WASH
Poverty Diagnostic | SERIES

Promising Progress

A Diagnostic of Water Supply, Sanitation, Hygiene, and Poverty in Bangladesh

WORLD BANK GROUP

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1818 H Street NW, Washington, DC 20433
Telephone: 202-473-1000; Internet: www.worldbank.org

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The Bangladesh WASH Poverty Diagnostic began in September 2015. The authors of this report are George Joseph and Sabrina Haque. The study team is led by George Joseph, Senior Economist, Nobuo Yoshida, Lead Economist, and Monica Yanez Pagans, Economist. Team members include Sabrina Haque, Bakhtiar Sohag, Nazia Moqueet, Dustin Smith, Santanu Lahiri, Mark Ellery, Somnath Sen, and Sophie Ayling.

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Abbreviations

APHA	American Public Health Association
APSC	Annual Primary Schools Census
ASA	Association for Social Advancement
AWWA	American Water Works Association
B20	bottom 20 percent of the population
B40	bottom 40 percent of the population
BBS	Bangladesh Bureau of Statistics
BMDA	Barind Multipurpose Development Authority
BOD	biochemical oxygen demand
BOOT	build-own-operate-transfer
BOT	build-operate-transfer
BRAC	Bangladesh Rural Advancement Committee
BSTI	Bangladesh Standards and Testing Institution
BUET	Bangladesh University for Engineering and Technology
BWPD	Bangladesh WASH Poverty Diagnostic
BWSPP	Bangladesh Water Supply Program Project
CBO	community-based organization
CQ	core question of WASH Poverty Diagnostic
DALY	disability-adjusted life year
DHS	Demographic and Health Survey
DPHE	Department of Public Health and Engineering
DSK	Dushtha Shasthya Kendra
DWASA	Dhaka Water Supply and Sewerage Authority
DWSSP	Dhaka Water Supply and Sanitation Project
ECDI	Early Childhood Development Indicators
EED	environmental enteric dysfunction
FSM	fecal sludge management

GDP	gross domestic product
GNI	gross national income
GoB	Government of Bangladesh
GP	global practice (World Bank)
GPOBA	Global Partnership for Output Based Aid
GWPD	Global WASH Poverty Diagnostic
HIES	Household Income and Expenditure Survey
HOI	Human Opportunity Index
IBET	International Benchmarking Network
ICDDRB	International Centre of Diarrheal Disease Research Bangladesh
IEC	International Education Centre
IGB	Indo-Gangetic Basin
ITN	International Training Network
JMP	Joint Monitoring Programme
KWASA	Khulna Water Supply and Sewerage Authority
LGD	local government division
LGED	local government engineering department
LGI	local government institution
LIC	low-income country
LIS	low-income settlements
LMIC	low- and middle-income country
MDG	Millennium Development Goal
MFI	microfinance institution
MHM	menstrual hygiene management
MICS	Multiple Indicator Cluster Survey
MLGRD&C	Ministry of Local Government, Rural Development and Cooperatives
MoF	Ministry of Finance
MoP	Ministry of Planning
NPAMIP	National Policy for Arsenic Mitigation and Implementation Plan
NFWSS	National Forum for Water Supply and Sanitation

NHBS	National Hygiene Baseline Survey
NPSWSS	National Policy for Safe Water Supply and Sanitation
NRW	nonrevenue water
NSS	National Sanitation Strategy
O&M	operation and maintenance
PPP	public-private partnership
PPSWSS	pro-poor strategy for water and sanitation sector
PSU	primary sampling unit
R&D	research and development
RDA	Rural Development Academy
RWASA	Rajshahi Water and Sanitation Sewage Authority
RD&C	Rural Development and Cooperative Division
SDF	Social Development Foundation
SDG	Sustainable Development Goal
SDP	sustainable development plan
SUN	Scaling Up Nutrition
T60	top 60 percent of the population
TBA	traditional birth attendant
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UP	*union parishad*
WARPO	Water Resources Planning Organization
WASH	water supply, sanitation, and hygiene
WASA	Water Supply and Sewerage Authority
WBCSD	World Business Council for Sustainable Development
WDB	Water Development Board (Bangladesh)
WHO	World Health Organization
WSP	Water and Sanitation Program (World Bank)
WSS	water supply and sanitation

Promising Progress

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Moving to higher quality WASH services

WASH Poverty Diagnostic | SERIES

WATER QUALITY

All improved water nationally, regardless of location of source . . .

Contaminated with E. Coli 41% **13% Contaminated with arsenic**

SANITATION AND HYGIENE

50.8 Million People Share Sanitation Facilities

7% Urban Population is Connected to a Piped Sewerage System

28% Access to Handwashing Station with Soap and Water

ACCESS INEQUALITY

TOP 60 HOUSEHOLDS

14% more access to improved sanitation

22% access to on-premise improved water

SLUMS IN TOP 5 CITIES

5 times less

Access to improved sanitation

HEALTHCARE FACILITIES, SCHOOLS, WORK PLACES

SEPARATE TOILET FOR FEMALES

1/2 Primary Schools **1/4** Healthcare Facilities

HEALTHCARE FACILITIES

1/3 Routine Water Shortages

Access to Piped Water

27% Rural Areas **52%** Urban Areas

HUMAN DEVELOPMENT STRATEGY

WASH-RELATED ENTERIC DISEASE

3 times greater burden for poorest than the richest

SLUMS IN THE FIVE LARGEST CITIES

Highest rate of Undernutrition

Nearly half of all children under five **stunted**

ADOLESCENT GIRLS

1 in 4 skip school when menstruating

WASH BUDGET ALLOCATION

2016-17 WASH budget allocation **less than half** of what it was in 2007-08

The estimated total budget gap **47%** to meet the government's water targets by 2025

Clean Water, a Stubborn Gap in Bangladesh's Development

Shilpi lives in a small house in a farming village near the Bay of Bengal. She has just begun primary school, though both her parents are illiterate. Her home recently received its first electric power but remains without running water. Therefore, her afterschool chores include walking half a kilometer to collect water from a well by a cow pen. The water is contaminated with E. coli *bacteria.*

Nadia lives in a flat in Bharidhara, an affluent neighborhood of Dhaka. Her parents are university graduates who hold well-paying jobs. She has just begun primary school. Her home has air conditioning. Hot and cold running water are available at the turn of a tap. The water is still contaminated with E. coli *bacteria*.

Executive Summary

Moving from MDGs to SDGs in Bangladesh's WASH Sector

Ensuring safe water supply, sanitation, and hygiene (WASH) environments in Bangladesh is a cornerstone for its development. Poor WASH is, of course, an important issue of public health, due to its potential to cause water-borne illness and even increased risk of mortality. But its ultimate impact extends much further. Poor WASH can ripple through the country's entire development process, holding back gains in human capital and efficient use of labor that are needed for sustainable prosperity. Perhaps one of the most extreme effects of inadequate WASH is the onset of chronic intestinal infections that can cause a higher rate of stunting: the failure of children to grow to full physical stature and mental capabilities. A less dramatic but still severe impact is the recurring disruption of education as bouts of diarrheal disease can keep children home from school. Productive wealth-creating activities and income can be lost to the days of illness recovery or to excursions for collecting water. These are just a few ways the larger campaign to fight poverty can be impeded. Yet, inadequate WASH can be seen as attributes to poverty itself. Being poor is not just a matter of too little income. Poverty is also measured by dimensions such as basic services that are available to a household and the quality of its shelter and surroundings. In the end, inadequate WASH, with its accompanying sights and smells, can make people poor.

The new Sustainable Development Goal 6 (SDG-6) challenges countries to provide universal access to safe and affordable WASH services by 2030. By 2015, the end of the Millennium Development Goal (MDG) period, Bangladesh's population experienced a 20-percentage point gain in water access and 29-percentage point gain in sanitation access since 1990. Now, it is estimated that close to 98 percent[1] drinks from a technologically improved water source,[2] and about 63 percent[3] uses an improved sanitation facility. Though very few Bangladeshis now fetch water from rivers or defecate in fields, the vast majority still live in environments plagued by inadequate WASH that hinder the country's overall development. WASH is inadequate in the sense that most Bangladeshis rely on *rudimentary* water and sanitation facilities that cannot be effortlessly accessed or guaranteed safe and sustainable in the long run.

Compared to the MDGs, the SDGs shift from increasing basic access to improving service delivery of WASH. The high access numbers to improved water and sanitation facilities achieved during the MDG period overlook critical dimensions of safe WASH such as water quality, convenience, continuity of service, fecal sludge management, and hygiene. However, SDG-6 aims to specifically tackle these issues. Bangladesh and 192 other countries are committed to providing safely managed water and safely managed sanitation to all by 2030. Safely managed water services guarantee that a household not only has access to a technologically improved water source,[4] but also has access to one that is available when needed on their immediate premise and free of priority bacterial and chemical contaminates. Safely managed sanitation services warrant that a household is accessing a technologically improved sanitation facility[5] that is not shared with other households, where excreta are safely disposed in situ or transported and treated off-site. These are ambitious targets but addressing these issues are pertinent to improving the well-being of populations.

The Bangladesh WASH Poverty Diagnostic (BWPD) is a data-driven exercise with an objective to highlight the key inadequacies in WASH service delivery and guide country and sector priorities for maximum impact during the SDG era. BWPD gives a snapshot of the quality and inequality

of WASH access by generating statistics from numerous datasets. BWPD also attempts to show the implications of these numbers on human development and poverty reduction. A large portion of the work is dedicated to presenting stylized facts on the synergies between different dimensions of WASH and human development outcomes such as in health, nutrition, and education. Further, the generated numbers should help government and other stakeholders identify the gaps in service delivery and ask questions on why these gaps exist. Therefore, the final portion of this study begins a discussion on the institutional challenges that could be inhibiting high-quality service delivery. Some of the key findings are presented below.

The State of WASH in Bangladesh

A major barrier to clean water access is the fact that Bangladesh's natural water resources are heavily contaminated. Bangladesh is not known as a water-scarce country, but the quality of its water resources is poor and deteriorating as a result of forces of climate change, urbanization, and population growth. Though households are usually not too far from a river or pond, surface water sources are far too polluted to be efficiently treated for consumption as they are vulnerable to agricultural, industrial, and municipal waste. Nevertheless, a little less than 3 percent of the population uses unimproved water sources, which translates to nearly 4 million Bangladeshis continuing to draw drinking water from ponds, rivers, streams, or unprotected wells and springs. The rest of the country primarily relies on improved water infrastructure that taps from groundwater sources. Groundwater is safer than surface water because it is theoretically less exposed to and can filter contaminants, particularly fecal bacteria. However, groundwater is not immune to issues of water quality in Bangladesh. For instance, aquifers in many parts of the country contain elevated levels of naturally occurring arsenic, doing grave harm to the health of people who consume it long-term. Aquifers in the low-lying nation on the front line of climate change are also vulnerable to another contaminant, salt water, as high tides surge inland over distances that are gradually increasing.

Though Bangladesh has made strong progress in a crucial step toward better quality drinking water—the switching to improved water infrastructure—much of what is tapped remains stubbornly contaminated with dangerous microbes, heavy metals, or salt. Much of the success of meeting the MDG targets for increasing access to improved water sources came courtesy of the tube well, a low-cost technology that extracts groundwater. Close to 90 percent of the population currently uses some tube well variation. However, tube wells do not necessarily filter out all contaminants, cannot always withstand natural disasters, and are poorly regulated. As a result, many citizens are sometimes unknowingly consuming unsafe water with either fecal bacteria, arsenic, salinity, or other contaminants. Continuity of service and resilience of water infrastructure are also likely problems. During times of flooding or cyclones, which affects a vast majority of the population almost every year, households may resort to highly polluted surface water sources, as their usual tube wells may have become inaccessible. During dry season, groundwater is over exploited and tube wells can become nonfunctional in some areas.

Poor water quality seems be an issue for the rich and poor alike and is pervasive throughout regions and different types of water technologies. For instance, piped water, an exclusive asset for rich urban populations, seldom faces issues of arsenic or salinity, yet it is still highly contaminated with fecal bacteria. Piped water offers benefits of convenience and centralized regulation and treatment. However, it is a telling statistic that people who use piped water on their premise, which is theoretically the best, safest kind, face *E. coli* contamination more than 80 percent of the time, a rate not much different than that of water drawn from ponds and streams.

Poor sanitation could contribute to the fecal contamination of water but also presents its own set of complex issues. Bangladesh is known as a global leader in collective approaches to behavior-change and household sanitation innovations such as its development of Community-Total Led Sanitation (CLTS), the most widely used intervention to end traditional practices of

open defecation. Though the country has nearly eliminated the practice of open defecation and built household toilets, the environment continues to be highly polluted with fecal contamination. Whether this contamination is coming from human or animal fecal matter is debated. One contributing factor could be that in the transition from open defecation to fixed point defecation, millions of Bangladeshis have switched not to modern sanitation facilities but to primitive pit latrines that they share with neighbors. Heavy use and ambiguous ownership of these facilities often mean that their safety, upkeep, and cleanliness suffer. Now, close to 40 percent or 58 million Bangladeshis do not have access to a private improved sanitation facility in their home, most of whom are among the bottom 40 percent (B40) of the national wealth distribution.[6]

However, the underlying issue is most likely the lack of a holistic approach in improving the entire sanitation chain–ensuring all types of waste are being effectively separated from humans, while doing no harm to the environment. Just 3 percent of the population, a figure that has been nearly stagnant in the past 10 years, is connected to a sewer system, but even having a sewage connection does not mean that sewage is being properly transported and treated at a wastewater treatment plant. In Dhaka, for example, only 2 percent of fecal sludge is estimated to be properly treated, despite a sewerage connection of 22 percent. The vast majority of the population have on-site sanitation facilities including pit latrines, but on-site fecal sludge management is lacking, thus the entire sanitation chain remains unmonitored or unregulated.

An overall absence of good hygiene practices exacerbates the perils of poor water and sanitation access. It all adds up to an environment in which harmful pathogens and parasites can be pervasive and detrimental to public health. Certain behavioral practices can determine the risk of being affected from poor sanitary environments. In the home, basic hygiene practices such as washing hands with soap after defecation are often lacking. Nationally, 28 percent of the population are observed to have access to a handwashing station with both water and soap. Most households with young children do not properly dispose of infant feces, and just a quarter of women practice safe menstrual hygiene, a neglected issue with implications on education and availability of sanitary materials and sanitation facilities. Despite high contamination of water sources, only 10 percent of the population report using an appropriate water treatment method in their household. And though there are few differences between rich and poor concerning water contamination that is not true in other measures of hygiene behaviors, such as these. The poor consistently fare worse than the well-off and are at greater risk of having worse health outcomes such as diarrheal disease and stunting.

At the root of inadequate WASH access are institutional challenges that inhibit high-quality service delivery. Unclear and overlapping allocations of functions, funds and functionaries are a binding limitation to improving WASH services in Bangladesh. Despite its efforts, Bangladesh remains a centralized country, with limited devolution to lower tiers of governance. Though assigned the role of service provider, many local government institutions (LGIs), including *union parishad*s (UPs), *pourashavas*, and city corporations, do not have the technical nor financial capacity to deliver and sustain high-quality WASH services. Instead, central agencies play multiple roles of financing, designing, implementing, and regulating WASH investments, blurring incentives and accountability of service provision in these areas. Though the private sector potentially could fill these service gaps, the current environment does not incentivize sustaining private sector participation. Finally, weak public demand for better WASH services and limited state capability do not incentive the government and the relevant institutions to improve service delivery.

Though WASH strategy is well defined, the regulatory framework is incomplete. The Government of Bangladesh (GoB) uses an SDG framework for sector planning that is anchored in its 2014 National Strategy for Water Supply and Sanitation, which provides uniform strategic guidance to the sector stakeholders for achieving sector targets. In larger cities, water supply and sewerage authorities (WASAs) are set up as public utilities for WASH, but lack of institutional and financial capacities and formal regulation as well as damaged infrastructure and intermittent

service have left major gaps in service delivery both in water supply and sanitation. Even if standards are in place, identifying appropriate monitoring mechanisms and accountability are also some of the key challenges.

Apart from deficiencies in the governing and regulatory structure, financial allocation for overall sector development is insufficient. The share of budget allocation to the WASH sector in the national budget has significantly decreased in the past decade. In 2016–17, the WASH budget allocation was less than half of what it was in 2007–08. Internal and external budgets show similar declines. The estimated total budget gap is about 47 percent of the total allocation in the sector to meet just the government's envisioned water targets by 2025.[7]

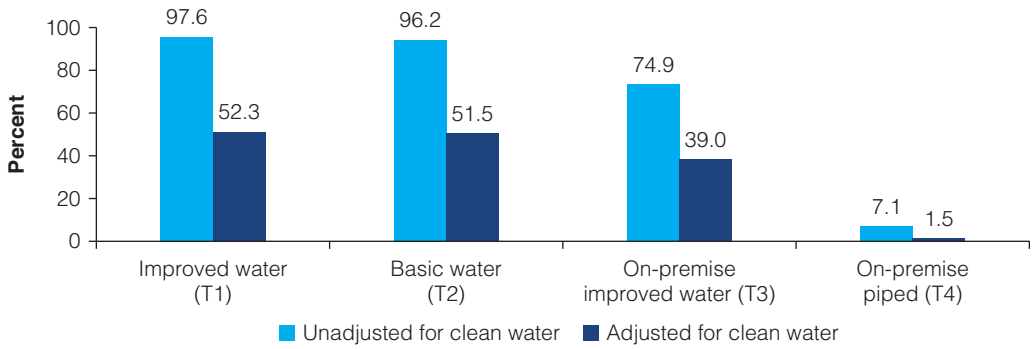
Priority Areas for Action

Bangladesh can be proud of its advances in the sector to date, but the task remaining will be particularly difficult because it not only involves delivering higher quality WASH services but also delivering such services to those populations and areas that are often left behind. The BWPD outlines 6 priority areas of action (in no order of ranking) based on the study's findings.

Priority 1: Improving the Quality of Water Services

Despite having high access to water infrastructure, the population has low access to clean drinking water available on household premises. Bangladesh's baseline access level to the new SDG target for "safely managed water" is likely lower than 39 percent. Figure ES.1 compares improved water access unadjusted and adjusted for water quality indicators of *E.coli* and arsenic presence at the source. According to previous MDG standards, 98 percent of the population has access to a technologically improved water source. However, the SDG water target for "safely managed water" includes dimensions of water quality, continuity of service, and proximity of water sources. At this time, national data on continuity of service is unavailable. Nevertheless, when considering contamination and location of water sources, about 39 percent of the population has access to an on premise improved water source that taps water free of *E. coli* or arsenic.[8] In terms of clean, on-premise piped service, the figure drops even lower. Less than 2 percent has access to on-premise piped water free of contamination.

Figure ES.1: Comparison of Unadjusted and Adjusted Clean Water Access, by Tier, Bangladesh, 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016) and Multiple Indicator Cluster Survey 2013 data (UNICEF and BBS 2015).
Note: T1 = Tier 1: Use of improved water technologies; T2 = Tier 2: Use of improved water technologies within 30 minutes of access; T3 = Tier 3: Use of improved water technologies available on household premises; T4 = Tier 4: Use of piped water supply available on household premises. Clean water implies that water is free of *E. coli* and arsenic, 50 parts per billion.

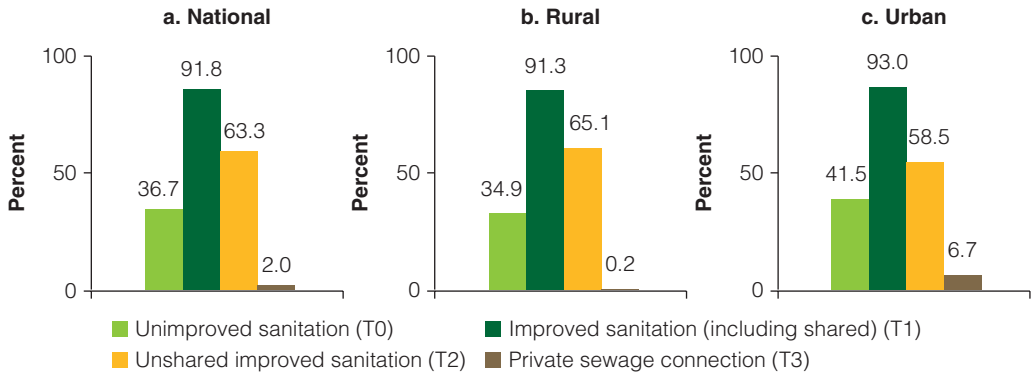
Priority 2: Reducing Shared Sanitation, Fecal Contamination of the Environment, and Poor Hygiene Practices

The population relies heavily on shared sanitation facilities that most likely lack proper fecal sludge management. Bangladesh's baseline access level to the new SDG target for "safely managed sanitation" is estimated to at most be 63 percent. The baseline access level to basic hygiene (e.g. handwashing station with available soap and water) is 28 percent. Figures ES.2 a, b, and c provide estimates on national, rural, and urban improved sanitation access. BWPD makes the "safely managed sanitation" estimation by only considering access to improved sanitation facilities that are unshared between households. However, this figure is likely to be significantly lower when including safe fecal sludge management practices. Some studies have estimated that 1 to 2 percent of all fecal sludge is safely managed in urban cities, but little data exists in rural areas. (Blackett, Hawkins, and Heymans 2014; Gunawan, Schoebitz, and Strande 2015; Kabir and Salahuddin 2014; Ross et al. 2016). Aside from the infrastructural and regulatory mechanisms needed to reduce pollution in the environment, proper hygiene practices are also needed. Though handwashing with soap is a person's first line of defense for preventing the transmission of disease, many people lack even basic knowledge of when to wash hands and 28 percent have access to an observed handwashing station with available soap and water in their household.

Priority 3: Bringing Services to the Poor and Other 'Left-Behind' Populations

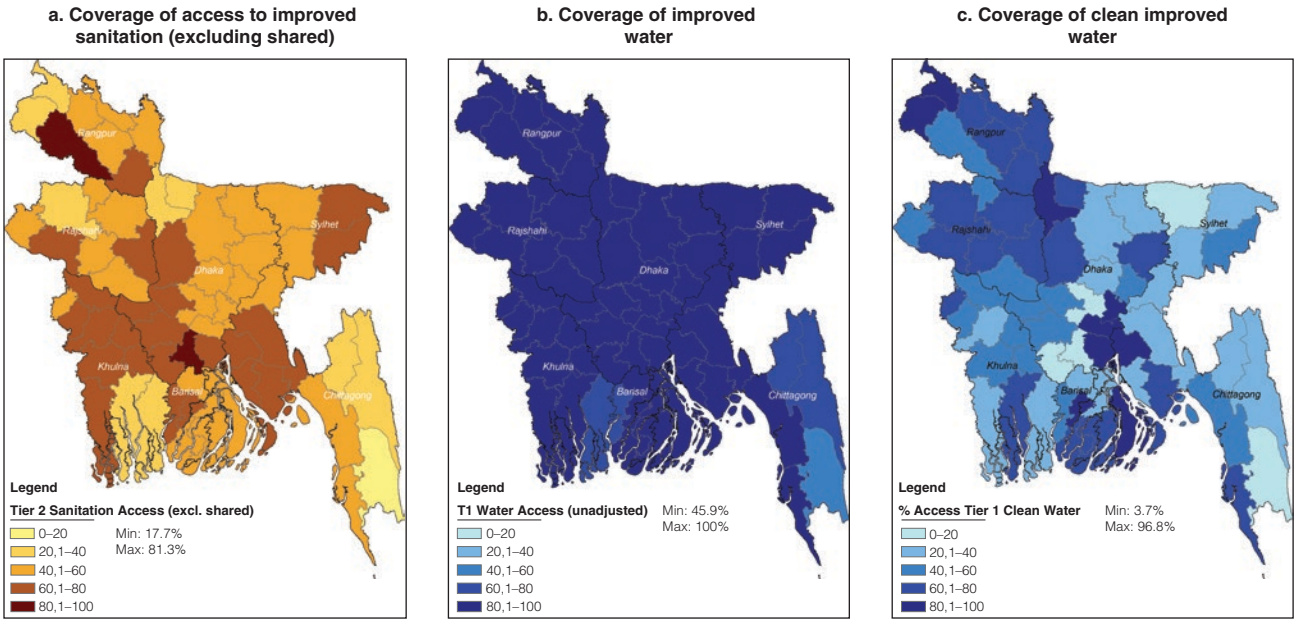
There are substantial inequities in WASH service levels, which hinder strategies to promote shared prosperity and meet universal WASH coverage. Those who are left without or with low quality WASH access are in the bottom 40 percent of the wealth distribution, including in remote and hard-to-reach villages, disaster-prone areas, and crowded urban slums. Household wealth alone explains 70 to 75 percent of whether a child will have access to improved water or improved sanitation infrastructure.[9] Map ES.1a illustrates disparities in improved sanitation access between districts. Map ES.1b shows the few districts that do not have universal access to improved water infrastructure, while map ES.1c illustrates that most districts lack access to water that is free of *E. coli* and arsenic contamination Particularly, households living in some

Figure ES.2: Access to Sanitation, by Tier, Bangladesh, 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).
Note: T0 = Tier 0: use of unimproved sanitation technologies; T1 = Tier 1: use of improved sanitation technologies including those that are shared; T2 = Tier 2: use of improved sanitation technologies that are unshared between households; T3 = Tier 3: use of improved sanitation technologies connected to sewer system. T0 and T2 will add to the total population because T0 includes improved sanitation that is shared.

Map ES.1: Proportion of Access to WASH, by District, Bangladesh, 2013



Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: WASH = water supply, sanitation, and hygiene.

remote areas of the country are outliers to national access rates, with more than half of the population remaining without access to improved water sources or any fixed place to defecate in some hard-to-reach districts. Coastal regions and other disaster-prone areas deal daily with the impacts of climate change and need resilient water infrastructure that can adapt to issues of salinity intrusion or frequent flooding. In urban areas, the rapidly growing population places further stress on utilities as evidenced by stagnant coverage rates and increasing intercity disparities in access between the rich and the poor.

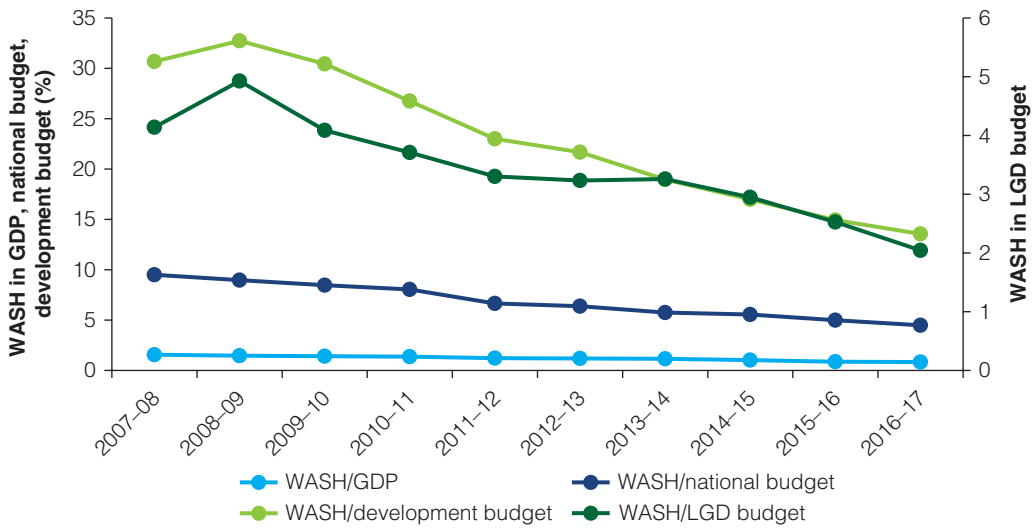
Priority 4: Implementing WASH Beyond the Household

Community establishments such as healthcare facilities, schools, and work places overlook safe WASH services. Overall, data is sparse on WASH coverage beyond households. In primary schools, access to improved water supply is 80 percent and access to at least one sanitation facility is 85 percent. Yet, the average student to toilet ratio is 100:1, double the national standard. About a third of healthcare facilities[10] experience routine water shortages and the convenience of access to water supply is poor, where only 27 percent and 52 percent of healthcare facilities in rural and urban areas have access to piped water supply. Moreover, access to handwashing stations with soap and water in many healthcare facilities is also lacking. Among manufacturing enterprises with more than 5 employees, only 52 percent were found to have access to at least one toilet.

