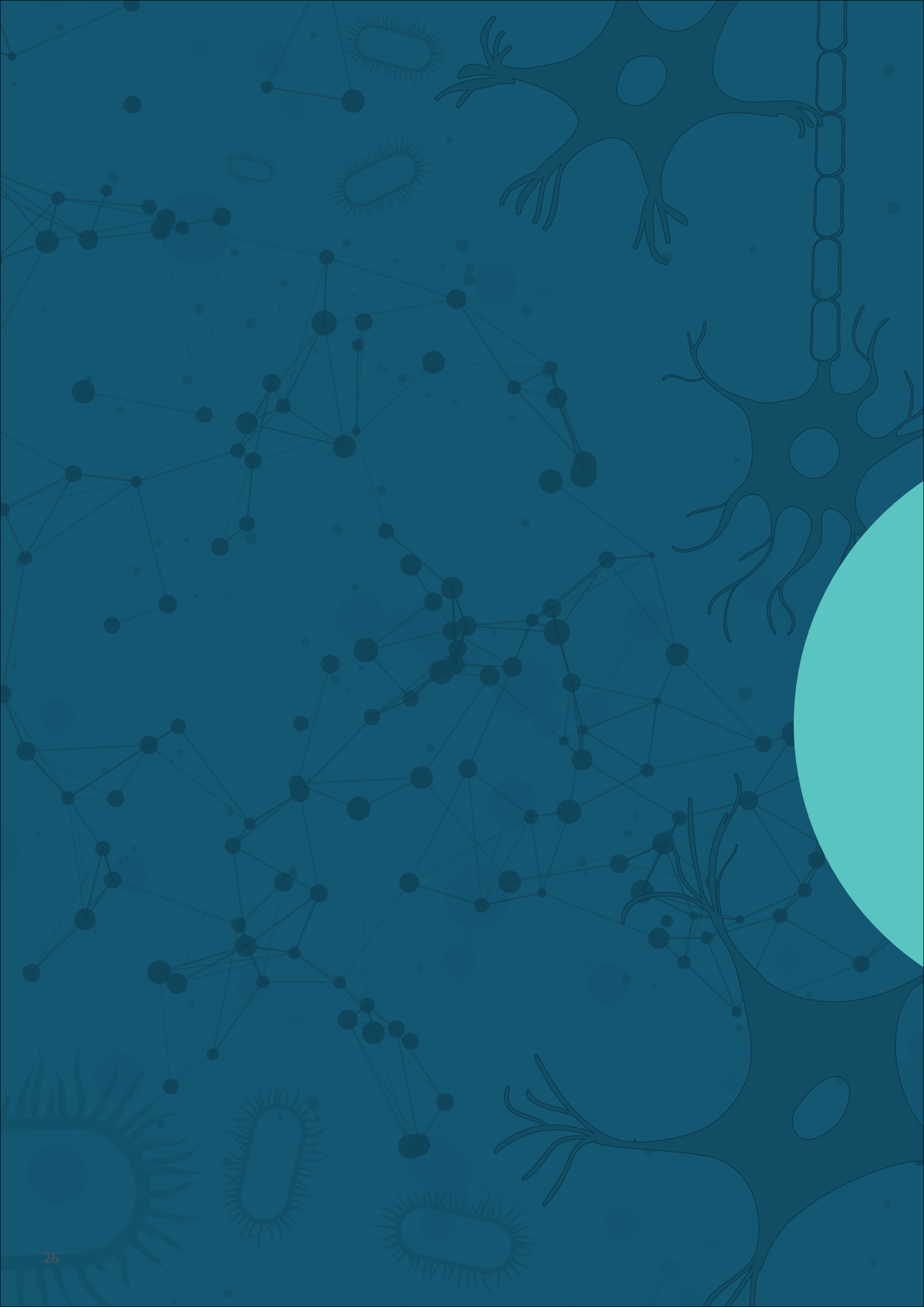
technical assistance and training to NGO stakeholders and successfully transferred the necessary skills to operate OST clinics independently. It expanded its services to five OST clinics – two in Dhaka city and the other three in Chattogram, Khulna, and Narayangonj. The HIV Programme is also working with the Department of Narcotics Control (DNC), GoB, to hand over the Chattogram and Khulna OST clinics after skill transfer and training to DNC staff. This would ensure the continuity and sustainability of the OST programme in two major divisional cities outside Dhaka.

Health Intervention Framework to Promote Socio-Economic Empowerment

Health is often neglected due to poverty and other social issues, especially for marginalised populations, such as MSM, MSW, hijra, and OST clients. icddr,b is piloting a community-based empowerment intervention that addresses their health and social and economic empowerment. This community-responsive intervention could significantly enhance their quality of life. If successful, this could be further scaled up to ensure sustainability and facilitate the mainstreaming of these populations.

HIV Antiviral Drug Resistance

In Bangladesh, antiretroviral therapy (ART) is provided without screening for drug resistance-associated mutations (DRM) among people living with HIV, even though DRM might emerge and transmit to the newly infected individual. The Programme identified DRM among ART-naïve clients from an HIV testing and counselling (HTC) centre in Dhaka. The findings from this study warrant an ART policy with a DRM monitoring system in Bangladesh.





RESEARCH HIGHLIGHTS

In 2021, we published findings of national, regional, and international significance.

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

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

RESEARCHING EVERY NEWBORN BIRTH INDICATORS



In response to the UN Secretary General's Global Strategy for Women's and Children's Health in 2010 and the Every Woman Every Child strategy, The Every Newborn: an Action Plan to End Preventable Deaths (ENAP) was developed and endorsed at the World Health Assembly in 2014. ENAP proposed a framework to end all preventable newborn deaths by 2035, which was later aligned with the Sustainable Development Goals.

Every year, there are about 6 million deaths at birth, and most of these occur in settings with the least data. Since accurate data are crucial to track progress, ENAP included ambitious milestones to improve measurement by 2020, including defining, validating, and integrating indicators measuring the coverage of some facility-based interventions essential for improving neonatal health. "Every Newborn Birth Indicators Research Tracking in Hospitals" (EN-BIRTH), a multi-country study, was undertaken

between 2017 and 2018 to assess measurement validity (accuracy) for these high-priority indicators to inform their use in the Routine Health Information System (RHIS). The Children's Investment Fund Foundation funded EN-BIRTH through the London School of Hygiene & Tropical Medicine. icddr,b contributed to developing the global protocols, led the implementation of EN-BIRTH in Bangladesh and was responsible for data management and analysis across all sites. In addition, icddr,b was the thematic lead for indicators related to early initiation of breastfeeding, use of chlorhexidine, and infection management.

The study was conducted in five secondary/tertiary hospitals in Bangladesh, Nepal, and Tanzania, where trained data collectors observed 23,471 births and 840 mother-baby pairs receiving kangaroo mother care services and verified the hospital records of 1,015 newborns

admitted for inpatient management. Additionally, the researchers compared the observed practice (as Gold Standard) with women's reports through hospital exit interviews and hospital records through register data extractions. It was found that hospital records are more valid than women's recall-based reports for interventions primarily delivered through healthcare providers, such as applying chlorhexidine for umbilical cord care, resuscitation of babies born with birth asphyxia, and administration of injection antibiotics for managing severe infections. On the contrary, for interventions primarily delivered through the women, such as early initiation of breastfeeding and initiation of kangaroo mother care for babies who are born preterm or with low birth weights, women's recall-based report is more valid than hospital register records. However, the validity of women's recall-based reports significantly drops when they undergo caesarean births.

The results of EN-BRITH directly contributed to developing WHO's Every Newborn Action Plan: 2025 Coverage Targets and Milestones. The overall paper was published in the Lancet Global Health in 2020, and a supplement consisting of 14 articles was published in the BMC Pregnancy and Childbirth in 2021.

Rahman AE, Hossain AT, Zaman SB, et al. Antibiotic use for inpatient newborn care with suspected infection: EN-BIRTH multi-country validation study. BMC Pregnancy Childbirth. 2021 Mar 26;21(Suppl 1):229. doi:10.1186/s12884-020-03424-7

Tahsina T, Hossain AT, Ruysen H, et al. Immediate newborn care and breastfeeding: EN-BIRTH multi-country validation study. BMC Pregnancy Childbirth. 2021;21(Suppl 1):237. Published 2021 Mar 26. doi:10.1186/s12884-020-03421-w

Zaman SB, Siddique AB, Ruysen H, et al. Chlorhexidine for facility-based umbilical cord care: EN-BIRTH multi-country validation study. BMC Pregnancy Childbirth. 2021 Mar 26;21(Suppl 1):239. doi:10.1186/s12884-020-03338-4

Ameen S, Siddique AB, Peven K, et al. Survey of women's report for 33 maternal and newborn indicators: EN-BIRTH multi-country validation study. BMC Pregnancy Childbirth. 2021 Mar 26;21(Suppl 1):238. doi:10.1186/s12884-020-03425-6

THE LONGITUDINAL IMMUNE RESPONSE OF COVID-19

Very little is known about disease characteristics and serological responses in different spectrums of COVID-19 disease in patients. Additionally, understanding of the underlying risk factors causing severe COVID-19 illness and data on clinical, biochemical, and immunological parameters are still lacking or insufficient across different geographical regions for predicting the disease outcomes.

Against this backdrop, icddr,b carried out the first longitudinal study in Bangladesh in two COVID-19 hospitals in Dhaka between November 2020 and March 2021. The study evaluated

the data on clinical, haematological parameters, viral load, and antibody responses in COVID-19 infected asymptomatic, mild, moderate, and severe patients.

The study revealed that older age, male gender, multiple co-morbid conditions, and elevated NLR, D-dimer, ferritin, and CRP levels could help clinicians to predict progression to more severe outcomes. It was found that patients with moderate and severe disease developed higher levels of IgM and IgG antibodies to the receptor-binding domain (RBD) of the spike protein of SARS-CoV-2 compared to patients suffering

from mild disease or those with asymptomatic infections. However, all infected individuals developed higher antibody responses than those seen in healthy controls.

Akter A, Ahmed T, Tauheed I, Akhtar M, Rahman SIA, Khaton F, Ahmmed F, Ferdous J, Afrad MH, Kawser Z, Hossain M, Khondaker R, Hasnat MA, Sumon MA, Rashed A, Ghosh S, Calderwood SB, Charles RC, Ryan ET, Khatri P, Maecker HT, Obermoser G, Pulendran B, Clemens JD, Banu S, Shirin T, LaRocque RC, Harris JB, Bhuiyan TR, Chowdhury F, Qadri F. Disease characteristics and serological responses in patients with differing severity of COVID-19 infection: A longitudinal cohort study in Dhaka, Bangladesh. PLoS Negl Trop Dis. 2022 Jan 4;16(1):e0010102. doi: 10.1371/journal.pntd.0010102.



ESTIMATING EXCESS MORTALITY DURING COVID-19

Mortality data is essential to understand and monitor the population's health outcome in the absence of effective and reliable civil registration of deaths in the country. Deaths due to COVID-19 have been underreported in many countries, including Bangladesh, and the true impact of the disease remains unknown. It is thus important to find excess mortality, which is a more comprehensive measure of the total impact of the pandemic on deaths than the confirmed COVID-19 death count alone.

In 2021, icddr,b conducted a study with support from the BMGF and measured excess mortality during COVID-19 in Bangladesh using two distinct approaches. icddr,b conducted a household survey in Chattogram's Sitakunda Upazila by following the WHO-developed technical package for estimating the excess mortality caused by COVID-19. Additionally, a review of the availability and usability of death-related information from

the graveyards to estimate excess mortality and to explore the feasibility of digitisation of record-keeping systems and service automation by developing an application was done.

The study focused on understanding the mortality of the elderly population of 40 years and above because of the direct or indirect effects of COVID-19. The researchers conducted 1,885 verbal autopsies on all the observed deaths from 25,000 households covered in the study area. It was found that compared to the average or expected deaths in 2018 and 2019, the excess mortality for deaths among 40 years and above was 55%, and for all ages, it was 54% in 2020. Time series and survival analysis were conducted using this data and found significant excess mortality during COVID-19 in Sitakunda. The major causes of death in 2020 included stroke, cardiac disease, and acute respiratory infections. All these causes had higher cause-specific rates in the year 2020 compared to 2018 and 2019.

The next phase of the study will assess excess mortality in Dhaka and is also supported by the BMGF.

In another study, icddr,b scientists used data from Matlab HDSS, which covers 239,030 individuals living in 54,823 households in 142 villages of Matlab, Chandpur, to measure the community level excess mortality. The study reported a 28% increase in excess deaths among the elderly population during the first months of the pandemic.

Additionally, excess mortality was assessed in an urban site in Baliakandi, Rajbari, where significant excess mortality was observed during COVID-19 in the year 2020 compared to previous years.

Hanifi SMA, Alam SS, Shuma SS, Reidpath DD. Insights into excess mortality during the first months of the covid-19 pandemic from a rural, demographic surveillance site in Bangladesh. *Front Public Health*. 2021 Jul 29;9:622379. doi: 10.3389/fpubh.2021.622379

ONE HEALTH APPROACH – ANTIMICROBIAL USE IN HUMANS, COMMERCIAL CHICKEN, AND AQUACULTURE WARRANT INTERVENTION

icddr,b scientists have conducted a point prevalence survey of antimicrobial use in humans, commercial chicken, and aquaculture using the One Health Approach. It involved a multidisciplinary team of physicians, veterinarians, anthropologists, epidemiologists, and lab scientists. The study identified a high proportion of irrational use of antibiotics among hospital admitted

patients, drug sellers at pharmacies, community population, aquaculture, and commercial chickens.

Hospital Survey on antimicrobial usage (AMU): Among the enrolled 1,417 inpatients, 78% received at least one antibiotic during the survey period. Third-generation Cephalosporins (44.6%), Penicillins (12.3%), Imidazoles

(11.8%), Aminoglycosides (7.2%), and Macrolides (5.8%) were documented as top 5 antibiotics. According to WHO AWaRe classification, overall, 64.0% of Watch, 35.6% of Access, and 0.1% of Reserve group antibiotics were being used for treatment. Use of Watch group antibiotics was high in medicine (78.7%) wards both at tertiary and secondary level hospitals, and overall high use

of Watch antibiotics was observed at secondary level hospitals (71.5%).

Pharmacy survey on AMU: Of 2,686 customers interviewed, 21.6% (580) purchased antibiotics. Among them, 523 purchased one, 52 purchased two, and 5 purchased three courses of antibiotics (a total of 642 courses). Of the antibiotic courses, the Watch group accounted for the majority (53.6%), followed by the Access (234, 36.4%) and Reserve (64, 10.0%) groups. Approximately half of the antibiotics (327/642, 50.9%) were purchased without a registered physician's prescription. Dispensing of non-prescribed antibiotics was higher in the Access group (139/234, 59.4%), followed by Watch (160/344, 46.5%) and Reserve (28/64, 43.8%) groups. These findings highlight the need to implement strict policies and enforce existing laws and pharmacy-targeted antibiotic stewardship program (ASP), focusing on proper dispensing practices to mitigate

antimicrobial resistance in Bangladesh.

Community survey on AMU: Using computer-assisted telephone interview (CATI) software, a mobile phone-based survey was conducted to assess antibiotic use among the community population, and the findings showed that 32.7% (95% CI: 27.2–38.6) of respondents used antibiotics for their recent illness in the last four weeks. Increased antibiotic use for illnesses reported in the preceding four weeks and an elevated knowledge at the community level during the COVID-19 pandemic compared with the pre-pandemic period.

Commercial chicken, aquaculture, and poultry feed survey on AMU:

Irrational and inappropriate use of antibiotics in commercial chicken production, aquaculture, and livestock can contribute to the development of antibiotic resistance. icddr,b's

Programme for Emerging Infections conducted studies to assess antibiotic usage in animal production sectors. The proportion of commercial chicken and fish farms reporting usage of antibiotics in the 24 hours preceding the interview was 41% and 3%, respectively. The study's findings suggest improving chicken health through good farming practices and changes in key stakeholders (feed dealers and practitioners) attitudes toward antibiotic recommendations to farmers that may help reduce antibiotic usage levels and thus contribute to mitigating antimicrobial resistance.

Akhtar Z, Mah-E-Muneer S, Rashid MM, Ahmed MS, Islam MA, Chowdhury S, Khan Z, Hassan MZ, Islam K, Parveen S, Debnath N, Rahman M, Chowdhury F.. Antibiotics Use and Its Knowledge in the Community: A Mobile Phone Survey during the COVID-19 Pandemic in Bangladesh. *Antibiotics* 2021 Aug 29;10(9):1052. doi: 10.3390/antibiotics10091052



DISCOVERY OF A COST-EFFECTIVE YET HIGHLY SENSITIVE METHOD FOR DETECTING MALARIA INFECTION



Traditionally, PCR has been the most sensitive and finest diagnostic method for the detection of human malaria. However, conventional PCR is time-consuming and takes about 5-6 hours to produce the result. It is also expensive and needs infrastructure with resources. On the contrary, real-time probe-based qPCR assays can be quite costly and may not often be suitable for detecting all human malaria species at a time.