Priority 5: Addressing Binding Institutional Constraints and Challenges

Despite its efforts with a national WASH strategy and well defined legal framework, Bangladesh remains a centralized country, with limited devolution of functions, funds, and functionaries to lower tiers of governance. Improper assignment, mixed roles, warped accountability and poor

Figure ES.3: Proportion of WASH Allocations in GDP, National Budget, Development Budget, and LGD Budget, Bangladesh, 2007–17



Source: World Bank calculations using WaterAid 2017 data.
Note: GDP = gross domestic product; LGD = local government division; WASH = water supply, sanitation, and hygiene.

capacities thus combine to produce a policy and institutional setting that is unlikely to be responsive to the emerging challenges of scaling up access—especially for the poor—to water systems that ensure quality and reliability, and sanitation systems that address the full chain of safe excreta management. A lack of national service standards or pricing and monitoring mechanisms have left gaps in water quality and safe excreta management. In addition, financial allocation for the overall sector development is insufficient. The WASH budget as a proportion of national and LGD budget has been declining since 2007 (figure ES.3). The estimated total budget gap is about 47 percent to meet just the government's envisioned water targets by 2025. An appropriate mix of policy changes, gradual and time bound institutional changes, implementation of regulations and effective citizens participation to ensure improved water quality and maintain service standards is needed to overcome many of these constraints to achieve the goal of safe universal access. It is pertinent to make WASH service providers more efficient and accountable for meeting the demand for piped water services within premises from a rapidly growing economy and an expanding middle class in Bangladesh. In addition, there is an urgent need to raising finances to meet sector goals.

Priority 6: Harnessing Complimentary Effects of WASH to Improve Human Development

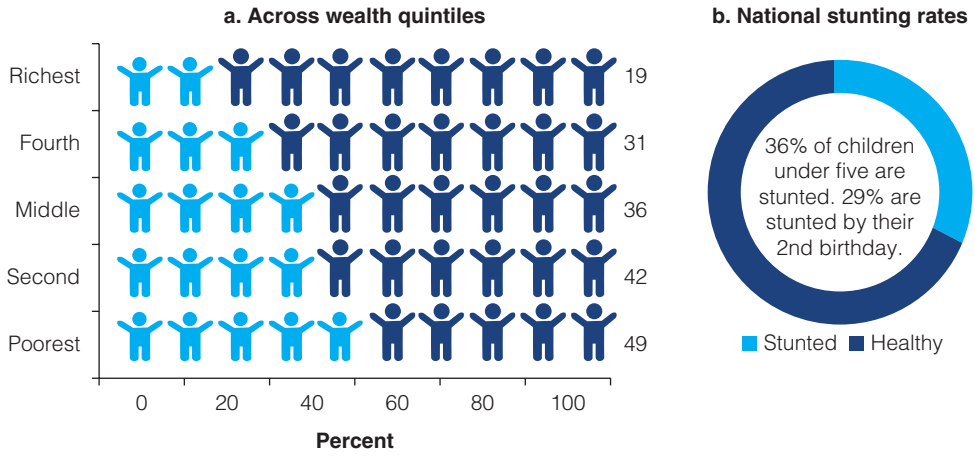
WASH has a catalyzing role in improving human development outcomes. Beyond the scientific linkages of WASH and human development outcomes, addressing WASH issues is a fundamental component for any program that aims to reduce poverty and meet the 17 goals of the SDG agenda. Bangladesh has special incentives to implement higher quality WASH services, because they have broad multiplier effects in improving health, nutrition, education, and early childhood development outcomes. They improve public health but also facilitate, directly and indirectly, a collection of other important development and poverty reduction goals that improve the capability of populations such as increasing educational attainment, reducing stunting, and creating a healthy and skilled work force.

However, gaps in WASH service delivery including poor water quality, inconvenient access, and high fecal contamination of environments are particularly holding back the effectiveness of investments in the sector. For instance, inadequate WASH is significantly shown to increase the incidence of enteric infections that impair nutrient absorption and healthy growth and development among expectant mothers and children. Currently, Bangladesh has one of the highest stunting rates, a marker of undernutrition, in the world, with about 36 percent of children under five stunted (figure ES.4b). Moreover, nearly half of children under five in the poorest wealth quintile are stunted (figure ES.4a). The B40 feel the greatest burdens of inadequate WASH because of its synergies with other life deprivations such as little income, poor access to health services, food insecurity, and low levels of education. Nationally, the WASH-related enteric disease burden for the poorest quintile is about 3 times greater than the burden for the richest quintile. Those who are already impoverished thus face indefinite challenges to their health and well-being, adversely impacting their ability to obtain education, skills, and participate in economically productive opportunities. Policies and programs are needed to specifically target quality WASH expansion in areas where the B40 are most prevalent.

None of the WASH challenges that Bangladesh faces are easily met. But in view of its past successes, the country can achieve the new targets in the next decade and a half and meet the SDGs through a combination of well-crafted investment and innovation. Detailed analysis and recommendations are provided in the full report on how future WASH programs can prioritize safety, inclusion, and sustainability.

The cost of meeting the next generation of challenges will be substantial, but Bangladesh can look forward to broad multiplier effects from its investment. Better WASH conditions are key to basic human development outcomes, including better health, nutrition, and education. The energetic, skilled work force that will drive future prosperity in Bangladesh needs clean water and modern sanitation thus helping to break themselves from the vicious cycles of intergenerational poverty. Improvement in this sector will be welcomed by the entire population, rich and poor, urban and rural, because the problems affect virtually everyone to a greater or lesser degree.

Figure ES.4: Stunting among Children under Five across Wealth Quintiles in Bangladesh, 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (as cited in NIPORT, Mitra and Associates, and ICF International 2016) data 2014.

Notes

1. This number differs from official Joint Monitoring Programme reports, which estimate 87 percent improved water access to adjust for arsenic contamination. The BWPD accounts for arsenic adjustments separately.
2. Per WHO/UNICEF Joint Monitoring Programme (JMP) definitions, "an 'improved' drinking-water source is one that, by the nature of its construction and when properly used, adequately protects the source from outside contamination, particularly faecal matter. An 'improved' sanitation facility is one that hygienically separates human excreta from human contact and is unshared between households."
3. Note that this number differs from the latest JMP estimates of improved sanitation of 61 percent. The report references improved water and sanitation access numbers that were generated by the authors' secondary analysis of 2014 Demographic and Health Survey and 2013 Multiple Indicator Cluster Survey data.
4. Improved sources include piped water, boreholes or tube wells, protected dug wells, protected springs, and packaged or delivered water.
5. Improved sanitation facilities include flush/pour flush-to-piped sewer systems, septic tanks, or pit latrines; ventilated improved pit latrines; composting toilets; or pit latrines with slab.
6. This figure is calculated using the DHS 2014 and WDI 2014. Unless otherwise noted, all figures described in this document are derived from the authors' calculations using available rounds of WDI, DHS, MICS, UHS, and NHBS data.
7. As per the government's target in the Sector Development Plan (2011), by 2025, 100 percent population would be provided with improved water supply and sanitation facilities. Piped water supply further expanded with the city corporations with 100 percent, large pourashavas having 90 percent, small Pourashavas 85 percent, urban centers 40 percent and rural area 10–20 percent coverage. The sewerage coverage would be increased to 60 percent in Dhaka, 30 percent in Chittagong, 25 percent in Khulna and 10 percent in city corporations. Sewerage systems would be introduced to the large pourashavas covering about 10 percent of the population. One hundred percent population would be provided with sanitation facilities ranging from sewerage systems to pit latrines with about 10 percent use of septic tanks in rural areas.
8. Water is considered to be contaminated when sample has greater than 1 colony-forming units per 100 milliliters *E. coli* or greater than 50 parts per billion arsenic (Bangladesh standard).
9. Finding from Human Opportunity Index analysis. Methods are discussed in chapter 4.
10. Included government or private/NGO hospitals or clinic that provided overnight inpatient healthcare service facilities inside the hospitals or clinics.

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Chapter 1
Introduction

In recent years Bangladesh has made remarkable strides in achieving development outcomes and reducing poverty. The gross national income (GNI) per capita (Atlas method) increased substantially from US$100 in 1972 to US$1,409 in 2016 allowing Bangladesh to cross the World Bank threshold for a low middle income country in FY14. Between 2000 and 2016, Bangladesh encountered solid gross domestic product (GDP) growth of about 6 percent per year on average and saw steady decline in its poverty rates. The share of the population living below the official upper poverty line declined from 49 percent in 2000 to 24.3 percent in 2016 (World Bank 2017). In 2000, approximately 34 percent of the population was living with less than US$ 1.90 a day (2011 Purchasing Power Parity). In 2016, this was true for only 13.8 percent of the population. Based on these numbers, approximately 20 million Bangladeshi escaped extreme poverty since 2000. Bangladesh is also among the few countries able to reduce inequality between 2000 and 2010, as measured by the Gini index of real per capita consumption. However, since 2010, inequality increased slightly, particularly in rural areas. In 2016, Bangladesh had a Gini index of 0.31 which is lower than those observed in the region (Jolliffe et al. 2013). Despite having one of the highest population densities in the world and frequent natural disasters, the country also met a wide range of its Millennium Development Goals (MDGs), including lower infant mortality, higher food security, and a place in primary school for almost every one of its children (World Bank 2015a).

The country has a number of development achievements, yet there are many areas that need attention, which are prerequisites for an environment that fosters inclusive growth and human capital. Bangladesh is still one of the poorest countries in Asia, with nearly half of all workers in agriculture and majority in the informal sector. Unemployment is highest for the youth, and rapid urbanization is contributing to a fast proliferation of informal settlements. Bangladesh also has one of the highest undernutrition rates among children under five in the world, which ultimately has implications on building a healthy and skilled population.

Although there have been improvements in the poverty rate nationally, there are some inconsistencies in progress across regions and divisions since 2000. Overall, poverty in rural areas is more pervasive and extreme compared to urban areas. However, though the bulk of the poor live in rural areas, the share of the total number of poor has been rapidly reducing in rural areas and increasing in urban areas since 1990. Moreover, persistent pockets of poverty exist throughout the country. Improved infrastructure can partially explain high spatial variations of poverty rates and is an important determinant for agricultural and nonagricultural income particularly in rural areas (Jolliffe et al. 2013). Further, urbanization will place further stresses on infrastructure and quality of services. However, Bangladesh's public investment in infrastructure is only 2 percent of its GDP and ranks 130 out 144 countries in infrastructure quality (Jolliffe et al. 2013). Moving to higher *quality* infrastructure will be an important investment in both rural and urban areas for continuing to reduce poverty and inequality. The next set of challenges for all sectors address inclusiveness of access–whether it be infrastructure, education, health, energy, or food security–by reaching remaining neglected populations and improving the overall quality of service delivery, which can tackle more nuanced issues of nonmonetary poverty such as gender equality, poor health outcomes, and low human capital and skills.

In its strategy to combat poverty, Bangladesh made crucial strides in its development by substantially increasing basic access to water supply, sanitation, and hygiene, (WASH) services in the past 25 years. By 2015, the end of the MDG period, Bangladesh's population experienced

a 20 percentage point gain in water access and, since 1990, achieved a 29 percentage point gain in sanitation access. Now, it is estimated that close to 98 percent[1] drink from a technologically improved water source,[2] and about 63 percent use an improved sanitation facility. Its progress in the WASH sectors ranks Bangladesh as second in basic water access and third in sanitation access among other South Asian countries. Bangladesh is also one of three countries in the region that were able to essentially eliminate the practice of open defecation (table 1.1).

However, to continue to be a leader in the sector and to maximize the impact of WASH on human development, Bangladesh will need to invest in *higher quality* WASH services. Though very few Bangladeshis now fetch water from rivers or defecate in fields or open areas, the vast majority still live in environments plagued by inadequate WASH, which hinders the country's overall development. In Bangladesh, WASH is inadequate in the sense that most Bangladeshis rely on rudimentary water and sanitation technologies that cannot be effortlessly accessed or guaranteed safe and sustainable in the long run. The high access numbers to basic improved water and sanitation facilities overlook critical dimensions of safe WASH such as water quality, convenience of access, fecal sludge management, and hygiene behaviors. Bangladesh's next challenge is to transition from basic to safe WASH access that protects the health and dignity of all populations and to strengthen those institutions that can deliver and sustain higher quality WASH services.

Bangladesh's WASH sector faces a complex set of issues. Bangladesh is often referred to as the "land of rivers," with the Ganges, Jamuna, and Megna rivers and their tributaries shaping the country's culture and way of life. The low-lying delta is vulnerable to frequent flooding and cyclones, and the rising seas are expected to take some 17 percent of the land, displacing 18 million people by 2050 (Harris 2014). Though surface water is a common sight, it is too polluted to be consumed. Almost all Bangladeshis rely on groundwater for drinking water supply and livelihood for agricultural purposes. The Indo-Gangetic Basin (IGB) aquifer is the country's primary source of ground freshwater; however, it too faces issues of contamination. This reality means that the country remains unable to provide many of its citizens with water they can consume without fear of illness, whether from microbes, naturally occurring arsenic, or even salt. This is a sad fact of life that can affect rich and poor alike. For instance, whatever income level a family may have, whatever its area of residence, the water that arrives at its home can contain *E. coli* bacteria, a marker of fecal contamination. Problems of bad water supply are compounded by shortcomings in the related field of sanitation. Even if water reaching a home is clean, it often becomes tainted by the time a family member raises it in a cup to drink. Unwashed hands, dirty storage vessels, and the pervasive environmental presence of fecal contaminants in a country undersupplied with improved sanitation facilities with safe fecal sludge management and hygiene practices all play a role.

Entering the Sustainable Development Goal (SDG) era raises an opportunity to reevaluate the sector's progress and direction for improving WASH environments to be more impactful in promoting health and development throughout the country. SDG-6 calls for equitable access for all by the year 2030 to safe and affordable drinking water and environmentally responsible sanitation. Table 1.2 lists the 8 targets of SDG-6. To reach the new SDG water target, Bangladesh will need to measure access to "safely managed water," which builds on the MDG era's improved water indicator by requiring that households have access to an improved water source that is also (a) free from fecal and chemical contamination; (b) continuously available when needed; and (c) located on the household's premises. For sanitation, the country will need to deliver universal access to "safely managed sanitation," which requires that households have access to an unshared sanitation facility where excreta are safely disposed and treated. For the first time, hygiene practices will also be included in the monitoring strategy, and households will need to have access to a handwashing station with available soap and water. Finally, WASH monitoring will expand beyond the household and into community establishments such as schools and healthcare settings.

Table 1.1: Regional Comparison of Improved Water and Sanitation Access in South Asia
Percent

	Total improved water		Total improved sanitation		Open defecation
	1990	2015	1990	2015	2015
Afghanistan	—	55	—	32	13
Bangladesh[a]	79	98	34	63	3
Bhutan	72	100	19	50	2
India	71	94	17	40	44
Nepal	66	92	4	46	32
Pakistan	86	91	24	64	13
Sri Lanka	68	96	71	95	0

Source: WHO/UNICEF 2015.
Note: — = not available (no data).
a. Access numbers presented are higher than in JMP report because arsenic adjustment is taken out.

Table 1.2: SDG-6 Targets

SDG-6 Targets	
6.1	By 2030, achieve universal and equitable access to safe and affordable drinking water for all
6.2	By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes
6.7	By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, and recycling and reuse technologies
6.8	Support and strengthen the participation of local communities in improving water and sanitation management

Source: UN 2016.
Note: SDG = Sustainable Development Goal.

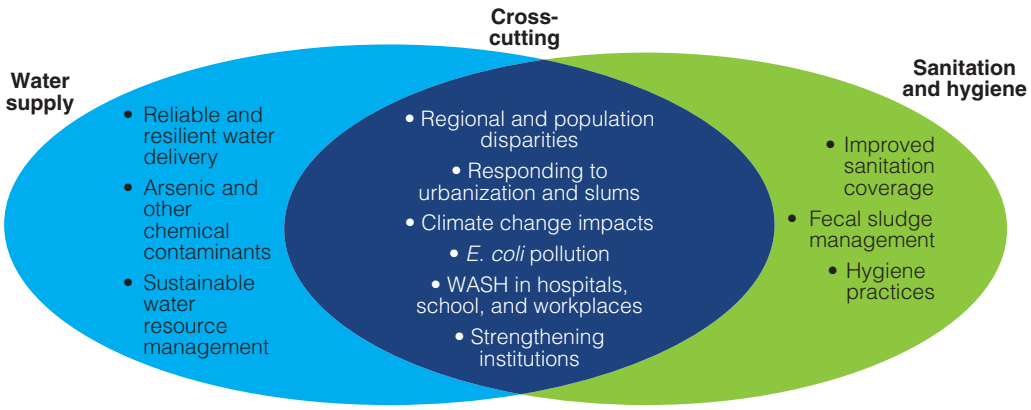
Background on the Bangladesh WASH Poverty Diagnostic

The Bangladesh WASH Poverty Diagnostic (BWPD) is a novel attempt to provide data analytics and pieces of evidence specific to the poor to inform the design of future WASH policies and operations for the meeting the SDGs. In line with the World Bank's twin goals for eliminating poverty and increasing shared prosperity, BWDP responds to the demand for pro-poor strategy by utilizing knowledge and expertise from the Poverty, Water, Governance, and Health Global Practices (GP). In comparison to other WASH monitoring initiatives, the value of BWPD is (a) **disaggregated statistics on poverty and WASH coverage in localized areas of Bangladesh** including slums, coastal areas, and within local government boundaries; (b) **econometric evidence on the synergies of WASH and human development**; and (c) **institutional analysis on WASH service delivery challenges.** Figure 1.1 gives an overview of some of the key WASH issues examined.

BWPD is a part of the larger Global WASH Poverty Diagnostic (GWPD) initiative being implemented in 18 countries across regions. The GWPD is led by the Water and Poverty GP with collaborations with the Governance and Health GP of the World Bank. The motivation behind GWPD was to begin a global benchmarking and knowledge platform that focused on WASH service delivery inequities of the bottom 40 (B40) percent to guide World Bank operations and strategy. **The central framework is defined by four core questions, each intended to examine WASH from a pro-poor critical lens that can be adapted to a unique country context.** The four core questions are as follows: (a) Who and where are the poor? (b) What is the level of access and quality of WASH services experienced across regions and populations including the poor? (c) What are linkages and synergies between WASH and other sectors? and (d) What are the WASH service delivery constraints and potential solutions to improving services to the poor? As a result, the GWPD framework has steered the analytical work of the BWPD. This summary document highlights some of the findings to the four core questions. The methodology is detailed in box 1.1.

This detailed discussion on Bangladesh's WASH challenges is framed around the provision of inclusive, safe WASH access, the paramount issue for the sector. The discussion begins with Bangladesh's successes in providing simple infrastructural access to water and sanitation facilities and moves on to the gaps in this provision by considering safety elements such as convenience of access, sustainable use, reliability, quality, and hygiene behaviors. Preliminary estimations for the SDG 6.1 target indicators developed by the Joint Monitoring Programme are also included (box 1.2). The discussion also considers WASH service levels in schools,

Figure 1.1: A Snapshot of WASH Issues in Bangladesh



Note: WASH = water supply, sanitation, and hygiene.

hospitals, and workplace—in other words, public areas in which the young, sick, and everyday people are vulnerable to unsanitary environments. Next, the burdens of poor WASH are observed, implying that solving the problems will require broad initiatives from multiple sectors, sometimes involving major capital investment and institutional change, sometimes involving changes in long-established patterns of human behavior. Later, the study identifies bottlenecks in the institutional framework that might hinder implementation efforts to provide citizens with clean water. Finally, the study provides some recommendations on how the sector can improve WASH service delivery and meet the SDGs.

Box 1.1: Bangladesh WASH Poverty Diagnostic Methodology

The BWPD undertook several quantitative and qualitative analytical activities, each employing distinct methodologies. This document summarizes some of the key findings from these various analytical activities. The methodologies of the primary activities are provided below:

- **Estimations on current WASH levels.**[a] The BWPD takes advantage of numerous secondary datasets to generate statistics on WASH coverage. Guided by the new SDG-6 targets (table 1.1) and the World Health Organization (WHO)–United Nations Children's Fund (UNICEF) Joint Monitoring Programme (JMP) (box 1.2), the study employs a new tier framework (described in table B1.2.1 for measuring access to various WASH service levels. The tier framework incorporates new indicators on quality, including water contamination, fecal sludge management, and accessibility. Access to tiers is disaggregated in numerous ways, including by wealth quintiles (as measured by asset distribution) and urban and rural regions. Statistical analysis was done in *Stata 14* software. Access levels were also mapped at the district level using *ArcGIS* software. The datasets are from nationally representative household surveys including several rounds from the Bangladesh Demographic and Health Survey (DHS) and the Multiple Indicator Cluster Survey (MICS). Some WASH indicators were not incorporated into the tier analysis, but are still analyzed and presented on their own, including menstrual hygiene practices, child feces disposal, handwashing knowledge, and WASH access in schools, healthcare facilities, and workplaces. The raw data come from the National Hygiene Baseline Survey (NHBS) (2014), Urban Health Survey (2013), the Bangladesh Health Facility Survey (2014), DHS (several rounds), MICS (2006,2012) and the Economic Census (2011). BWPD also carried out some primary data collection using household surveys to examine unique service delivery challenges in low-income communities in Dhaka and coastal regions affected by salinity intrusion.
- **Econometric analysis.** A large portion of the work is dedicated to presenting stylized facts on the synergies between different dimensions of WASH and human development outcomes such as in health, nutrition, and education. The document presents five analyses that were carried on WASH and human development linkages: (a) effect of arsenic contamination in drinking water on early childhood development; (b) effect of *E. coli* contamination in drinking water on childhood

box continues next page

Box 1.1: Continued

stunting; (c) effect of exposure to poor sanitary environments on school enrollment; (d) effect of water collection duties on school enrollment; and (e) risk of enteric burden from poor WASH. These analyses all apply distinct econometric methods using different secondary datasets. The analyses are presented in boxes throughout the document and describe the general methodologies. Detailed descriptions of the methodologies can be found in the working papers cited. Working papers can be requested from the authors of this document.

- **Institutional analysis.** Consultations with sector practitioners and desk studies of key policies, strategies, and sector reports were carried out to examine institutional constraints in service delivery.

a. Note that WASH access numbers presented in BWPD analysis differ slightly (0-5 percentage points) from the latest JMP reports from 2015 and 2017. BWPD numbers are based on point estimates of noted cross-sectional surveys. In comparison, JMP aggregates survey data from multiple surveys and uses regression analysis to project access levels.

Box 1.2: JMP Monitoring in the SDG Era—Frequently Asked Questions

Q1. What is JMP?

A1. The JMP for Water Supply and Sanitation is hosted by WHO and UNICEF and is the official UN mechanism for monitoring MDG and now SDG progress in WASH.

Q2. What are the water and sanitation ladders?

A2. JMP developed the drinking water and sanitation ladders to serve as a common WASH framework for global- and country-level monitoring for measuring harmonized benchmark indicators for MDG 7-c targets. The ladders were essentially divided into two simple and mutually exclusive groups for both water and sanitation: improved or unimproved. Improved drinking water includes access to various water sources that by nature of their construction and proper use, "adequately protected the source from outside contamination, particularly faecal matter" (WHO/UNICEF 2015, page 50). Improved sanitation facilities are ones that were unshared and "hygienically separated human excreta from human contact" (WHO/UNICEF 2015, page 50).

Q3. How will the JMP monitoring framework change in the SDG era?

A3. A common criticism of the drinking water and sanitation ladders is that they consider only technological construction to indicate quality rather than their actual capacity to block bacterial contamination (Sutton 2008). Despite the great progress

box continues next page

Box 1.2: Continued

Figure B1.2.1: JMP WASH Ladders in the SDG Era

Source: WHO/UNICEF 2017.
Note: JMP = Joint Monitoring Programme; SDG = Sustainable Development Goal; WASH = water supply, sanitation, and hygiene.
a. Improved sources include piped water, boreholes or tube wells, protected dug wells, protected springs and packaged or delivered water.
b. Improved facilities include flush/pour flush-to-piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, composting toilets or pit latrines with slab.

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Box 1.2: Continued

in meeting targets for access to improved water and sanitation, nations still face WASH-related disease and illness, which are still leading causes of morbidity and mortality. Therefore, focusing on other dimensions beyond access to certain types of technology could help meet public health objectives. Therefore, in alignment with SDG-6, the new ladder for drinking water encompasses five service levels, which take into account the amount of time needed to access such sources, water quality (the extent of arsenic, fluoride, and *E. Coli* contamination), and whether water from these sources is available when needed (see figure B1.2.1). As for sanitation, a fecal sludge management component was added for the highest tier, *safely managed sanitation*. The updated framework also introduces separate ladders for handwashing and healthcare waste management, as well as specific ladders for water supply in schools and healthcare facilities.

Q4. Who will implement JMP monitoring?

Moving forward, both the DHS and the MICS will collect data in alignment with the new JMP monitoring framework. The JMP will aggregate data from these secondary sources, as well as data from censuses and other national surveys, to estimate the national, rural, and urban WASH coverage of countries and to see whether countries are on track to meet SDG-6 targets.

Q5. Are the estimates presented in the BWPD study aligned with the new JMP monitoring framework for SDG-6?

Due to data limitations, the Water and Sanitation Tier Framework utilized in the BWPD differs from the JMP ladders for SDG-6. For drinking water, BWPD Tier 0 effectively combines the *no service and unimproved tiers* from JMP. Tiers 1 and 2 effectively correspond with the JMP limited and basic tiers, taking into account access to improved *water sources within 30 minutes or more, roundtrip*. BWPD adds an additional tier (Tier 3)—taking into account access to *improved water sources on premise, while Tier 4 looks solely at on-premise piped water*. To account for the new SDG-6 dimensions for water quality, we also examine the WASH Tier Framework as adjusted for *levels of E. coli and arsenic contamination*. Data on continuity and shortages of water services were not available to estimate the JMP's definition of "safely managed water." BWPD effectively combines the JMP *open defecation and unimproved tiers* into a single tier: *unimproved sanitation*. Tiers 1 and 2—*improved sanitation (including shared)* and *improved sanitation (excluding shared)*—correspond with the JMP limited and basic tiers. Tier 3 (*private sewage connection*) differs from the JMP safely managed tier, which specifies that excreta may be safely disposed in situ or transported and treated off-site. Data on this indicator were absent. BWPD also estimates population access to handwashing stations with soap and water and other hygiene behaviors such as handwashing practices, child feces disposal, and menstrual hygiene management.

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Box 1.2: Continued

Table B1.2.1: Water Tier Framework Used in the Bangladesh WASH Poverty Diagnostic

Water tiers[a]	JMP improved water technology	Within 30 minutes roundtrip collection	On-premise	Piped
4—On-premise piped	✓	✓	✓	✓
3—On-premise improved	✓	✓	✓	n.a.
2—Improved water within 30 minutes	✓	✓	n.a.	n.a.
1—Improved water	✓	n.a.	n.a.	n.a.
0—Unimproved water	n.a.	n.a.	n.a.	n.a.

Note: JMP = Joint Monitoring Programme; n.a. = not applicable; WASH = water supply, sanitation, and hygiene.
a. Water Tier Framework analysis presented with two types of estimates: (a) unadjusted for clean water (*E. coli* and arsenic) and (b) adjusted for clean water.

Table B1.2.2: Sanitation Tier Framework Used in the Bangladesh WASH Poverty Diagnostic

Sanitation tiers	JMP improved sanitation technology	Unshared	Sewage connection
3—Private sewage connection	✓	✓	✓
2—Improved sanitation	✓	✓	n.a.
1—Improved sanitation (regardless of sharing)	✓	n.a.	n.a.
0—Unimproved/open defecation	n.a.	n.a.	n.a.

Note: JMP = Joint Monitoring Programme; n.a. = not applicable; WASH = water supply, sanitation, and hygiene.

Notes

1. This number differs from official JMP reports, which estimate 87 percent improved water access to adjust for arsenic contamination. The BWPD accounts for arsenic adjustments separately.
2. Per JMP definitions, "an 'improved' drinking-water source is one that, by the nature of its construction and when properly used, adequately protects the source from outside contamination, particularly faecal matter. An 'improved' sanitation facility is one that hygienically separates human excreta from human contact" (WHO/UNICEF 2015, page 50).

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Chapter 2
Population Water Access

Main Points

- **Bangladesh achieved the Millennium Development Goal (MDG) water target to halve the proportion of people using unimproved water sources by 2015.** Today, close to 98 percent of the population have access to some technologically improved water source, and 96 percent have access to improved water sources that are within 30 minutes of collection time.
- **Improved water sources, however, do not ensure that water is clean.** When considering *E. coli* and arsenic contamination, only 52 percent of the population have access to clean improved water sources. About 39 percent have access to clean improved water on household premises. Approximately 13 percent of the country's water sources contain arsenic levels above 50 parts per billion—Bangladesh's recommended limit. Further, a full 41 percent of the water that goes into collection jugs or cups from all improved sources contain dangerous levels of *E. coli*.
- **Promoting household water treatment practices is critical for addressing water quality issues.** Drinking water becomes even more contaminated after being stored, yet only 10 percent of households actually treat their water before drinking—meaning that most individuals routinely suffer the adverse effects of water contaminants.

Water Infrastructure Access—The Final Push for Achieving Universal Access to Improved Water Source

Bangladesh has made excellent headway in recent years toward the goal of universal access to improved water sources. Across the country, capital-intensive programs of public and private investment have replaced unimproved sources of water (e.g., unprotected springs and surface water with wells, managed reservoirs, and piped water supply schemes). To assess progress in expanding water services, our analysis defines four tiers of household water access motivated by an important dimension of safe access: *convenience* of access to the household. Tier 1, improved water,[1] is the simplest form of access and merely follows the improved water source target indicator for the MDG. Tier 2, basic water, adds a condition that households do not have to travel more than 30 minutes to collect water from the improved water source. Tier 3, on-premise improved water, requires that the improved water source is within a household's premises. And Tier 4, on-premise piped, examines access to piped water supply that is also within a household's premises (see chapter 1, box 1.2). This chapter highlights

some of the findings of the water tier analysis, but additional disaggregated statistics can be found in appendix A: Drinking water and sanitation trends by tiers; appendix B: Drinking water and sanitation tiers by wealth; and appendix C: Clean water access by tiers.

The MDG water target to halve the proportion of people using unimproved water sources by 2015 was achieved, and now close to 98 percent of the population have access to some technologically improved water source (T1). About 96 percent of the population have access to improved water access that is also within 30 minutes of collection time (T2). This is a tremendous achievement and testimony to the country's commitment to guaranteeing every citizen's human right to water (figure 2.1 summarizes access to water by tiers). Achievements in expanding improved water access are due largely to rapid progress in rural areas through the expansion of tube wells (see box 2.1 and map B2.1.1). In urban areas, improvement has come more slowly, with rates of access remaining roughly stagnant. In absolute numbers, about 3.8 million remain without access to improved water sources (figure 2.2).

Of the people classified as having access to improved water, about a quarter must still go off-premise to collect it. The fetching of water is primarily a rural practice, but whether in cities or villages, the job almost always falls to the girls and women of a household—in 2013, females had 90 percent of the share of water collection responsibility. This can impinge on their

Box 2.1: Sustainability and Regulatory Issues of Tube Wells

Much of the MDG progress came courtesy of the tube well, a low-cost technology in which a steel tube is driven down through the soil to the table, with groundwater raised to the surface by pumps powered by hand or motor. Since their introduction in numbers in the 1970s, tube wells have become all but ubiquitous in Bangladesh, with close to 70 percent of urban dwellers using them today, and 95 percent of rural people.

Groundwater accounts for over 90 percent of the country's drinking water and is the principal water for domestic, industrial, and irrigation use. The proliferation of tube wells for multiple purposes has given rise to concerns about the sustainability of the underlying resource they are tapping. Shallow aquifers can be recharged by rainfall and seasonal flooding, but deeper aquifers may be more vulnerable to excessive withdrawal and require energy. There are also important regional differences in the number of suitable aquifers and the depth of water tables. In some cases, wells dry up in rainless months due to intensive pumping for *boro* rice cultivation. Hand-powered pumps, capable of lifting water only about 7 meters, are impractical for lower level tables. Taken together, these constraints could threaten water security in the long-term (Shamsudduha et al. 2011).

Another major challenge of tube wells is the feasibility of regulation for sustainable use and water quality. Shallow tube wells are largely responsible for the arsenic crisis, and though tube wells are less likely to be contaminated with fecal bacteria, 38 percent of them do face issues of *E. coli* contamination. There are few practical solutions to regulating and monitoring tube wells. Moreover, as incomes rise, more people will demand more convenient sources of water, such as piped water. Long-term strategies for provision of water supply should begin to lessen the population's dependence on tube wells.

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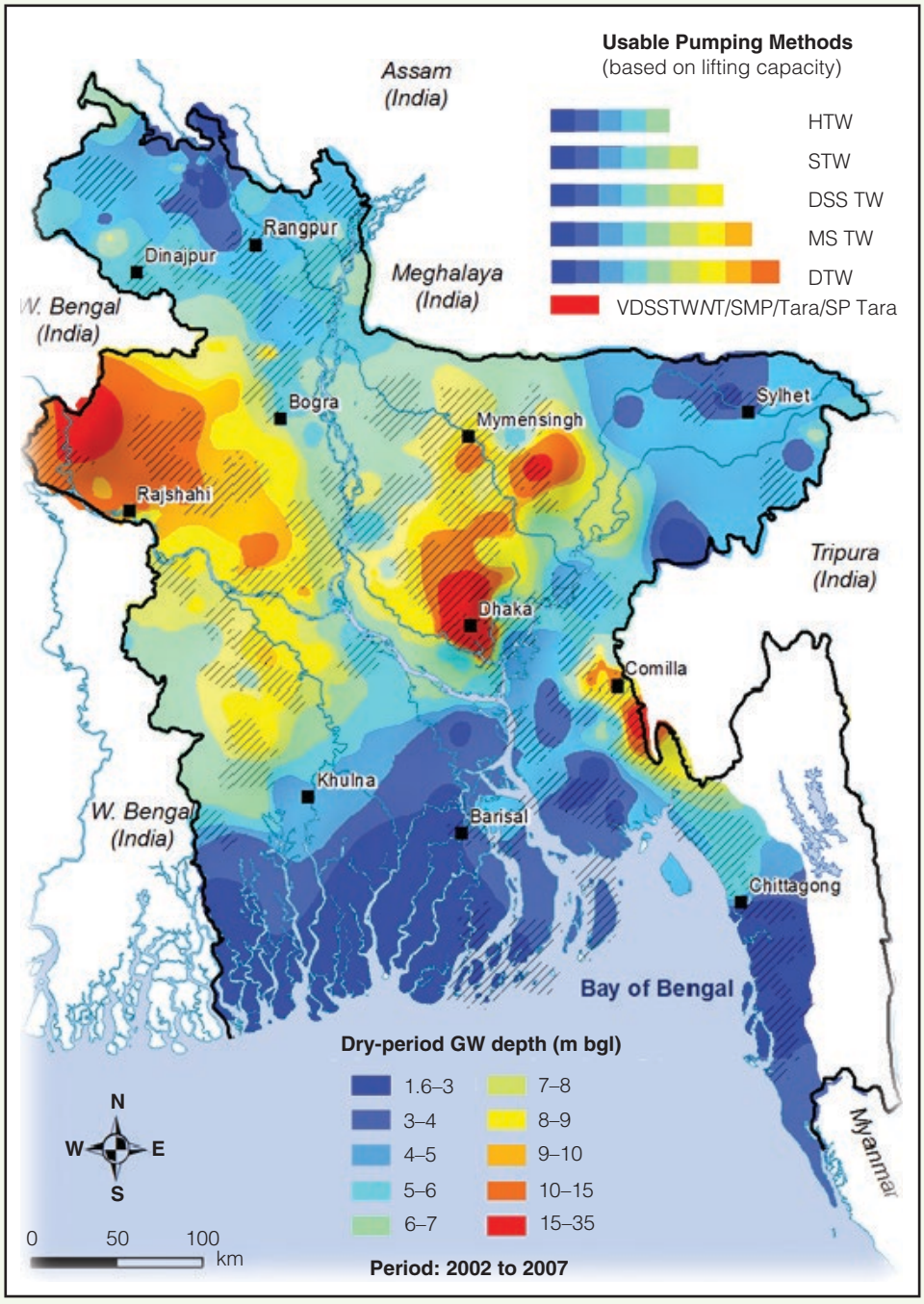
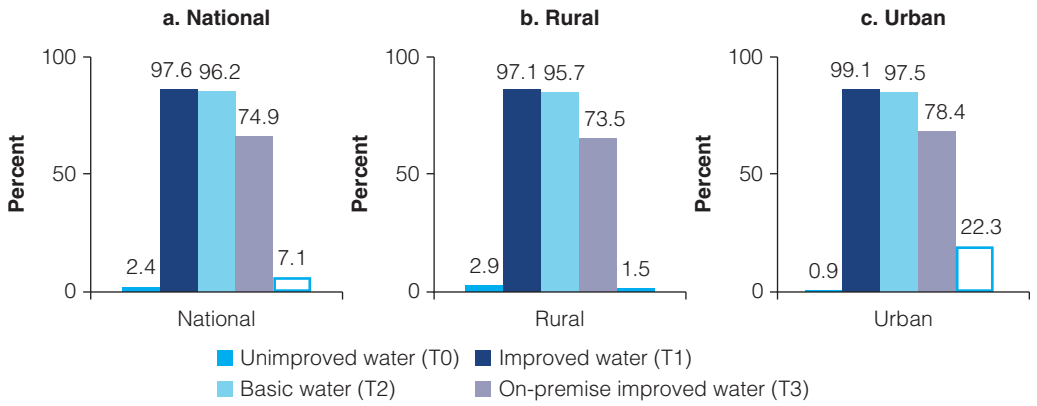
Box 2.1: Continued

Map B2.1.1: Usable Pumping Methods, Bangladesh, by District, 2002–07



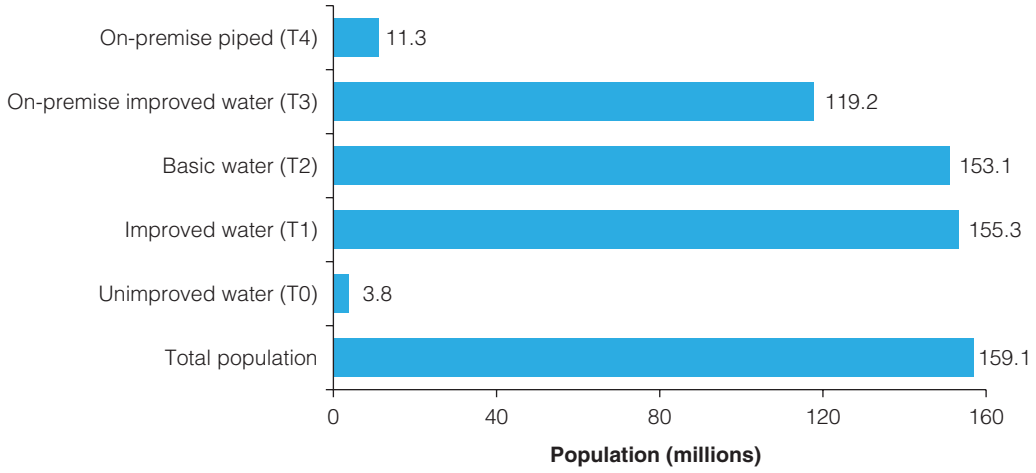
Source: Shamsudduha et al. 2011.
Note: DSSTW = deep set shallow tube well; DTW = deep tube well; GW = groundwater; HTW = hand tube well; m bgl = meters below ground level; MSTW = mini-submersible shallow tube well; SMP = submersible pump; SP Tara = super Tara pump; STW = shallow tube well; Tara = Tara pump; VDSSTW = very deep-set shallow tube well; VT = vertical turbine pump.

Figure 2.1: National, Rural, Urban Access to Water, Bangladesh, 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).
Note: T0 = Tier 0: Use of unimproved water technologies; T1 = Tier 1: Use of improved water technologies; T2 = Tier 2: Use of improved water technologies within 30 minutes of access; T3 = Tier 3: Use of improved water technologies available on household premises; T4 = Tier 4: Use of piped water supply available on household premises.

Figure 2.2: Water Access, by Population, Bangladesh, 2014, by Tier

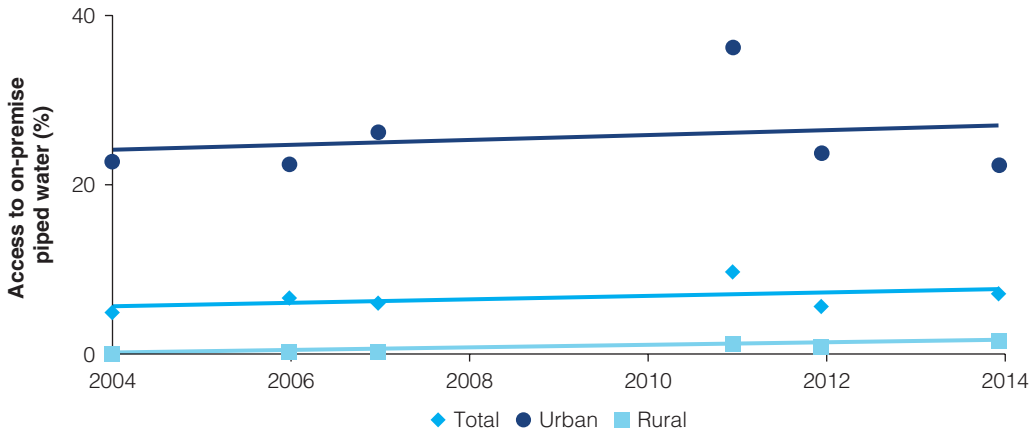


Sources: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016), and World Development Indicators (WDI) 2014 data (World Bank 2014).
Note: T0 = Tier 0: Use of unimproved water technologies; T1 = Tier 1: Use of improved water technologies; T2 = Tier 2: Use of improved water technologies within 30 minutes of access; T3 = Tier 3: Use of improved water technologies available on household premises; T4 = Tier 4: Use of piped water supply available on household premises.

education and their work for income, which is seen in BWPD analysis on water collection responsibilities and school enrollment in the Sundarbans (see box 4.1 in chapter 4). It can also mean the household lacks sufficient water, and it can encourage unsafe practices concerning storage and hygiene.

Piped water is rare in Bangladesh, used by only 10 percent of the population, with a minority of the population (7.1 percent) enjoying its convenience in their homes. Piping systems, due to their centralized management and treatment, hold the potential to be a reliable, noncontaminating means of moving water. Most of the on-premise piped water coverage is in urban areas, which have a 22 percent rate, while the figure drops to just 2 percent in rural areas. However, in the

Figure 2.3: National, Urban, and Rural On-Premise Piped Water Access, Bangladesh, 2004–14



Sources: World Bank calculations using Demographic and Health Survey (DHS) 2004, 2007, 2011, and 2014 data (NIPORT, Mitra and Associates, and ORC Macro 2005; NIPORT, Mitra and Associates, and Macro International 2009; NIPORT, Mitra and Associates, and ICF International 2013; NIPORT, Mitra and Associates, and ICF International 2016) and Multiple Indicator Cluster Survey (MICS) 2006 and 2013 data (UNICEF and BBS 2007; 2015).

past 10 years, coverage has been relatively stagnant, most likely indicating that new connection rates have been able to keep up only with population growth (figure 2.3).

Clean Water Access—The Paradox of Improved Water Sources

Though Bangladesh has made substantial progress in expanding improved water infrastructure, it has low access to improved water infrastructure that actually taps clean water. Clean water implies that it is free from both bacterial and chemical contamination. The Bangladesh government has water quality standards; however, national water quality standards have not been enforced due to institutional challenges and a lack of systemic monitoring of water quality.[2] Data on water quality at the national level in most countries in South Asia and around the world are sparse. Currently, only one source of household data (MICS 2013) exists for nationally representative indicators on water quality in Bangladesh. However, even this dataset is not comprehensive and collects data only on two water quality indicators: *E. coli* bacteria and arsenic in household water sources. Our analysis's definition of clean water accounts for just these two measures, which are two of the three priority contaminants[3] that will be measured for the SDGs.[4,5] However, there could be other contamination issues, such as from industrial and agricultural waste in water bodies (see box 2.2)

Only 52 percent of the population have access to clean improved water sources, when considering *E. coli* and arsenic contamination. This is a 46 percentage point drop from improved water access that is *not* adjusted by *E. coli* and arsenic contamination. This also means that roughly 74 million Bangladeshis are drinking from unclean or unimproved water sources. In addition, only 39 percent have access to contamination-free improved water sources available on premises. This figure is likely to be close to the baseline for the new SDG safely managed water indicator. Less than 2 percent have access to on-premise piped water free of contamination (figure 2.4). Urban dwellers are more likely to have access to contaminated sources than rural residents (55 percent vs. 45 percent access to clean water—appendix C table C.1). This may infer that in spite of the presence of more advanced WASH infrastructure in many urban areas, the implications of increasing urbanization—including rising population densities in areas with already overburdened infrastructure—raise the risk of source point

contamination. Moreover, poor water quality (with both arsenic and *E. coli*) seems to affect all types of water source technologies. Arsenic and *E. coli* problems are also examined in separate analyses to identify their unique patterns of contamination.

Altogether, 13 percent of the country's improved water sources contain arsenic levels above 50 parts per billion, which the Bangladesh government defines as the threshold of danger. Arsenic is a natural contaminant and due to quirks of geology occurs in many of its shallow groundwater sources. Arsenic is a heavy metal released from sediment by biogeochemical processes. In Bangladesh, it occurs in higher concentrations at shallower depths of groundwater tables. Awareness of this problem has only emerged in recent decades, generating disturbing data: from 2000 to 2010, somewhere between 35 million and 77 million people in the country were chronically exposed to arsenic through their drinking water (Flanagan, Johnston, and Zheng 2012). This has been described as the largest mass poisoning in history. In popular culture, arsenic is thought to cause rapid death, but the real-world effect of chronic low-level exposure through drinking water is higher rates of a large variety of long-term illnesses and mortality: diabetes, various forms of cancer and skin lesions, increased mortality from heart attacks, and neurological disorders that impair intellectual function, especially in children (see box 2.3).

Box 2.2: Environmental Pollution of Water Bodies in Dhaka—Providing a Crucial Baseline

The Dhaka Water Supply and Sewerage Authority (DWASA) undertook a study with financial support from the World Bank Water Global Practices (GP)—namely the Dhaka Water Supply and Sanitation Project (DWSSP)—to gauge water quality in the greater watershed around Dhaka City, which comprises several rivers and lakes. Applying the Standard Methods (reference methods of the American Public Health Association [APHA] and the American Water Works Association [AWWA]) of quantitative analysis of water and wastewater, all samples collected from six rivers, one canal, and six industrial clusters were analyzed for 10 specific water quality parameters. These parameters included dissolved oxygen and biochemical oxygen demand (BOD), among others.

Data were collected during a nine-month monitoring period, between May 2015 and January 2016, to obtain a complete picture of pollution load and its seasonal variation throughout the year. All water sources were then categorized into five water quality classes, as defined by national and international criteria, in which Class I is the cleanest water, which may be used as a drinking water source after direct disinfection treatment, and Class V is the most polluted water (with high organic matter), which can possibly be used for irrigation.

It was found that most of the river water is very polluted, with some areas being very seriously polluted. Only during the wet season could some rivers be classified as Classes II and III. No river water was found to meet the requirements for Class I. Maps B4.2.1 and B4.2.2 present the classification of the sampling locations during the dry period, with regard to dissolved oxygen and BOD measurements. Furthermore, the pollution load in outfall water was relatively high as compared to other sampling points, implying that industrial discharge has a direct impact on river water. Overall, the findings of this study provide a crucial baseline for stakeholders to target future policies and programming for ensuring the quality and usability of water sources in Dhaka.

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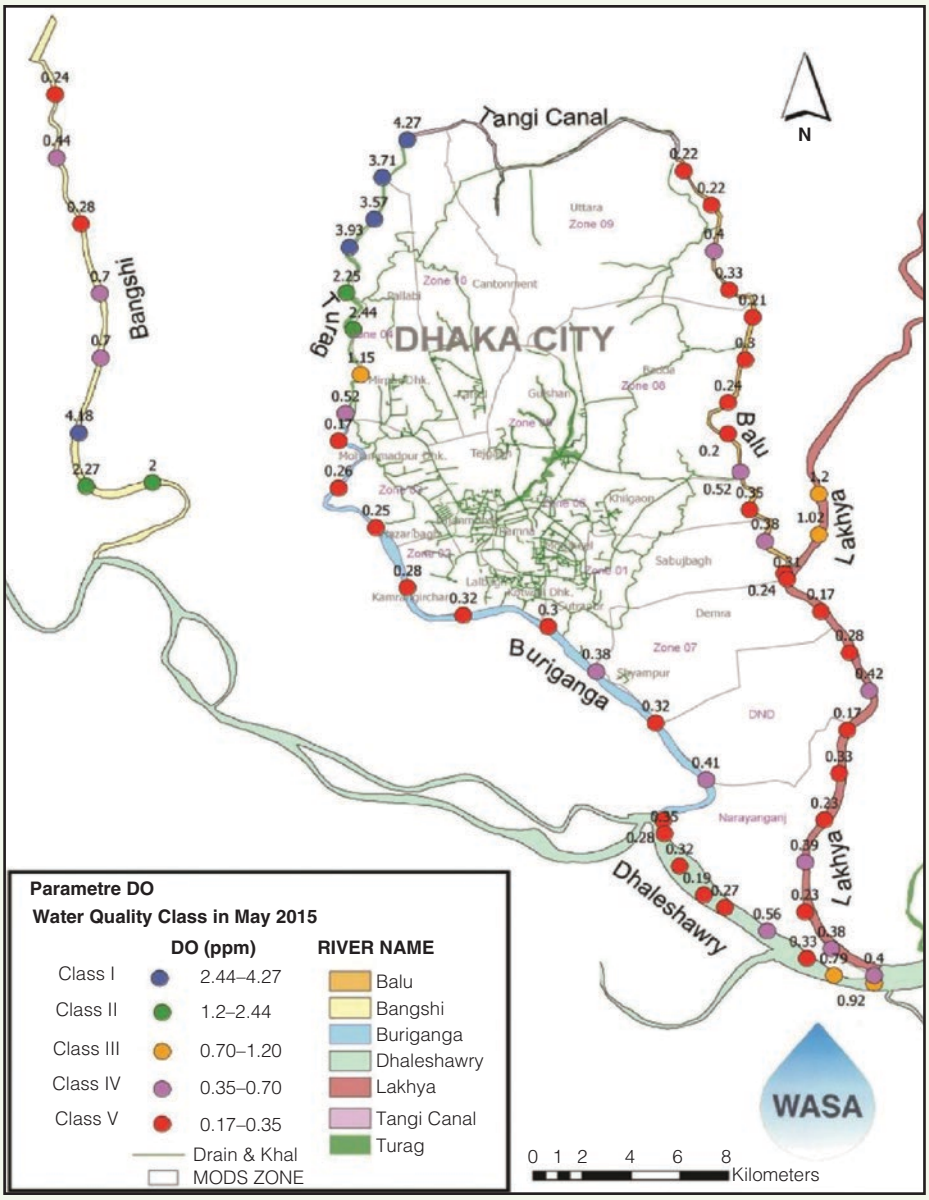
Box 2.2: Continued

Map B2.2.1: Water Quality with Respect to DO, Dhaka City, May 2015



Source: DWASA 2016.
Note: Data from water quality monitoring in six rivers around Dhaka City, Bangladesh. DO = dissolved oxygen; Class I = 2.44–4.27 ppm; Class II = 1.2–2.44 ppm; Class III = 0.70–1.20 ppm; Class IV = 0.35–0.70 ppm; Class V = 0.17–0.35 ppm; MODS = maintenance, operation, and distribution system.