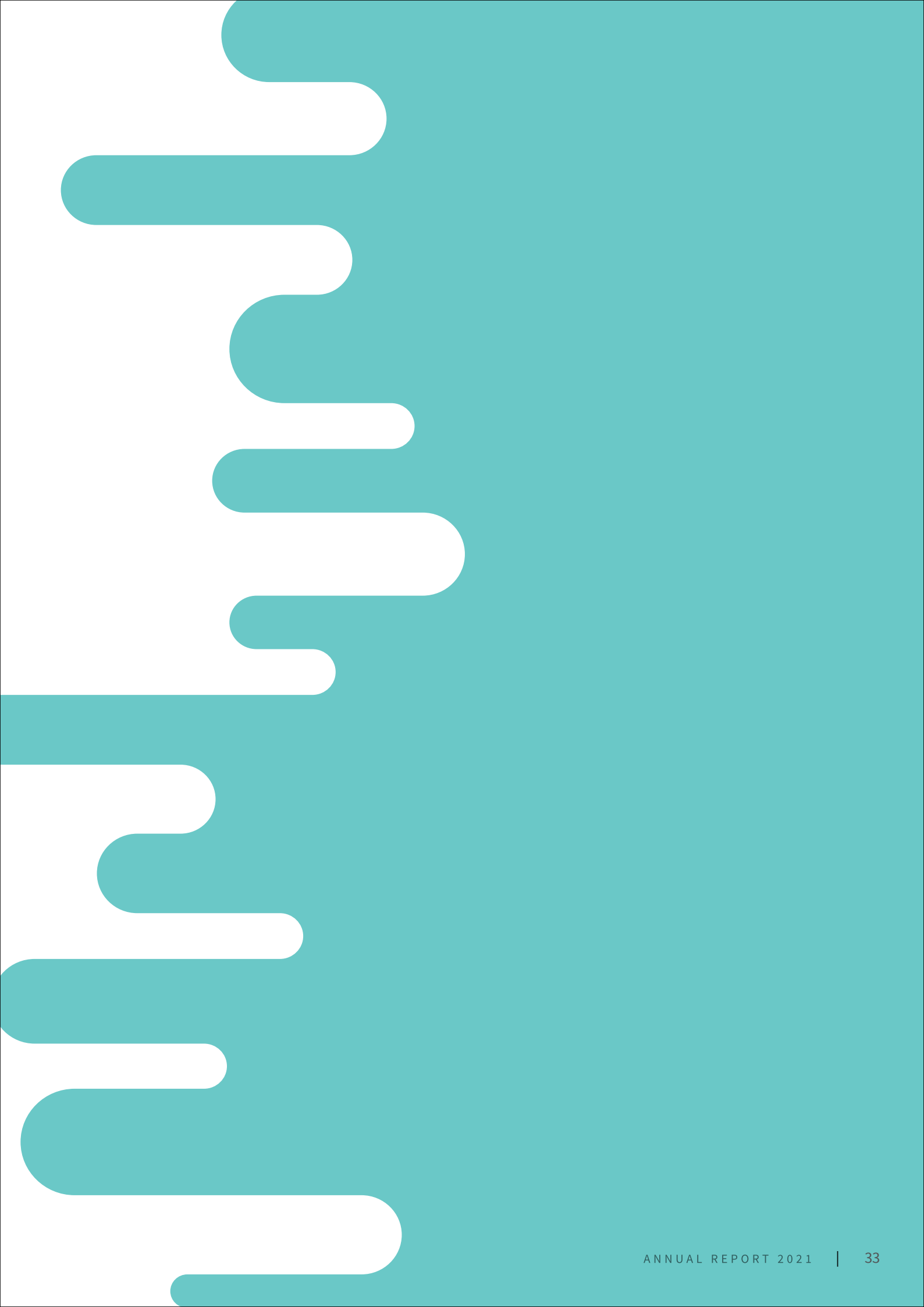
Against this backdrop, icddr,b scientists developed a time and cost-effective real-time qPCR method optimised to detect and distinguish five human malaria parasites (*Plasmodium* species) at a single reaction condition. It takes only about 2 hours.

Even though it employs primers that are used for conventional diagnostic PCR, the new method's performance in terms of sensitivity and specificity has been greatly improved (100%). It allows detection as low as 0.064, 1.6, and 0.32 parasites/ μL of *Plasmodium falciparum*, *P. vivax* and *P. malariae*, respectively, without any cross-reactivity. Additionally, icddr,b scientists developed melt curves analysis for further confirmation and validation of species in multiplex systems. The new method was found analytically 5-15 folds more sensitive depending on species than the conventional methods and identical to competitive probe-based methods. Compared to conventional and probe-based methods, it is 5 to 2.5 folds

cheaper, respectively. This method is already in use by icddr,b in different research projects.

Additionally, the method showed excellent performance in WHO external quality assurance (EQA) programme. It has a huge commercial potential for further scale-up and uses in Bangladesh and other malaria-endemic countries.

Sazed SA., Kibria MG, Alam MS. An Optimized Real-Time qPCR Method for the Effective Detection of Human Malaria Infections. *Diagnostics* 2021 Apr 21;11(5):736. doi:10.3390/diagnostics11050736

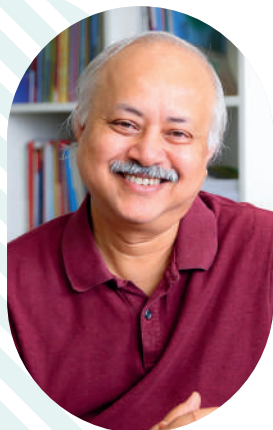






PROGRAMME SUMMARIES

REDUCING MATERNAL, NEONATAL AND CHILD MORTALITY AND IMPROVING THE WELL-BEING 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, basic upstream research, clinical trials (e.g. on new interventions), health systems research, and operations and implementation research. We take a life-course approach, encompassing maternal and neonatal health, child health and development as well as adolescent health and well-being.

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 lower-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.

THE ADVANCING SEXUAL AND REPRODUCTIVE HEALTH AND RIGHTS (AdSEARCH)

AdSEARCH is a multi-year research project of icddr,b, involving different divisions and supported by the Department of Foreign Affairs, Trade and Development (DFATD), Canada. The project aims to improve sexual and reproductive health (SRH) outcomes and realisation of rights among different population groups with distinct SRH needs in Bangladesh, including adolescents and young people, newlyweds, pregnant women, women working in the RMG sector, and key populations with diverse gender and sexual orientations. The project focuses on generating new evidence by developing and testing innovations to address existing gaps, improve SRHR status, and influence policies and programmes related to family planning, abortion, post-abortion care, STIs/RTIs, reproductive cancers, and

maternal and neonatal health. The project also supports women and girls in realising and practising agency and autonomy related to SRHR. The project activities are implemented through several work packages and other project components.

CHILD MORTALITY – WHY, WHEN, WHERE AND HOW?

To generate updated estimates of cause, timing, and place of death among children under-five years of age (u-5), Bangladesh Demographic and Health Survey (BDHS) 2017-18 data was analysed. Major causes of under-five deaths comprised pneumonia (19%), birth asphyxia (16%), prematurity and low birth weight (11%), serious infections including sepsis (8%), drowning (8%) and congenital anomaly (7%). However, variation exists in age- and illness-specific timing of death, about 29% of all deaths occurred on

the first day, 52% within the first week, and 66% within the first month of life, while about 70% of deaths from birth asphyxia, prematurity, and low birth weight occur on the day of birth, about 43% deaths from pneumonia occur at age 1-11 months, and about 51% deaths from drowning occur at age 12-23 months. This analysis was based on data from BDHS's verbal autopsy of 456 deaths of under 5 age children.

Rahman AE, Hossain AT, Siddique AB, et al. Child mortality in Bangladesh - why, when, where and how? A national survey-based analysis. *J Glob Health.* 2021 Sep 11;11:04052. doi:10.7189/jogh.11.04052

SERVICE AVAILABILITY AND READINESS FOR IMCI SERVICES AT THE PUBLIC HEALTH FACILITIES

Secondary analysis of Bangladesh Health Facility Survey (BHFS) 2017 data found that the majority of facilities mandated to provide integrated management of childhood management (IMCI) services are providing IMCI-based pneumonia management services, but less than two-thirds of their staff received relevant training. Among the ten essential items representing pneumonia-specific service availability and readiness, functional ARI timers or precision watches were available in only one-third of the facilities; pulse oximetry was available in 27% of district hospitals (DHs), 18% Upazila Health Complexes (UHCs) and none in Union Health and Family Welfare Centres (UH&FWCs). More than 80% of facilities had amoxicillin syrup or dispersible tablets, but only 16% had injectable gentamicin. Availability of oxygen sources was highest in UHCs (72%), followed by DHs (66%) and Maternal and Child Welfare Centres (MCWCs) (59%). IMCI service registers and monthly reporting forms were available in about two-thirds and 90% of the facilities, respectively. Overall, only 18% of facilities had high readiness (score 8-10), contrasted with 20% having low

readiness (score 0-4), with readiness being significantly low among rural and lower level facilities. Since pneumonia is the single largest cause of death among young children in Bangladesh, good facility readiness for IMCI-based pneumonia management in public health facilities is crucial. The analysis was limited to DHs, MCWCs, UHCs, and UH&FWCs, as these are mandated to provide IMCI services.

Rahman AE, Mhajabin S, Dockrell D, Nair H, El Arifeen S, Campbell H. Managing pneumonia through facility-based integrated management of childhood management (IMCI) services: an analysis of the service availability and readiness among public health facilities in Bangladesh. *BMC Health Serv Res.* 2021 Jul 7;21(1):667. doi: 10.1186/s12913-021-06659-y.

PREVALENCE OF HYPOXAEMIA AND ITS ADVERSE CLINICAL OUTCOMES

icddr,b scientists explored the prevalence of hypoxaemia (SpO₂ <90% on admission) among children with WHO-defined severe pneumonia by analysing secondary data of 2,646 children aged 2-59 months who received care at icddr,b's Dhaka Hospital during 2014-17. The overall prevalence of hypoxemia was 40%, but girl child and those with cough or difficulty in breathing for 0-48 hours before admission had higher odds of having hypoxemia. Hypoxemia was the strongest predictor of mortality during hospital stay and referral to higher-level facilities for clinical deterioration. Age, sex, history of fever and cough, or difficulty in breathing also contribute to adverse clinical outcomes. The median duration of hospital stay was slightly higher and statistically significant for hypoxemic children compared to their non-hypoxemic counterparts.

The high burden of hypoxaemia and its clinical outcomes call for urgent attention to promote oxygen security in low-resource settings like Bangladesh. The availability of pulse oximetry for rapid identification and an effective oxygen delivery system for immediate

correction should be ensured to avert many preventable deaths.

Rahman AE, Hossain AT, Chisti MJ, et al. Hypoxaemia prevalence and its adverse clinical outcomes among children hospitalised with WHO-defined severe pneumonia in Bangladesh. *J Glob Health.* 2021 Sep 11;11:04053. doi:10.7189/jogh.11.04053

EFFECTS OF PSYCHOSOCIAL STIMULATION AND UNCONDITIONAL CASH TRANSFER ON CHILD DEVELOPMENT

A three-arm cluster randomised controlled trial conducted in rural Bangladesh provided early childhood development (ECD) sessions and unconditional cash transfer (UCT) to mother-child dyads in the intervention groups, aiming for the psychosocial development of their under two children. Initially, the research team trained locally recruited village health workers (VHWs) on a previously tested ECD curriculum. VHWs later provided psychosocial stimulation (PS) to children and simultaneously trained mothers. A total of 594 mother-child dyads were assigned to one of the three arms: i) PS + UCT, ii) UCT-only, and iii) Comparison. After one year of intervention, PS + UCT children had significantly higher scores in cognitive and language components, along with being more responsive to the examiner, compared to the UCT-only group. Compared to the comparison group, PS + UCT children also had higher motor scores. The interventions improved mothers' self-esteem significantly.

The study concluded that psychosocial stimulation could be successfully integrated into an unconditional cash transfer programme to improve poor children's development in rural Bangladesh.

Hossain SJ, Roy BR, Sujon HM, et al. Effects of integrated psychosocial stimulation (PS) and Unconditional Cash Transfer (UCT) on Children's development in rural Bangladesh: A cluster randomised controlled trial. *Soc Sci Med.* 2022 Jan;293:114657. doi:10.1016/j.socscimed.2021.114657.

PREVENTING AND TREATING MATERNAL AND CHILDHOOD MALNUTRITION



Programme lead
DR TAHMEED AHMED
Executive Director

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 undernutrition 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 undernutrition, 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.

MICROBIOTA-DIRECTED FOOD INTERVENTION FOR UNDERNOURISHED CHILDREN

This work has been presented under the Spotlight section (see page 20).

GESTATIONAL AGE, WEIGHT GAIN AND PERINATAL OUTCOMES

Although validated in other parts of the world, the suitability of the US Institute of Medicine (IOM) 2009 recommendations on gestational weight

gain (GWG) for Bangladeshi women remained unexamined until now. icddr,b researchers evaluated the association between the weekly rate of weight gain during the second and third trimester of pregnancy, categorised according to IOM recommendations, and adverse perinatal outcomes among 1,569 pregnant women with singleton live births in rural Matlab, Bangladesh.

The results suggest that the IOM recommendations on GWG rate during the second and third trimesters could be suitable for guiding rural Bangladeshi

women in the prenatal period, although the women should aim for rates near the lower bound of the range.

Hasan SMT, Khan MA, Ahmed T. Institute of medicine recommendations on the rate of gestational weight gain and perinatal outcomes in rural Bangladesh. *Int J Environ Res Public Health* 2021 Jun 17;18(12):6519. doi: 10.3390/ijerph18126519.

Haider MM, Mahmud K, Blencowe H, Ahmed T, Akuze J, Cousens S, Delwar N, Fisker AB, Ponce Hardy V, Hasan SMT, Imam MA, Kajungu D, Khan MA, Martins JSD, Nahar Q, Nettey OEA, Tesega AK, Yargawa J, Alam N, Lawn JE; Every Newborn-INDEPTH Study Collaborative Group. Gestational age data completeness, quality and validity in population-based surveys: EN-INDEPTH study. *Popul Health Metr* 2021 Feb 8;19(Suppl 1):16. doi:10.1186/s12963-020-00230-3.

CHRONIC INFLAMMATION OF THE DUODENUM IN CHILDREN

This study explored the prevalence of *Helicobacter pylori* (*H. pylori*) infection and duodenal histopathology in 2-year-old chronic malnourished Bangladeshi slum-dwelling children and investigated their association with

dyspeptic symptoms. 83.3% (45/54) of the children had histopathological evidence of duodenitis. Chronic mild duodenitis was found to be the most prevalent form of duodenitis (53.7%) in children. Only 8.9% (4/45) of the children with duodenitis had dyspepsia. 14.8% (8/54) of the children were positive for *H. pylori* infection. Logistic regression analysis revealed children positive for *Helicobacter pylori* stool antigen had a significant association with dyspepsia.

The study concluded that the number of chronic malnourished children suffering from duodenitis was found to be very high. The majority of these children were asymptomatic. Children positive for HpSA had a significant association with dyspeptic symptoms.

Hossain MS, Das S, Begum SMKN, Rahman MM, Mazumder RN, Gazi MA, Fahim SM, Mahfuz M, Haque R, Petri WA, Sarker SA, Ahmed T. Asymptomatic Duodenitis and *Helicobacter pylori* associated dyspepsia in 2-year-old chronic malnourished Bangladeshi slum-dwelling children: a cross-sectional study. *J Trop Pediatr* 2021 Jan 29;67(1):fmaa079. doi: 10.1093/tropej/fmaa079.

NUTRITIONAL STATUS AND MENTAL HEALTH OF PREGNANT WOMEN

The study investigated the association of household food insecurity (HFI) with the nutritional status and mental health of 672 early-gestation (5-16 weeks) pregnant women with a singleton fetus in Matlab, Bangladesh, from January 2020 and January 2021. Height, weight, body mass index, mid-upper arm circumference (MUAC), depression, anxiety, and stress were the outcomes studied. HFI was assessed using the Household Food Insecurity Access Scale. Women's depression, anxiety, and stress were assessed using the Depression, Anxiety, and Stress Scales-21. Propensity score matching based on weighted multivariable linear and logistic regression were used to evaluate the independent association of HFI with the outcomes. It was found that pregnant women from food-insecure households in rural Matlab were, on average 2.0 cm shorter, 2.0 kg lighter, and had 0.6 cm lower MUAC than their food-secure counterparts. HFI was associated with higher odds



of depression, anxiety, and stress among women.

It concluded that public health measures should focus on ensuring proper nutrition during the critical growth periods of life, pregnancy, and external environmental shocks, to mitigate the adverse effects of HFI on women's health.

Hasan SMT, Hossain D, Ahmed F, Khan MA, Begum F, Ahmed T. Association of household food insecurity with nutritional status and mental health of pregnant women in rural Bangladesh. *Nutrients* 2021 Nov 28;13(12):4303. doi: 10.3390/nu13124303.

EARLY CHILDHOOD APPETITE AND SATIETY TOOL (ECAST)

Stunted children often have a poor appetite, which may limit their response to nutritional interventions. A study was conducted to investigate the effect of a nutritional intervention on the appetite status of stunted children. The stunted children received one boiled egg and 150 ml milk daily six days a week for three months; psychosocial stimulation, including structured play activities and parental counselling for six months; and routine clinical care. Appetite status was measured using an interview-based tool, the Early Childhood Appetite and Satiety Tool (ECAST).

It was found that the mean appetite score increased from 49 to 60 in stunted children and was associated with increased food consumption. Assessment of appetite status using ECAST appears to be a useful tool for monitoring a nutritional intervention in stunted children. This tool may be useful for programmes in managing child stunting in low-income countries and an important way to assess the efficacy of the nutritional intervention in these children.

Naila NN, Mahfuz M, Hossain M, Arndt M, Walson JL, Nahar B, Ahmed T. Improvement in appetite among stunted children receiving nutritional intervention in Bangladesh: results from a community-based study. *Eur J Clin Nutr* 2021 Sep;75(9):1359-1367. doi: 10.1038/s41430-020-00843-9.

INTESTINAL HEALTH AMONG SLUM-DWELLING MALNOURISHED ADULTS

Blastocystis spp. (*Blastocystis*) is a widely distributed gastrointestinal organism frequently reported in countries with tropical and sub-tropical climates. icddr,b researchers sought to determine the factors associated with *Blastocystis* infection and investigate its role on biomarkers of intestinal health among slum-dwelling malnourished adults in Bangladesh. A total of 524 malnourished adults were included in this analysis. *Blastocystis* tested positive in 78.6% of the participants. Prevalence of infection with atypical strains of enteropathogenic *Escherichia coli* (aEPEC) and *Trichuris trichiura* was significantly greater in adults with *Blastocystis*, while *Giardia intestinalis* was significantly lower in *Blastocystis* positive adults. Malnourished adults who were living in households with high crowding and infected with aEPEC and *Trichuris trichiura* were more likely to be infected with *Blastocystis*.

The study findings suggest that the presence of *Blastocystis* in the human intestine influences gut health and may have a potential pathogenic role in the presence of other pathogens.

Fahim SM, Gazi MA, Hasan MM, Alam MA, Das S, Mahfuz M, Rahman MM, Haque R, Sarker SA, Ahmed T. Infection with *Blastocystis* spp. and its association with enteric infections and environmental enteric dysfunction among slum-dwelling malnourished adults in Bangladesh. *PLoS Negl Trop Dis* 2021 Aug 18;15(8):e0009684. doi: 10.1371/journal.pntd.0009684.

EVALUATION OF SUCHANA INTERVENTION

Adequate maternal healthcare practices are crucial to both maternal and infant nutrition outcomes. Unfortunately, the Sylhet region of Bangladesh is vulnerable and performs poorly, as maternal and child health indicators are falling behind compared to other areas. *Suchana*, is a large-scale intervention programme aimed at improving the health and nutritional status of mothers and children in this region. icddr,b evaluated the changes in indicators related to maternal healthcare practices among *Suchana* beneficiaries.

It was found that the *Suchana* intervention significantly and positively improved indicators related to maternal healthcare practices. The findings support future larger-scale programmes to improve maternal healthcare practices among vulnerable people in rural Bangladesh.

Haque MA, Choudhury N, Ahmed SMT, Farzana FD, Ali M, Naz F, Raihan MJ, Rahman SS, Siddiqua TJ, Faruque ASG, Ahmed T. The large-scale community-based programme 'Suchana' improved maternal healthcare practices in north-eastern Bangladesh: findings from a cluster randomized pre-post study. *Matern Child Nutr* 2022 Jan;18(1):e13258. doi: 10.1111/mcn.13258.