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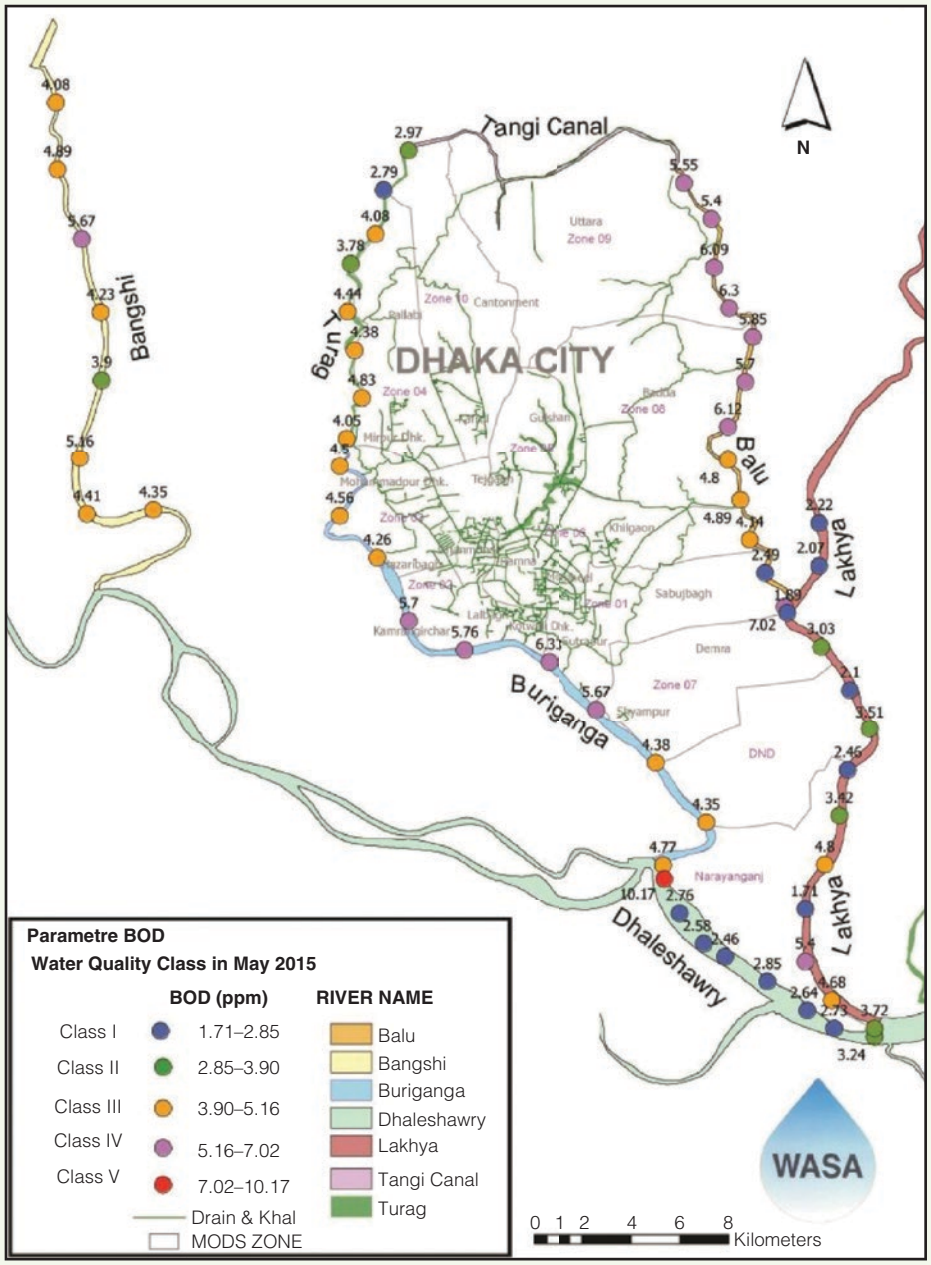
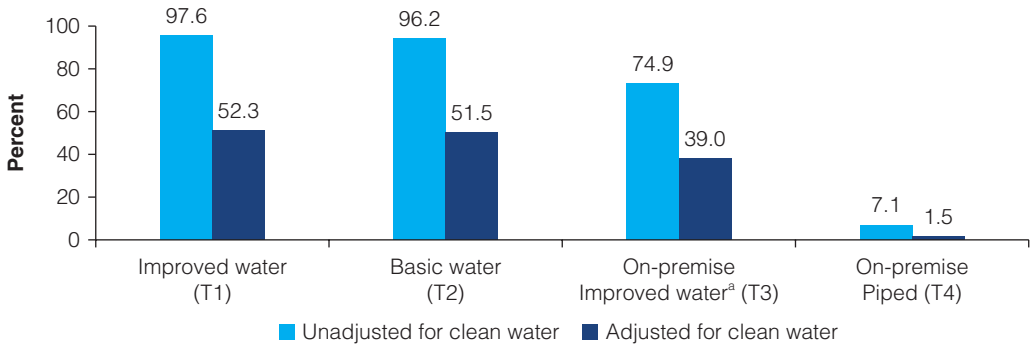
Box 2.2: Continued

Map B2.2.2: Water Quality with Respect to BOD, Dhaka City, May 2015



Source: DWASA 2016.
Note: Data from water quality monitoring in six rivers around Dhaka City, Bangladesh. BOD = biochemical oxygen demand; BOD, Class I = 1.71–2.85 ppm; Class II = 2.85–3.90 ppm; Class III = 3.90–5.16 ppm; Class IV = 5.16 ppm–7.02 ppm; Class V = 7.02–10.17 ppm; MODS = maintenance, operation, and distribution system.

Figure 2.4: Comparisons of Unadjusted and Adjusted Clean Water Access, by Tier, Bangladesh, 2014 and 2013



Sources: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016) and Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: T0 = Tier 0: Use of unimproved water technologies; T1 = Tier 1: Use of improved water technologies; T2 = Tier 2: Use of improved water technologies within 30 minutes of access; T3 = Tier 3: Use of improved water technologies available on household premises; T4 = Tier 4: Use of piped water supply available on household premises.
a. The closest proxy for safely managed water indicator, which considers improved water access that is on-premises and free of *E. coli* and arsenic contamination. Does not include continuity measurements or fluoride contamination due to data limitations.

Box 2.3: Arsenic—Slow Poison—the Effects on Early Childhood Development

Arsenic contamination in shallow groundwater aquifers remains a major barrier to providing universal access to safe drinking water in Bangladesh. The effect of arsenic on health has long been established: chronic exposure has been shown to cause costly and deadly health impacts—including various cancers, skin lesions, neurological damage, cardiovascular and pulmonary disease and hypertension (Flanagan et al. 2012; Smith, Lingas, and Rahman. 2000; Sohel et al. 2009). The neurotoxic effects of arsenic can be particularly apparent in children during their critical growth periods and are shown to have significant impairments to their cognitive development, with a negative impact on memory and the ability to focus and solve problems (Rosado et al. 2007).This effect on cognitive development can, in turn, lead to long-term reductions in educational attainment and performance. In rural Bangladesh, male children who were exposed to arsenic at home had lower mathematics scores compared to those who had no contact with arsenic (Asadullah and Chaudhury 2008). Similarly, a study by Murray and Sharmin (2015) indicates that Bangladeshi boys (aged 6 to 10 years) who drink arsenic-contaminated water attend fewer days of school per year compared to those who drink safe water. As such, the presented analysis sought to ascertain the extent to which exposure to arsenic-contaminated water limits early childhood development.

The study uses cross-sectional data from the nationally representative 2012–13 Bangladesh Multiple Indicator Cluster Survey (MICS) to investigate the effect of

box continues next page

Box 2.3: Continued

arsenic contamination in drinking water on early childhood development outcomes in a sample of around 7,500 children aged three to five. Early childhood development was measured in four domains: literacy-numeracy, physical, social-emotional, and learning using the Early Childhood Development Indicators (ECDI)—a novel 10-item module developed by the United Nations Children's Fund (UNICEF) to systematically monitor milestones a child is expected to reach by the age of three and four. A composite ECDI is also constructed for every child, such that the ECD Index will take a value of 1 if a child meets at least three out of the four domains above.

After controlling for individual, household, and community characteristics, the results from the logistic regression models show that arsenic contamination is significantly and negatively associated with the overall ECD Index, particularly on outcomes representing the physical, social-emotional, and learning domains. Specifically, the presence of arsenic in drinking water above the WHO standard of greater than 10 parts per billion reduces the likelihood of meeting the combined ECD level by about 7 percentage points, while the presence of arsenic above the Bangladesh standards reduces the likelihood by about 11 percentage points. Similar effects can be found for three out of four domains—physical, social-emotional, and learning—ranging from 3 to 8 percentage points. The analysis further reveals that there is a clear dose-response relationship, in which those children with exposure to higher concentrations of arsenic tend to have worse developmental outcomes. Further, children belonging to the B40 bear a higher burden than children in T60 households—so much that children belonging to bottom 40 percent (B40) households without arsenic tend to perform better than children in top 60 percent (T60) households with arsenic. This indicates that arsenic contamination more than offsets the advantages of belonging to a nonpoor household. Similar patterns are reflected in learning outcomes as well.

Based on this analysis, it is clear that arsenic contamination—widespread across the country—has drastic impacts on early childhood development. In response, policy makers and key stakeholders should take additional steps toward mitigating arsenic contamination in the worst affected communities. In particular, it is necessary to increase access to deep tube-wells or piped water supply from safe water sources. Arsenic-mitigation should especially be targeted to caregivers and expectant mothers. Furthermore, means for arsenic testing and safe water sources must be made both readily accessible and affordable, particularly in B40 communities.

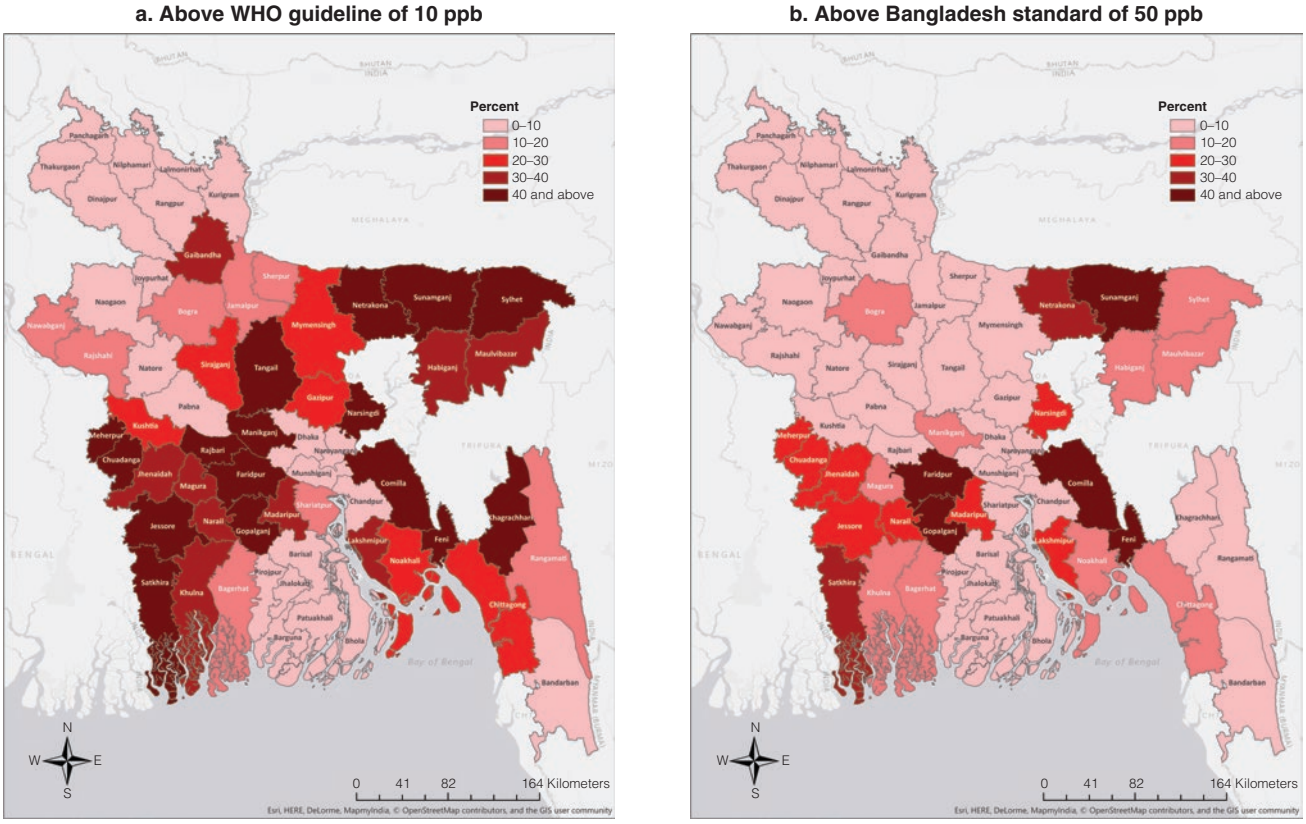
Source: Haque, Joseph, and Moqueet 2017.

Compared to the Bangladesh threshold of 50 parts per billion, when using the more rigorous World Health Organization (WHO) guideline of more than 10 parts per billion, the arsenic contamination rate goes up to 26 percent of all water sources in Bangladesh. Arsenic contamination is predominantly a rural issue and found to primarily affect shallow tube wells. The extent of this contamination varies by region, with the eastern areas of Sylhet and

Chittagong suffering much higher concentration levels than the northwest regions of the country (map 2.1, panels a and b).

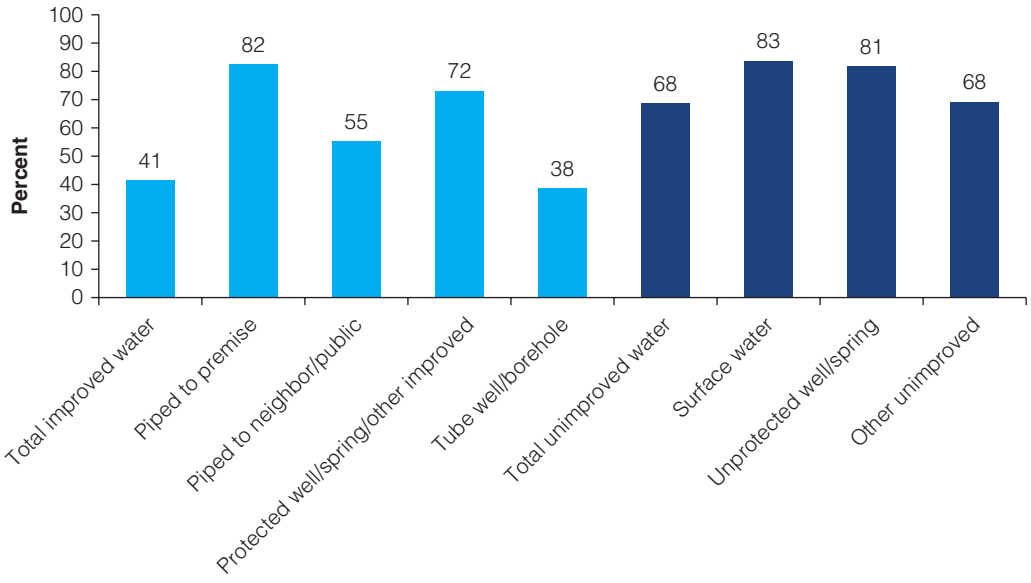
The bulk of water contamination is coming from *E. coli* bacteria, which seems to be pervasive in all types of water sources in Bangladesh (figure 2.5). A full 41 percent of the time, what goes into a collection jug or pipe from improved water sources contain dangerous levels of *E. coli*.[6] For those who consume tube well water, that translates into more than 50 million Bangladeshis facing risk of the microbe. MICS 2013 data indicate that surface water in Bangladesh has an 83 percent rate of *E. coli*. Yet on-premise piped water, theoretically among the safest due to centralized control and processing, was virtually the same at 82 percent. Overall, improved water sources have a lower contamination rate than unimproved water sources (41 percent compared to 68 percent). Still, a 41 percent contamination rate of improved water sources is high. Drinking dirty water has detrimental consequences on health and nutrition, especially for children (see box 6.1 in chapter 6). Rates vary too by region of the country—factors such as population and farm animal density, frequency of flooding, leakages in piped systems due to improper installations, low water pressure, and intermittent supply may play a role—but almost everywhere the rates are unacceptably high. Understanding the reasons for this contamination is one of the biggest knowledge gaps of WASH programs in Bangladesh.

Map 2.1: Proportion of Water Sources Contaminated with Arsenic, Bangladesh, 2013



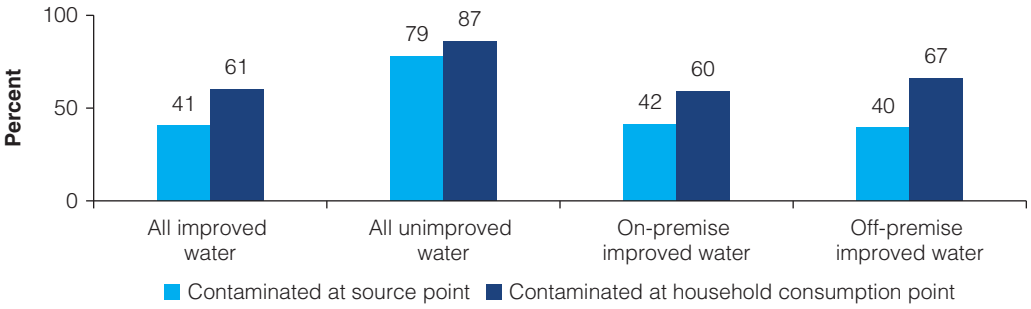
Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: ppb = parts per billion; WHO = World Health Organization.

Figure 2.5: *E. coli* Contamination Rates across Types of Water Sources, Bangladesh, 2013



Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).

Figure 2.6: *E. coli* Contamination at Source and Household Consumption Points in Bangladesh, by Tier, 2013



Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).

Water Treatment

Even if we solve the issue of contamination at the source, water that reaches the home in clean condition faces a host of threats to its purity before it is consumed. Figure 2.6 shows how pervasive this effect can be, comparing source point and consumption point contamination levels. Improved water, for instance, is found at the source to be contaminated 41 percent of the time, but when that same type of water is tested at the household consumption point,[7] the figure jumps to 61 percent. Water pumped up from tube wells fills plastic, metal, and ceramic containers. Women walking with these heavy loads balanced on their hips are a common sight in many parts of the country. In other places, carts and tanker trucks move the water for distribution to multiple households. The insides of these containers can be hothouses for microbes. If just a few drops of contaminated water from an earlier filling remain, they can contaminate the incoming clean water.

Box 2.4: Chlorination at the Point of Collection—Low-Cost Strategy for Scaling up Decentralized Water Treatment

To reduce *E. coli* contamination in household water, several treatment options have been experimented across urban areas in low- and middle-income countries (LIMCs) with mixed success. Many of the point-of-use treatment options—including the use of disinfectants such as chlorine tablets, and household-level treatment such as boiling water before drinking—requires considerable behavioral change on the part of households, leading to eventual failure due to low uptake. However, automated point-of-collection chlorination interventions have the potential to be scaled up on a large scale due to limited requirement of behavioral change on the part of the households as well as its cost effectiveness.

In a recent World Bank–funded experimental evaluation of the impact of low-cost inline chlorination systems (which dispense chlorine into water at collection points) in low-income communities in Dhaka, it was found that when compared with control households, chlorination at the point of collection through a solid tablet chlorine dose significantly reduced reported child diarrhea by about 23 percent as well as illness-related health care expenditures per child in the previous two months by US$0.50 (Tk 40) among treatment households. The results suggest targeting a low chlorine residual dose (0.3–0.5 parts per million) in an effort to increase acceptability of chlorinated water can still improve water quality and reduce the risk of diarrhea. The intervention is relatively inexpensive: BDT 170 per household per month (US$1.25 per household per month) translates to BDT 24 per person per month or US$0.31 per person per month). The Aquatabs Flo chlorine dose does not require electricity to operate, requires minimal behavior change for the user, and is compatible with intermittent flow systems that utilize water storage tanks. The study suggests this decentralized approach to water treatment could be one strategy for reducing gastrointestinal disease burden in low-income urban communities in Bangladesh and other countries.

Source: Pickering et al. 2015.

A reality for addressing the water quality problem will be promoting household water treatment practices; however, few households currently take action. According to the latest DHS data, only 10 percent of the population use an appropriate water treatment[8] method for their drinking water, with a large rural-urban divide. Nationally, about 5.6 percent resort to boiling water, 4.6 percent use various means to filter water, and 0.2 percent add chlorine or bleach.[9] Box 2.2 presents research from Dhaka on potential point-of-collection water treatment options for decentralized water systems.

Notes

1. See box 1.2 for detailed JMP and BWPD definitions of improved water and definitions of tiers.
2. See chapter 7 for further details on these challenges.
3. Priority contaminants measured for the SDGs include fluoride, arsenic, and *E. coli*.

4. *E. coli* contamination is defined as 1 coliform forming unit per 100 milliliters of water, and arsenic contamination is defined as above 50 parts per billion arsenic. See UNICEF and BBS 2015 for sampling and testing methodology.
5. Tests were conducted only at one point in time, and fecal contamination of drinking water is highly variable depending on the season.
6. *Escherichia coli* (*E. coli*) is just one marker of fecal bacteria, and its presence in drinking water indicates only that the water is definitely contaminated. However, there still could be other pathogens present, meaning that no detection of *E. coli* in drinking water does not guarantee it is free from contamination (UNICEF 2015).
7. That is, by the time the water is poured into a glass to drink.
8. Appropriate water treatment method includes boiling, filtering, and chlorination (WHO/UNICEF 2012).
9. Note these figures will not add to 6 percent (appropriate water treatment value) because some people use multiple water treatment methods.

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Chapter 3
Population Sanitation and Hygiene Access

Main Points

- **Bangladesh made a paradigm shift in rural sanitation and pioneered an innovative approach in achieving collective behavior change.** The community led total sanitation (CLTS) approach enabled the population, especially a vast majority of the rural population, to end open defecation and use sanitation facilities. Access to sanitation increased dramatically from 70 percent to 92 percent at the national level which largely owed to the successful implementation of the collective behavior change campaign at the grassroots level and strong political leadership.
- **Despite the massive shift in behavior change among communities, Bangladesh failed to achieve the Millennium Development Goal (MDG) sanitation target because of high rates of sharing improved sanitation facilities between households.** Only 63 percent of people use improved, unshared sanitation facilities. The situation is direr in urban areas: 43 percent of urban households that lack private sanitation share such facilities with over five households, as compared to just 12 percent of rural households.
- **Sewage connections are scarce.** Only 2 percent have access to a private sanitation facility that is connected to a sewerage system. As expected, access to sewerage is lower in rural areas (1 percent) compared to in urban areas (7 percent).
- **Fecal sludge management is most likely lacking, and some studies estimate that between 0 percent to 2 percent of fecal sludge is safely treated in some cities.** For instance, in Dhaka city, it has been estimated that less than 2 percent of human excreta is safely managed, while the rest is discharged into open water—potentially having drastic impacts on health.
- **Only 28 percent have access to a designated place for handwashing with both water and soap, despite the many benefits.** There are also major urban-rural gaps: 48 percent of urban residents have a handwashing station with water and soap, as compared to only 21 percent of rural residents. Additionally, surveys have revealed gaps in people's perceptions of when and how they should wash their hands.

box continues next page

- **The improper disposal of child feces is widespread—and a likely contributor to enteric disease.** Altogether, about 60 percent of children aged two years or below live in households that practice unsafe child feces disposal. These rates are also higher in urban areas (60 percent) than in rural areas (33 percent).
- **Improvements in menstrual hygiene management (MHM) will likely improve outcomes for women.** A quarter of Bangladeshi females report missing school when they are menstruating—thus hampering their access to economic opportunities later in life. This is in addition to the adverse health impacts of inadequate MHM.

Sanitation Infrastructure Access—Building on MDG Successes

During the MDG years, Bangladesh almost eliminated a major cause of bacterial spread: defecation in fields, ponds, and other "open" environments. Globally, sanitation can be an overlooked sector, despite its momentous impacts on health, dignity, and human development. For example, box 3.1 shares findings from an analysis on effects of community-level sanitation on school enrollment. However, Bangladesh has been leader in giving importance to the sector. As of 2014, only 3 percent of the population engaged in this once widespread practice. This achievement can be credited to Total Sanitation Campaigns, which implemented innovations such as community-led total sanitation (CLTS), a sanitation behavior-change intervention that was pioneered in Bangladesh and adapted all over the world. But as open defecation declined, the challenge emerged to provide people with good fixed-point sanitation facilities. Ideally these facilities are (a) technologically improved, that is, able to safely separate excreta from human contact, and (b) used by only one household, which avoids the bad conditions common through overuse and lack of clear responsibility.

In a similar vein of measuring progress in water access, this sanitation analysis follows a tier framework for assessing convenience of sanitation access. Tier 0, *unimproved sanitation*, includes people who use technologically unimproved sanitation facilities (open defecation, hanging latrines, buckets, flush to no pit, septic, sewer) or any shared sanitation facilities. Tier 1, *improved sanitation including shared*, uses the Joint Monitoring Programme (JMP) definition of technologically improved sanitation regardless of sharing status. Tier 2, *unshared improved sanitation*, follows the MDG target of having access to a technologically improved sanitation facility that is unshared between households. Tier 3, *sewage connection*, examines those households that have access to a private sanitation facility with sewerage connection, which can theoretically transport sewage to a wastewater treatment plant. This chapter highlights some of the findings of the sanitation tier analysis, but additional disaggregated statistics can be found in appendix A: Drinking water and sanitation trends by tiers; appendix B: Drinking water and sanitation tiers by wealth; and appendix C: Clean water access by tiers.

From 2006 to 2014, national access to improved sanitation regardless of sharing status (tier 1) increased dramatically from 70 percent to 92 percent. In urban areas, access levels improved from 81 percent to 93 percent, and from 70 percent to 91 percent in rural areas. The success of at least moving households from open defection to technologically improved fixed-point defecation can largely be owed to on-site sanitation facilities such as pit latrines with about 70 percent of the population using some variation. Now only 3 percent of the population lack a sanitation facility, and 5 percent use a nonimproved sanitation facility such as hanging latrine, bucket, or other type of nonimproved facility that does not flush to pit, septic tank, or sewerage system. Figure 3.1 gives access by absolute numbers of people and figure 3.2 gives the proportion with access by tiers.

Box 3.1: Long-Run Educational Impacts of Exposure to Poor Sanitation in Childhood

The study to examine whether in Bangladesh, exposure to poor sanitary environments during early childhood has an impact on the late enrollment of children in primary schools. Children living in communities with a large proportion of households that have unimproved sanitation facilities or practice open defecation tend to be more exposed to bacteriological or fecal pathogens, which in turn lead to poor nutritional outcomes and poor cognitive and early childhood development (Humphrey 2009; Spears and Lamba 2013). Several longitudinal studies have been undertaken on the long-term impact of nutrition outcomes on schooling attainment. It was found that low stature in childhood delayed enrollments in and years of school accomplished in Tanzania. Similar results were found for Uganda and other African countries and Guatemala (Alderman 2007; Alderman et al. 2001; Almond and Currie 2011; Glewwe and King 2001; Maluccio et al. 2009).

For the purposes of the analysis, the study utilized DHS data from 2014, 2011, 2007, and 2004, for which the location of the primary sampling units (PSUs) is available with some random error. We then conducted a probit regression, for which we found that an increase in the proportion of households with no toilets in the community during infancy reduces the likelihood of primary school enrollment among six year olds by about 11 percentage points. On the other hand, an increase in the proportion of households with no toilets and unimproved toilets reduces the likelihood of late enrolment by about 33 percentage points. Current sanitation conditions of the household and communities have only a limited effect on the late enrollment of children in primary schools. As expected, mothers' educational status and household wealth have a positive and significant effect on increasing the likelihood of enrollment.

For further verification, PSUs in 2014 and 2011 were ranked based on the share of households with no toilets and the share of households with unimproved toilets in 2007 and 2004. Twenty percent of PSUs were chosen from the top and bottom of the distribution, and a subset of households was chosen using matching techniques such that the matched households are similar in the other observable characteristics except for the level of sanitation at the community level in 2004. PSUs that had a high share of no toilets or unimproved toilets tend to have low enrollment rates among the six-year-old group. Specifically, for PSUs with a high share of no toilets in 2004, enrollment rates in 2001 were 15 percentage points lower among the six-year-old children when compared to PSUs with a low share of no toilets. Similarly, for PSUs with high share of unimproved toilets in 2004, enrollment rates in 2011 were 12 percentage points lower among the six-year-old

box continues next page

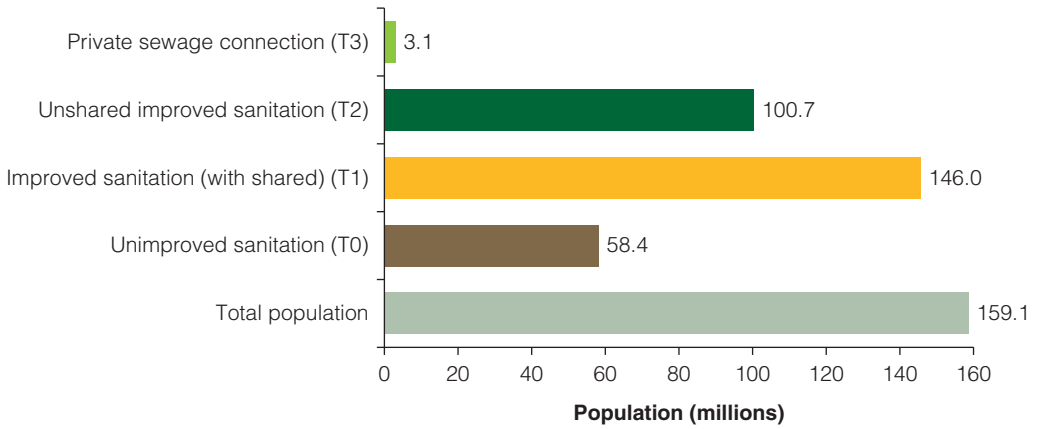
Box 3.1: Continued

children as compared to PSUs with a low share of no toilets. This analysis further highlights the influence of improved sanitation at the community level in the early years of childhood on educational outcomes in later years.

These findings reinforce the connection between WASH and educational outcomes, thereby placing added weight on the need for policy makers to address deficiencies in the sanitation sector. In particular, efforts should focus on ensuring access to toilets in the poorest households, considering the fact that household wealth has a significant impact on the likelihood of primary school enrollment. As results also demonstrate the impact of poor community level sanitation, a more holistic approach to area-wide sanitation is needed to bolster enrollment rates.

Source: Joseph, Olivier, and Chellaraj 2016.

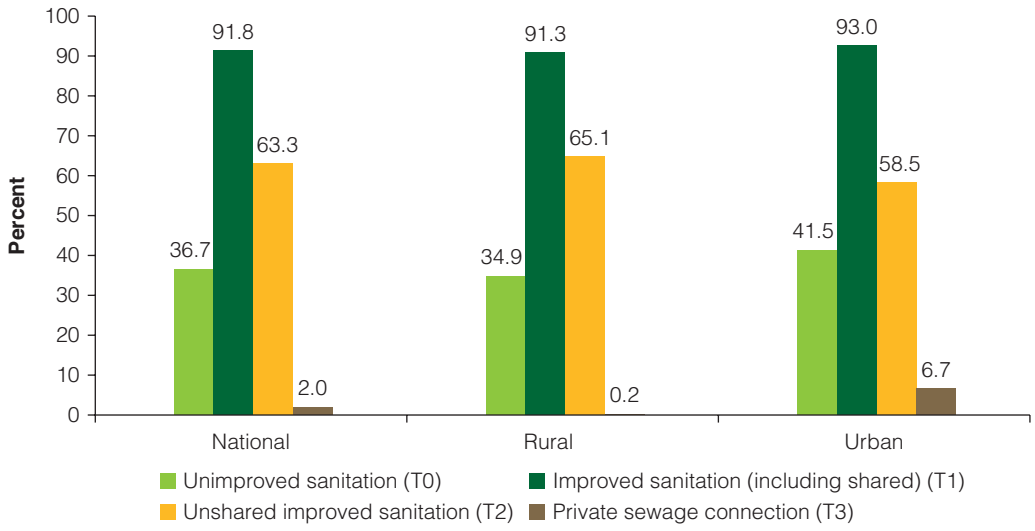
Figure 3.1: Absolute Number in Bangladesh with Access to Sanitation, by Tier, 2014



Sources: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016) and World Development Indicators (WDI) 2014 data (World Bank 2014).
Note: T0 = Tier 0: Use of unimproved sanitation technologies; T1 = Tier 1: Use of improved sanitation technologies including those that are shared; T2 = Tier 2: Use of improved sanitation technologies that are unshared between households; T3 = Tier 3: Use of improved sanitation technologies connected to sewer system. T0 and T2 will add to the total population as T0 includes improved sanitation that is shared.

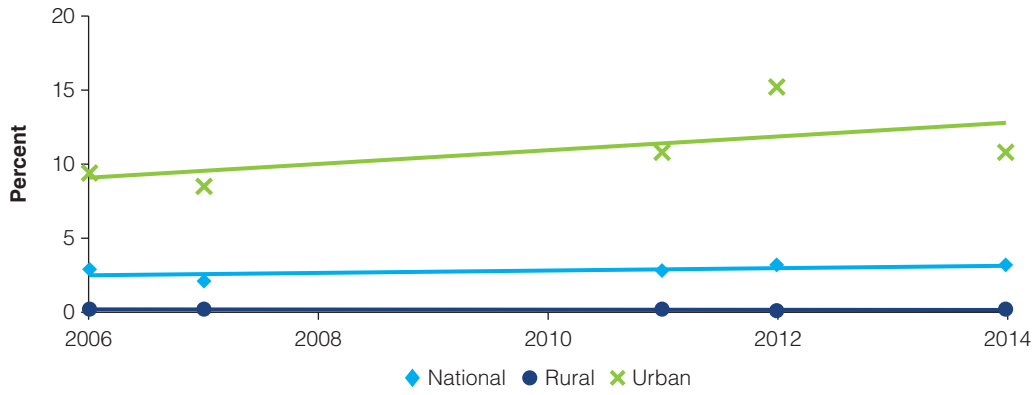
Nevertheless, Bangladesh failed to achieve the MDG sanitation target due to high sharing of improved sanitation facilities between households (figure 3.2). On this challenge, Bangladesh continues to struggle. Only 63 percent of people use improved, unshared sanitation facilities (tier 2). The lack of unshared improved sanitation is more of an issue in urban areas than rural areas most likely due to space constraints and high population density. In urban areas, only 58 percent of the population have unshared improved access, while in rural areas 65 percent have access. Moreover, the ratio of number of households to sanitation facilities in urban areas is higher. In urban areas, 43 percent of households that lack unshared sanitation, share their sanitation facility with over 5 households compared to just 12 percent of rural households. In crowded urban areas, guaranteeing an improved sanitation facility for every household might be infeasible, but it should be a priority to at least reduce the sharing ratio of sanitation.

Figure 3.2: Access to Sanitation in Bangladesh, by Tier, 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).
Note: T0 = Tier 0: Use of unimproved sanitation technologies; T1 = Tier 1: Use of improved sanitation technologies including those that are shared; T2 = Tier 2: Use of improved sanitation technologies that are unshared between households; T3 = Tier 3: Use of improved sanitation technologies connected to sewer system.

Figure 3.3: Access to Private Sewage Connection in Bangladesh, 2006–14



Source: World Bank calculations using Demographic and Health Survey (DHS) 2004, 2007, 2011, and 2014 data (NIPORT, Mitra and Associates, and ORC Macro 2005; NIPORT, Mitra and Associates, and Macro International 2009; NIPORT, Mitra and Associates, and ICF International 2013; NIPORT, Mitra and Associates, and ICF International 2016).

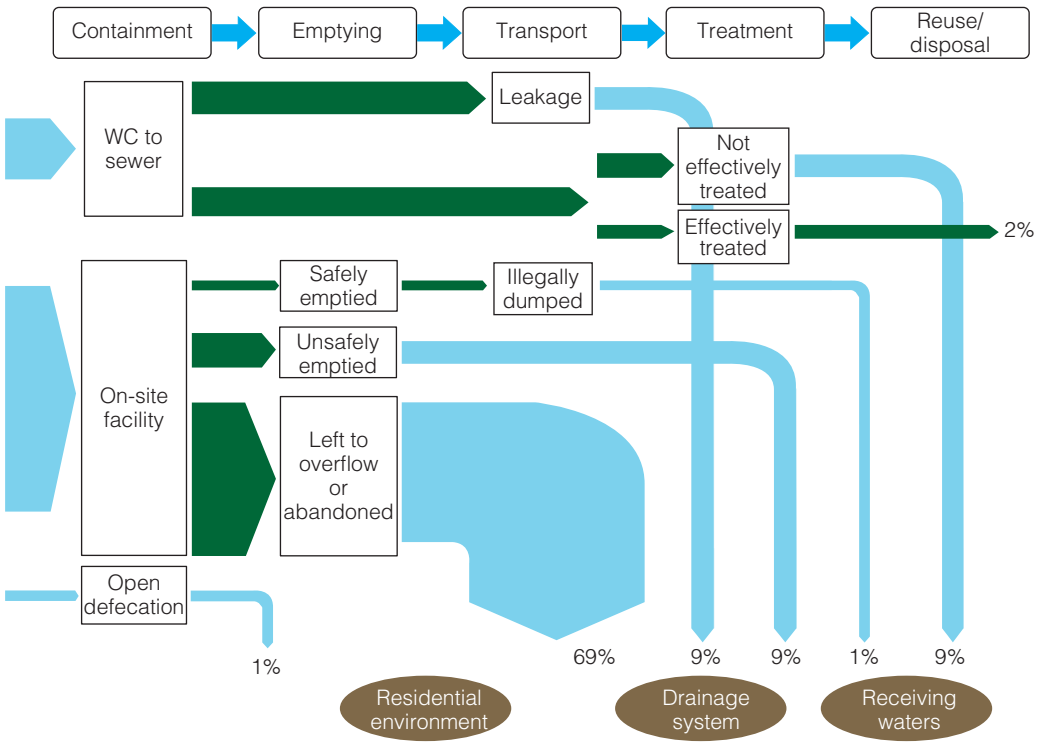
Only 2 percent of the national population have access to a private sanitation facility that is connected to a sewage system (tier 4) (figure 3.2). Further, there have been modest increases in the overall sewage connection rate over nearly a decade (figure 3.3). As expected, in urban areas this figure is higher at 7 percent and is less than 1 percent in rural areas. Connecting to sewer systems is certainly impractical for many areas of Bangladesh due to space constraints, but there is still a large gap in this service from city corporation Water and Sanitation Sewerage Authority (WASA). The new sanitation Master Plan by Dhaka WASA is striving to make improvements in sewerage services by building new consulates for sewerage delegation, improved coordination between jurisdictions, and encouraging more residents that are in sewerage catchments to connect to the system.

Fecal Sludge Management—A Missing Necessity

At least 75 percent of the population use a sanitation facility that is some variation of a pit latrine, and other 12 percent are connected to a septic system, indicating that there is need for regular on-site fecal sludge management (FSM) and systematic monitoring of FSM practices. There is no available nationally representative household data on on-site FSM, such as information on pit or septic tank emptying practices or waste disposal and treatment. Regular pit or septic tank emptying is vital for sustainability of sanitation facilities, and proper waste disposal and treatment is necessary to protect the environment from human fecal pollution. The high *E. coli* contamination of improved water sources is indicative that the environment is highly polluted with *E. coli*. Whether this *E. coli* is coming from human or animal fecal matter is unknown, but improved FSM practices can most likely reduce environmental contamination. Collecting household data on fecal sludge management practices should be stressed for Sustainable Development Goal (SDG) monitoring.

Waste and sewage raises special problems in densely populated cities. Urban sewage systems should safely process and dispose of sludge, but they connect to only a small minority of houses and apartment buildings. About 11 percent of the urban population are connected to a sewer system (regardless of sharing status), but small-scale studies on urban fecal sludge management find that only a small portion of sewage is being centrally treated before being disposed into water bodies. In Dhaka city, for instance, about 20 percent of the population are served by sewage systems, official data show, though that figure overstates sewage systems' significance because the networks often malfunction and fail to treat sludge. The high prevalence of on-site sanitation also needs to be ensured to have proper fecal sludge management. One study estimates that only 2 percent of the human excreta in the city is safely managed; the rest is discharged into open water (Blackett, Hawkins, and Heymans 2014). The study estimates that nearly 80 percent of fecal sludge from on-site facilities is not being properly managed (figure 3.4).

Figure 3.4: Fecal Flow in Dhaka, 2014



Source: Blackett, Hawkins, and Heymans 2014.
Note: WC = waste collection.

This situation is not unique to Dhaka and is most likely representative of other cities in Bangladesh. A fecal flow study was also carried out in Khulna, and it was estimated that nearly zero percent of the human excreta was safely managed (Gunawan, Schoebitz, and Strande 2015). SNV Netherlands Development Organisation conducted a baseline survey in Khulna, Kushtia, and Jhenaidah in 2014. The study finds that most households have access to a latrine or toilet, but that safe emptying and conveyance of fecal sludge is low in all three cities (Kabir and Salahuddin 2014).

Hygiene—A New Priority for the SDGs

Currently, the SDGs plan to monitor only access to handwashing stations in households, but there are aspects of hygiene that should also be considered. This section provides an assessment on hygiene behaviors including household handwashing, child feces disposal, and MHM. In most cases, data on behaviors can be limited due to self-reporting or observational biases, but such data can be useful for designing and targeting hygiene promotion interventions. Formal education levels of household heads or caregivers is known to be one of the main drivers of good hygiene, but targeting specific hygiene messages can also improve behaviors.

Handwashing

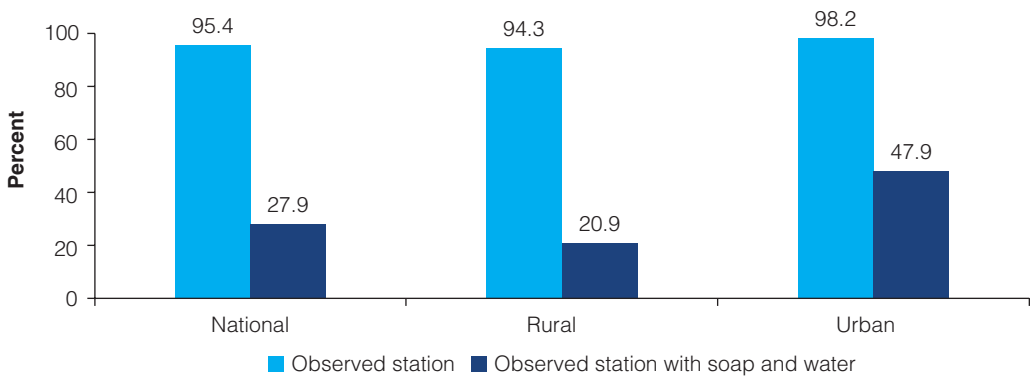
Basic hygiene practices are a first defense mechanism against exposure to fecal pathogens and disease-carrying agents. Too often, fundamental behaviors of hygiene are lacking. Studies in Bangladesh have shown that washing hands with soap can significantly reduce the incidence of diarrhea in children under five (Biswas et al. 2017). There is major and very cost-effective potential for health gains through promoting good hygiene practices. Calculations show that a US$3.35 per disability-adjusted life year (DALY)[1] loss is averted from hygiene promotion, compared to US$11.15 per DALY loss averted due to a sanitation intervention, and more expensive options such as oral hydration therapy and immunization (Mara et al. 2010). Yet most people lack a designated place for handwashing in the household with the required water and soap. Only 28 percent nationally have access to a handwashing station with soap and water. There are major urban-rural gaps in this indicator: about 48 percent of urban residents have a handwashing station with water and soap compared to only 21 percent of rural residents (figure 3.5). The reasons could be differences in awareness of proper handwashing practices or simply the cost and availability of soap. Moreover, the majority of handwashing stations are not located inside the dwelling, which is not convenient for regular handwashing (figure 3.6).

Only about half of children's caregivers were found to wash both hands with both soap and water. Surveys have also found major gaps in people's perceptions of when and how they should wash their hands. A 2014 study found that the most common time mentioned (70 percent of respondents cited it) was after defecation. The least-mentioned time was after cleaning up from a baby's defecation (figure 3.7). Figure 3.8 offers data on how caregivers wash their hands.

Child Feces Disposal

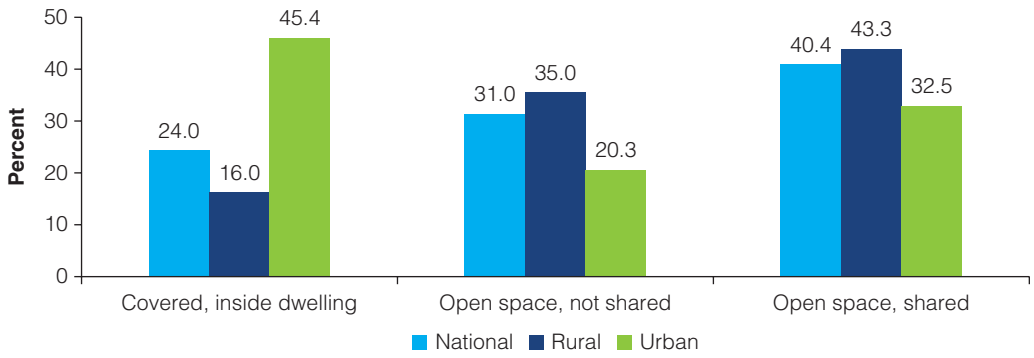
Disposal of child feces, which needs to go into a toilet or latrine, was another area of lax practice (figure 3.9). In 20 percent of households, this waste was thrown into a drain or a ditch, while in 19 percent of them, it was simply left in the open. Altogether, about 60 percent of children aged two or below in Bangladesh live in households that do not have safe practices in this regard. Unsafe child feces disposal is particularly common in rural areas (33 percent urban compared to 60 percent rural). The most common unsafe practice is to put or rinse a child's feces into a drain or ditch (20 percent), followed by being left in the open (19 percent) and thrown into garbage or solid waste (14 percent).

Figure 3.5: Access to Handwashing Station with Soap and Water in Bangladesh, 2014



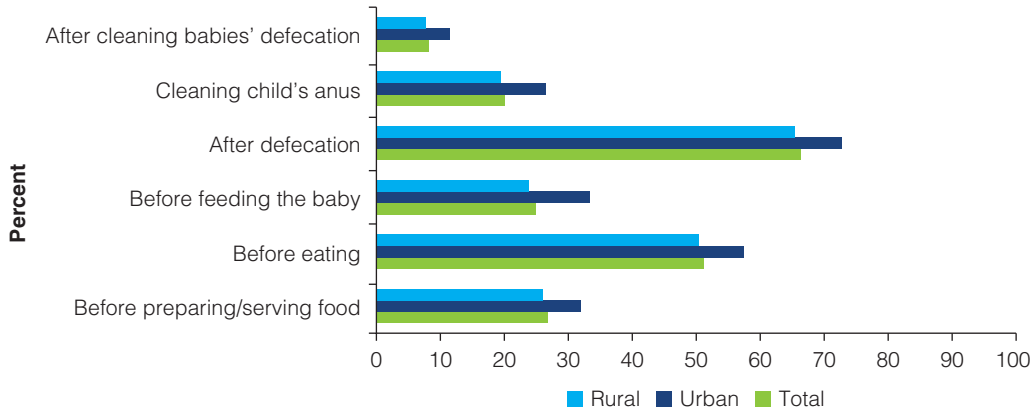
Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).

Figure 3.6: Access to Handwashing Stations by Location in Bangladesh, 2014



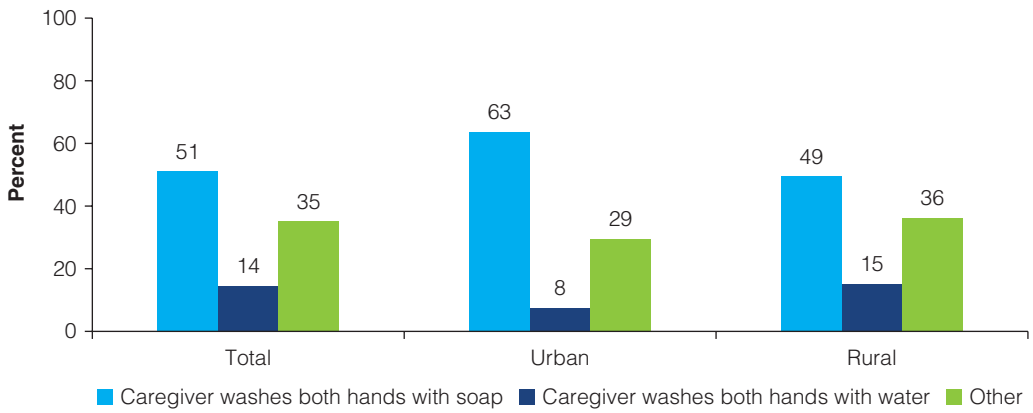
Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).

Figure 3.7: Caregiver Knowledge in Bangladesh of Handwashing at Critical Times, 2014



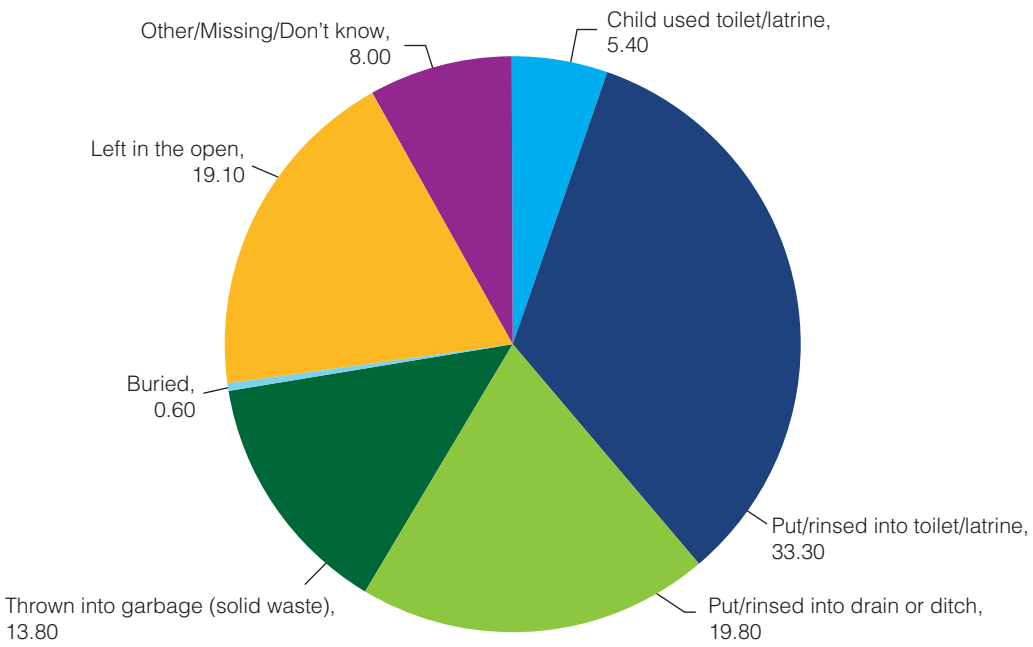
Source: World Bank calculations using National Hygiene Baseline Survey (NHBS) 2014 data (ICDDRB, WaterAid Bangladesh, Local Government Division 2014).

Figure 3.8: Caregiver Handwashing Practices in Bangladesh, 2014



Source: World Bank calculations using National Hygiene Baseline Survey (NHBS) 2014 data (ICDDRB, WaterAid Bangladesh, Local Government Division 2014).

Figure 3.9: Child Feces Disposal Practices in Bangladesh, 2013

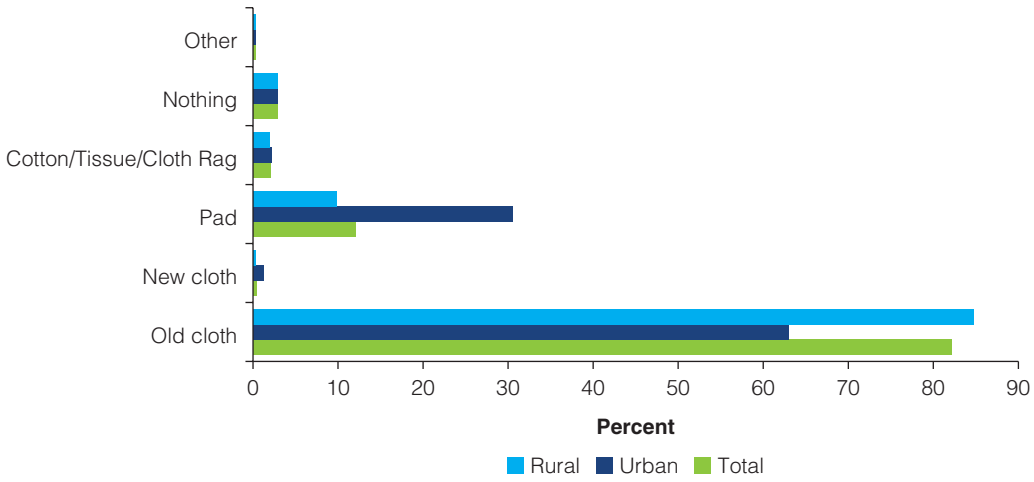


Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).

Menstrual Hygiene Management

One of the most ignored aspects of household hygiene is management of menstrual materials, but good MHM[2] practices can have a significant impact on women's health and human capital since times of menstruation can prevent some women from attending school or working. There are many different dimensions of MHM, including access to private facilities, use of clean materials, washing, disposal of materials, and access to basic information about

Figure 3.10: Use of Menstrual Materials, in Bangladesh, by Type, 2014



Source: World Bank calculation using National Hygiene Baseline Survey (NHBS) 2014 data (ICDDRB, WaterAid Bangladesh, Local Government Division 2014).

menstruation. However, indicators on these dimensions are rarely or at all collected in household surveys in Bangladesh and globally. In Bangladesh, this analysis finds that only 23 percent of women use appropriate menstrual materials (figure 3.10). Many repeatedly use cloths that are not adequately washed and dried between uses. This is an overlooked path by which bacteria might affect women's health through incidence of urinary tract infections or other complications.

Having basic knowledge on how menstruation works, the health risks, and how to care for oneself during menstruation can influence good MHM practices. Generally, surveys have found high levels of social misunderstanding about menstruation. About 74 percent of students, for instance, think that activities such as going out, cooking, and eating certain types of food are forbidden during menstruation. Moreover, a quarter of females report missing school when they are menstruating. Currently, only 6 percent of schools even provide education on MHM, and only 36 percent of women had prior knowledge about menstruation before their first period.

Notes

1. DALYs are a common health metric that combines both the years of life lost (YLL) due to a particular cause or risk factor as well as the years lived with disability. A single DALY can be considered as one year of healthy life lost.
2. According to the JMP, adequate MHM facilities provide privacy for changing materials and for washing hands, private parts, and clothes with soap and water; include access to water and soap within a place that provides an adequate level of privacy for washing stains from clothes and drying reusable menstrual materials; include disposal facilities for used menstrual materials (from collection point to final disposal).