CONTROLLING ENTERIC AND RESPIRATORY INFECTIONS



Programme lead
DR RUBHANA RAQIB
 Senior Scientist
 Infectious Diseases Division

We inspire to gain deeper knowledge on disease burden, transmission dynamics, risk factors and disease pathogenesis of key enteric and respiratory infections, associated host immune response and environmental factors in order to develop and evaluate low-cost potentially scalable diagnostics, vaccines and therapeutic interventions.

Our outstanding research spanning from clinical, epidemiological and surveillance studies to basic laboratory sciences in collaboration with national and international partners, has aided us to make major contributions to the research areas of enteric and respiratory infections, and infectious diseases in general. We also translate our research to policy development and implementation.

Our well-established urban and rural field sites and collaboration with national health facilities enabled us to carry out clinical studies ranging from phase I to phase IV vaccine trials (e.g. vaccines for *Vibrio cholera*, *Shigella*, enterotoxigenic *E. coli*, *Salmonella*, *Neisseria meningitidis*, rotavirus, hepatitis E and B viruses, human papillomavirus, respiratory syncytial virus (RSV), rabies and influenza viruses), as well as therapeutic intervention trials. Since the beginning of the COVID-19 pandemic, we have put substantial efforts in tracking, testing, and understanding the disease burden and immune responses to natural infection and vaccination. We also study impact of environmental pollutants on diseases and evaluate interventions to reduce exposure.

We are expanding our research portfolio on assessing the burden of antimicrobial resistance (AMR), investigating the mechanism of AMR and approaches to control and prevent it. We are also focusing on integrated control strategies, e.g. integration of WASH and nutrition with vaccination and treatment specially in disadvantaged populations (e.g. internally displaced people, FDMN), where the burden of infectious disease is the greatest. Additionally, we are pursuing to enhance our capacity to characterise causative agents of pandemic potential.



DR FIRDAUSI QADRI
 Emeritus Scientist
 Infectious Diseases Division

THE LONGITUDINAL IMMUNE RESPONSE OF COVID-19

This work has been presented under the Research Highlight section (see page 29).

NATIONWIDE CHOLERA SURVEILLANCE STUDY

icddr,b in partnership with IEDCR, has been undertaking systematic hospital-based cholera surveillance among

diarrhoea patients in different sites across Bangladesh since 2014. Stool specimens were collected and tested for *Vibrio cholerae* by microbiological culture. Participants' socioeconomic status and clinical, sanitation, and food history were recorded. Cholera risk increased with age, occupation, and recent history of diarrhoea among household members. The majority of patients reported some (63.9%) or severe (14.2%) dehydration. Vomiting (67.3%), abdominal cramps

(61.6%), and fever (60.5%) were also reported. Twenty-eight per cent of patients had eaten food from roadside vendors, 11% had eaten food in large gatherings, and 14% had neighbours with diarrhoea in the week before illness. The proportion of cholera in Dhaka and Chattogram Division was consistently high. Biannual seasonal peaks (pre-and post-monsoon) for cholera across the country, with higher cholera positivity during the post-monsoon in western regions and during the pre-monsoon season in the eastern areas were observed.

1. Khan AI, Rashid MM, Islam MT, Begum YA, Salimuzzaman M, Shirin T, Habib ZH, Khan IA, Zion MI, Khan ZH, Rahman M, Flora MS, Qadri F. Enteric Disease Surveillance in Bangladesh: Findings from nationwide hospital-based surveillance in ten selected sites. *Natl BullPublic Health*. 2018 Jun;1(1):2-3.

2. Islam MT, Khan AI, Sayeed MA, Amin J, Islam K, Alam N, Sultana N, Jahan N, Rashid MM, Khan ZH, Zion MI, Afrad MH, Siddique SA, Khanam F, Begum YA, Islam MS, Qadri F. Field evaluation of a locally produced rapid diagnostic test for early detection of cholera in Bangladesh. *PLoS Negl Trop Dis*. 2019 Jan 31;13(1):e0007124. doi: 10.1371/journal.pntd.0007124.

3. Taniuchi M, Islam K, Sayeed MA, Platts-Mills JA, Islam MT, Khabir MIU, Rahman M, Khan ZH, Begum YA, Khanam F, Khan AI, Liu J, Houpt ER, Qadri F. Etiology of Diarrhea Requiring Hospitalization in Bangladesh by Quantitative Polymerase Chain Reaction, 2014-2018. *Clin Infect Dis*. 2021 Nov 2;73(9):e2493-e2499. doi: 10.1093/cid/ciaa840.

LONG-TERM ARSENIC AND CADMIUM EXPOSURES IN RURAL CHILDREN

In a longitudinal study of rural Bangladeshi children (MINIMat cohort), exposure to cadmium and/or arsenic were found to be associated with altered levels of indicators of metabolic diseases such as an increase in systolic and diastolic blood pressure, and decrements in total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), oxidized lipids, glucose and eGFR. Continued exposure to arsenic and cadmium from prenatal period and their negative associations with biomarkers of cardiometabolic diseases (indicated adverse effects of both metalloids

on carbohydrate and fat metabolism from early childhood.

Akhtar E, Roy AK, Haq MA, von Ehrenstein OS, Ahmed S, Vahter M, Ekstrom EC, Kippler M, Wagatsuma Y, Raqib R. A longitudinal study of rural Bangladeshi children with long-term arsenic and cadmium exposures and biomarkers of cardiometabolic diseases. *Environ Pollut*. 2021 Feb 15;271:116333. doi: 10.1016/j.envpol.2020.116333

EFFECT OF HIGH-SELENIUM LENTIL DIET IN AN ARSENIC-EXPOSED POPULATION

Many different diseases, including cardiovascular disease, are associated with chronic arsenic exposure. Intervention with selenium, an essential trace element, was found to neutralize arsenic toxicity in the animal model. In a six-month randomised controlled dietary intervention trial with high-selenium-containing lentils in Saharastri, Chandpur, icddr, scientists showed increased excretion of arsenic from the body and improvement of overall health status. A decrease in total



cholesterol in women and an increase in HDL in men were observed in the group who received selenium-rich lentils. Irrespective of the selenium content, lentil supplementation itself had some beneficial effect on lipid profile, highlighting the importance of increasing the consumption of lentils.

Krohn RM, Akhtar E, Kwong GPS, Raqib R, Smits JEG. The effect of a high-selenium lentil diet on cardiovascular risk markers in an arsenic-exposed population. *Eur J Clin Nutr.* 2022 May;76(5):772-774. doi: 10.1038/s41430-021-01029-7.

NOVEL OPV2 (NOPV) VACCINE TRIAL AMONG NEWBORNS

Existing Sabin type 2 poliovirus vaccines can mutate and become

neurovirulent, causing vaccine-associated paralytic polio (VAPP) and circulating vaccine-derived polioviruses (cVDPVs). As a result, outbreaks of type 2 cVDPV are now a major challenge to achieving global polio eradication.

In light of ongoing cVDPV2 emergencies, the Global Polio Eradication Initiative (GPEI) partners together with countries are deploying an innovative tool – novel oral polio vaccine type 2 (nOPV2). The nOPV2 vaccine is a modified version of existing OPV2. Clinical trials have demonstrated its safety and effectiveness in protecting against type 2 polio while being more genetically stable and decreasing the likelihood of cVDPV2 emergence in low immunity settings. nOPV2

vaccines were tested in adults, toddlers, and infants, and there were no safety concerns. However, no study has been conducted on truly naive newborns without prior receipt of any polio vaccines.

icddr,b in collaboration with BMGF, EPI, DGHS, WHO, CDC, and Biopharma, Indonesia, has conducted a clinical trial to demonstrate the safety, immunogenicity, and shedding of a nOPV2 candidate in healthy newborns at Matlab. Between September 2020 and May 2021, 330 participants were enrolled and randomised to receive two doses of either the nOPV2 vaccine or placebo. Safety data was collected throughout the entire study period. Blood and stool samples were collected at different time points for immunogenicity and viral shedding.





Preliminary results showed nOPV2 vaccine is safe and immunogenic.

This trial result will be included in the final regulatory dossier for the prequalification of the vaccine. It will guide WHO for pre-licensure use of nOPV2 in outbreak scenarios and eventual WHO prequalification and full licensure which is expected in 2023.

STUDYING DENGUE VACCINE

Dengue viruses (DENV) are now the leading arboviral infection globally, with over 2 billion persons at risk of infection with continually expanded regions affected by dengue. A dengue vaccine has not yet been available in the Indian subcontinent, despite very large populations at risk of

infection. In Dhaka, an extremely densely populated city of around 20 million inhabitants, antibody testing demonstrates that 80% of the population has had exposure to dengue. Recently, several live attenuated dengue vaccines have been developed and tested in different parts of the world. The safety and immunogenicity of a live attenuated dengue vaccine developed by the NIH, USA, have shown promising results in the Bangladeshi population. icddr,b is now researching the protective efficacy of this vaccine against a live, recombinant attenuated strain. After administering the tetravalent dengue vaccine, the population will be challenged with a live recombinant attenuated strain

administered at 6, 12, or 24 months after vaccination.

This study will evaluate the safety and immunogenicity of the recombinant live attenuated tetravalent dengue virus vaccine admixture in healthy and sera naive adults in Dhaka, Bangladesh. The results of this study will show the protective efficacy of this vaccine in Dhaka, which will help to scale up the vaccine in our health system and other parts of the world where dengue is endemic.

HIV/AIDS CARE AND PREVENTION

This work has been presented under the Spotlight section (see page 24).

DETECTING AND CONTROLLING EMERGING AND RE-EMERGING INFECTIONS



Programme lead

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 commit our efforts to combat emerging infectious diseases from early detection to intervention. Our work spans epidemiology, virology, virus ecology, surveillance, risk analysis, prevention, and social and behavioural change. Our long-standing collaboration with the US CDC provides the opportunity to foster the tracking of infections through hospital-based surveillance and population-based surveys. Our laboratory capacity enabled us to study emerging infections and antimicrobial-resistant pathogens. We are leading USAID's Alliance for Combatting TB in Bangladesh Activity. We perpetually respond to infectious disease outbreaks in coalition with the IEDCR of the Bangladesh Government and in collaboration with the national One Health initiative. Being a member of the Asia Pacific Malaria Elimination Network, we are contributing to the regional elimination of malaria by 2030.

Our future priorities include advancing tuberculosis control, developing a better understanding of the impacts of COVID-19, evaluating Nipah virus diagnostics, vaccines and therapeutics, and adopting a One Health Approach to investigate and limit the impact of antimicrobial resistance and infections spanning the human-animal interface, such as avian influenza, Nipah and anthrax.

COMBATTING TUBERCULOSIS

This work has been presented under the Spotlight section (see page 23).

ANTIMICROBIAL USE AND RESISTANCE

Point prevalence survey of antimicrobial use in human, commercial chicken, and aquaculture using One Health Approach in Bangladesh

This work has been presented under the Research Highlight section (see page 30).

EXPANSION OF NIPAH VIRUS RESEARCH

Bangladesh has experienced 40 outbreaks of the Nipah virus from 2001 to 2022. To

date, 325 Nipah cases have been reported with a 72% fatality rate; two were reported in 2021. There are precise shreds of evidence of person-to-person transmission of the Nipah virus in Bangladesh, suggesting a broader population at risk. Findings demonstrate that although interhuman transmission and morbidity/mortality indicators were stable, the number of spillovers and geographic context varied significantly over time.

icddr, in collaboration with IEDCR and US CDC, Atlanta has been continuing the National Nipah Virus Surveillance since 2006. In 2021, active surveillance activities expanded in non-Nipah belt areas of Bangladesh. In addition to the ten surveillance sites, an extended surveillance network under the enhanced surveillance covers 107 government and 318 private healthcare facilities during the Nipah season



(December to April). In collaboration with CEPI, US-CDC, Stanford University, and NIBSC, icddr,b initiated a project named “Nipah Virus (NiV) infection survivors blood banking for assay development and long-term clinical effects of infection” to develop standard assays and laboratory supports for future Nipah vaccine trials.

Alongside, icddr,b scientists began a mixed-methods study named “Assessing the willingness to receive a Nipah trial vaccine to generate a recommendation for Phase II of the Nipah vaccine trial in Bangladesh” to understand people’s knowledge, perceptions, attitudes, and concerns regarding a test and an approved NiV vaccine. Based on this study’s findings, icddr,b scientists will develop a communication strategy to raise awareness and involve stakeholders and partners so that they can decide on the use of a trial and approved Nipah vaccine. They will also evaluate the immunogenicity of three NiV vaccine candidates (developed by Pirbright Institute and Oxford University, UK) in pigs under field conditions in Bangladesh. In collaboration with EcoHealth Alliance and IEDCR, initiated an NIH-funded research project on

“Spillover dynamics and genetics of Nipah virus in its bats’ reservoir and predicting the human outbreaks in Bangladesh.”

In collaboration with ANRS, France, and Montana State University, icddr,b scientists are sampling different species of bats to test for Nipah and coronavirus through two studies named “Understanding the ecology of the Nipah virus in Bangladesh” and “Monitoring of the circulation of SARS-CoV-2 in Bats in Bangladesh and generation of cell models for in vitro studies (SARSRhinCell)”.

AVIAN INFLUENZA

Avian influenza is endemic in poultry in Bangladesh. More than 560 outbreaks in poultry and eight human cases with H5N1 infection were reported from 2007 to 2021. icddr,b scientists have been conducting live bird market (LBM) based avian influenza surveillance since 2007. From January-December 2021, the surveillance detected influenza A viral RNA in 16% of waterfowls, 12% of commercial chickens, 4% of backyard chickens,

and 58% in environmental samples of LBM. Among influenza A-positive specimens, 28% were confirmed for the H5 subtype. An epidemiological study revealed that 25% of commercial farms administered vaccines against H5N1 in commercial chickens. The effectiveness of ongoing avian influenza vaccination in commercial chickens is under investigation. Under another study, a new culture-independent laboratory method for full-genome characterisation has been developed to detect avian influenza viruses. A quasi-experimental study estimated increases in respirable aerosol concentrations during poultry slaughtering and de-feathering using five different types of implements used in LBMs. The findings helped to identify procedures that can minimise human exposure to potentially hazardous aerosol particles during poultry slaughtering and de-feathering in Bangladeshi LBMs. These activities provide useful information for both animal health and public health authorities to respond to epidemics by intervening to reduce transmission from poultry to poultry and poultry to humans.



VARIATION IN G6PD ACTIVITY WITH OR WITHOUT MALARIA

Glucose-6-phosphate dehydrogenase deficiency (G6PD) is a common, X-linked hereditary enzyme deficiency affecting approximately 400 million people worldwide, mainly in malaria-endemic regions. The primaquine-based radical cure is the only available treatment for the effective clearance of the vivax malaria parasites from the human host. Still, it can cause severe side effects in individuals with G6PD deficiency.

For the purpose of three studies—a clinical trial of uncomplicated *P. falciparum* or *P. vivax* malaria patients, a cross-sectional survey, and a case-control study, test subjects were screened and included from Chittagong Hill Tracts (CHT) of Bangladesh where the prevalence of malaria is the highest. First, the activity of G6PD in the symptomatic and confirmed malaria patients selected for clinical trial and apyretic, normal subjects with no malaria during the study for the cross-sectional survey were measured and recorded. Next, the results were compared to each other to find out the presence of differences. Later, another comparison of G6PD activity was made among the normal, healthy subjects, with or without a history of malaria.

It was found that G6PD activity was much higher in patients with acute malaria than in healthy people, which could not be explained by the claimed protective impact of G6PD deficiency. They also had a lower risk of primaquine-induced hemolysis when compared to healthy, uninfected normal people. The study also proved the safety of treatment measures taken in case of *P. vivax* infection, which was considered less safe previously.

Ley B, Alam MS, Kibria MG, Marfurt J, Phru CS, Ami JQ, et al. Glucose-6-phosphate dehydrogenase activity in individuals with



and without malaria: Analysis of clinical trial, cross-sectional and case-control data from Bangladesh. *PLoS Med.* 2021 Apr 23;18(4): e1003576. doi: 10.1371/journal.pmed.1003576

INFLUENZA AND SARS-CoV-2 INFECTION ON RECURRENT CARDIOVASCULAR DISEASES

To determine the prevalence and three-month outcomes of SARS-CoV-2 infection in patients with myocardial infarction (MI) who do not meet the WHO clinical criteria for suspected COVID-19 (e.g. fever, cough, sneezing, etc.), icddr,b in collaboration with National Institute of Cardiovascular Diseases (NICVD) hospital and Orebro University of Sweden conducted a research during the first wave of the COVID-19 pandemic.

It was identified that a substantial rate of occult SARS-CoV-2 infection in Bangladesh, suggesting SARS-CoV-2 might precipitate MI. Asymptomatic patients with COVID-19 admitted with MI could contribute to disease transmission and warrants widespread testing of hospital admissions.

The findings highlighted the need for adopting preventive measures for frontline healthcare workers, including cardiologists, to avoid transmission of SARS-CoV-2 in hospital environments.

Akhtar Z, Chowdhury F, Aleem MA, et al. Undiagnosed SARS-CoV-2 infection and outcome in patients with acute MI and no COVID-19 symptoms. *Open Heart* 2021 Apr;8(1):e001617. doi:10.1136/openhrt-2021-001617

ACHIEVING UNIVERSAL HEALTH COVERAGE



Programme lead (Acting)

**DR MAHBUB ELAHI
KHAN CHOWDHURY**

Scientist

Health Systems and
Population Studies Division

We support the achievement of universal health coverage (UHC) in Bangladesh through health system research, policy research and advocacy to increase accessibility, improve quality and reduce financial barriers to healthcare services.

We are committed to the principle that all people, irrespective of their social and economic position, have access to affordable, acceptable, high-quality and responsive healthcare. The conceptual framework for our work is provided by the six building blocks of health systems identified by the World Health Organization: service delivery, health workforce, information systems, medical products, financing, and leadership and governance.

We continue to leverage our expertise to strengthen the health service delivery system, improve access to quality care, minimise the impact of social determinants of health, improve health financing mechanisms, develop models for efficient utilisation of the health workforce, and identify new approaches to achieve greater compliance from the private sector through regulatory measures. Our research focuses on health and system issues in urban areas. Our research also focuses on Digital Health, Telemedicine, Health Management Information Systems evaluation, and testing of innovative digital technologies. During COVID-19, our researchers contributed to understanding the epidemiology, tracking COVID patients who used national telemedicine, and the impact of COVID-19 on health and the health system and food environment to inform policy. We also continue undertaking research on monitoring and supervision of health systems for improved governance and accountability.

We continue to engage policymakers and implementers at the national and grassroots level by encouraging them to use evidence-based strategies to address health system issues. We also develop stronger links with the global universal health coverage by undertaking research on regional and country comparisons to assess progress in the implementation of UHC.