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Chapter 4
Inequities in WASH Access

Main Points

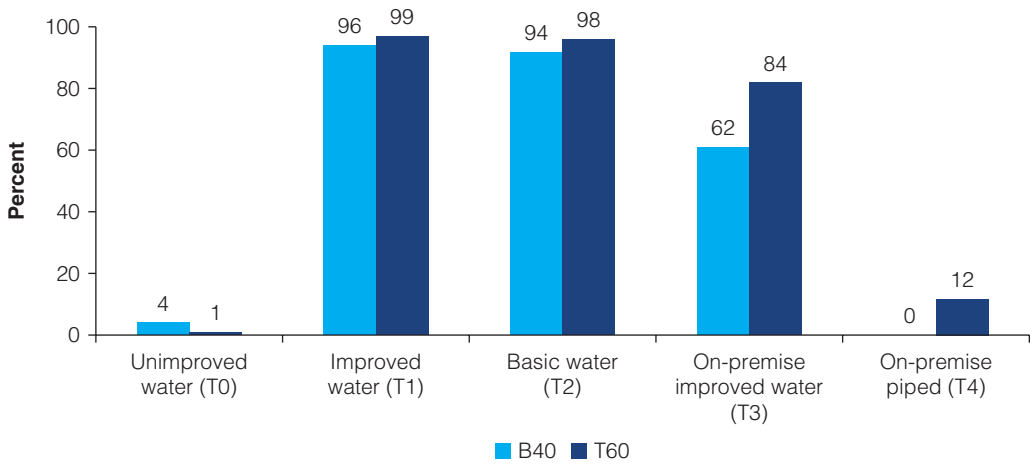
- **In terms of access, those residing in the bottom 40 percent (B40) of the wealth distribution almost always fare worse than those in the top 60 percent (T60).** The poor are more likely to rely on water from unimproved sources, share sanitation facilities, and lack basic hygiene.
- **Household wealth is the biggest determinant of inequality in children's access to all types of improved water and improved, unshared sanitation.** Using the Human Opportunity Index (HOI), it is found that wealth explains 70 percent of the inequality experienced in access to improved water, and 75 percent of inequality in access to improved, unshared sanitation.
- **Salinity is a major water quality issue in coastal areas, particularly for the poor.** Results from our survey in three *upazila* (subdistricts) located in coastal regions vulnerable to salinity intrusion suggest that poorer areas are less likely to have access to the infrastructure needed to circumvent salinity, namely deep tube wells and tap water.
- **When mapping access to water and sanitation, we find that many highly urbanized districts are in need of special attention.** When taking population into account, it is found that many highly urbanized districts feature severe deficiencies in water and sanitation access. For instance, despite high coverage, many districts in Dhaka have a high number of people without access to improved water and sanitation infrastructure.
- **Within urban areas, slum dwellers are more poorly served than other residents.** Only 13 percent of households in the slums of Bangladesh's five largest cities (city corporations) have their own sanitation facilities. It is common, in fact, for 10 households to share a single facility. Moreover, the "urban advantage" seems to be gone for slum dwellers. Children living in slums are 1.5 times more likely to be stunted compared to children living in other urban areas.

Bottom 40 versus Top 60—An Unequal Distribution of WASH Services

The numbers in aggregate are good among tiers of water supply, sanitation, and hygiene (WASH) service, but analysis by wealth group shows serious disparities. In all four tiers of water infrastructure access, three tiers of sanitation infrastructure access, and various hygiene practices, the B40 does worse than the T60. The poor are consistently more likely to rely on

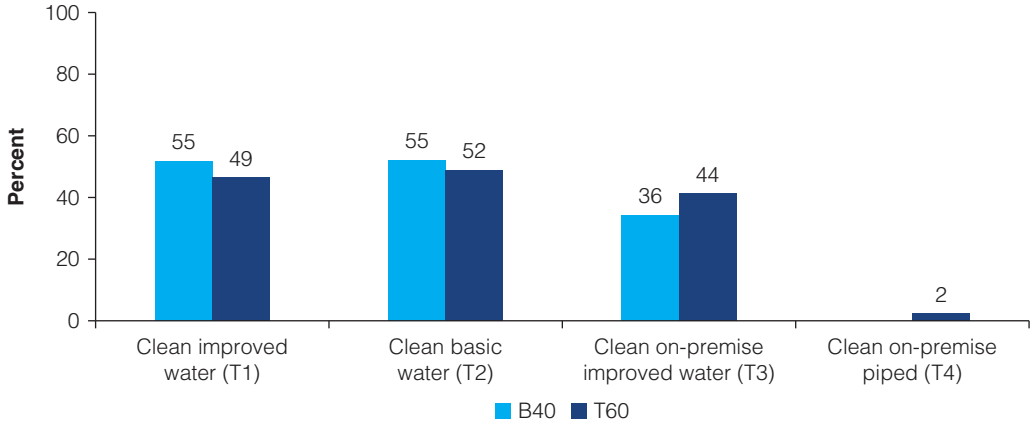
water from unimproved sources, share sanitation, and lack basic hygiene. Only clean water access did not present clear trends of inequality, and the rich actually had lower access to clean improved water. However, this is most likely due to the high contamination rate of on-premised piped water and its exclusive access to the rich. Figures 4.1, 4.2, 4.3, and 4.4 show disparities between the B40 and T60 in water infrastructure access, clean water access, sanitation infrastructure access, and hygiene practices, respectively.

Figure 4.1: Access to Water Infrastructure in Bangladesh, by B40 and T60, 2014



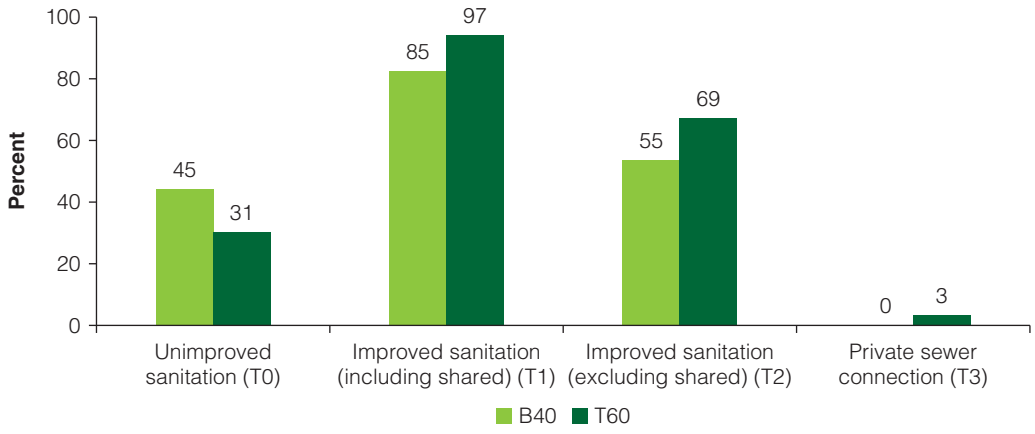
Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).
Note: B40 = bottom 40 percent; T60 = top 60 percent; T0 = Tier 0: Use of unimproved water technologies; T1 = Tier 1: Use of improved water technologies; T2 = Tier 2: Use of improved water technologies within 30 minutes of access; T3 = Tier 3: Use of improved water technologies available on household premises; T4 = Tier 4: Use of piped water supply available on household premises.

Figure 4.2: Access to Clean Water in Bangladesh, by B40 and T60, 2013 and 2014



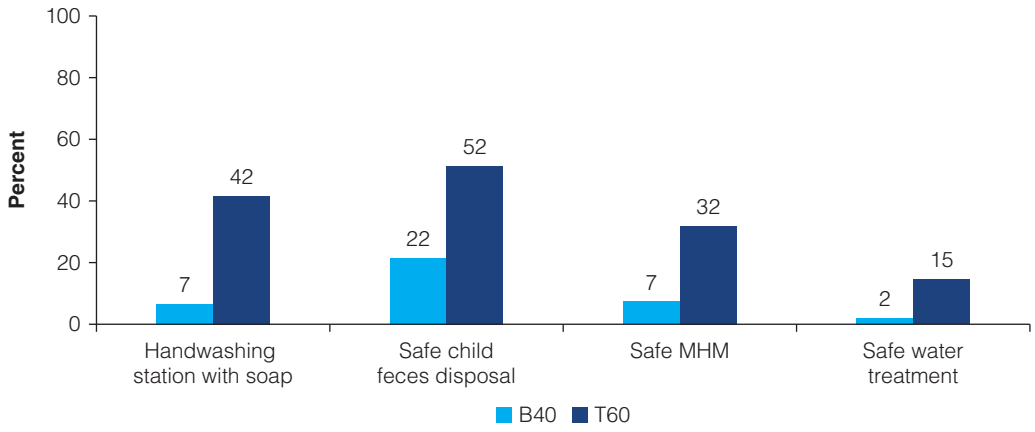
Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016) and Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: B40 = bottom 40 percent; T60 = top 60 percent; T0 = Tier 0: Use of unimproved water technologies; T1 = Tier 1: Use of improved water technologies; T2 = Tier 2: Use of improved water technologies within 30 minutes of access; T3 = Tier 3: Use of improved water technologies available on household premises; Tier 4: T4 = Use of piped water supply available on household premises. Clean water implies that water is free of *E. coli* and arsenic, 50 parts per billion.

Figure 4.3: Access to Sanitation Infrastructure in Bangladesh, by B40 and T60, 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).
Note: B40 = bottom 40 percent; T60 = top 60 percent. T0 = Tier 0: Use of unimproved sanitation technologies; T1 = Tier 1: Use of improved sanitation technologies including those that are shared; T2 = Tier 2: Use of improved sanitation technologies that are unshared between households; T3 = Tier 3: Use of improved sanitation technologies connected to sewer system.

Figure 4.4: Hygiene Behaviors in Bangladesh, by B40 and T60, 2013 and 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016); Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015); and National Hygiene Baseline Survey 2014 data (ICDDRB, WaterAid Bangladesh, Local Government Division 2014).
Note: B40 = bottom 40 percent; MHM = menstrual hygiene management; T60 = top 60 percent.

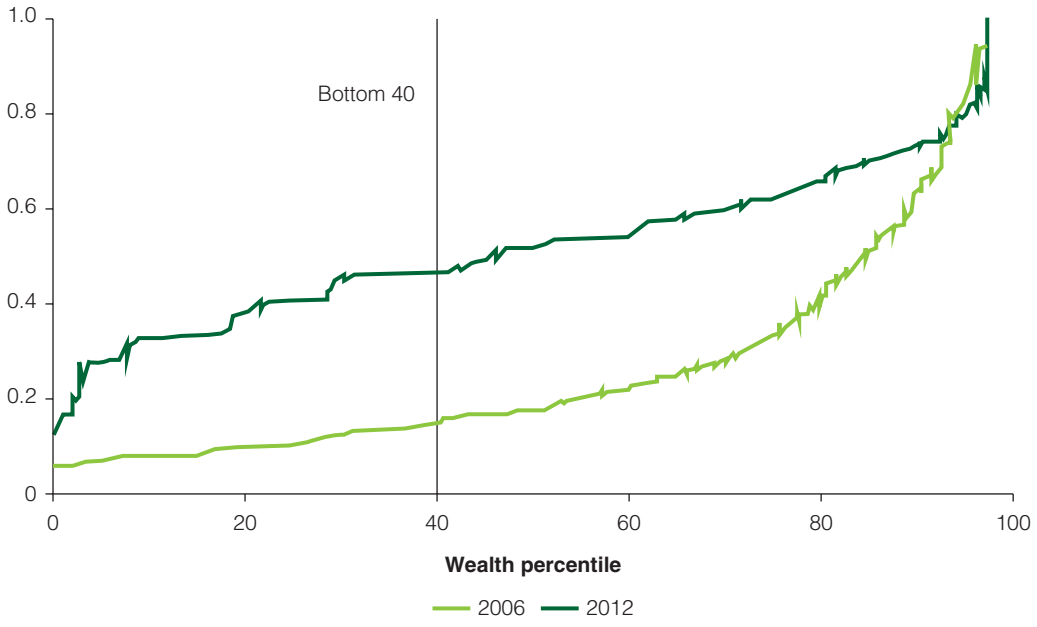
Using HOI analysis,[1] the study also shows that wealth is the biggest determinant of inequality in access by children to all types of improved water, explaining more than 70 percent of the difference. Concerning improved water direct to the home, the number rises to 75 percent. As with access to improved water by children, wealth has the biggest impact—a full 75 percent—in explaining why a child lacks access to improved, unshared sanitation.

Moreover, the B40 are not being served clean water and improved sanitation across the majority of districts. To compare the relative service delivery performance of districts with one another, districts are classified into low-, mid-, and high-performing groups based on

their coverage levels of clean improved water and improved sanitation access. To be considered a high-performing district, the district has to have good performance in both clean improved water and improved sanitation (i.e., higher than the national average), and to be considered a mid-performing district, the district has to have only good performance in just one area. Low-performing districts have poor relative performance in both areas. Map 4.4 shoes district performance for serving the total population, while maps 4.5 and 4.6 distinguish performance by B40 and T60 populations within districts. Overall, when it comes to serving the T60, the majority of districts can be classified as high- or mid-performing (map 4.6). However, only three out the 64 districts can be classified as high performing when considering access among the B40 (map 4.7). This shows that poorer households need to be targeted within districtwide water supply, sanitation, and hygiene (WASH) policy and planning, identified by the appropriate local government institutions (LGIs).

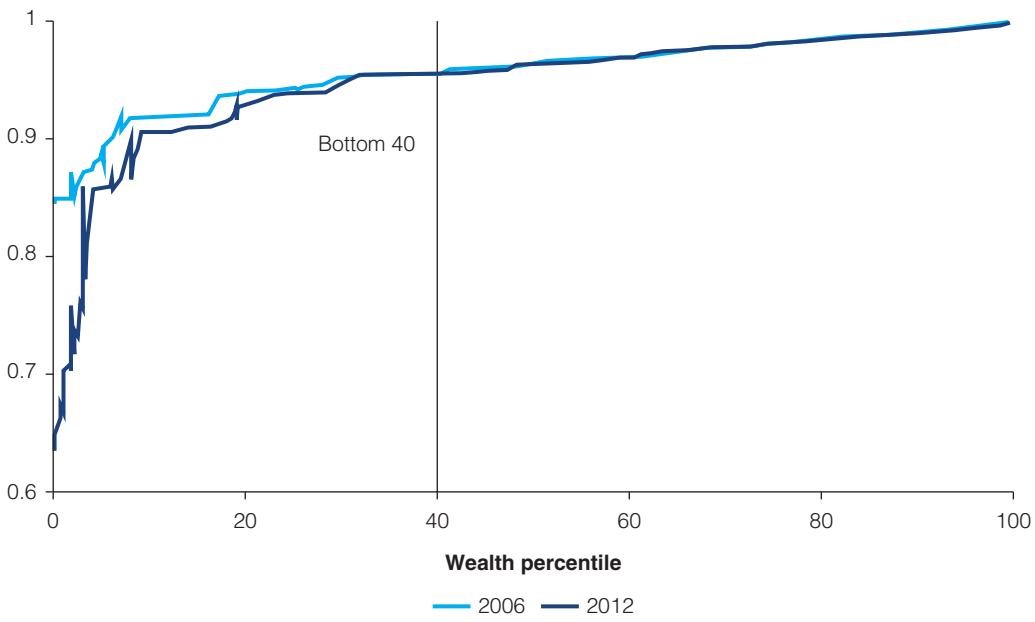
Has expansion in WASH access been pro-poor? The following locally weighted smoothed scatterplots (figures 4.5 and 4.6) depict the segments of the asset distribution as measured by asset percentiles, benefited from the expansion of improved water supply and sanitation between 2006 and 2012. Between 2006 and 2012, access to improved water within 30 minutes increased from 90 percent to 96 percent, while that of unshared improved sanitation increased from 28 percent to 56 percent. As for water, the level of access was quite high even for the bottom 20 (B20) percent of the distribution in 2006, but in 2012, there was a marginal but discernible drop in access for the extreme poor. As for sanitation, the significant jump observed between 2006 and 2012 was distributed largely uniformly, especially from the bottom 15 percentile to about around 80 percentile of the asset distribution. The improvement in sanitation experienced by Bangladesh during this period—through a combination of a community-led total sanitation (CLTS) campaign, sanitation marketing, mobilization at the grassroots level, and political leadership—might explain the higher reach to the poorer and vulnerable populations.

Figure 4.5: Incidence of Improved Sanitation in Bangladesh, 2006–12



Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2006 and 2013 data (UNICEF and BBS 2007; 2015).

Figure 4.6: Incidence of Improved Water in Bangladesh, 2006–12



Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2006 and 2013 data (UNICEF and BBS 2007; 2015).

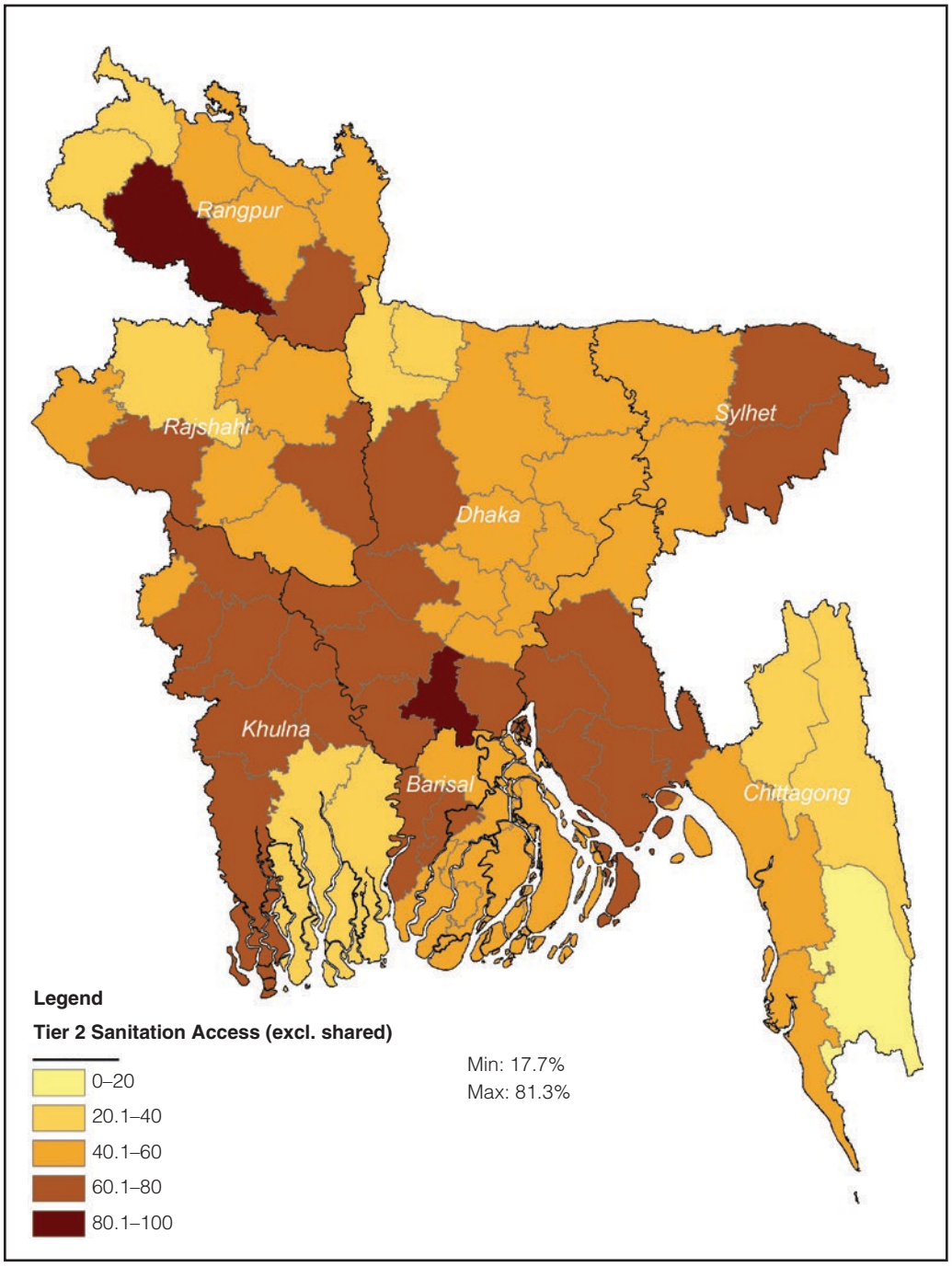
Remote Regions–Delivering WASH to Hard-to-Reach Areas

General disparities in access level also exist between geographical regions, particularly the Chittagong Hill Tracts (maps 4.1–4.3). In general, districts in the southeast fare worse than the rest of the country in terms of infrastructural access to improved water and sanitation. A part of the Chittagong Hill Tracts, the mountainous and sparsely populated district of Bandarban ranks as the country's most poorly served, with only 44 percent of its people having access to technologically improved water sources. When considering those with access within 30 minutes, that number drops to 38 percent. Bandarban also has a relatively high open defecation rate at nearly 60 percent. According to poverty estimates in 2010, about 40 percent of people in Bandarban live under the national poverty line (Jolliffe et al. 2013). The Chittagong Hill Tracts region is also home to a number of ethnic minorities and a growing population of Rohingya refugees.

Coastal and Disaster-Prone Regions–Unique Climate-Related Barriers for Sustainable WASH

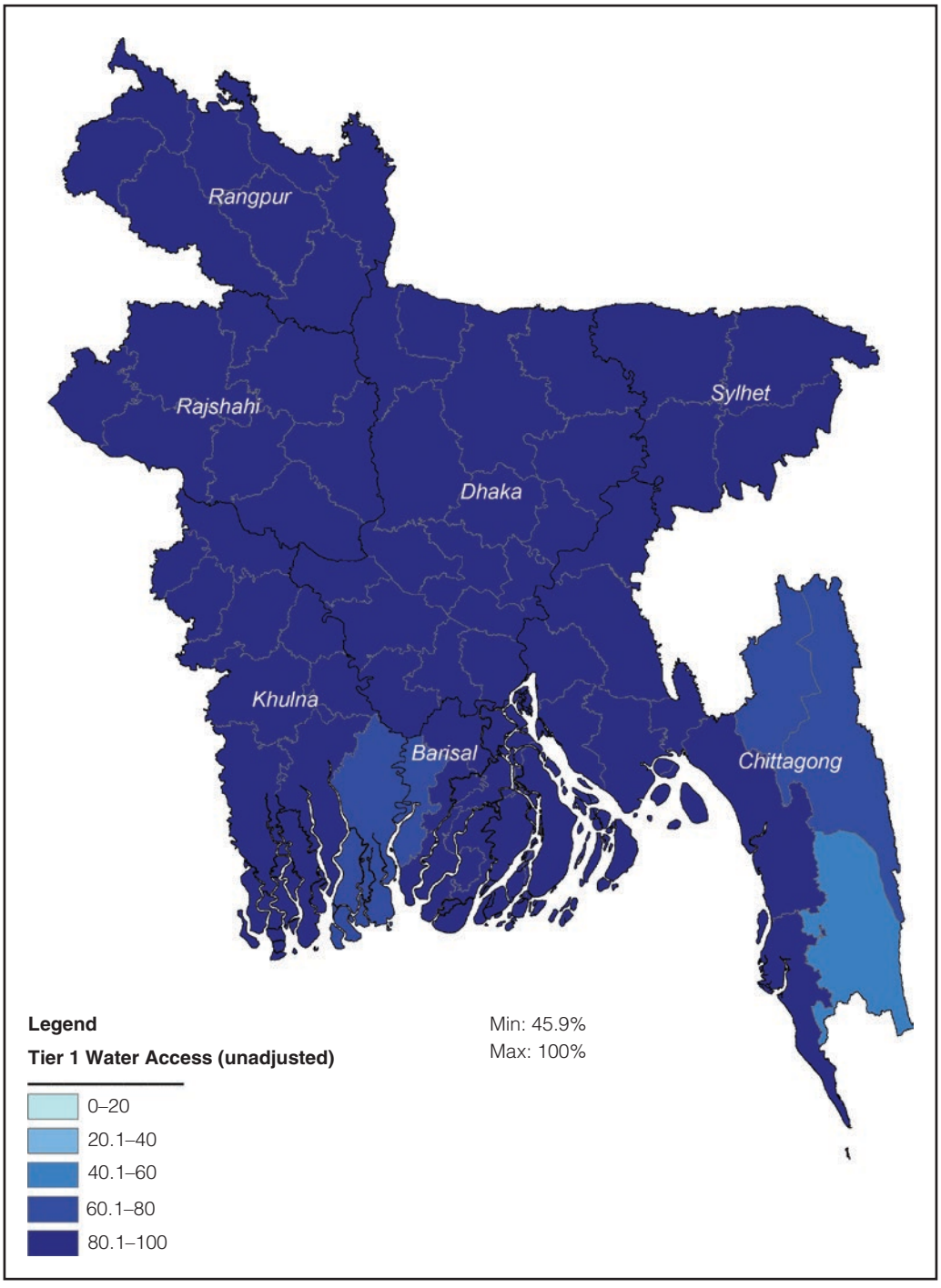
Geographical disparities in improved water access also correspond to districts that are disaster-prone or vulnerable to climate change. Bangladesh stands on the front line of climate change—about two-thirds of its land area is less than 5 meters above sea level. Already troubling signs have emerged in the country, as seawater surges progressively further inland, leaving coatings of salt when it recedes. While these trends have grave long-term implications for flooding and damage to agriculture, they also pose a less-examined threat to water supply through salinity intrusion (Dasgupta et al. 2015; Rabbani, Rahman, and Mainuddin 2013). The sources and mechanisms of high salinity in coastal shallow groundwater are not well understood, but

Map 4.1: Share of Coverage of Access to Improved Sanitation (Excluding Shared), by District, Bangladesh, 2013



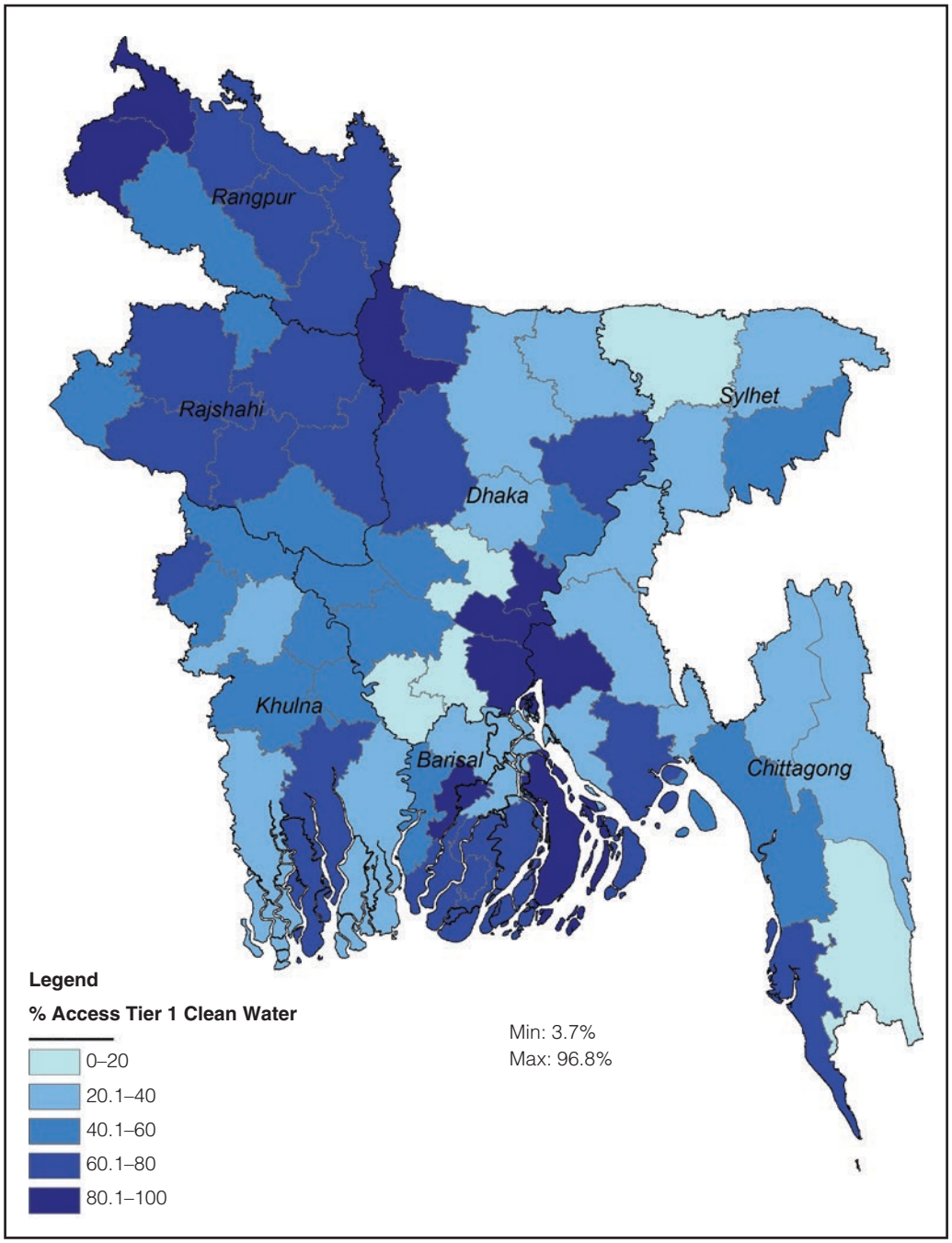
Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: Tier 2 Sanitation includes use of improved sanitation facilities that are unshared.