RESEARCH GROUP: HEALTH SERVICE DELIVERY

MENTAL HEALTH OF FRONTLINE PHYSICIANS WORKING WITH COVID-19 PATIENTS

The impact of the COVID-19 pandemic has triggered new challenges for mental health. A cross-sectional survey was conducted adopting a quantitative approach and using an online questionnaire through the Facebook Platform Group. Data was

collected from August-October, 2020 on socio-demographic status, information on COVID-19 and questionnaires about Depression Anxiety Stress Scale (DASS-21). 395 participants were enrolled from all eight administrative divisions of Bangladesh.

The study revealed that the mental health of physicians was deeply affected by the pandemic situation. The availability of

appropriate mental health support will help foster resilience by giving them the ability and confidence to manage crises like the COVID-19 pandemic.

Rahman A, Deeba F, Akhter S, Bashar F, Nomani D, Koot J, Koly KN, Salah FB, Haverlag K, Anwar I. Mental health condition of physicians working frontline with COVID-19 patients in Bangladesh. *BMC Psychiatry* 2021 Dec 9;21(1):615. doi: 10.1186/s12888-021-03629-w.

DETECTING DIABETIC RETINOPATHY

Diabetic retinopathy can cause blindness even in the absence of symptoms. Although routine eye screening remains the mainstay of diabetic retinopathy treatment and can prevent 95% of blindness, this screening is not available in many low- and middle-income countries even though these contribute to 75% of the global diabetic retinopathy burden.

A double-blinded diagnostic approach was used to test the accuracy of the diabetic retinopathy screening done by non-ophthalmologists against the Gold standard diagnosis by ophthalmology-trained eye consultants in 6 peripheral health facilities in Bangladesh from July 2017 to June 2018. Retinal images



were taken by using either a desk-based camera or a hand-held camera following pupil dilatation.

The findings suggest that diabetic retinopathy screening can be accurately performed by healthcare personnel other than eye consultants. People with more than five years of diabetes should receive priority in any community-level retinopathy screening programme. In a country like Bangladesh, where no

diabetic retinopathy screening services exist, hand-held cameras can be considered a cost-effective option for potential system-wide implementation.

Begum T, Rahman A, Nomani D, Mamun A, Adams A, Islam S, Khair Z, Khair Z, Anwar I. Diagnostic accuracy of detecting diabetic retinopathy by using digital fundus photographs in the peripheral health facilities of Bangladesh: validation study. *JMIR Public Health Surveill* 2021 Mar 9;7(3):e23538. doi:10.2196/23538

RESEARCH GROUP: HEALTH ECONOMICS AND FINANCING

BANGLADESH MATERNAL HEALTH VOUCHER SCHEME

icddr,b assessed the completeness of antenatal care coverage following the implementation of a voucher scheme for maternal health. The investigation used interview data from a survey conducted in Bangladesh in 2017 of 2,400 randomly selected women aged 15-49 with children aged 0-23 months in four geographical areas. Of these women, 1,944 had attended at least one antenatal clinic visit and were included in the analysis. A 'completeness index' for antenatal

visits was constructed as an outcome variable based on the recall of thirteen elements of care. Voucher scheme membership was associated with higher 'completeness index' scores for voucher recipients. Scheme membership reduced the differentials associated with health facility type and socioeconomic status. Women from the lowest socioeconomic group who were voucher recipients received substantially more components of antenatal care compared with non-recipients. This favourable effect of voucher scheme membership on the

most vulnerable socioeconomic group remained significant after adjusting for educational status.

The study concluded that Bangladesh voucher scheme model has the potential to maximise gains in maternal and newborn health through enhancing the completeness of service provision.

Mia MN, Mahmood SS, Iqbal M, Bhuiya A, Pallikadavath S, Stones W. The Bangladesh Maternal Health Voucher Scheme: impact on completeness of antenatal care provision. *J Biosoc Sci* 2022 Mar;54(2):217-224 doi: 10.1017/S0021932020000784.



ECONOMIC BURDEN OF DIARRHOEA IN CHILDREN UNDER 5

Diarrhoea is a leading cause of morbidity and mortality among under-five children in Bangladesh. Hospitalisation for diarrhoea can pose a significant burden on households and health systems. A cross-sectional study with an ingredient-based costing approach was conducted in 48 healthcare facilities with 899 caregivers of under-five children with diarrhoea being interviewed.

The average cost per episode for caregivers was US\$62, with \$29 direct and \$34 indirect costs. From the societal perspective, the average cost per episode of diarrhoea was \$71. In 2018, an estimated \$79 million of economic costs were incurred for treating diarrhoea in Bangladesh. Using 10% of income as the threshold, over 46% of interviewed households faced catastrophic expenditure from diarrhoeal disease.

The study concluded that the economic costs incurred by caregivers for treating

per episode of diarrhoea were around 4% of the annual national gross domestic product per capita. Therefore, investment in vaccination can help reduce the prevalence of diarrhoeal diseases and avert this public health burden.

Hasan MZ, Mehdi GG, De Broucker G, Ahmed S, Ali MW, Martin Del Campo J, Constenla D, Patenaude B, Uddin MJ. The economic burden of diarrhea in children under 5 years in Bangladesh. *Int J Infect Dis*; 2021 Jun;107:37-46. doi: 10.1016/j.ijid.2021.04.038.

RESEARCH GROUP: URBAN HEALTH

DEPRESSION AMONG PUBLIC UNIVERSITY STUDENTS IN BANGLADESH.

icddr,b scientists assessed the prevalence of depression among public university students in Bangladesh, with a larger and more diverse sample than those included in previous studies. A cross-sectional study was conducted between April and September 2018 at two public universities in Bangladesh. Data was collected on socio-demographic

characteristics, lifestyle factors, history of depression, and symptoms of depression. Multivariable logistic regression was applied to explore the independent relationships between depression and student characteristics. A total of 400 students participated in the survey. Nearly half of the students met the criteria for moderate to severe depression.

The study revealed that poor academic performance, use of social media and history of depression

were the main factors associated with depressive symptoms. Given the high prevalence of depression in this student population, it is imperative to develop psychosocial interventions to better support students during this critical phase of life.

Koly KN, Sultana S, Iqbal A, Dunn JA, Ryan G, Chowdhury AB. Prevalence of depression and its correlates among public university students in Bangladesh. *J Affect Disord* 2021 Mar 1;282:689-694. doi: 10.1016/j.jad.2020.12.137.

COVID-19 RISK FACTORS IN URBAN SLUMS

There is a lack of research investigating the confluence of risk factors in urban slums that may make them accelerators for respiratory droplet infections like COVID-19. In an exploratory, secondary analysis of World Bank cross-sectional microdata from slums in Bangladesh, icddr,b scientists investigated the relationship between crowding and access to private or shared water sources and toilet facilities. The analysis showed that most households were single-room dwellings (80.4%). Most of the dwellings (83.3%) shared both toilet facilities and the water source, and there was a significant positive relationship between crowding and the use of shared facilities.

The findings highlight the practical constraints on implementing, in slums, the conventional COVID-19 management approaches of social distancing, regular hand washing, and not sharing spaces. In addition, it has implications for the management of future respiratory epidemics.

Hasan SM, Das S, Hanifi SMA, Shafique S, Rasheed S, Reidpath DD. A place-based analysis of COVID-19 risk factors in Bangladesh urban slums: a secondary analysis of World Bank microdata. *BMC Public Health* 2021 Mar 15;21(1):502. doi: 10.1186/s12889-021-10230-z.

PROMOTING HEALTHY FOODS AMONG URBAN SCHOOL CHILDREN

Urban school children in Bangladesh tend to consume foods dense in calories and few fruits and vegetables, which is associated with overweight and obesity. An icddr,b study explored the barriers and opportunities for promoting healthy diets among school children from the perspective of teachers and parents in Dhaka. Schools were important for the development of food preferences of children. However, most school cafeterias provide foods based on profit rather than health considerations.

The study concluded that it is important to formulate policies and guidance to create a supportive environment for healthy foods in and in the proximity of schools. It is also important to educate consumers about identifying and choosing healthy foods. Laws related to food safety should be adequately implemented to boost the population's confidence in the safety of available healthy foods in the food system.

Hasan AMR, Smith G, Rashid MH, Selim MA, Rasheed S. Promoting healthy foods among urban school children in Bangladesh: a qualitative inquiry of the challenges and opportunities. *BMC Public Health* 2021 Jun 1;21(1):1029. doi: 10.1186/s12889-021-11085-0.

EDUCATIONAL AND MENTAL HEALTH TRAINING INTERVENTIONS

icddr,b researchers aimed to synthesise evidence of effective educational and training interventions so that healthcare workers could increase their ability to detect and manage mental health conditions in South and South-East Asia. A systematic review of six electronic academic databases from January 2000 to August 2020 was performed with the inclusion of 48 out of 3,654 screened articles. Thirty-six reported improvements in knowledge and skills in detecting and managing mental health conditions. The training was predominantly delivered to the community and primary care health workers to identify and manage common mental health disorders. Commonly used training included the World Health Organization's mhGAP guidelines and Cognitive Behavioural Therapy, which were successfully tailored and delivered to healthcare workers. Digitally delivered training was found to be acceptable and effective. Only one study analysed cost-effectiveness. Twenty-one studies were appraised as low/moderate and nineteen as high/critical risk of

bias. In low-resource country settings, upskilling and capacity building of primary care and community healthcare workers can lead to better detection and management of people with mental health disorders and help reduce the treatment gap.

Koly KN, Baskin C, Khanam I, Rao M, Rasheed S, Law GR, Sarker F, Gnani S. Educational and training interventions aimed at healthcare workers in the detection and management of people with mental health conditions in South and South-East Asia: a systematic review. *Front Psychiatry* 2021 Oct 11;12: 741328. doi: 10.3389/fpsy.2021.741328.

DIGITAL HR MANAGEMENT TOOL IN THE HEALTH SECTOR

In Bangladesh, to address the challenges of ensuring adequate human resources for health (HRH), the government began implementing a digital tool for HRH management in 2017. However, evidence suggests institutionalising such tools in low-and-middle-income countries is impeded by policy aspects like implementation strategy and poor regulatory framework. icddr,b researchers aimed to explore factors in the current policy landscape that might facilitate and challenge the tool's implementation. They conducted a review of policies related to ICT implementation and human resources management in the health sector.

The findings showed that strong upstream level commitments were reflected in the content of policies in terms of setting out specific objectives, targets, timelines, and budget allocation. However, the lack of explicit monitoring strategy and the extent of stakeholders' engagement was not well-defined, creating chances for impeding downstream implementation. Effective coordination among stakeholders and different HRH and ICT policies could be strengthened. Findings support the current discourse that national

commitment plays a vital role in the integration of ICTs in health services. However, a well-defined monitoring strategy and inter-ministry and intra-ministry policy coordination are crucial.

Bhattacharyya DS, Dutta GK, Nowrin I, Shafique S, Islam MZ, Islam BMR, Anwar I. Implementing a digital human resources management tool in the government health sector in Bangladesh: a policy content analysis. *BMC Health Serv Res* 2021 Dec 16;21(1):1346. doi: 10.1186/s12913-021-07304-4.

COVID-19 VACCINE HESITANCY AMONG TEMPORARY FOREIGN WORKERS

The COVID-19 pandemic poses an extraordinary threat to the health,

safety, and freedom of Temporary Foreign Workers (TFWs). Highly effective vaccines against COVID-19 may hold an outsized benefit for TFWs, particularly those living in congregate settings where protective measures such as social distancing are not possible. This observational study leveraged longitudinal data from an ongoing monthly rapid-response survey of TFWs from Bangladesh. Overall vaccine hesitancy was 25%, with significant variation by host country. Multivariate analyses confirmed that immigration system factors and threat perception are the strongest predictors of COVID-19 vaccine hesitancy for TFWs. The predicted probability of hesitancy for an undocumented TFW was 0.405, while the predicted probability for those with valid visas was 0.207

($p < .01$). The probability of being hesitant for TFWs who were worried about getting COVID-19 was 0.129 compared to 0.305 ($p < .01$) for those who were not worried.

Results reveal low vaccine hesitancy among TFWs from Bangladesh with differences in location, undocumented status, COVID-19 threat perception, and level of worry about side effects. There could be relatively high returns for targeting vaccine access and distribution to TFWs because of their high levels of vaccine acceptance.

West H, Lawton A, Hossain S, Mustafa AHMG, Razzaque A, Kuhn R. COVID-19 vaccine hesitancy among temporary foreign workers from Bangladesh. *Health Syst Reform* 2021 Jan 1;7(1):e1991550. doi: 10.1080/23288604.2021.1991550.

RESEARCH GROUP: DIGITAL HEALTH AND HEALTH INFORMATION SYSTEMS INITIATIVE

TARGETED COMMUNICATION TO PREGNANT WOMEN

Timely and appropriate evidence-based practices during antenatal care improve maternal and neonatal health. However, there is a lack of information on how pregnant women and families perceive antenatal care in Bangladesh. Using a phenomenological approach, icddr, b researchers conducted a qualitative study from May to June 2017 in two sub-districts of Chandpur district, Bangladesh. They aimed to develop targeted client communication via text messages for increasing antenatal care utilisation as part of an implementation of an electronic registry for maternal and child health. Almost no respondents mentioned antenatal care as a preventive form of

care and only perceived it as necessary if any complications developed during pregnancy. Knowledge of ANC content and pregnancy complications was low. Women reported various reasons for not attending ANC, including the lack of information on the timing of ANC; lack of decision-making power; long distance to access care; being busy with household chores, and not being satisfied with the treatment by healthcare providers. Study participants recommended phone calls as their preferred communication strategy when asked to choose between the phone call and text message but saw text messages as a feasible option. The researchers developed a library of 43 automatically customisable text messages based on the findings to increase ANC utilisation.

The study concluded that pregnant women and family members had limited knowledge about antenatal care and pregnancy complications. Therefore, effective health information through text messages could increase awareness of antenatal care among pregnant women. This study presents an example of designing targeted client communication to increase antenatal care utilisation within formal scientific frameworks, including a taxonomy of behaviour change techniques.

Pervin J, Sarker BK, Nu UT, Khatun F, Rahman AMQ, Venkateswaran M, Rahman A, Frøen JF, Friberg IK. Developing targeted client communication messages to pregnant women in Bangladesh: a qualitative study. *BMC Public Health* 2021 Apr 20;21(1):759. doi: 10.1186/s12889-021-10811-y.

RESEARCH GROUP: POPULATION SCIENCE

ADULT DEATH REGISTRATION

In many low- and lower-middle-income countries, civil registration and vital statistics (CRVS) systems do not adequately register significant numbers of births and, especially, deaths. In this study, icddr,b researchers aimed to estimate the completeness of adult death registration (for age 15 and older) in the Matlab health and demographic surveillance system (HDSS) area in Bangladesh and to identify reasons for not registering deaths in the national CRVS system. In the 3 years preceding the survey, only 17% of these deaths were registered in the national CRVS

system, with large gender differences in registration rates (male = 26% vs female = 5%). Respondents who reported that a recent death in the household was registered indicated that the primary reasons for registration were to secure an inheritance and to access social services. The main reasons cited for not registering a death were lack of knowledge about CRVS and not perceiving the benefits of death registration.

The study concluded that information campaigns to raise awareness of death registration, as well as stronger incentives to register deaths, may be

needed to improve the completeness of death registration in Bangladesh.

Haider MM, Alam N, Ibn Bashar M, HELLINGER S. Adult death registration in Matlab, rural Bangladesh: completeness, correlates, and obstacles. *Genus* 2021;77(1):13.doi: 10.1186/s41118-021-00125-7.

COVID-19 EXCESS MORTALITY

This work has been presented under the Research Highlight section (see page 30).



ACHIEVING GENDER EQUALITY AND PROMOTING SEXUAL AND REPRODUCTIVE HEALTH AND RIGHTS



Programme lead

**DR RUCHIRA
TABASSUM NAVED**

Emeritus 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 and rights (SRHR). Our research focuses on describing the problems, findings solutions and informing programmes and policies regarding gender equality and SRHR.

Violence against women and children is a major public health issue globally and in Bangladesh. While one in three women report experiencing intimate partner violence worldwide, in Bangladesh, almost three-fourths of the women experience this violence. Violence against children is almost universal in Bangladesh. We conduct research not only on violence against women and children but also on the intersections between the two.

Child marriage has been widely recognised as a harmful practice adversely impacting health, well-being, human rights and development. Bangladesh reports one of the highest rates of child marriage globally. While one in three girls worldwide gets married before reaching 18, two in five girls in Bangladesh face the same predicament. Thus, reducing child marriage features as one of the goals of icddr,b. Currently, we are assessing the impact of a social norms' intervention on child marriage.

Through research and intervention, we are promoting SRHR among vulnerable populations such as adolescents, young married women, garment workers, and sexual minorities. In addition, we are committed to promoting SRHR in services provided by icddr,b and some of its partner organisations.





WOMEN'S PARTICIPATION IN MICROFINANCE

The health and social effects of women's microfinance participation remain debated. Using propensity-score methods, icddr,b researchers assessed effects of microfinance participation on novel measures of agency; intimate partner violence (IPV) exposure; and depressive symptoms in 930 wives in Matlab, Bangladesh. Microfinance participation had no adverse health effects and favourable empowerment effects in Bangladeshi wives. Microfinance can empower women without adverse health effects. Social-norms programming with men and women may be needed to change gendered expectations about the distribution of unpaid labour and the rights of women.

Yount KM, Cheong YF, Khan Z, Miedema SS, Naved RT. Women's participation in microfinance: Effects on Women's agency, exposure to partner violence, and mental health. *Soc Sci Med*. 2021 Feb; 270:113686. doi:10.1016/j.socscimed.2021.113686

RELATIONSHIP BETWEEN DOMESTIC VIOLENCE AGAINST WOMEN AND CHILD GROWTH

Using data from the MINIMat cohort, icddr,b researchers evaluated the association between maternal lifetime experience of domestic violence in late pregnancy with their children's linear growth at 15 years in rural Bangladesh. Compared to the women with no experience of domestic violence, children of women with experience of any physical, sexual or emotional DV before and/or during pregnancy had significantly lower height for age Z-scores (HAZs) at the age of 15.

Ziaei S, Naved RT, Rahman SM, Rahman A, Ekström E-C. . Maternal experience of domestic violence before and during pregnancy and children's linear growth at 15 years, findings from MINIMat trial in rural Bangladesh. *Matern Child Nutr*. 2021 jul;17(3):e13175 doi: 10.1111/mcn.13175

MATERNAL HEALTH SERVICES DURING COVID-19

icddr,b scientists applied a qualitative research approach to study pregnant women's and health workers' vulnerability during the pandemic. It recognised the challenges and constraints, emphasising the crucial need for government and non-government organisations to improve maternal and newborn health services to protect pregnant women and health workers as they face predicted waves of the pandemic in the future. Further, it identified issues of gendered PPE that lead health workers to abandon the use of PPE while working. Considering the predictability of several waves of the COVID-19 pandemic, health professionals can design locally appropriate PPE to ensure that appropriate PPE is worn.