Map 4.2: Share of Coverage of Improved Water (Tier 1), by District, Bangladesh, 2013



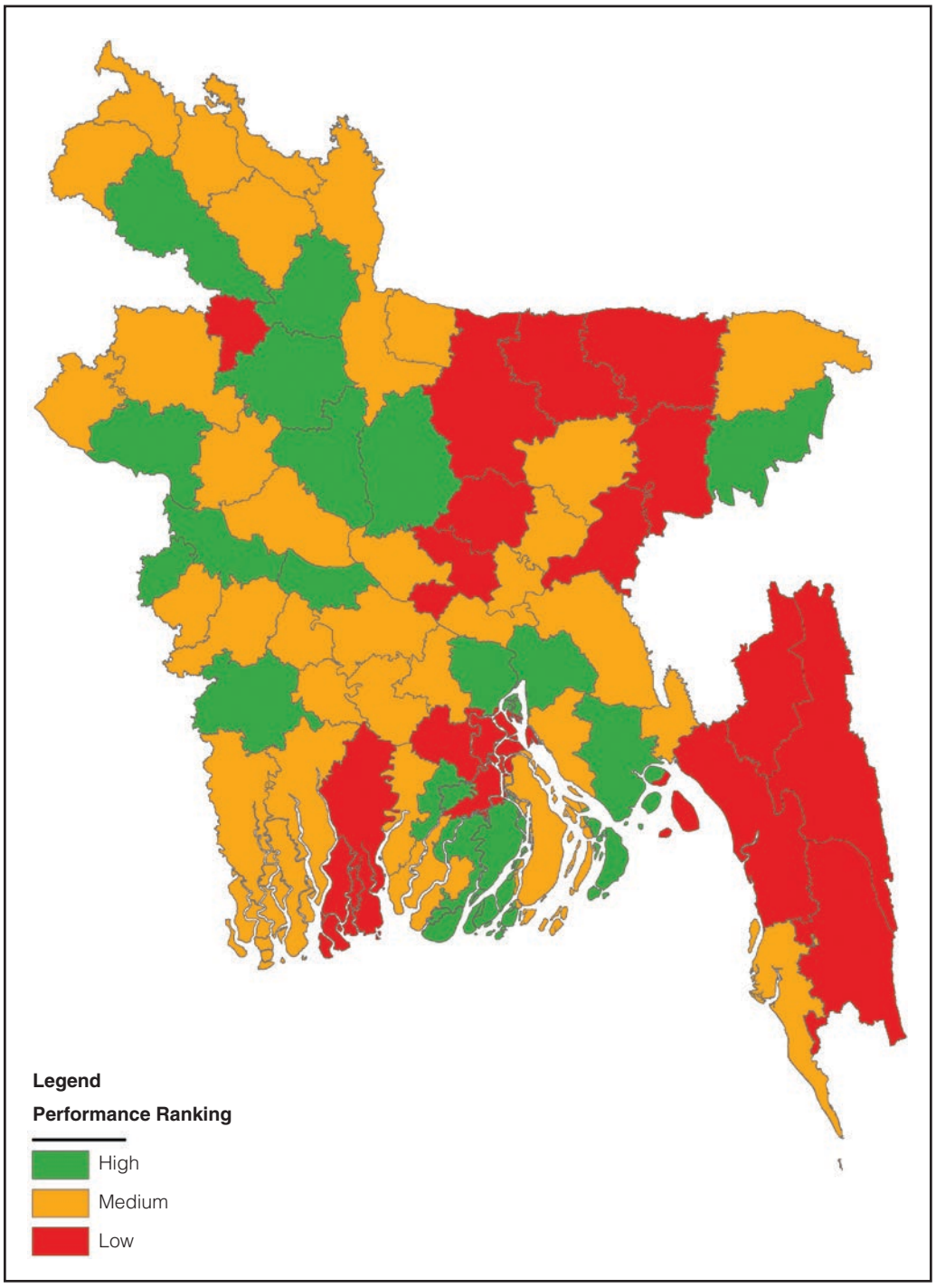
Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: Tier 1 water includes use of improved water technologies for main drinking source.

Map 4.3: Share of Coverage of Clean Improved Water, by District, Bangladesh, 2013



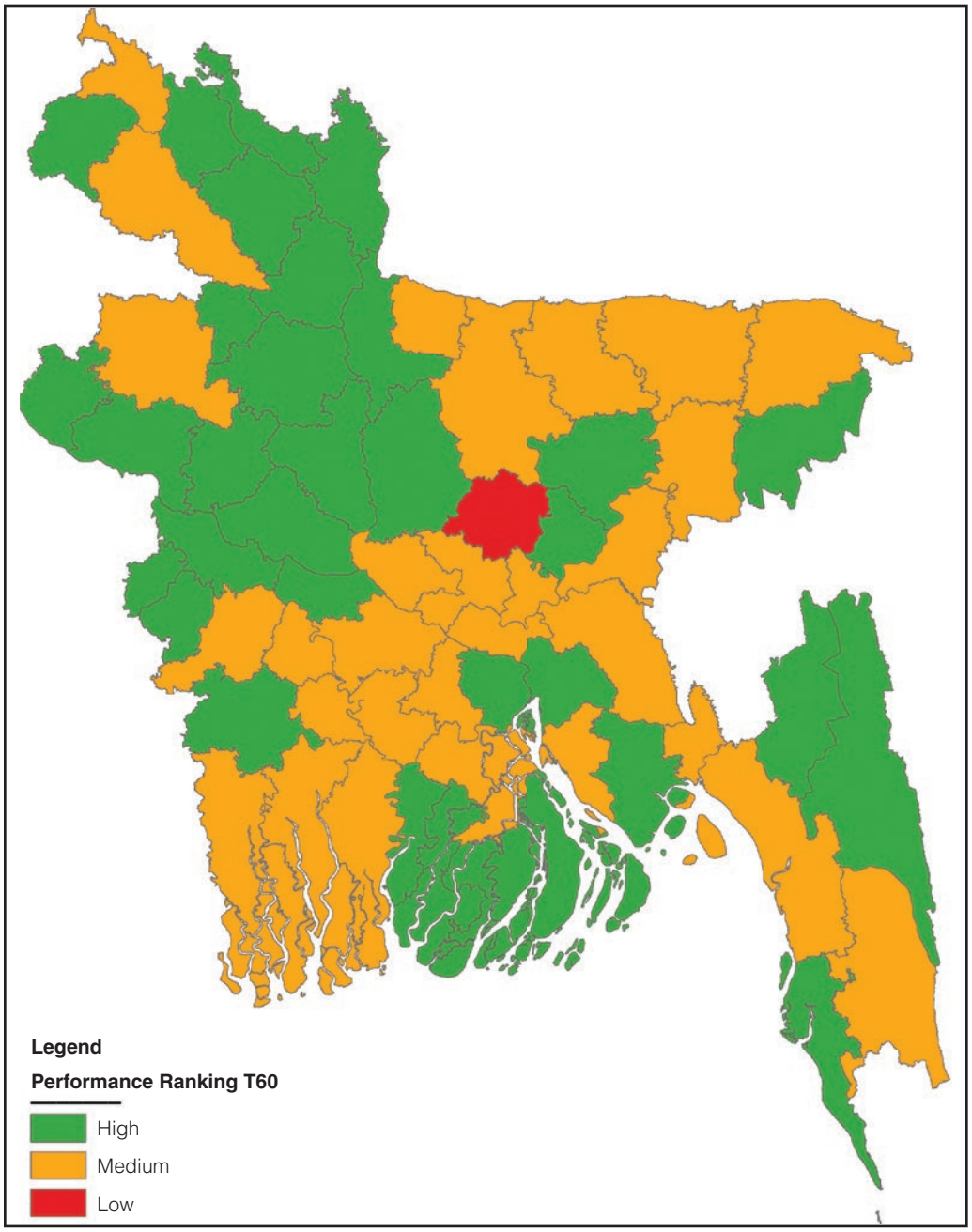
Source: World Bank calculation using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: Tier 1 Clean Water includes use of improved water technologies for main drinking source and adjusted for fecal and arsenic contamination.

Map 4.4: District Performance for Providing Clean Improved Water and Improved Sanitation to Total Population, Bangladesh, 2013



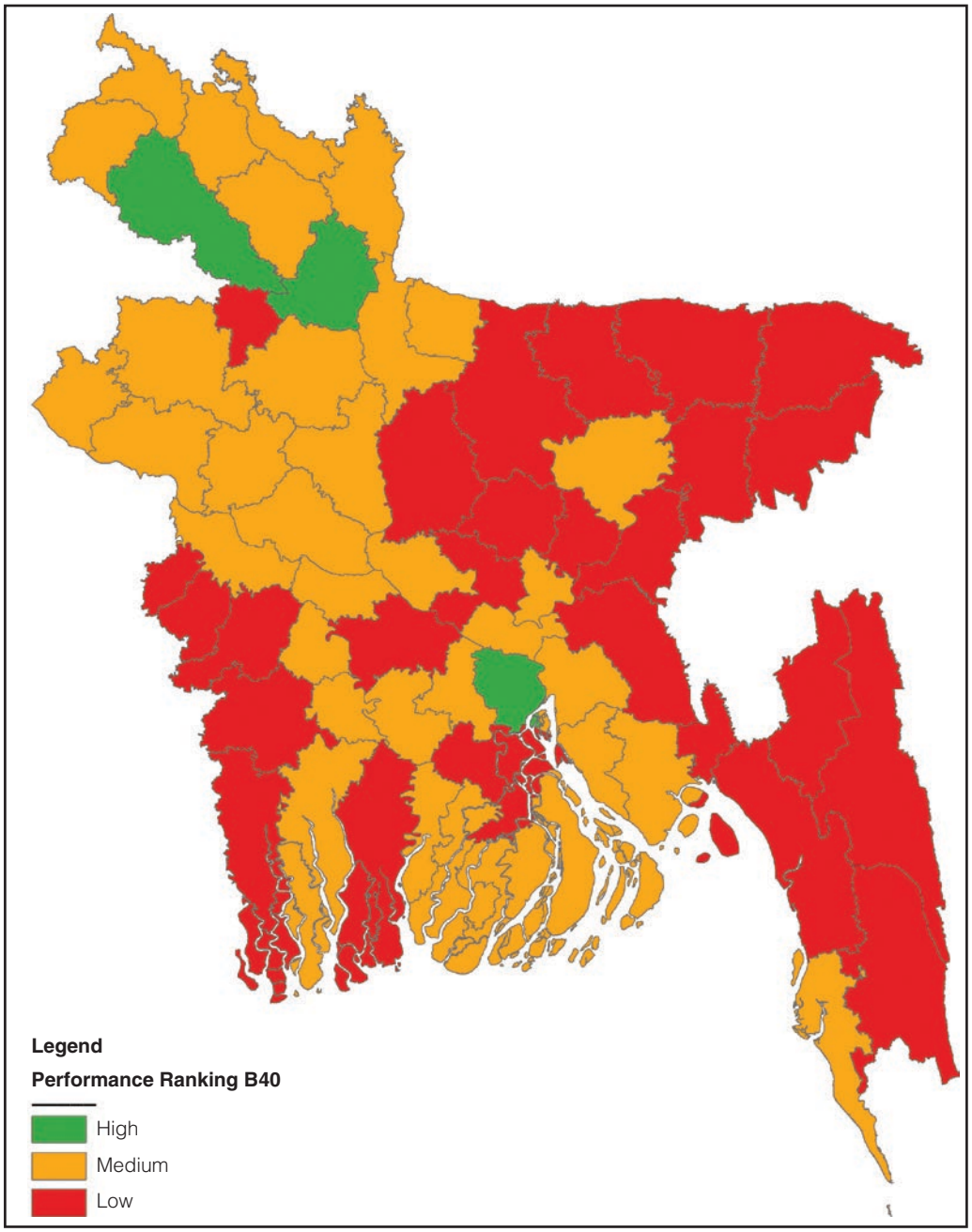
Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).

Map 4.5: District Performance for Providing Clean Improved Water and Improved Sanitation to T60 Population, Bangladesh, 2013



Source: World Bank calculation using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: T60 = top 60 percent of the population.

Map 4.6: District Performance for Providing Clean Improved Water and Improved Sanitation to B40 Population, Bangladesh, 2013



Source: World Bank calculation using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: B40 = bottom 40 percent of the population.

research to date suggests that sea level rise due to climate change will exacerbate groundwater salinity problems in coastal regions of Bangladesh (Talukder, Rutherford, and Chu 2015). This is of particular concern in a country where groundwater provides 95 percent of all drinking water (Das Gupta et al. 2005).

Studies suggest that the burden of rising salinity caused by climate change will fall disproportionately on the shoulders of the poor. One study found that in just the southwest coastal region, about 2.5 million poor (including 1.4 million extreme poor) are already suffering shortages of drinking water, scarcity of water for irrigation for dry-season agriculture, and significant changes in the coastal aquatic ecosystems. Researchers put together best- and worse-case scenarios for the situation in 2050. In the best case, the numbers of adversely affected would rise to 2.9 million poor and 1.7 million extremely poor. In the worst case, they would soar to 5.2 million poor and 3.2 million extremely poor (Dasgupta 2015; Dasgupta et al. 2014).

To avoid saline groundwater, Bangladeshis may resort to drawing water from unprotected sources of fresh water for drinking. Household surveys alone indicate that some districts in these coastal areas have access to improved water sources as low as 60 percent. BWPD implemented a survey of 1,500 households in three upazilas located in coastal regions vulnerable to salinity intrusion. People reported varying levels of salinity in their drinking water, and many felt that it had risen in recent years. Although, we found that those who had access to deep tube wells or tap water were less likely to report issues of salinity in their drinking water, which means this type of infrastructure could stay resilient to salinity changes. However, the study found that poorer areas in these coastal upazilas were less likely to have access to this type of infrastructure and thus reported more issues of salinity. Box 4.1 additionally shows how salinity can affect human development outcomes and summarizes an analysis examining the effects of salinity intrusion on school enrollment.

Apart from just salinity intrusion, households living in disaster-prone regions generally face issues of accessing improved water infrastructure during disasters. A survey carried out by the Government of Bangladesh (GoB) reports that 80 percent of households have felt affected by natural disaster (flood, water logging, cyclones, tornados, storm or tidal surges, river or coastal erosion, and salinity) within the past five years, and 14 percent of all households that had previously had an improved water source reported they did not have access to an improved water source during a disaster. This proportion of switching to unimproved water sources goes up to 30 percent in some areas, particularly areas in Chittagong, Barisal, and Sylhet divisions. Moreover, about 14 percent of all households reported suffering from a disease such as diarrhea, dysentery, fever due to the lack of access to good water. This number goes up to 35 percent in some areas of the country.

Box 4.1: Salinity, Water Collection Burden, and School Enrollment of Girls

Bangladesh has made significant achievements in increasing primary and secondary enrollment over the last 25 years, and attaining gender parity at these levels. Furthermore, girls have accomplished better results than boys in primary school completion rates and secondary school enrollment. However, at the postsecondary education levels, females' school enrollment is lower than that of males. Several reasons including early marriage, household responsibilities, and prevailing social norms are cited as the major reasons for females dropping out of school in later years. Domestic work is also a significant contributor—a number of studies in other

box continues next page

Box 4.1: Continued

countries find a negative effect of domestic work on females' schooling. In most low-income countries (LICs), including Bangladesh, the burden of collecting water falls on women—thus restricting their ability to stay in schools. While the impact of access to safe water and adequate sanitation on schooling has been studied in recent years, the impact of the burden of collecting water among children has been relatively unexplored. Information is even sparser for areas that contend with high levels of saline contamination—a major issue in coastal areas.

In response, using detailed household survey data from the Sundarbans in Bangladesh and West Bengal, collected as part of the World Bank Social Dimensions of Climate Change program (2011), the study examines whether greater salinity in water and the lack of access to quality water tend to have a gendered impact on children's schooling in these areas. In Bangladesh, the household survey of the Sundarbans has collected information from 2,144 households (9,799 household members). Like the rest of the populations in coastal areas in Bangladesh, the Sundarbans are affected by salinity intrusion and frequent natural disasters—such as cyclones and ocean surges—which make the drinking water sources such as surface water and shallow tube wells saline.

The impact of the increased burden of water collection on schooling was examined using a bivariate probit model. This revealed that girls in households affected by greater salinity in water in rivers and ponds are 11.8 percent less likely to attend school without being in charge of collecting water. They are also 5.3 percentage points more likely to be responsible for water collection while skipping school if salinity in rivers and ponds increases. Furthermore, girls with unimproved drinking water sources in the household are 10.2 percentage points less likely to focus on school attendance, although it is only significant at 10 percent. However, salinity in water and poor drinking water do not affect boys' probabilities. For girls, salinity in water and having unimproved drinking water sources also greatly increases the chance of being made responsible for water collection while not attending school. The gap with girls in households who have improved drinking water sources and do not experience salinity widens with age. Saline water and lack of access to improved water sources increase the chances of girls dropping out of school by age 16 and becoming responsible for collecting water by 33.7 percent, versus 15.9 percent if the water is not saline and the household uses improved water sources. In contrast, for boys, there is little difference among the households with different water quality and water source.

Altogether, this analysis indicates the importance of the provision of improved water to improve secondary education of girls—especially in areas where the poor quality of drinking water leads to girls being diverted to water collection from distance sources. Unless appropriate actions are taken to address shortcomings in salinity-prone areas, girls will continue to lag behind in education, and subsequently, in access to economic opportunities.

Source: Komatsu and Joseph 2016.

Urban Settings—The Disappearing 'Urban Advantage' for Delivering WASH Services

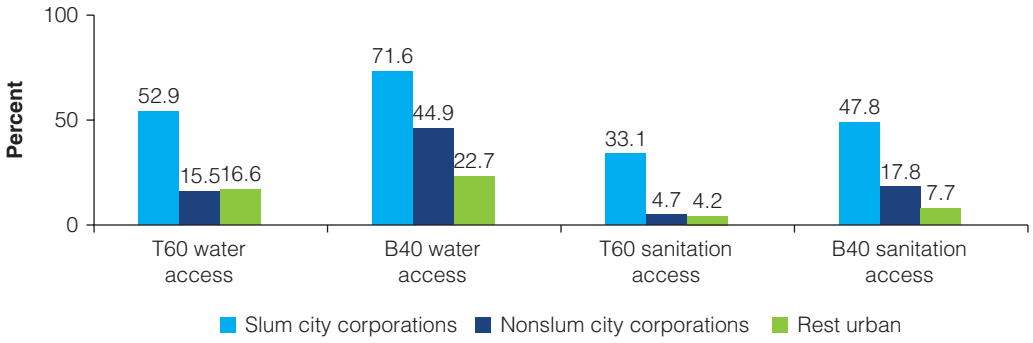
When taking population density into account, we find that many highly urbanized districts also need attention. For instance, many districts in Chittagong division exhibit low coverage for sanitation. When taking population density into account, it is evident that the absolute numbers of those without sanitation coverage in these districts are lower than that of many districts which boast higher sanitaiton coverage rates (e.g., Dhaka). Hence, policy makers must be cognizant of such disparities when targeting programming to raise clean water and sanitation coverage at the local levels.

Urban areas also face a number of safety dimensions of access such as water quality and shared sanitation. For instance, Dhaka is one of the well-served district in regard to simple water and sanitation infrastructure, but access levels to clean water and unshared sanitation are actually quite low. Access to clean improved water sources in Dhaka district is merely 8 percent, meaning that 92 percent of residents are drinking from contaminated water sources (primarily *E. coli*). The issue of contaminated water in Dhaka could be due to high environmental *E. coli* pollution from problems of sanitation as well as industrial pollutants (see box 2.4, chapter 2). Though most residents have access to improved sanitation infrastructure regardless of sharing status (93 percent), only 51 percent have access to unshared improved sanitation facilities. Generally, *E. coli* contamination of water sources was found to be worse in urban areas compared to rural areas. Moreover, in urban centers like Dhaka city, only 2≈percent of fecal sludge is estimated to be treated. Poor sanitation combined with high population density is problematic and increases the spread of fecal pathogens, which can lead to illness (Hathi et al. 2017).

The country's rapid urbanization has posed new challenges for delivering clean water and improved sanitation to city dwellers. Though the majority of Bangladesh's poor still live in rural areas, the absolute numbers there have been quickly declining as people move en masse to cities to find work, notably export sector jobs (Jolliffe et al. 2013). The migration is proceeding at such speed that the capital, Dhaka, is projected to become the world's sixth-largest city by 2030, with more than 27 million inhabitants (UN 2014). The growth is leaving authorities hard-pressed to incorporate the newcomers in an orderly, planned way. The result is the spontaneous generation of large slums, which by official count are today home to about 2.2 million people (BBS 2015). In addition to facing problems such as crowding, shabby housing, and air pollution, slum dwellers experience special challenges in getting access to improved water and sanitation. The cities' growth in population is consistently outstripping ability to install new water sources and providing safe sanitation. Overall access to water in slums is comparable to rates in nonslum areas, but 91 percent of people share a water source (such as a public tap or standpipe), which is almost twice as high as in urban nonslums (figure 4.7).

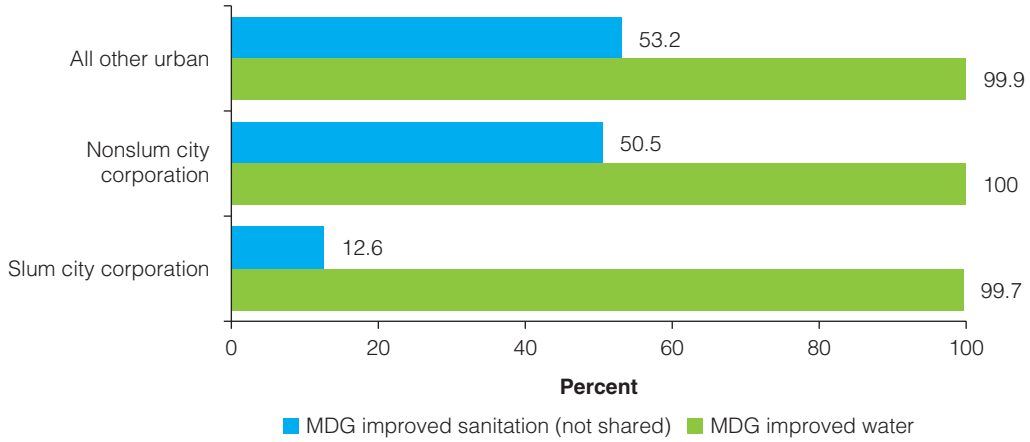
Similar disparities are found when comparing different sections of the country's cities—dwellers of slums are more poorly served than people who don't live in slums. For instance, only 13 percent of households in the slums of Bangladesh's five largest cities (city corporations) have their own sanitation facilities (figure 4.8). It is common, in fact, for 10 households to use a single facility, which is typically some type of ventilated pit latrines. These conditions, together with generally poor access to clean water in the cities, contribute to serious health and physical development issues: the mortality rate of children under five is 79 percent higher in urban slums compared to overall urban areas. Slums in the five largest cities have stunting rates that reach nearly 50 percent: a figure higher than the national, rural, and urban averages, which are 36 percent, 38 percent, and 31 percent, respectively. Box 4.2 discusses some of the findings from as survey on water supply and sanitation service provision in low-income settlements of Dhaka.

Figure 4.7: Improved Water Sources and Sanitation Facilities in Bangladesh Shared with 10-Plus Households across Urban Areas, by B40 and T60, 2013



Source: World Bank calculation using UHS 2013 data (NIPORT, ICDDRB, MEASURE Evaluation 2013).
Note: B40 = bottom 40 percent of population; T60 = top 60 percent of population.

Figure 4.8: Access to Improved Water and Sanitation across Urban Areas, Bangladesh, 2013



Source: World Bank calculation using UHS 2013 (NIPORT, ICDDRB, MEASURE Evaluation 2015).
Note: MDG = Millennium Development Goal.

Box 4.2: Preliminary Results from the Dhaka Urban Slum Survey, 2016

A recent Census of Slums and Floating Population conducted in 2014 (BBS 2014) suggests that the number of slums in Dhaka has been steadily increasing over the last decades from 1,579 communities in 1997 to 3,394 in 2014. Within these slums, there is evidence to suggest the existence of large disparities in access to and quality of basic service provision as compared to urban nonslum areas

box continues next page

Box 4.2: Continued

(NIPORT, MEASURE Evaluation, ICDDRB, and ACPR 2008, 2015); in particular, water and sanitation is understood to be quite deficient in slum areas.

In order to further explore such disparities, the Dhaka Urban Slums Survey was conducted by the BWPD team in May 2016, to study the main characteristics of the informal markets for water and sanitation in these areas. The resulting report describes the functioning of these markets and how they deliver services to slums of different sizes (small, medium, and large) and of different characteristics (e.g., government and privately owned land). In addition, the report explores how the socio-economic status of households within slums affects the degree of access and quality of water and sanitation services they receive.

The basic measures of access and quality in water and sanitation services collected in the survey were designed closely after the 2014 Demographic and Health Survey (DHS) and the 2012/13 Multiple Indicator Survey (MICS). The detailed consumption data follow closely the 2016/17 Household Income and Expenditure Survey (HIES) and were collected using the same field protocols. The survey is representative of all slums in the Dhaka city corporation, and the final sample includes a total of 588 slum households: 30 households from small slums (5–10 households); 259 households from medium slums (11–100 households); and 299 slum households from large slums (100+ households).

Interestingly, the data reveal that access to water in slums is reported to be quite high. Access to improved water seems to be almost universal at 97 percent. However, access to unshared improved sanitation is only about 9 percent. Given the lack of formal markets for water and sanitation services, these results are to some extent surprising and provide strong evidence of the importance of informal markets to provide access to these services for slums residents, which are regulated by local providers. Since data on water quality were not collected, no information is available on the cleanliness of the drinking water quality.

Among other findings, the data also suggest that infrastructure to access water services is installed mainly by (a) landlords, referred to as *mastaans*, 58.7 percent; (b) the Dhaka Water Supply and Sewerage Authority (D-WASA), the public utility responsible for water distribution, 17.5 percent; and (b) nongovernmental organizations (NGOs), 13.4 percent. Among households that rent their dwelling structure (71 percent), around 89 percent have their water facilities included as part of their rent, and this number is consistent regardless of slum size. Slum households spend just seven minutes to reach water sources, and this estimate is consistent across the sample, regardless of the size of the slum. Lastly, collecting water is an activity that is almost exclusively assigned to adult women in the household (91.1 percent).

box continues next page

Box 4.2: Continued

Sanitation facilities are mainly installed by landlords (63.1 percent), DWASA (20.1 percent), and private companies or individuals (14.6 percent). Access to toilets that are of exclusive use for one household are very rare in slums, with more than 90 percent of households reporting sharing their sanitation facilities with other households. On average, slum households share their toilet facilities with 16.2 households (around 70 people). Unlike the percentages related to water services, only 6 percent of tenants report having the use of their sanitation facilities included as part of their rents. Slum residents wait on average seven minutes to use sanitation facilities available in the slum. Overall, the findings of the survey provide a crucial knowledge base for those stakeholders engaged in improving the existing access and quality of WASH in slum communities.