Akhter S, Kumkum FA, Bashar F, Rahman A. . Exploring the lived experiences of pregnant women and community healthcare providers during the pandemic of COVID-19 in Bangladesh through a phenomenological analysis. *BMC Pregnancy Childbirth*. 2021 Dec 5;21(1):810. doi: 10.1186/s12884-021-04284-5.

EXAMINING THE HEALTH CONSEQUENCES OF AND ADAPTATION TO CLIMATE CHANGE



Programme lead (Acting)

**DR S.M. MANZOOR
AHMED HANIFI**

Scientist

Health Systems and
Population Studies Division

We are addressing health risks related to climate change through identifying the impact of climate change on human health, exploring gender issues and increasing the resilience of vulnerable communities by designing and testing adaptation models.

The Initiative for Climate Change and Health (ICCH) evaluates the impacts of climate change and migration patterns on population health in Bangladesh and the ways in which populations can adapt. While icddr,b has considerable experience in identifying the relationship between climate variables and infectious diseases, namely cholera, dengue, malaria and Kala-Azar, in recent years focus of climate research has been extended beyond infectious diseases. In particular, ICCH is researching heat stress and mortality, sea-level rise, salinity and hypertension, environmentally driven migration, ecosystem services and livelihood affected by climate change.

Through its work at ICCH, icddr,b has become a member of the Planetary Health Alliance, which is a consortium of over 70 dedicated universities, NGOs, government entities, research institutes, and other partners around the world committed to advancing planetary health. icddr,b also became a member of the Delta Alliance. Based in the Netherlands, it is an international knowledge-driven network organisation with the mission of improving the resilience of the world's deltas.

ICCH initiated the 'EnHealth-Bob' network in the Bay of Bengal to link information and data from public health and climate change domains to promote appropriate policy action plans representing community-based organisations, healthcare providers, policymakers, advocacy groups, research, and academia based in India, Bangladesh, Thailand, and the UK. ICCH is an active member of WHO South East Asian Region Consultation on Climate and Health to expand and mobilise health sector engagement in climate action and strengthen linkages between the country, regional and global initiatives on climate change and health.

EFFECTS OF CLIMATE CHANGE ON NUTRITION

This study looked at the impact of climate change on the nutritional status of very young children between the ages of 0-3 years by using weather data from coastal Bangladesh and evaluated the health consequences of rising temperature and, relative humidity and varying rainfall jointly employing alternate functional forms.

The findings showed that temperatures that exceed 25°C in the month of birth negatively affect children's nutritional status. A matter of grave concern as in Bangladesh and in many other countries the summers are getting

hotter and longer. Humidity has a positive impact which persists when child, mother and household controls are included. The finding also showed that exposure to changing climate in utero also matters. Explanations for these results include consequences of weather fluctuations on the extent of pasture, cropland, and rain-fed lands planted with rice and other crops, and on mother's age at first marriage. The results underline that climate change has real consequences for the health of very young populations in vulnerable areas.

Hanifi, SMMA, et al. The impact of climate change on Children's nutritional status in coastal Bangladesh." *Soc Sci Med.* 2022 Feb; 294; 114704. doi: 10.1016/j.socscimed.2022.114704.



PREVENTING AND TREATING NON-COMMUNICABLE DISEASES



Programme lead

DR ALIYA NAHEED

Scientist, and 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 based on the existing evidence and best practices available in different parts of the world. Our work will contribute to identifying scalable, cost-effective solutions in reducing the non-communicable disease (NCD) and related multimorbidity burden in Bangladesh and potentially applicable elsewhere in the global South.

icddr,b initiated a developmental research programme in 2015 dedicated to developing research for identifying solutions to the prevention and control of NCDs in Bangladesh. Since its inception, the Initiative for Non-Communicable Diseases has been conducting research on all major NCDs in a wide range of multiple disciplines in order to document credible evidence of burden, care practices, systems readiness, social challenges, financial barriers, and other aspects of social determinants of health that prevent access to universal health coverage for NCD care in Bangladesh. The vision of the programme is to evaluate new interventions relevant to LMICs, with a focus on cardiovascular disease, diabetes, and mental health disorders that would drive effective, pragmatic solutions for people of all ages.

We have also played a pioneering role in research capacity strengthening of the clinicians, public health researchers and faculty on NCD research through our innovative platform “Clinical Research Platform, Bangladesh”, a tripartite initiative of Bangabandhu Sheikh Mujib Medical University (BSMMU), British Medical Journal (BMJ) and icddr,b. We regularly exchange our research knowledge with a wide range of audiences globally through our network with The Global Health Network, Oxford University and currently leading The Global Health Network Asia to establish an effective knowledge-sharing and capacity building network within Asia.

Our future work will have a particular focus on developing pragmatic low-cost solutions for NCD risk reduction and implementing already identified best practices in order to support the current NCD management of Bangladesh. We will generate new evidence and knowledge from the existing data sets through pathfinder projects in NCD, along with the impact of other cross-cutting issues in NCD such as infectious diseases, nutrition, environmental change, genomics etc. We will apply the research-driven evidence for strengthening services at the primary care facilities for early detection of major NCDs (Hypertension, Cardiovascular Diseases, Mental Health, Diabetes, and Cancer) through a life course approach and control the disease severity of NCDs in order to prevent premature deaths due to NCDs.

INNOVATIVE, LOW-COST MODEL FOR HYPERTENSION MANAGEMENT

Our multi-country cluster-randomized, controlled trial, COBRA-BPS, found a cost-effective intervention in controlling blood pressure in the rural communities of three South Asian countries, Bangladesh, Pakistan, and Sri Lanka. These breakthrough findings will be disseminated on a large scale, and policy advocacy sessions to scale up this model country-wide.

Feng L, Jehan I, de Silva HA, Naheed A, Khan AH, Kasturiratne A, Clemens JD, Lim CW, Hughes AD, Chaturvedi N, Jafar TH. Effect of a Multicomponent Intervention on

Antihypertensive Medication Intensification in Rural South Asia: Post Hoc Analysis of a Cluster RCT. *Am J Hypertens*. 2021 Sep 22;34(9):981-988. doi: 10.1093/ajh/hpab072.

GESTATIONAL DIABETES MELLITUS

This study highlights the importance of contextual factors in influencing postpartum care and support for women diagnosed with gestational diabetes mellitus (GDM) in three South Asian countries (Bangladesh, India and Sri Lanka). Although the lifestyle intervention was not found to be significantly effective compared to the women who were recruited in the usual

care group from the same facilities, we have also observed that participation in the lifestyle programme was good (80.5% received all programme content), suggesting the proposed programme has been acceptable in the urban settings.

Tandon N, Gupta Y, Kapoor D, Lakshmi JK, Praveen D, Bhattacharya A, Billot L, Naheed A, de Silva A, Gupta I, Farzana N, John R, Ajanthan S, Divakar H, Bhatla N, Desai A, Pathmeswaran A, Prabhakaran D, Joshi R, Jan S, Teede H, Zoungas S, Patel A; LIVING Collaborative Group. Effects of a Lifestyle Intervention to Prevent Deterioration in Glycemic Status Among South Asian Women With Recent Gestational Diabetes: A Randomized Clinical Trial. *JAMA Netw Open*. 2022 Mar 1;5(3):e220773. doi: 10.1001/jamanetworkopen.2022.0773



CLINICAL SERVICES

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

icddr,b hospitals located in Dhaka and Matlab is home to clinicians who are dedicated to solving public health problems and saving lives through ground-breaking treatment for diarrhoea and other related diseases. All patients are treated free of cost and with the utmost care at every level.

At icddr,b Dhaka and Matlab Hospitals, our goal is to rise to the expectations of the patients and their attendants. We strive for expert and compassionate care at every level of our hospitals. Our premier services address quick diagnoses and offer evidence-based treatment. Doctors and nurses at icddr,b work as a team and have achieved a worldwide reputation as the largest diarrhoea hospital in the world.

In 2021, our clinicians treated 200,553 patients, which was lower in 2020 because of the effects of the COVID-19 pandemic. In 2021, the under 5-year children comprised nearly 59% of all patients, similar to previous years.

The COVID-19 treatment wards set up in 2020 for icddr,b staff, and their dependents continued operation in 2021 and provided treatment to a total of 1,016 staff, their dependents and suspected cases. These patients were tested and then given treatment either in the OPD or indoors in the improvised ICU. Some patients were also kept in the isolation facility which was built by converting the Daycare Centre.

Two hospitals cost about USD 5 million annually under normal conditions, with funds largely derived from our core funding. Donations help support doctors, nurses, ancillary staff, in-patient and out-patient wards, intensive care unit and the nutrition rehabilitation unit. We also respond to epidemic outbreaks of diarrhoea in both national and international settings where there is a dearth of expertise we have since the 1960s.

Since 2018 our efforts have continued to address diarrhoeal diseases in the Forcibly Displaced Myanmar Nationals around Cox's Bazar, where international aid efforts are concentrated.

Our work at SARI ITC is covered in (page 22).





DHAKA HOSPITAL



136,913

patients treated in 2021



42%

57,381
number of
females



58%

79,532
number of
males

MATLAB HOSPITAL



63,640

patients treated in 2021



55%

34,930
number of
females



45%

28,710
number of
males

BY AGE



<5

59%

37,400 patients treated



≥ 5

41%

26,240 patients treated



46%
females



54%
males

LABORATORY SCIENCES AND SERVICES

The Laboratory Sciences and Services Division (LSSD) of icddr,b discovers and innovates new tools and methods for better health of the people and provides quality lab services for research and everyday life.

The LSSD of icddr,b is a self-sustaining division and consists of research and clinical service laboratories. Its five research groups work in four research laboratories: Gut-Brain Signalling lab; Laboratory for Environmental Health; Laboratory of Food Safety and One health; and icddr,b Genome Centre. The Clinical lab services include Clinical Biochemistry; Clinical Microbiology and AMR unit, Clinical Immunology; Molecular diagnostics; Clinical Haematology and Cancer Biology Lab. The Quality Assurance unit and Biosafety Office of the LSSD ensure quality diagnostic services and a risk-free working environment across all laboratories, respectively. The Animal Facility Unit of the LSSD is the only animal facility in the country certified by the National Institute of Health, USA. It supports all research laboratories across icddr,b and contributes to research and other related activities of public and private institutions and organisations in the country. The Media and Lyophilization unit of LSSD is the pillar for quality media production for all labs in icddr,b and for external labs as well.

The ISO 15189 and ISO 15190 accreditation of clinical lab services is unprecedented in Bangladesh. LSSD's clinical lab is the first to achieve this feat in the country. It generates surplus revenues to support icddr,b's humanitarian projects, including its hospitals. Despite the challenges of the COVID-19 pandemic when the number of tests decreased compared to previous years, the clinical lab services contributed USD 3.1 million in net revenues in 2021 to icddr,b's core and introduced 158 new diagnostic tests. The laboratory has opened a new sample collection centre in Dhanmondi and another sample collection booth in Baridhara in collaboration with the Baridhara Society. The new sample collection centre/booth has played a significant role in revenue generation.

Apart from its flagship clinical lab services, the Division supports field and hospital-based clinical trials and basic and epidemiological research. In 2021, LSSD supported 21 research projects, including research projects to support the response to the COVID-19 pandemic. LSSD published 40 original research papers.

712
Number of tests offered

2,174
Number of tests as part of hospital surveillance

620,211
number of tests carried out

36
number of icddr,b projects supported by LSSD

158
Number of new tests

192,162
number of paid users

LSSD'S RESPONSE TO COVID-19 PANDEMIC

Correctly detecting COVID-19 in patients with the SARS-CoV-2 virus was imperative. In 2021, the COVID-19 corner at icddr,b tested 79,223 suspected patients.

QUALITY ASSURANCE

The Quality Assurance (QA) unit has been designing, implementing and maintaining laboratory Quality Management System (QMS) for icddr,b laboratories. The unit operates in-house quality assurance programmes, prepares laboratories for external quality assurance systems, internal QMS audits, and external audits from collaborators and donors. The ISO 15189 and ISO 15190 accreditation for diagnostic laboratories has been secured for a consecutive 6th term in 2021. For the External Quality Assurance System (EQAS), the clinical laboratories participated in 54 College of American Pathologists (CAP) panels consisting of 228 test parameters. In 2021, the QA unit conducted 29 Quality Management System (QMS) training sessions for 347 participants.

BIO SAFETY AND BIOSECURITY

To continue diagnostic laboratory activities and to safely conduct research activities at icddr,b 187 sessions of biosafety and biosecurity training programmes were organised by the Biosafety Office, where 2,366 participants of icddr,b attended. The Office also substantially contributed to achieving ISO 15190 accreditation.

RESEARCH AND ACTIVITIES FOR ANTIMICROBIAL RESISTANCE

LSSD is contributing to a project which addresses critical gaps in the surveillance of antimicrobial-resistant bacteria in human, animal and aquatic sectors in Bangladesh. Another study conducted by LSSD found that more than 75 per cent of infants in rural areas of Bangladesh are colonised with multidrug-resistant

E. coli. Furthermore, another study demonstrated the high prevalence of blaCTX-M-15 gene among extended-spectrum β -lactamase-producing *E. coli* isolates, causing extraintestinal infections in Bangladesh.

EXPLORING TREATMENT OF GBS

icddr,b's Gut-Brain Signalling lab has developed one of the world's largest cohorts of Guillain-Barré syndrome (GBS). In addition to molecular, genetic and epidemiological studies on GBS, the research group contributes to novel drug development for treating GBS.

A phase 1b clinical trial of a novel humanised monoclonal antibody (ANX005), a C1q inhibitor, has been completed among patients with GBS in Bangladesh, which was found to be safe and well-tolerated in patients with GBS, opening the door to further clinical stages of this trial. A phase two/phase three clinical trial of ANX005 is underway.



CENTRAL MANAGEMENT SERVICES (CMS)



The year 2021 has been one of embracing change because of the COVID-19 pandemic. The COVID-19 pandemic changed most aspects of the life of people all around the world and has created many challenges and uncertainties.

At icddr,b our staff also had to adapt to this change, which can be seen through our CMS's work to support our researchers doing their life-saving work. In the first half of 2021, with most staff working from home, we focused on the health of our staff and their family members and encouraged them to take their COVID-19 vaccination. Human Resources continued to work with their topmost proficiency and launched many initiatives, including staff mental health and wellbeing sessions. The dedication of our Information Technology (IT) Unit allowed all-time technical support and availability of IT infrastructure throughout 2021. Enabling staff members to work remotely was indeed a daunting task. Our Supply Chain and Facilities Management continued to support core business functions of the organisation and optimised the quality of work to lower waste and minimise business disruption.

Since the COVID-19 pandemic had financial implications on research activities, the finance department of icddr,b worked with great dedication to manage icddr,b resources effectively and efficiently. As a result, the cash reserves in 2021 have slightly increased, and we at icddr,b very much appreciate the support and collaboration of our donors, without whom it would be challenging to meet our central management costs.

As we prioritise evidence-based research, our Research Administration (RA) circulated more than 377 funding calls with a success rate of 26%, which increased from 23% in 2020. RA was also the Secretariat of the 'Mujib 100 Research Grants for Women' (Mujib 100 RGfW) launched in 2020 to commemorate the birth centenary of Bangladesh's Father of the Nation Bangabandhu Sheikh Mujibur Rahman and in celebration of icddr,b's 60 years of scientific brilliance.

Our Development Unit continued its engagement with icddr,b's core donors, and welcomed a wide range of visitors after the work from home and social distancing guidelines were relaxed. In addition, for the first time, the team reached out to more than 500 local and international philanthropies and businesses with tailor-made letters. Our Communications Unit also continued to support our researchers, clinical services, and diagnostic unit through digital and print platforms. The unit has produced the last Annual Report entirely in-house, saving a significant amount of cost.

The Regulatory and Legal Affairs (R&LA) Unit of icddr,b supported core functions by processing and reviewing legal documents, which included grant agreements, service agreements, collaboration agreements, etc.

As we look forward to a world without COVID-19, icddr,b CMS will continue to support our researchers and the life-saving work being done at icddr,b.

Mr Syed Monjurul Islam
Deputy Executive Director
(until 1 November 2021)



Mr Thomas Liam Barry
Director, Finance

FINANCE

2021 has been a successful year despite a slow resumption of activities after the COVID-19 pandemic emerged in 2020. We went from an expected projected surplus of over USD 1.9 million in April 2021 to a surplus of USD 3.2 million as of 31 December 2021. The overall income increased by USD 15.8 million due to increased restricted grant activities and the reopening of full laboratory services to the general public, coupled with cost-containment measures.

In addition, we achieved a successful unqualified audit report for 2021. Finance has managed icddr,b resources effectively and efficiently throughout the year. We started implementing a new enterprise resource planning (ERP) system, Microsoft 365, with a project duration of 18 months, tentatively going live in 2023.

Our cash reserves during 2021 increased slightly but remained strong, allowing icddr,b to manage future adverse circumstances. Full cost recovery targets have been achieved, but we continue to appreciate the excellent support from donors despite the challenges faced with COVID-19, which represented a significant contribution toward meeting our central management costs.

Some donors could not approve our official overhead costs due to their policies related to allowable overhead costs rate of about 10 to 15 per cent, leaving a potential shortfall in funding core operational costs. For sustainability, icddr,b has continued the development of a wider portfolio of income, donor and philanthropic sources, supporting and expanding laboratory income generation services, launching further hospital appeal funds, updating and negotiating tariffs, and securing appropriate recovery of costs to projects that are acceptable to all donors.



Mr Hugues BELLO
Director, Human Resources

HUMAN RESOURCES

In 2021, Human Resources continued to deliver and serve our clients everyday we proved our transformation and cost discipline. The emergence of the COVID-19 pandemic prompted a change in how we work. We provided the business with tools and analysis that enable them to effectively manage their people.

As the pandemic continues, we focus on the well-being of our staff and have encouraged all staff to take their COVID-19 vaccination and booster doses. We have also launched mental health awareness learning modules, where training was centred on the staff's mental well-being and those around them. This focus paid off. Engagement scores were high in our 2021 staff survey.

The competence of icddr,b in conducting training for health professionals from Bangladesh, the region, and beyond is high in demand. The Technical Training Unit of icddr,b hosted 834 participants from nine different countries (Australia, Bangladesh, Canada, India, Japan, Kyrgyzstan, Nepal, UK, and the USA) through 18 training programmes and student services.

Our approach to attracting, retaining, and developing talent has evolved since the pandemic and will continue doing so. Talent Acquisition (TA) dealt with 213 vacancies which included more than 60,000 applications and a turnaround time of 13 days compared to the service level agreement of 30 days. The TA team completed 2,732 recruitments in 2021.

icddr,b expects the highest standards of behaviour and conduct. The staff has a responsibility to do the right thing and awareness is provided through the Code of Conduct. HR has been strengthening its policies and procedures in this regard. Employee complaints have been dealt with in accordance with policies and procedures. Staff complaints decreased in 2021 compared to previous years due to the awareness and dissemination sessions conducted.



Mr Mohammad Noushad Chowdhury

Director, Supply Chain and Facilities Management (until 27 December 2021)

SUPPLY CHAIN AND FACILITIES MANAGEMENT

At icddr,b Supply Chain Management (SCM) supports core business functions by creating an effective and efficient operating environment. SCM maintains interactions with internal and external entities to provide optimum services across all goods and services.

In 2021, SCM continued to expand its service provision and optimise the quality of work undertaken to eliminate waste and minimise business disruption. All this happened in light of the COVID-19 pandemic that has hit global trade and investment at an unprecedented speed and scale. icddr,b faced an initial supply shock and then a demand shock as more and more countries were affected due to logistics challenges. Despite all challenges, SCM was able to support all core functions of icddr,b because of the Senior Leadership Team's foresight and preparedness to deal with such a situation.

Operationally, SCM successfully supported divisions and units to ensure business continuity by guaranteeing a continued supply of logistics, i.e. supply of imported critical health safety items like personal protective equipment (PPE), reagents, ICU equipment, ventilators, and testing kits. It also ensured uninterrupted oxygen and liquid nitrogen supplies to hospitals and labs. With the support of SCM, Matlab HRC upgraded their core network infrastructure at Matlab Data Centre along with the central Wi-Fi infrastructure.

Additionally, SCM assisted the Government of Bangladesh by providing critical Lab equipment and kits to different government institutes/hospitals in collaboration with WHO, UNICEF, USAID, CDC and Fleming Fund by DAI Global, LLC. SCM supported the renovation, supply and installation of Government laboratories up to Biosafety Levels (BSL2) standard.

Furthermore, cost savings of USD 1.1 million have been achieved. SCM also established a sample collection centre of the diagnostic unit at Dhanmondi. The Centre store inventory has been reduced by 22% through the implementation of departmental demand forecast planning and followed Just-in-Time deliveries. Strategic procurement services have been enhanced to secure the best value for money through Long Term Agreements.

Facilities Management (FM) supports core business functions by creating an effective and efficient operating environment for icddr,b by providing security, engineering, transport and cafeteria services while ensuring safety and quality with minimum downtime.

Additionally, FM has assisted the Government of Bangladesh by providing critical technical support for laboratory equipment, upgrading hospital and laboratory facilities of different Government establishments through USAID's ACTB initiative.



Ms Armana Ahmed

Head, Research Administration

RESEARCH ADMINISTRATION

Research Administration (RA) supports icddr,b researchers in exploring research funding opportunities, submitting grant applications, facilitating the institutional review process of research projects and assisting for publications of manuscripts. Similar to 2020, the COVID-19 pandemic also affected the funding landscape globally in 2021. Even then, RA circulated 377 (it was 380 in 2020) funding calls, and the success rate of icddr,b applications through competitive participation in 2021 increased to 26% from 23% in 2020. Compared with 2020, the number of ongoing research grants increased by 16 per cent in 2021.

In 2021, RA started tracking icddr,b's footprint in the global South. The number of projects where icddr,b collaborates with countries in the global South stood at 32 in December 2021. icddr,b acts as Lead/Co-Lead (Technical Assistance)/Site Investigator in these South-South collaboration projects.

In 2020, icddr,b launched the 'Mujib 100 Research Grants for Women' (Mujib 100 RGfW) commemorating the birth centenary of Bangladesh's Father of the Nation Bangabandhu

Sheikh Mujibur Rahman and in celebration of icddr,b's 60 years of scientific brilliance. RA, as the Secretariat, coordinated this initiative. We received more than 200 applications from different public and private universities and research institutes across the country and from applicants who are on study leave and are outside of Bangladesh. The applications were screened anonymously using defined criteria by an Allocation Committee, comprised of members who are subject experts from both inside and outside of icddr,b. Forty concept notes were shortlisted, which were then reviewed by members of icddr,b's Scientific Advisory Group (SAG), comprising of world-renowned scientists. SAG scored the applications anonymously on a 100-point scale, and 10 applications (5 led by external applicants and 5 led by applicants from icddr,b) were selected for the award. The external applicants will have a mentor from icddr,b to help them implement their projects. Senior scientists from icddr,b will act as mentors in these projects.

Throughout 2021, RA along with icddr,b mentors, worked with these applicants; especially the ones from outside of icddr,b in developing their full proposals and budgets for review by icddr,b's Institutional Review Board (IRB), which is recognised in Bangladesh and beyond.



Mr Tanvir Azad Chowdhury

Head, Information
Technology

INFORMATION TECHNOLOGY

To achieve efficient, effective, sustainable, and productive outcomes, IT automated nine business processes to reduce turnaround time and improve efficiency. The implementation of a new ERP system named Rupantor is currently in process; the contract was awarded in the first quarter of 2021. About 97 per cent of IT projects were completed on time and within budget.

During the Covid 19 pandemic, IT delivered mission-critical and priority automated solutions. This included creating the donation page for icddr,b Zakat fund, conflict of interest and code of conduct, 5th staff engagement survey, incorporation of logistics (C&F, Freight, Insurance and others) costs in the purchase order process of ERP, modification of local travel requisition process in ERP to assist implementing new paradigm, store ESPF and PF data along with accrued interests and modification in the pay slips and final settlement process, automation of email notification process for retirement letter in ERP, incorporate new store "Staff Clinic Pharmacy Matlab (SCPM)" for Staff Clinic health benefits system and dispensed drug to entitled staff clinic staff employee and their eligible dependents, Urban HDSS (Project 1 and Project 2).

In 2021, work from home had been strongly encouraged (and sometimes mandated). Technical support and the availability of IT infrastructure were maintained throughout this period. All staff had easy access to the Centre's IT facilities from home, resulting in smooth institutional operations.

To enhance information and cyber security, IT has replaced the email protection system with the industry-best solution provided by Microsoft to minimise spam and phishing emails. Moreover, IT has reviewed the security configurations of the email system and executed necessary changes to ensure the best cyber security is in place. Digital forensic investigation of email intersection cases has commenced with the Bangladesh Government's e-Government Computer Incident Response Team (BGD e-GOV CIRT).

A cybersecurity awareness program was launched by IT and delivered training to 854 users in 2021. IT security policy has been implemented successfully, including restriction of USB access, isolation of legacy Operating systems, and password policy of icddr,b domain. To minimise vulnerabilities, IT has completed risk management, regular vulnerability assessment, and patch updates. The Senior Leadership Team approved the IT operation manual.

IT began implementing security information and event management (SIEM), which will store, normalize and aggregate information collected from IT tools/applications and apply analytics to that data to discover trends, and detect threats and vulnerabilities.



Mr Mohammad Nafiu Alam

Head, Regulatory and Legal Affairs

REGULATORY AND LEGAL AFFAIRS

The Regulatory and Legal Affairs (R&LA) unit reviewed/processed 829 legal documents in 2021, including grant agreements, collaboration agreements, sub-agreements, service agreements, material transfer agreements, memorandums of understanding, confidentiality agreements, pre-teaming agreements, data sharing agreements, procurement-related agreements, rental agreement, PARRF (Pre-Award or After Award Requirements Review Form) and amendments of several agreements.

The Institutional Governance Framework (IGF) has been updated to its 1.8 version with the initiative of R&LA. The crucial modifications in the IGF version 1.8 include introducing the “Compliance Framework” chapter, updating different aspects of policy compliance requirements (for instance – for Lab services to ensure the applicable national and international guidelines [i.e. Good Laboratory Practice (GLP), International Organization for Standardization (ISO) Standards, Good Clinical Laboratory Practice (GCLP), Bio-safety related principles/guidelines/policies, applicable policies and guidelines issued by the Directorate General of Health Services or any other authority]; updating the gift value for avoiding conflict of interest; updating the Organisational structure; updating the list of statutes; and others.

R&LA has actively contributed to the facilitation of training and awareness sessions organised by HR on code of conduct, different policies, the management of disciplinary proceedings, and awareness sessions relating to grant/contractual obligations for the stakeholders/PI Offices in collaboration with Finance, and providing oversight in the sourcing process managed by SCFM.

R&LA is now managing and cooperating with the government body to complete the process of four patent applications filed in the Department of Patent, Design and Trademark (DPDT). Another five Patent applications are in the pipeline. As part of icddr,b’s intellectual property (IP) capacity development, R&LA arranged seminars and sessions facilitated by national and international government officials and keynote speakers in order to train the researchers of icddr,b about IP-related matters.



Mr A K M Tariful Islam Khan

Senior Manager, and in charge of Communications (since 25 April 2021)

COMMUNICATIONS

The unit has renewed its emphasis on icddr,b’s digital landscape. Under the Executive Director’s guidance, the communications unit initiated a campaign to profile next-generation scientists on its social media platforms and covered 20 young researchers and scientists. In 2021, icddr,b Facebook page reach accounted for more than 2.4 million, which is 387% higher than in 2020. icddr,b Facebook page views accounted for more than 110,000, a 327% increase from the last year. Altogether, social and digital media content was viewed more than 4 million times; the official website achieved 15% greater traffic and 10% more unique users in comparison to 2020; we gained around 40,000 new followers across social media channels.

Our success in gaining national and international media coverage was maintained, totalling over 1,300 news reports, which include reports in Al Jazeera, France 24, Anadolu, MSN and Forbes Alert. Additional articles were published on icddr,b’s website, blogs, and with our advocacy partners, such as Devex. For the first time in decades, we produced the Annual Report in-house and saved a significant amount of cost.

We have continued showcasing our scientists and their work in mainstream media by facilitating exclusive interviews and talk shows.



Ms Aysha Wisam Rashid

Grant Writer, and in charge of Development (since 25 April 2021)

DEVELOPMENT

The Development Unit has overseen continued positive engagement with icddr,b's core donors – Foreign, Commonwealth, and Development Office, UK; Global Affairs Canada, the Swedish International Development and Cooperation Agency; and the Government of Bangladesh.

The Government of Bangladesh provided unrestricted support and has continued to provide increased funding for ongoing projects, including bilateral funding for research

icddr,b's COVID-19 appeal that was launched in 2020 to sustain free life-saving services for the vulnerable communities of Bangladesh has continued to secure substantial commitments. This includes donations from corporations, ready-made garment manufacturers, and high-net-worth individuals in response to the appeal.

With the ongoing challenges of the COVID-19 pandemic, international agencies have been redirecting their funds to the domestic priorities of their home country. The Development unit is conducting regional and international donor landscaping, which involves extensive research and shortlisting of prospective donors. icddr,b is currently exploring support from 'non-conventional' donors, including Turkey, the Middle East, and the Far East.

An impressive array of visitors in 2021 included representatives from the Embassy of the Republic of Turkey, the Royal Thai Embassy, the Republic of Korea, the High Commissioner of Brunei, the First Secretary of the Canadian High Commission, Dhaka, and the USAID Mission Director of Bangladesh visited icddr,b to gain further insight on our organisation including recent COVID-19 research activities.





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KEY VISITORS IN 2021



TURKISH AMBASSADOR TERMS icddr,b's LIFE-SAVING RESEARCH AS 'INSPIRING'

On 27 September, His Excellency Mustafâ Osman Turan, the Honourable Turkish Ambassador to Bangladesh, paid his first-ever visit to icddr,b at Mohakhali, Dhaka. Ambassador Turan was keen on learning about icddr,b and its ongoing COVID-19 research activities.



UNICEF REPRESENTATIVE VISITS SARI ITC AT TEKNAF, COX'S BAZAR

Mr Tomoo Hozumi, UNICEF Representative to Bangladesh, paid a visit to icddr,b's Severe Acute Respiratory Infection Isolation and Treatment Centre (SARI ITC) at Teknaf, Cox's Bazar on 12 September 2021.



UNFPA'S HEALTH CHIEF VISITS icddr,b

Dr Vibhavendra Raghuyamshi, Chief of Health at the UNFPA Country Office, paid a visit to icddr,b Mohakhali Campus on 07 September 2021. He was accompanied by Dr Md. Dewan Emdadul Haque, Health Systems Specialist and Ms. Rondi Anderson, International Midwifery Specialist of UNFPA.

US AMBASSADOR VISITS icddr,b TB ACTIVITIES IN CUMILLA

On 25 September 2021, Earl R. Miller, US Ambassador to Bangladesh, visited USAID's ACTB Child TB Corner at Cumilla Medical College Hospital (CuMCH), where he interacted with USAID's ACTB staff members and CuMCH physicians.



KOREAN AMBASSADOR VISITS icddr,b

LEE Jang-keun, His Excellency the Ambassador of the Embassy of the Republic of Korea in Bangladesh, visited icddr,b on 2 November 2021. He was accompanied by Mr Lee Jungyoul, First Secretary of the South Korean Embassy.



HIGH COMMISSIONER OF BRUNEI DARUSSALAM VISITS icddr,b

The High Commissioner of Brunei Darussalam in Bangladesh, His Excellency Haji Haris bin Haji Othman, paid a visit to icddr,b on 1 November 2021.



AHRI TEAM VISITS icddr,b

Researchers from the AHRI visited icddr,b from 11-13 November 2021. The visiting team comprised Dr Meseret Gebre, Principal Investigator, Dr Kassa Haile, Co-Principal Investigator, and Ms Muluye SHEMELES, Internal Monitor.

THAI AMBASSADOR VISITS icddr,b HQ AND SARI ITC

On 1 December 2021, Her Excellency Ms Makawadee Sumitor, The Honourable Ambassador of the Kingdom of Thailand to Bangladesh, visited icddr,b with her team.



Earlier on 16 November 2021, the Honourable Ambassador also visited icddr,b's SARI ITC in Teknaf, Cox's Bazar, and expressed her willingness to collaborate between Thailand and SARI ITC for humanitarian work.



ADB COUNTRY DIRECTOR VISITS SARI ITC

On 17 November, Mr Edimon Ginting, Honourable Country Director of the ADB visited SARI ITC, Teknaf.



ATTACHÉ OF THE EU VISITS SARI ITC

On 18 November, Ms Raija Norkia, Attaché of the European Union to Bangladesh, paid a visit to SARI ITC, Teknaf.



USAID MISSION DIRECTOR VISITS icddr,b

USAID Mission Director Ms Kathryn Stevens with her colleagues visited icddr,b on October 28, 2021. The visitors learned about the type of work icddr,b does and also toured the icddr,b hospital.



icddr,b

DHAKA HOSPITAL

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 disseminating information to scientific, practitioner, policy and programme communities.

HIGH-PROFILE PUBLICATIONS IN 2021

In 2021, icddr,b researchers were authors on 573 original publications – about a 25 per cent increase from 2020 – and also contributed to 150 letters, editorials, book reviews and abstracts. These included publications in the leading journals, including the New England Journal of Medicine, The Lancet, Lancet Global Health, Lancet Infectious Diseases, PLoS Medicine, PLoS Neglected Tropical Diseases and Vaccine. The majority of papers were co-authored with national and international colleagues.

Book
Chapters

3



Original
Papers

573

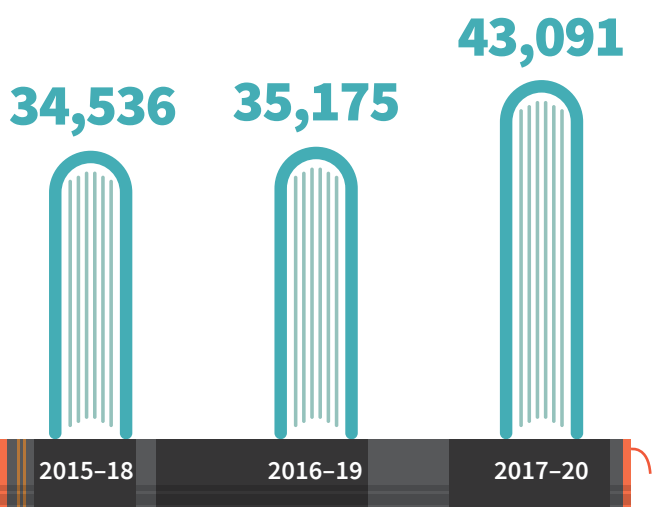
Reports/
Monographs

3

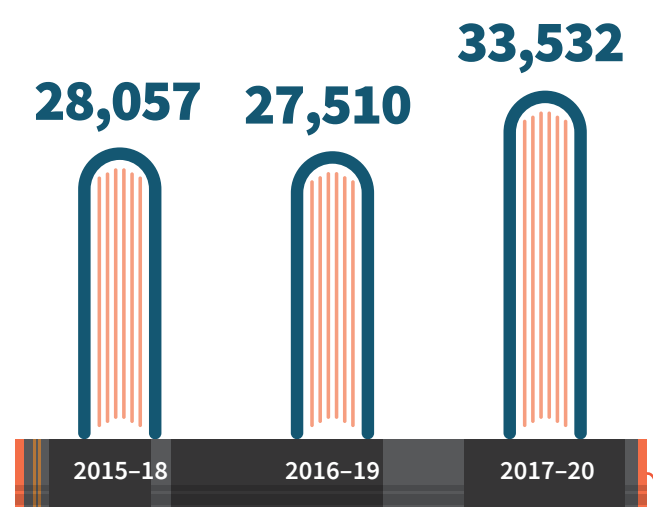


Letters,
Editorials, etc.

22



CITATIONS I: ALL PAPERS



CITATIONS II: PAPERS IN HIGH-IMPACT JOURNALS



COLLABORATIONS

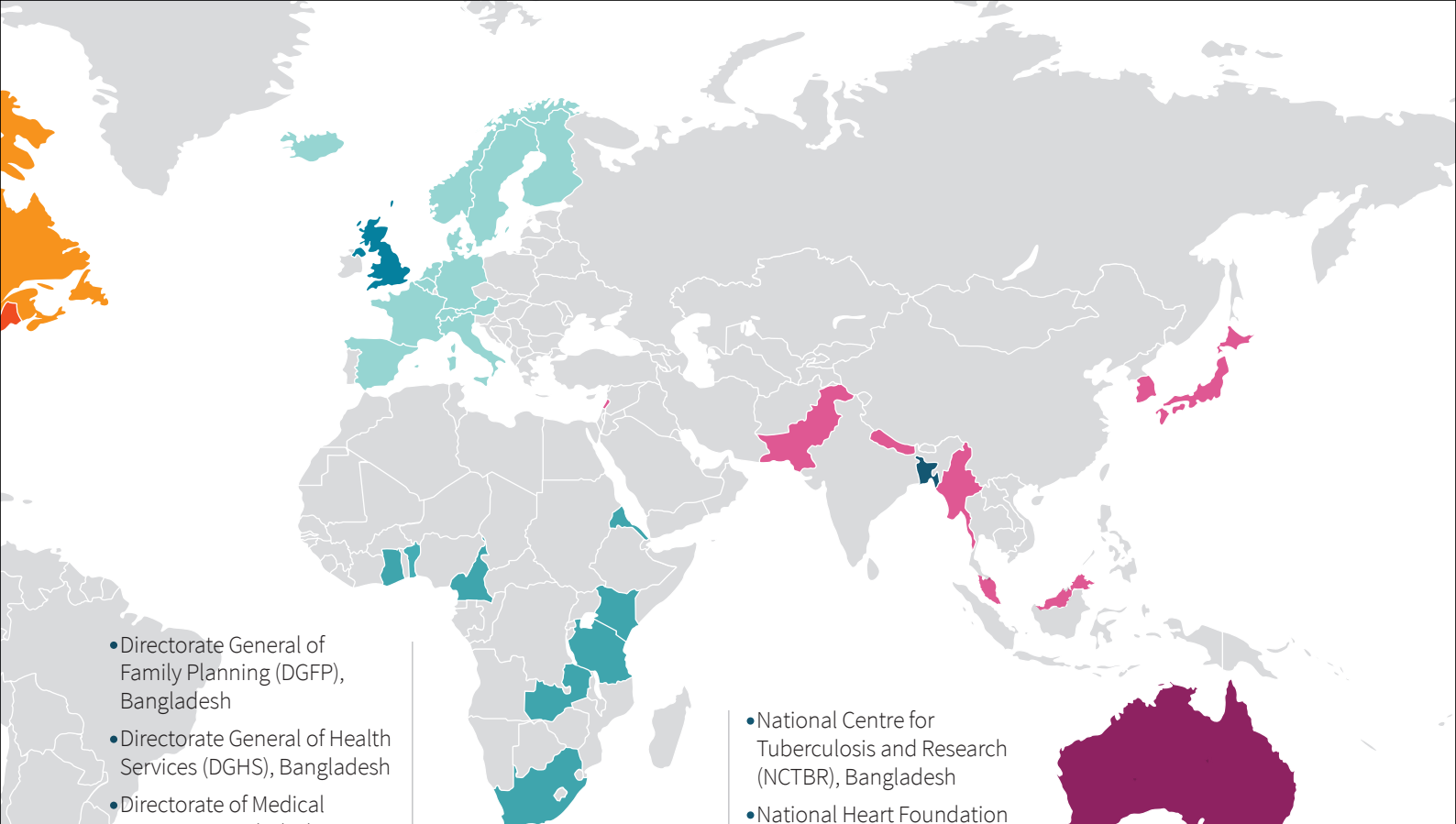
Collaborations are central to our work. We work with multiple governments, academic and NGO partners in Bangladesh, ensuring a strong focus on local health issues, and have long-standing ties with scientific collaborators in leading research institutions worldwide.

We are also members of a range of regional networks and work closely with partners across South Asia and the Global South.

COLLABORATING INSTITUTIONS

BANGLADESH

- 500 Bed Mugda General Hospital, Bangladesh
- a2i, Bangladesh
- Ad-Din Medical college Hospital (AMCH), Bangladesh
- Apollo Hospitals, Bangladesh
- Armed Forces Research Institute of Medical Science (AFRIMS), Bangladesh
- Asgar Ali Hospital, Bangladesh
- Bangabandhu Sk. Mujib Medical University and Hospital, Bangladesh
- Bangladesh Agricultural University, Bangladesh
- Bangladesh Atomic Energy commission, Bangladesh
- Bangladesh Forest Department, Bangladesh
- Bangladesh Institute of Child Health (Dhaka Shishu Hospital), Bangladesh
- Bangladesh Institute of Research and Rehabilitation in Diabetes, Bangladesh
- Bangladesh Jute Mill Corporation, Bangladesh
- Bangladesh Livestock Research Institute (BLRI), Bangladesh
- Bangladesh Lung Foundation, Bangladesh
- Bangladesh National Nutrition Council (BNNC), Bangladesh
- Bangladesh Specialized Hospital, Bangladesh
- Bangladesh University of Engineering Technology (BUET), Bangladesh
- BCSIR, Bangladesh
- bKash, Bangladesh
- BRAC, Bangladesh
- Center for Women and Child Health (CWCH), Bangladesh
- Central Drug Addiction Treatment Centre (CTC), Bangladesh
- Centre for Communication Programs, JHU, Bangladesh
- Centre on Integrated Rural Development for Asia and the Pacific (CIRDAP), Bangladesh
- Child Health Research Foundation, Bangladesh
- Chittagong Veterinary and Animal Sciences University, Bangladesh
- Civil Surgeon Office, Natore, Bangladesh
- Colonel Malek Medical College, Manikganj, Bangladesh
- Connecting people, Saving Life, Bangladesh
- Daffodil International University, Bangladesh
- Department of Fisheries, Bangladesh
- Department of Livestock Services (DLS), Bangladesh
- DGHS and Institute of Epidemiology Disease Control and Research, Bangladesh
- Dhaka Medical College and Hospital (DMCH), Bangladesh
- Dhaka Mohanogor Shishu Hospital, Bangladesh
- Dhaka North City Corporation, Bangladesh
- Dhaka Shishu Hospital, Bangladesh
- Dhaka Tribune, Bangladesh



- Directorate General of Family Planning (DGFP), Bangladesh
- Directorate General of Health Services (DGHS), Bangladesh
- Directorate of Medical Services, Bangladesh
- District Family Planning Office, Natore, Bangladesh
- Enam Medical College & Hospital, Bangladesh
- Faridpur Medical College Hospital, Bangladesh
- Food and Agricultural Organization (FAO), Bangladesh
- Global Fund Programme for People Who Inject Drugs (GFPWID), Bangladesh
- Gonoshasthaya Kendra, Bangladesh
- High Commission of Canada, Bangladesh
- Ibrahim cardiac hospital and research institute, Bangladesh
- icddr,b, Bangladesh
- ideSHi /CMBT (Institute for Developing Science & Health Initiatives), Bangladesh
- Incepta Pharmaceuticals, Bangladesh
- Institute for developing science & Health initiatives (ideSHi), Bangladesh
- Institute of Child and Mother Health (ICMH), Bangladesh
- Institute Of Child Health & Dr. M R Khan Shishu Hospital (ICHSH), Bangladesh

- Institute of Epidemiology Disease Control and Research (IEDCR), Bangladesh
- Institute of Public Health (IPH), Bangladesh
- Institute of Public Health Nutrition (IPHN), Bangladesh
- International Food Policy Research Institute (IFPRI), Bangladesh
- Kurmitola General Hospital (KGH), Bangladesh
- Labaid Specialized Hospital, Bangladesh
- LAMB Hospital, Bangladesh
- Marie Stopes Clinic Society (MSCS), Bangladesh
- Maternal & Child Health Training Institute, Bangladesh
- Measure Evaluation, Bangladesh
- Ministry of Health and Family Welfare, Bangladesh
- Mohammadpur Fertility Services & Training Center, Bangladesh
- Mymensingh Medical College and Hospital, Bangladesh
- National Centre for Hearing and Speech for Children (SAHIC), Bangladesh

- National Centre for Tuberculosis and Research (NCTBR), Bangladesh
- National Heart Foundation and Research Institute, Bangladesh
- National Heart Foundation of Bangladesh, Bangladesh
- National Institute of Cardiovascular Disease (NICVD), Bangladesh
- National Institute of Diseases of Chest and Hospital (NIDCH), Bangladesh
- National Institute of Ear, Nose and Throat (ENT), Bangladesh
- National Institute of Neurosciences and Hospital (NINS), Bangladesh
- National Institute of Preventive and Social Medicine, Bangladesh
- National Malaria Elimination Program (NMEP), Bangladesh
- National Medical College and Hospital, Bangladesh
- National Tuberculosis Control Programme (NTP), Bangladesh
- NIPORT, Bangladesh
- North South University, Bangladesh
- Northern University, Bangladesh
- Nutrition International (NI), Bangladesh

- Obstetrical and Gynecological Society of Bangladesh (OGSB), Bangladesh
- Patuakhali Science and Technology University, Bangladesh
- Patwary General Hospital pvt ltd, Bangladesh
- Projahnmo Research Foundation, Bangladesh
- Shaheed Suhrawardy Medical College (SSMC), Bangladesh
- Sheikh Russel Gastro Liver Institute and Hospital, Dhaka, Bangladesh
- SHIMANTIK, Bangladesh
- Sir Salimullah Medical College and Hospital, Bangladesh
- UChicago Research Bangladesh, Bangladesh
- UH&FPO, Bangladesh
- United Nations Children's Fund (UNICEF), Bangladesh
- United Nations Population Fund (UNFPA), Bangladesh
- United States Agency for International Development (USAID), Bangladesh
- University of Dhaka, Bangladesh

COLLABORATIONS

- Urban Primary Healthcare Project (UPHCP), Bangladesh
- US Embassy Dhaka, Bangladesh
- World Health Organization, Bangladesh
- World Vision Bangladesh, Bangladesh

AFRICA

- African Population & Health Research Centre, Kenya
- Armauer Hansen Research Institute (AHRI), Ethiopia
- Center for Infectious Disease Research in Zambia, Zambia
- Centre Pasteur du Cameroun, Cameroon
- Chris Baragwanath Hospital, South Africa
- International Institute of Tropical Agriculture, Benin
- KEMRI-Wellcome Trust Research Programme, Kenya
- Malaria Research Centre, Agogo Presbyterian Hospital, Ghana
- Muhimbili University of Health and Allied Sciences, Tanzania
- Mycobacteriology Laboratory, Centre Pasteur du Cameroun (CPC)

ASIA

- Armed Forces Research Institute of Medical Science (AFRIMS), Thailand
- Banaras Hindu University, India
- Bharat Biotech International Limited, India
- Bio Farma, Indonesia
- Centre for Development Studies, India
- Center for Public Health Kinetics, India
- Chinese Center for Disease Control and Prevention, China
- Christian Medical College, Vellore, India

- Clinigent, India
- Duke-NUS Graduate Medical School Singapore, Singapore
- GlaxoSmithKline, India
- Greentech Knowledge Solutions Pvt. Ltd. (GKSPL), India
- Hiroshima University, Japan
- Institute for Human Development, India
- Institute of Medical Biology Chinese Academy of Medical Sciences, China
- Institute of Social and Economic Change, India
- Interactive Research and Development (IRD), Pakistan
- International Centre for Genetic Engineering and Biotechnology (ICGEB), India
- International Food Policy Research Institute (IFPRI), India
- International Vaccine Institute (IVI), Korea (South)
- Lebanese University, Lebanon
- Mahidol University, Thailand
- Ministry of Health and Welfare of the Korean government, Korea (South)
- Myanmar Ministry of Health & Sports, Myanmar
- National Institute of Infectious Diseases, Japan
- National University Hospital (NUH), Singapore
- Nay Pyi Taw, Myanmar,
- Oxford University Clinical Research Unit Nepal
- Postgraduate Institute of Medical Education and Research, India
- Rajendra Memorial Research Institute, India
- Serum Institute of India Ltd, India
- Sinovac Biotech Co, China
- Sree Chitra Tirunal Institute for Medical Science and Technology, India
- Tokyo-Kasei University, Japan
- Universitas Nasional (UNAS), Indonesia

- University of Malaya, Malaysia
- University of Tokyo, Japan
- University of Tsukuba, Japan
- XIAMEN Innovax BIOTECH CO.Ltd, China

AUSTRALIA

- CSIRO
- Griffith University
- James Cook University
- Menzies School of Health Research
- The Royal Children's Hospital
- The University of Queensland
- University of Melbourne
- University of New South Wales
- University of Sydney
- University of Technology Sydney
- University of Western Australia, Australia
- Western Sydney University

USA

- Albany Medical College
- Barnard College
- Berkeley Air Monitoring Group, USA
- Bill & Melinda Gates Foundation
- Boston University School of Public Health
- Brown University
- Centers for Disease Control and Prevention
- Children's Hospital Oakland Research Institute
- Children's Hospital of Richmond at VCU
- Columbia University
- CTK Biotech Inc.
- Data for Impact (D4I)
- Department of Pharmaceutical Sciences, College of Pharmacy, USA
- Duke Global Health Institute, Duke University
- EcoHealth Alliance
- Emory University
- Evolve BioSystems, Inc.
- Frederick National Laboratory for Cancer Research, Leidos Biomedical Research Inc
- Gynuity Health Projects
- Harvard Kennedy School
- Harvard Medical School
- Harvard TH Chan School of Public Health, USA
- Infectious Disease Research Institute
- Johns Hopkins Bloomberg School of Public Health (JHBSPH)
- Johns Hopkins University School of Medicine
- La Jolla Institute of Immunology
- Mailman School of Public Health, Columbia University, USA
- Management Sciences for Health (MSH)
- Massachusetts General Hospital (MGH)
- Maternal, Child and Community Health (MCCH) Division, USA
- National Institute of Allergy and Infectious Diseases (NIAID)
- Nationwide Children's Hospital
- North Carolina State University, USA
- Novavax, Inc.
- PATH Vaccine Solutions (PVS)
- PATH
- Pennsylvania State University
- PREVENT
- Pure Earth
- Rollins School of Public Health
- RTI International
- Save the Children
- Scripps Research
- Stanford University
- TechLab Inc.

- The Consortium for Conservation Medicine
- The Emmes Company, LLC
- Tufts University School of Medicine
- United States Agency for International Development (USAID)
- United States Department of Agriculture
- University at Albany
- University at Buffalo
- University of California, Berkeley
- University of California, Davis
- University of California, Los Angeles (UCLA)
- University of California, San Diego
- University of Central Florida
- University of Chicago
- University of Colorado
- University of Florida
- University of Georgia College of Veterinary Medicine
- University of Kentucky
- University of Maryland School of Medicine
- University of Maryland
- University of North Carolina (UNC)
- University of Notre Dame (UND)
- University of Pennsylvania
- University of Texas at Galveston
- University of Texas Health Sciences Center
- University of Utah
- University of Vermont
- University of Virginia Health System
- University of Virginia
- University of Washington
- U.S. National Poultry Research Center, USA
- Vanderbilt University
- Virginia Commonwealth University

- Warren Alpert Medical School of Brown University
- Washington State University
- Washington University School of Medicine
- Washington University
- Western Human Nutrition Research Center (WHNRC)
- Yale University

CANADA

- Salu Design
- St. Michael's Hospital
- The Hospital for Sick Children
- University of Alberta
- University of Calgary
- University of Saskatchewan
- University of Toronto

UK

- Bangor University
- Imperial College London
- Institute of Child Health
- Institute of Development Studies (IDS)
- Liverpool School of Tropical Medicine
- London School of Hygiene and Tropical Medicine (LSHTM)
- Loughborough University
- M&C Saatchi World Services
- Oxfam GB, UK
- Sheffield Hallam University
- The Children Investment Fund Foundation
- The Jenner Institute
- The Pirbright Institute
- The University of Edinburgh
- The University of Sheffield
- University College London
- University of Aberdeen
- University of Bath
- University of Cambridge
- University of Glasgow
- University of Greenwich
- University of Huddersfield, UK

- University of Nottingham
- University of Oxford
- University of Portsmouth
- University of St. Andrews
- University of Stirling
- University of Warwick

EUROPE

- Antoni van Leeuwenhoek Hospital/the Netherlands Cancer Institute, Netherlands
- CIRI, France
- DNDi, Switzerland
- Drugs for Neglected Diseases initiative, Switzerland
- Eawag, Switzerland
- Erasmus MC University Medical Ctr Rotterdam, The Netherlands
- European Molecular Biology Laboratory (EMBL), Germany
- European Vaccine Initiative, Germany
- EveliQure Biotechnologies GmbH, Austria
- Fondation Mérieux, France
- Georg-August-Universität Göttingen, Germany
- Göteborg University, Sweden
- Institut Pasteur, France
- Institute of Tropical Medicine, Belgium
- International Atomic Energy Agency (IAEA), Austria
- International Maternal and Child Health Department, Sweden
- Karolinska Institute, Sweden
- KU Leuven, Belgium
- Laboratorio de Referencia de Leishmaniasis, Spain
- Laboratoire des Pathogènes Emergents, Fondation Mérieux, Lyon, France
- Max Planck Institute for Evolutionary Anthropology, Germany
- Ministry for Social Affairs and Health, Finland
- Nestle Research Center, Switzerland

- Nestle Nutrition, Switzerland
- Norwegian Institute of Public Health, Norway
- Norwegian University of Science and Technology, Norway
- Örebro University Hospital, Sweden
- REGA Institute, Belgium
- San Raffaele Scientific Institute, Italy
- Stockholm University, Sweden
- TDR, WHO, Switzerland
- Université de Neuchâtel, Switzerland
- University of Basel, Switzerland
- University of Bergen, Norway
- University of Copenhagen, Denmark
- University of Gothenburg, Sweden
- University of Heidelberg, Germany
- University of Iceland, Iceland
- University of Leipzig, Germany
- Uppsala University, Sweden
- Wageningen University, Netherlands
- World Health Organization, Switzerland
- Zoetis, Spain

OTHERS

- FHI 360
- International Centre for Genetic Engineering and Biotechnology (ICGEB)
- School of Pharmacy, University of Otago, New Zealand
- Stop TB Partnership
- University of Auckland, New Zealand

SELECTED AWARDS AND ACHIEVEMENTS



DR FIRDAUSI QADRI

Dr Firdausi Qadri has been awarded the 2021 Ramon Magsaysay Award, often cited as “Asia’s Nobel Prize”. It was announced on 31 August 2021.

PROFESSOR JAMES F. PHILLIPS

Professor James F. Phillips, a member of icddr,b’s scientific advisory group (SAG), has received the 2021 Robert J. Lapham Award from the Population Association of America in recognition of his prolific career invested in health system development.





DR ZAHIRUL ISLAM

Dr Zahirul Islam, Scientist and Head, Laboratory of Gut-Brain Signaling under Laboratory Sciences and Services Division, has been awarded the prestigious National Institutes of Health (NIH) R21 Developmental Research Grant.

FARHANA SULTANA

Farhana Sultana won the grand prize from The American Society for Tropical Medicine and Hygiene (ASTMH) for her proposed innovation of developing a machine to produce jute cellulose-based sanitary pads for sustainable menstrual health.



DR REHNUMA HAQUE

Dr Rehnuma Haque was awarded the Early Career Award from Thrasher Research Fund for her research titled “The pivotal relationship between heavy metal exposures and tuberculosis in Bangladeshi children.”



SHAKEEL MAHMOOD

Mr Shakeel Mahmood, Senior Manager, Research Administration and PhD Candidate at the University of Newcastle, Australia, received HDR Publication Award 2021 from the School of Humanities and Social Science.



DR SHOMA HAYAT

Dr Shoma Hayat has been awarded the prestigious Fogarty Global Health Equity Scholar (GHES) postdoctoral fellowship for 2021-2022.

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.



INTERNAL TRAINING

In line with icddr,b's strategic plan, TTU continued to develop the skills and abilities of icddr,b staff, emphasising young and mid-level researchers.

In collaboration with Research Administration, SIDA sponsored four technical training courses held in four priority areas where 113 participants (male 50, female 63) were trained. In addition, four workshops were held in collaboration with other divisions of icddr,b, where 54 participants (male: 32, female: 22) were trained. A total of eight training events were held, and 167 participants (male: 49%, female: 51%) were trained.

OPEN TRAINING

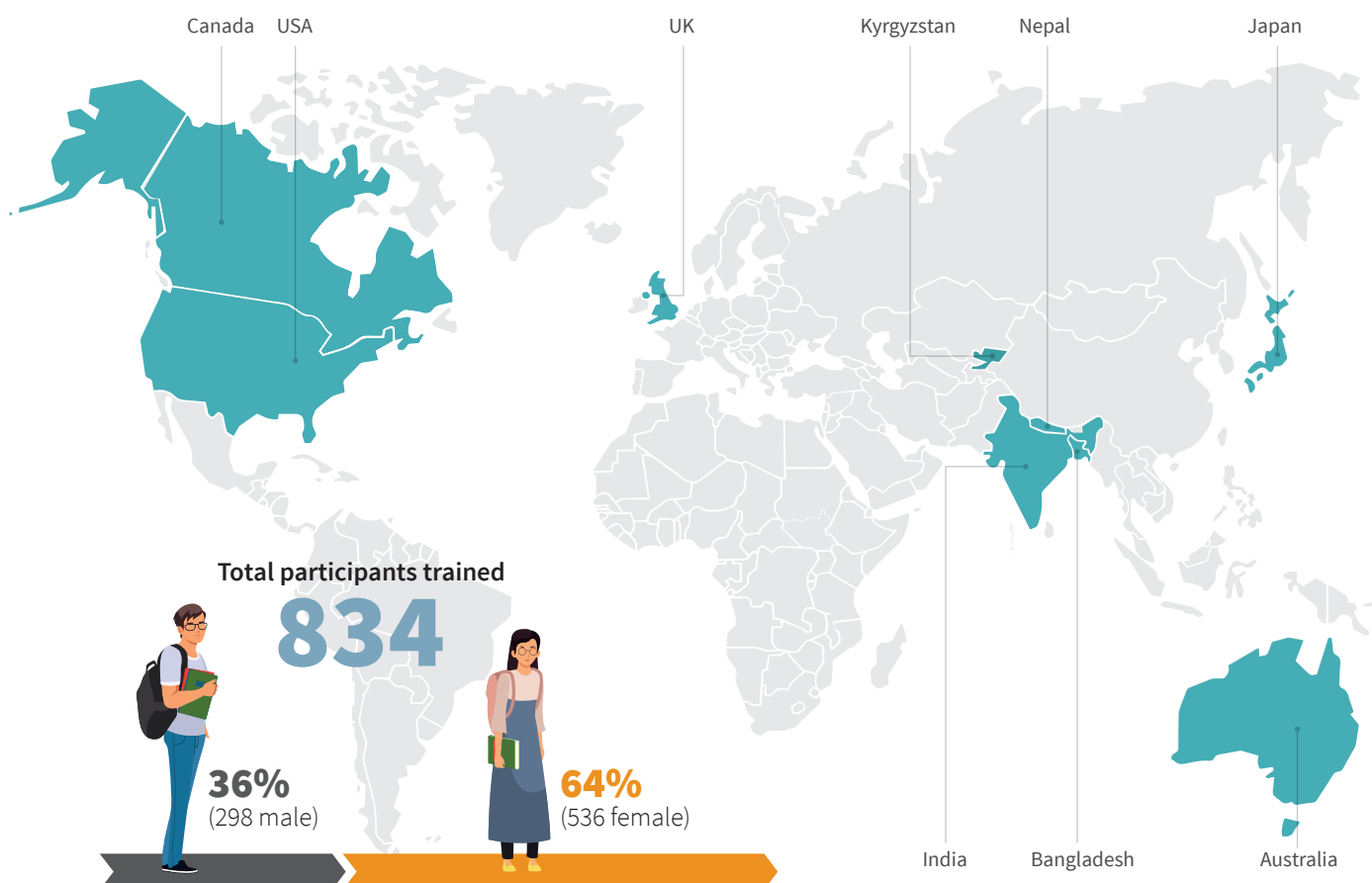
TTU organised and conducted four open training courses in 2021. The courses drew a total of 88 participants (male 31, female 57) from three countries – Bangladesh (84), Canada (2), Kyrgyzstan (2) and the USA (1).

ACADEMIC TRAINING

Academic training refers to orienting undergraduate students from different medical colleges and post-graduate students from public health and allied institutes on the diverse activities of icddr,b. A total of 474 students (male 151, female 323) attended the academic training, of which national and international participants were 336 (71%) and 138 (29%), respectively, representing three countries - Bangladesh (336), India (91), and Nepal (47).

STUDENT SERVICES

Working alongside experienced researchers at icddr,b, 'Student Services' helps in developing the knowledge and skills of local and international students by offering internships and field experience programmes. A total of 105 students (male 34, female 71) were enrolled in the internship programme from seven countries – Australia, Bangladesh, Canada, India, Japan, UK and the USA. In 2021, TTU hosted 834 participants (male 298, female 536; national 687, international 147) representing nine countries - Australia, Bangladesh, Canada, India, Japan, Kyrgyzstan, Nepal, UK and the USA through 18 training events and student services.



SENIOR LEADERSHIP TEAM

Our staff of over 4,600 are led by Executive Director Dr Tahmeed Ahmed 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 December 2021



Dr Tahmeed Ahmed
Executive Director



Mr Syed Monjurul Islam
Deputy Executive Director
(until 1 November 2021)



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



Professor Allen G Ross
Senior Director, Infectious
Diseases Division
(until 15 November 2021)



Dr Firdausi Qadri
Acting Senior Director,
Infectious Diseases Division
(from 1 December 2021)



Professor Daniel Reidpath
Senior Director, Health
Systems and Population
Studies Division



Dr Dinesh Mondal
Acting Senior Director,
Laboratory Sciences and
Services Division



Mr Thomas Liam Barry
Director, Finance



Mr Hugues BELLO
Director, Human Resources



Mr Mohammad Noushad Chowdhury
Director, Supply Chain and Facilities
Management (until 27 December 2021)



Ms Armana Ahmed
Head, Research Administration

SECRETARIAT



Ms Loretta Saldanha
Executive Assistant to the
Executive Director

OBSERVERS



Mr Nagarajan Nagarajan
Director, Internal Oversight



Mr Khaja Salauddin Ahmed
Head, Regulatory and Legal Affairs
(until 2021)

BOARD OF TRUSTEES

As of December 2021

icddr,b's Board of Trustees comprises 15 professionals and researchers from 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 Government of Bangladesh, with the World Health Organization 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 follows the Rules of Procedure. The Board of Trustees' roles and responsibilities include fund oversight; approving and monitoring the budget; setting broad institution-wide policies, as well as 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:



Ms Nancy Y Cheng

Chair, Board of Trustees
Former Assistant Auditor General, Canada

Member Secretary:



Dr Tahmeed Ahmed

Executive Director
icddr,b



Mr Syed Monjurul Islam

Deputy Executive Director, icddr,b
(Observer)
(until 1 November 2021)

NOMINATED BY THE GOVERNMENT OF BANGLADESH



Ms Fatima Yasmin

Secretary, Economic
Relations Division, Ministry
of Finance



Mr Md. Abdul Mannan

Secretary, Health Services Division
Ministry of Health and Family Welfare
(until April 2021)



Mr Md. Lokman Hossain Miah

Secretary, Health Services Division
Ministry of Health and Family Welfare
(from April 2021)



Dr Abbas Bhuiya

Former Deputy Executive Director
icddr,b

NOMINATED BY UNICEF



Dr Therese Dooley

Senior Adviser (Water, Sanitation, and Hygiene), UNICEF Regional Office for South Asia (until July 2021)



Dr Peter Harvey

Regional Office for South Asia (from September 2021)

NOMINATED BY WHO



Dr Siswanto

Senior Adviser Science Research and Innovation WHO-SEARO, New Delhi, India (from April 2021)

INDEPENDENT MEMBERS



Professor Abdullah H Baqui

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



Dr Sara Bennett

Professor, International Health (Primary), Health Systems Division, Center for Global Health, John Hopkins University



Mr Amol Khisty

Expert, Finance & Accounting Services



Professor Thein Thein Htay

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



Dr Anu Kantele

Professor, Infectious Diseases Helsinki University, Finland



Ms Andrea J Lucard

Executive Vice President, External Relations, Medicine for Malaria Venture, Geneva, Switzerland



Dr Ogutu Bernhards Ragama

Chief Research Officer, Kenya Medical Research Institute



Dr Fred Binka

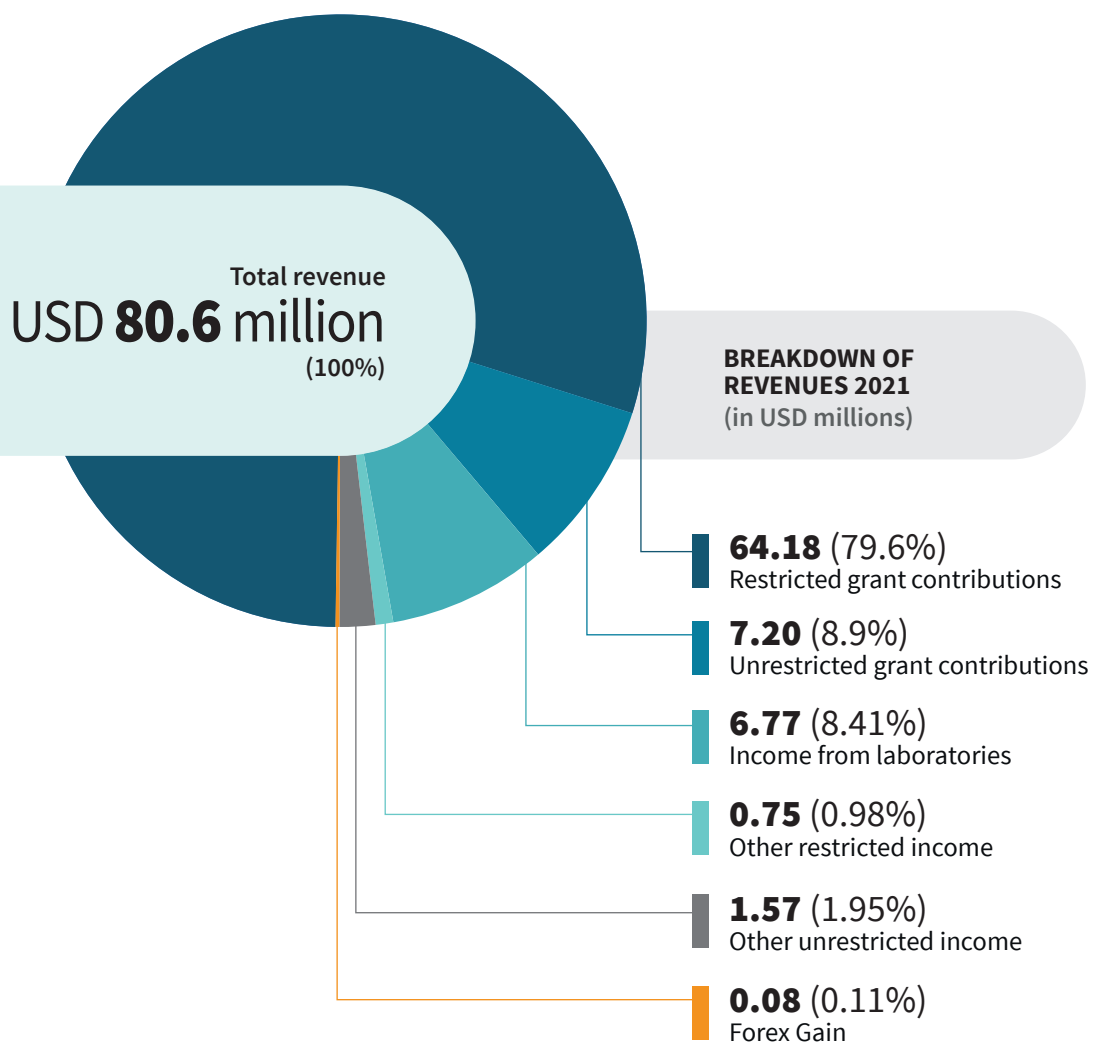
Professor of Clinical Epidemiology, University of Health and Allied Sciences, Ho, Ghana

FINANCE

icddr,b's overall revenue for 2021 amounted to USD 80.6 million compared with a total expenditure of USD 77.4 million, generating a net surplus for the year of USD 3.2 million.

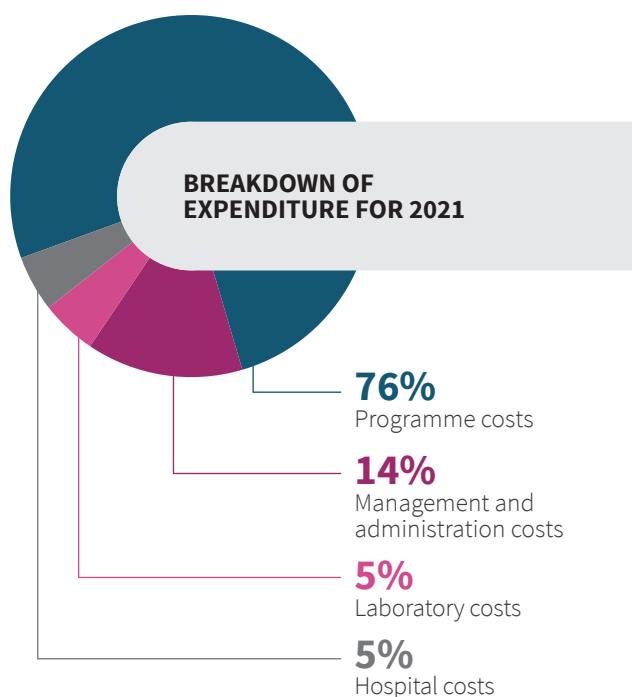
REVENUE

Our overall revenue for 2021 was USD 80.6 million (see below) representing an increase of 24 per cent, amounting to USD 15.8 million compared with 2020. Research grant income for 2021 increased by 32 per cent amounting to USD 15.7 million vs 2020, which is mainly due to the increase in the post-pandemic project activities. Unrestricted lab income increased by USD 1.6 million.



EXPENDITURE

- Overall expenditure for 2021 was USD 77.4 million, representing an increase of 20.7% per cent, equivalent to USD 13.3 million compared with 2020, due to a significant increase in restricted project activities.
- The bulk of total expenditure, 60.9%, relates to staff salaries and benefits. Other key costs are; supplies and materials 14.2%, collaborative partnership costs 5.9%, travel and vehicle hire charges 4%, rent, communication and utilities 2.2% and training, dissemination and staff development 1.5%.



DETAILED EXPENDITURE FOR 2021: (in USD millions)

National staff	USD 40.82
International staff	USD 4.67
Emeritus staff	USD 1.31
Supplies and materials	USD 10.91
Collaborative partnership costs	USD 4.51
Travel and vehicle hire charges	USD 3.08
Consultancy fees	USD 0.61
Rent, communication and utilities	USD 1.67
Training, dissemination and staff development	USD 1.15
Other operational costs	USD 8.68

ABBREVIATED STATEMENT OF FINANCIAL POSITION

31 December 2021 vs. 31 December 2020

	31 December 2021 USD ('000)	31 December 2020 USD ('000)
Assets		
Total non-current assets	30,851	29,339
Total current assets	57,440	53,404
Total assets	88,291	82,743
Liabilities and Funds		
Non-current liability	-	-
Total current liabilities	45,074	44,615
Total liabilities	45,074	44,615
Total funds	43,217	38,128
Total funds and liabilities	88,291	82,743

OTHER KEY FINANCIAL STATISTICS FOR 2021

1. At the end of the year, icddr,b had USD 43 million in net assets which increased by USD 5.1 million equivalent to 13%, due to increased investments by 12%, receivables by 21% and liabilities by 1%.
2. Cash and cash equivalents amounted to USD 36.5 million at the end of the year.
3. Accounts receivables (debtors) increased by 21.4 percent. The main reason is due to delays in payments by different donors which includes University of Oxford for \$2.1 m and Emory University for \$527k etc.
4. Accounts payables increased by 37.52 per cent overall as a result of substantial increases in restricted project activities in 2021.
5. Provisions increased by 17.6 per cent due to a rise in "Staff allowances" and "Staff End of service benefits".
6. The current ratio (liquidity) is 1.27 increased by 6.5% compared with 2020.
7. Stock inventories have decreased by 24 per cent amounting to USD 112k, mainly due to reduction in procurement of laboratory supplies relating to Covid-19.
8. Investments increased by 12 per cent as a result of market value appreciation.
9. Loans and advances increased by 38 per cent as advances to suppliers increased by \$1.2 million.
10. Indirect costs (expenses that are not readily identified with a particular grant, contract, project function or activity, but are necessary for the organisation's general operations) rate has now reduced to 19.5% on direct costs which is comprised of central management and administrative costs. However, with reference to the above graph, 14% is derived on total costs but not direct costs. The indirect cost rate may change in 2022 as costs vary from year to year.

icddr,b received an unqualified (healthy) audit opinion of its financial statements for 2021 from A. Qasem & Co. Chartered Accountants.

We are deeply indebted to our donors, including governments, foundations, institutions, corporations, development agencies, NGOs and multilateral bodies that support our work.

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 2021

Donor partners	Restricted (USD)	Unrestricted (USD)	Total (USD)
1 Bill & Melinda Gates Foundation	13,914	-	13,914
2 US Government – United States Agency for International Development (USAID)	11,575	-	11,575
3 United Nations Development Group (UNDG)	5,502	-	5,502
4 US Government – Centers for Disease Control and Prevention (CDC)	4,717	-	4,717
5 Global Affairs Canada (GAC)	1,268	2,929	4,197
6 Foreign, Commonwealth & Development Office (FCDO)	1,607	2,223	3,830
7 The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM)	2,651	-	2,651
8 Government of the People’s Republic of Bangladesh (GoB)	446	2,054	2,500
9 US Government – National Institutes of Health (NIH)	2,471	-	2,472
10 The Swedish International Development Cooperation Agency (Sida)	1,960	(2)*	1,958

* Note - \$2,398 was refunded as the grant ended and as per closure requirements.

A complete list of donors is provided in Note 22 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, which provide care free of charge to the poorest communities
4. Allows us to continue modernising 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.



ANNUAL REPORT 2021



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