Source: Arias-Granada et al. 2018.

Note

1. The HOI takes the coverage of each service and discounts the measure by how unequally the services are distributed among the population (Paes de Barros et al. 2009). The indicator summarizes in a composite indicator (i) the coverage rate of a basic services (e.g. access to water and sanitation); and (ii) how equitably those opportunities are distributed, that is, whether the distribution of that coverage is related to exogenous circumstances (e.g. location, gender, household characteristics).

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Chapter 5
WASH in Community Establishments

Main Points

- **Access to water and sanitation in primary schools is high, but still inadequate.** Overall, 80 percent of primary schools have access to an improved water source, while 85 percent provide access to at least one sanitation facility. Yet the student to toilet ratio in primary schools is 100 to 1—double the national standard.
- **Healthcare facilities also face challenges.** Although 87 percent of healthcare facilities have access to an improved water source, and 86 percent possess improved sanitation coverage, one-third of such facilities experience routine water shortages.
- **Females are disproportionately affected by poor water supply, sanitation, and hygiene (WASH) coverage in hospitals and schools.** Only half of schools and a quarter of healthcare facilities provide a separate toilet for females. In the case of schools, this is particularly detrimental when considering that nearly a quarter of female students are not in attendance during menstruation.
- **Hygiene knowledge among traditional birth attendants (TBAs) is low.** Only around half are aware of the importance of handwashing and sterilizing instruments prior to delivery, which puts expectant mothers and newborn babies at a risk of infection. This is a significant matter of concern when considering that 71 percent of births in Bangladesh occur at home, of which 63 percent take place in the presence of a TBA.
- **In workplaces, WASH deficiencies are likely significant.** Although information is scarce, existing data suggests that among manufacturing enterprises with more than five employees, only 52 percent had at least one toilet for their employees. WASH access in workplaces remains a poorly monitored knowledge gap in the sector.

Monitoring WASH Access in Community Establishments—Going Beyond the Household

WASH issues extend beyond the home to community establishments where people gather daily. The new Sustainable Development Goal-6 (SDG-6) monitoring framework proposes to include community establishments, particularly giving attention to schools and health facilities. Data on WASH coverage beyond the home are limited, making it difficult to understand the scale of

the problem. However, scattered evidence suggests that inadequate WASH access in places outside the home is a significant barrier in people's daily lives. The fact that a quarter of females report missing school during menstruation and only 6 percent of schools provide education on menstrual hygiene management (MHM) suggest that schools should be giving more priority to WASH issues. Globally across healthcare facilities, poor WASH in hospitals causes up to 56 percent of all neonatal deaths among hospital-born babies in developing countries (WHO 2015). Healthcare facilities are also critical in responding to disease outbreaks, but healthcare workers are unable to implement proper preventative and control measures without basic WASH access and knowledge. Though not included in the SDG-6 monitoring framework, workplaces should also implement safe WASH to mitigate occupational hazards and improve overall working conditions. Box 5.1 also includes a discussion of public toilets in Dhaka city. BWPD study drew from numerous sources to provide some estimations on the WASH coverage in schools, healthcare settings, and workplaces.

Box 5.1: Assessing Public Toilets in Dhaka City

Dhaka city has one of the highest population growth rates among all megacities and is expected to be the world's sixth largest city by 2030, with over 27 million people. Yet at the same time, it is evident that public services have not been able to cope with this increasing growth.

In response to this deficit, in 2011, the Centre for Urban Studies and WaterAid conducted an assessment of public toilets in Dhaka. The study gathered information related to the toilets' physical condition and operational status, gender appropriateness, and cost of use, among other factors. A total of 164 toilets were observed for the purpose of the study, encompassing four different types of facilities: (a) public toilets (open access), which remain open almost 24 hours and are meant to be used exclusively by the general public; (b) public toilets in markets, which are open during shopping hours; (c) public toilets with restricted access—located in mosques, government offices, cinemas, and similar places; and (d) public toilets for special occasions, which are typically mobile and temporary.

Information on the operational status and physical condition of three of the aforementioned categories of toilets was collected. With regard to public toilets (open access), only around 9 percent were fully operational, and 8 percent were in good physical condition. For public toilets in markets, around a third were fully operational and in good physical condition. Sixty-four percent of public toilets with restricted access were deemed fully operational, and 42 percent were in good condition.

For the same three categories, the study also collected significant information on the level of gender-appropriateness and disabled-friendliness of the toilets, the security situation in the toilets' surroundings, and the availability of water and light in the toilets. Combined, all of these elements hinder the ability of women and girls to regularly and safely access such units. Few toilets were deemed gender-appropriate—thus lacking separate provisions for women—and save for public toilets with restricted access, most had deficiencies in providing adequate security, water, and lighting.

box continues next page

Box 5.1: Continued

Altogether, these findings highlight the critical lack of public toilets in Dhaka, as well as a number of deficiencies that disproportionately increase risks or altogether deter women and girls from accessing existing toilets. Policy makers must not only bolster the number of public toilets in this burgeoning city but also ensure the quality of management of the new facilities to overcome barriers to access to safe sanitation.

Source: Shafi et al. 2011.

Schools

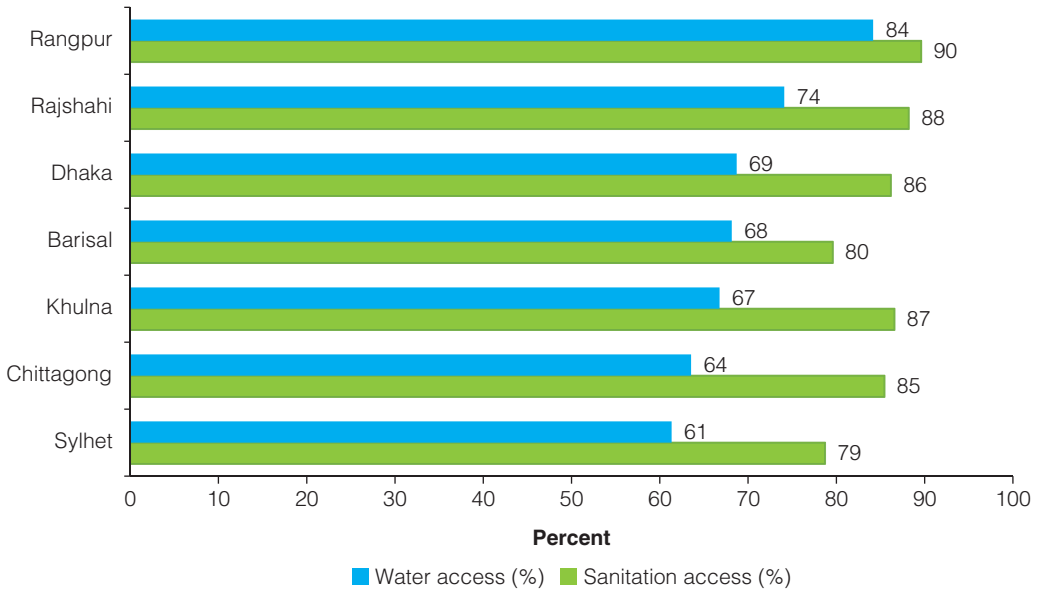
Although 80 percent of schools in Bangladesh have access to an improved water source, the coverage rate is lower in primary schools than secondary schools. Around 70 percent of primary schools have access to a "potable" water source while majority (94 percent) of secondary schools use an improved water source (Ministry of Education 2014 and ICDDRB, WaterAid Bangladesh, Local Government Division 2014).[1] Tube wells are the main source of water in both types of schools, except for secondary schools in urban areas, in which tap water is more prevalent. Only 20 percent of schools had been tested for arsenic in 2013, indicating that even a high availability of improved water does not necessarily mean that it is safe for students to drink. In addition to increasing overall water coverage in schools, testing for arsenic and other contaminants must be conducted to ensure that drinking water in school is indeed safe.

Despite 85 percent access to at least one sanitation facility in schools, only half have a separate toilet for female students. The most common type of sanitation facility in schools is a sanitary pit toilet and a septic tank toilet, with the latter being more prevalent in urban schools. Only 8 percent of schools have access to handwashing station with soap and water. The absence of separate toilets, particularly in secondary schools, deprives female students of privacy and security, which can discourage them from using sanitation facilities in school.

The student to toilet ratio in primary schools is 100 to 1, which is double that of the national standard. In 2011, Bangladesh adopted a national standard for WASH in schools, which requires the presence of at least one accessible toilet for 50 students and gender-specific toilets when possible. This standard is based on the World Health Organization/United Nations Children's Fund (WHO/UNICEF) guideline, which states that the student-toilet ratio must be 25 to 1 for females and one toilet and urinal for per 50 male students (Adams et al. 2009). Despite national standards, schools fail to provide enough toilets for all, particularly for female students. The female student to toilet ratio in primary schools is 130 to 1, whereas the male student to toilet ratio is 160 to 1. With such a high number of students depending on one sanitation facility, the likelihood of contamination is significant, particularly in cases in which pit latrines are not emptied on a regular basis. This poses as a health risk and can be corrected by providing proper drainage systems and increasing the number of toilets available to students. Figure 5.1 shows access to improved water and sanitation in schools by divisions.

A quarter of female students do not go to school during menstruation and over one-third claim that menstrual issues adversely affect their school performance. The lack of separate toilet facilities for female students makes it difficult to manage menstrual hygiene effectively

Figure 5.1: Water and Sanitation Access in Schools, by District, Bangladesh, 2014



Source: World Bank calculations using NHBS 2014 data (ICDDRB, WaterAid Bangladesh, Local Government Division 2014).
Note: Water access indicates the presence of safe water in school and sanitation access indicates the presence of at least one toilet in school.

in schools. According to the 2014 NHBS, only 8 percent of schools have a separate toilet with soap and water that female students can use for menstrual management. An even smaller number of schools had proper disposal mechanisms for used cloth or sanitary pads. As a result, a majority of female students (86 percent) choose not to change their pads at all when they are in school, which can lead to severe discomfort or health problems. Moreover, female students tend to miss, on average, three days of school per menstrual cycle, which can affect their academic performance and put them at a disadvantage compared to their male counterparts. While it is difficult to say whether a lack of sanitation infrastructure alone leads to low attendance, having on-site hygiene management tools would certainly reduce its influence on school absence. Poor attendance can also be attributed to misconceptions and low awareness of menstruation. Around 74 percent of students think that certain nonreligious activities, such as going out, cooking, or eating certain types of food, are forbidden during menstruation. Such misconceptions can be dispelled through improved menstrual hygiene education in schools, which is currently provided by only 6 percent of schools in the country.

Healthcare Facilities

Although 87 percent of healthcare facilities have access to an improved water source, a third experience routine water shortages. The 2014 Bangladesh Health Facility Survey evaluates basic access to services in healthcare facilities that are public, private, or managed by NGOs in all 64 districts. Urban facilities have a higher water coverage rate compared to rural ones (96 percent compared to versus 86 percent) and are less likely to experience routine water shortages. When disaggregated by division, access to water is found to be the highest in Rajshahi and Rangpur (95 percent) and the lowest in Barisal (67 percent). Chittagong, Dhaka, and Sylhet have the highest prevalence of disruptions in service, with over 37 percent of hospitals reporting routine water shortages.

Since the level of water access is quite high, the focus should be on improving continuity and convenience of existing service. The 2014 NHBS estimates even higher improved water access coverage, but finds that the convenience of access is also poor. For general water use, only 30 percent of rural and 25 percent of urban health facilities have more than one source of water. In urban areas, water sources are more likely to be indoors compared to in rural areas (87 percent compared to 78 percent, respectively). Moreover, many healthcare facilities rely on tube wells for water access, with only 27 percent of rural healthcare facilities having piped water access and 52 percent in urban healthcare facilities.

Improved sanitation coverage is 86 percent, but only a quarter of healthcare facilities across the country provide a separate toilet for females. The 2014 Health Facility Survey indicates that urban facilities have close to universal sanitation coverage, while rural coverage is 85 percent. In addition, separate toilets for females are around three times more likely to be in urban facilities than rural ones. Across divisions, Dhaka has the lowest sanitation coverage in healthcare centers with 77 percent while Sylhet and Rangpur have the highest (96 percent, each). Rangpur also has the highest share of separate female toilets in healthcare facilities.

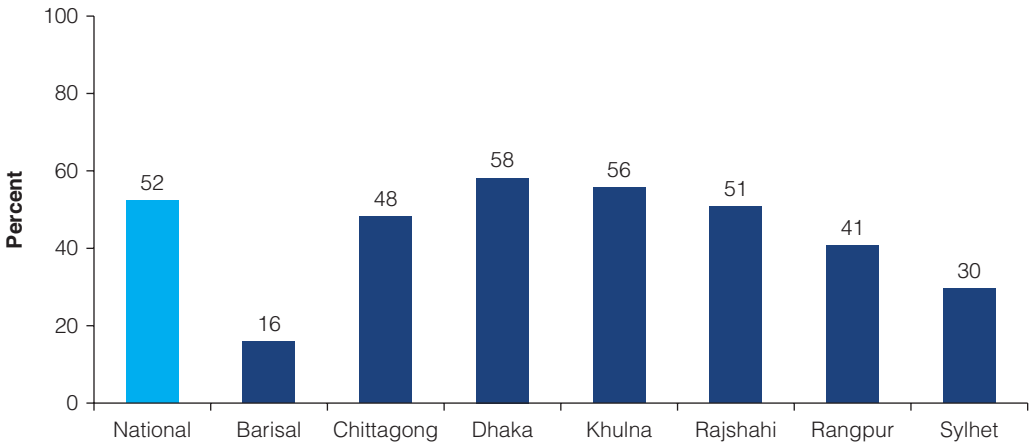
Access to handwashing stations with available soap near toilets is low for both patients and staff. According to the 2014 NHBS only 41 percent of rural and 46 percent of urban health facilities had available handwashing stations with soap for patients. Only 51 percent in rural and 61 percent in urban areas had soap available in handwashing stations for nurses. The availability of soap in doctors' handwashing stations was slightly higher with 75 percent in rural and 84 percent in urban areas.

Hygiene knowledge among traditional birth attendants (TBAs) is low with around half being aware of the importance of handwashing and sterilizing instruments prior to delivery, which puts expectant mothers and newborn babies at a risk of infection. About 71 percent of births in Bangladesh occur at home, of which 63 percent take place in the presence of a TBA.[2] Despite a low awareness of handwashing, when asked to demonstrate, 77 percent of TBAs washed both hands with soap, but only 10 percent of them dried their hands using a clean cloth (ICDDRB, WaterAid Bangladesh, Local Government Division 2014). Around half of the TBAs report using bare hands during delivery, making predelivery handwashing critical. Furthermore, over half of the TBAs do not recognize the importance of sterilizing delivery equipment or cleaning the delivery surface. Given the high dependence on TBAs in Bangladesh, it is important to provide proper training on hygiene practices to reduce the risk of infection among expectant mothers and babies.

Workplaces

Though one of the most convincing arguments for investments in WASH is to increase productivity of workforces, one of the most neglected issues in the sector is WASH access in work environments. For example, during the Millennium Development Goal (MDG) era, WHO estimated for every US$1 invested in achieving universal household water and sanitation access, there would be a nearly US$5 return in South Asia. Among the largest benefits were the gained wages and lessened absenteeism from work (WHO and UN-Water 2014). Working populations typically spend a considerable portion of their time at workplaces and adjacent environments. Yet the implementation of WASH interventions in work environments has not been prioritized. Though one could assume workers could have access to sanitation in the area surrounding their workplace, public sanitation facilities are scarce and are sometimes unsafe or unhygienic (see box 5.1). The private sector should ensure that the work environment is conducive to all basic needs of individuals, including a place to relieve themselves during the work day. Women in particular may face additional barriers to missing work when menstruating if there is no access to private sanitation facility (Sommer et al. 2016). Moreover, WASH access in the workplace is a question of occupational safety. It is estimated that 17 percent of all deaths in workplaces, globally, are due to disease transmission at work (ILO 2003).

Figure 5.2: Proportion of Manufacturing Enterprises in Bangladesh with At Least One Toilet, by District, 2013



Source: World Bank calculations using Economic Census 2013 data.
Note: Data reflect manufacturing enterprise with five or more employees.

WASH in work environments remains a poorly monitored area. Monitoring in the private sector may be difficult since there are numerous types of work environments. For example, in the rural context, the biggest employing sector is agriculture, and ensuring WASH access in remote fields may be difficult, with workers perhaps having to resort to open defecation. For those employed in the informal sector, employers may not feel obligated to ensure access to WASH facilities. The self-employed, such as food vendors, may have trouble finding a toilet in the marketplace. In the urban context, manufacturing jobs are more prevalent. Women employed in garment factories might face challenges due to limited privacy and overcrowding in workplaces (Sommer et al. 2016). Outside of school and healthcare work environments, our study could find data on toilet access only in manufacturing enterprises, but even this data do not give specific details on sanitation monitoring at the Joint Monitoring Programme (JMP) standard. However, data from the 2013 Economic Census show that only 52 percent of manufacturing enterprises (with over five employees) have access to at least one toilet (figure 5.2). Though this is a grim statistic, there are at least now some global efforts to address WASH in work environments, including the World Business Council for Sustainable Development (WBCSD), which advocates for businesses to sign and implement the "Pledge for Access to Safe WASH at the Workplace" (WBCSD 2013).

Notes

1. The 2013 Annual Census for Primary Schools (ACPS) is a national representative survey that provides information on current conditions and access to services in primary schools across all districts in Bangladesh. The 2014 National Hygiene Baseline Survey (NHBS) is a nationally representative survey that reports hygiene practices at the household and institutional levels across Bangladesh.
2. A traditional birth attendant is "a person who assists the mother during childbirth and who initially acquired her skills by delivering babies herself or through an apprenticeship or other TBAS" (WHO 1992, page 18).

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Chapter 6
WASH and Human Development—Unlocking 'Capabilities' with WASH

Main Points

- Water is central to any sustainable development strategy. Well beyond the attainment of material well-being, provision of sustainable and safe water supply, sanitation, and hygiene (WASH) services to the population has implications on overall human development and long-term poverty reduction.
- Inadequate WASH alone does not cause poverty, but its synergies with other life deprivations can cause poor human development outcomes (e.g. in health, nutrition, and education) and deepen poverty. Demonstrating the role of WASH in other development sectors and vice versa can help inform multisectoral strategies for reducing poverty.
- WASH benefits cannot be maximized without acknowledging their complimentary effects. The interlinkages between WASH and other development objectives across sectors call for coordination in meeting the new Sustainable Development Goal (SDG) WASH targets.

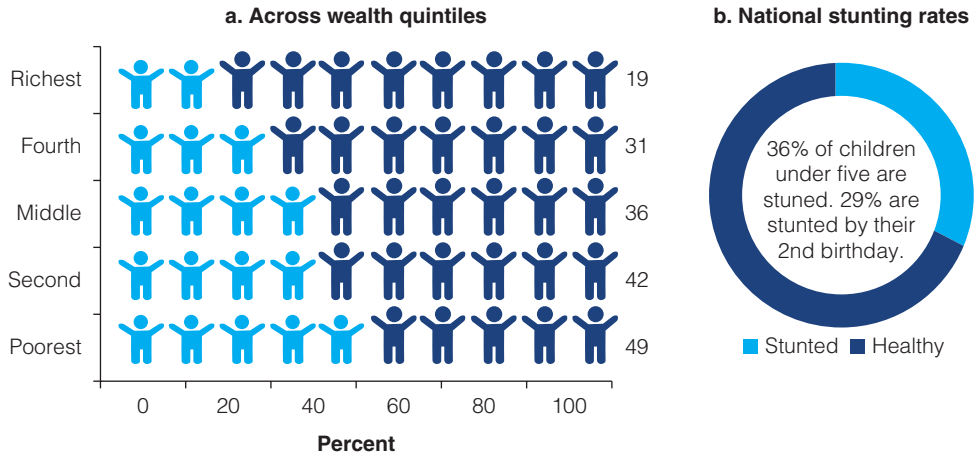
Overall, inadequate WASH serves only to keep the impoverished in poverty. The bottom 40 percent (B40) carry burdens that are beyond seeking better WASH services. They also carry burdens of disease, poor human capital, financial instability, and feelings of neglect. The combination of these burdens has synergizing effects that deter capability and human development. A myriad of deleterious effects of poor WASH on health reduces productivity, and the associated costs of healthcare place an added stress on the individual poor and their households. Even when individuals seek work, education, or training to improve their economic standing, inadequate access to WASH serves as additional barriers to success. The frequent necessity of traveling to collect water or the need to care for sick children stricken with diarrheal disease reduce the time available for engaging in productive activities. Typically, women and girls usually bear the brunt of this burden.

The concept of "capability" comes from Amartya Sen's assertion that public policies should improve a person's "capability" to live a good life. To meet this objective, Sen argues that policy makers must expand entitlements that are linked to valuable functionings, such as being healthy or educated (Sen 1989). When considering the consequences of inadequate WASH on human development, the argument is helpful for advocating for investments in the sector as well as considering the potential impact of WASH on different populations, particularly the poor. Using Sen's approach, the importance of the sector is no longer to merely expand access to basic WASH infrastructure, but instead to expand access to quality WASH services that relieve multiple burdens of poverty and improve a person's ability to thrive.

Perhaps the best example of the synergizing effects of WASH in inhibiting capability is on childhood stunting. About 35 percent of all children under five in Bangladesh are stunted or are too short for their age (figure 6.1b). Stunting is a marker of chronic deprivation of essential nutrients and reflects a child's inability to grow to their full physical and cognitive potential. Stunting quite literally reduces an individual's capability, with long-lasting effects on his or her future schooling and earnings (Devlin 2012). The condition arises from two major causes: inadequate dietary intake and disease (UNICEF 1990) (figure 6.2). Inadequate WASH primarily contributes to the disease causal pathway. The link between WASH and infections has been long established in public health, but in recent years, growing evidence shows the implications of these infections on long-term health, nutrition, and development (Humphrey 2009; Ngure et al. 2014; Piper et al. 2017; Prüss–Ustün et al. 2014). The most recent hypothesis on one of the mediating factors of WASH impact on stunting is environmental enteric dysfunction (EED), a malformation of the gut induced by repeated exposure to fecal bacteria (Humphrey 2009). If a young child develops EED, he or she is unable to retain the essential nutrients needed to properly develop and grow, which can be indicated by stunting. Though EED, parasites, and diarrhea are the most direct WASH pathways to undernutrition, there are several indirect pathways of WASH (e.g., time savings, price, education) that could also contribute to poor health and nutrition outcomes (Ngure et al. 2014). A recent costing study estimates the type of investments needed to "reduce stunting by 40 percent by 2025", which is the global nutrition target incorporated into the SDGs. Combined with nutrition-specific and other nutrition-sensitive interventions, the study roughly estimates that scaling up WASH coverage to 90 percent from country baselines in 2016 can potentially reduce stunting by 6 percent, globally, by 2025 (Shekar et al. 2017).

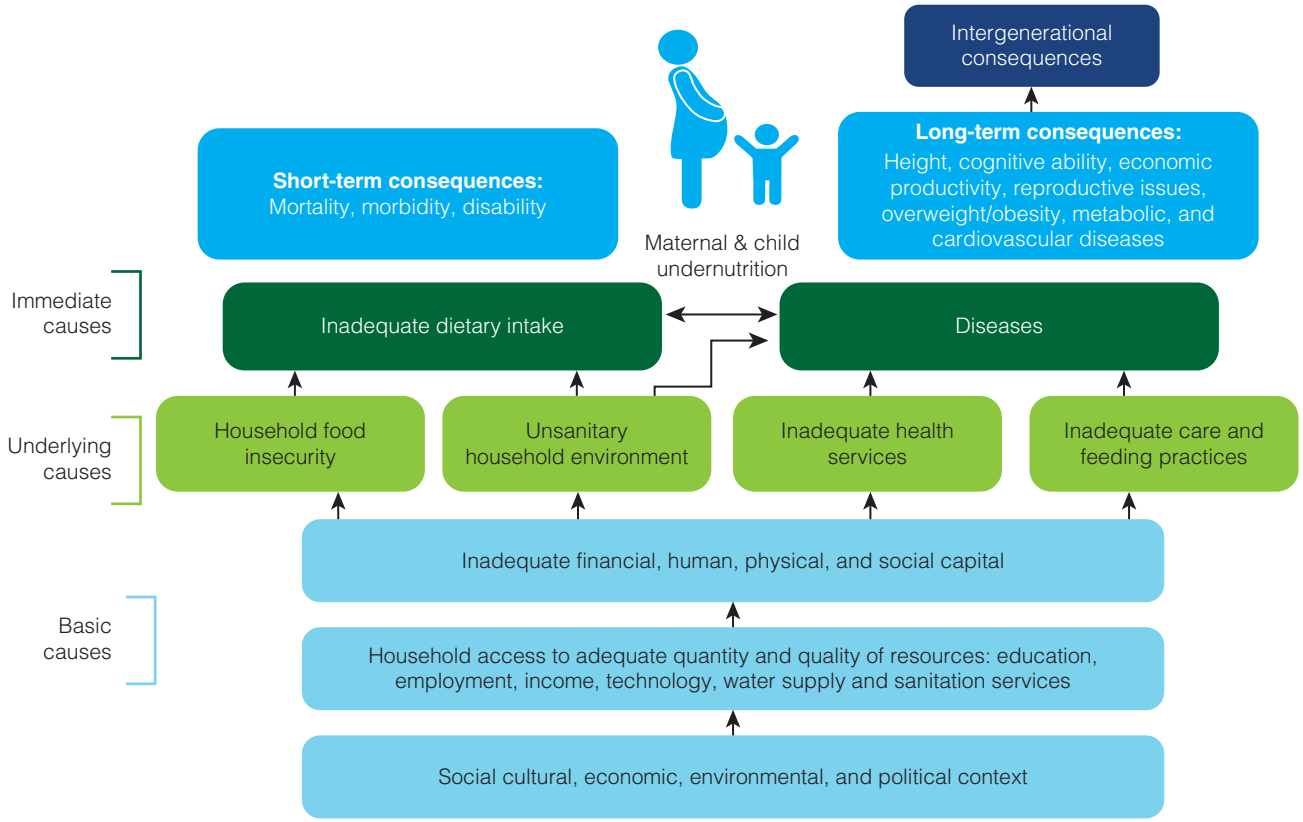
The burdens of inadequate WASH are not equally felt among all populations in Bangladesh. The highest rates of stunting and diarrheal disease are among the poorest segments of the population. Nationally, nearly half of all children under five in the lowest wealth quintile are stunted compared to 19 percent in richest wealth quintile (figure 6.1a). Similarly, slums in Bangladesh's five largest cities have stunting rates that also reach nearly 50 percent compared to 30 percent among non-slum populations in the same cities. The B40 are also most likely to lack access to WASH. However, a lack of access to WASH does not necessarily translate to negative impacts. Instead, it is most likely the lack of access combined with other deprivations associated with being poor that lead to worse human development outcomes.

Figure 6.1: Stunting among Children under Five across Wealth Quintiles in Bangladesh, 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).

Figure 6.2: Stunting Framework

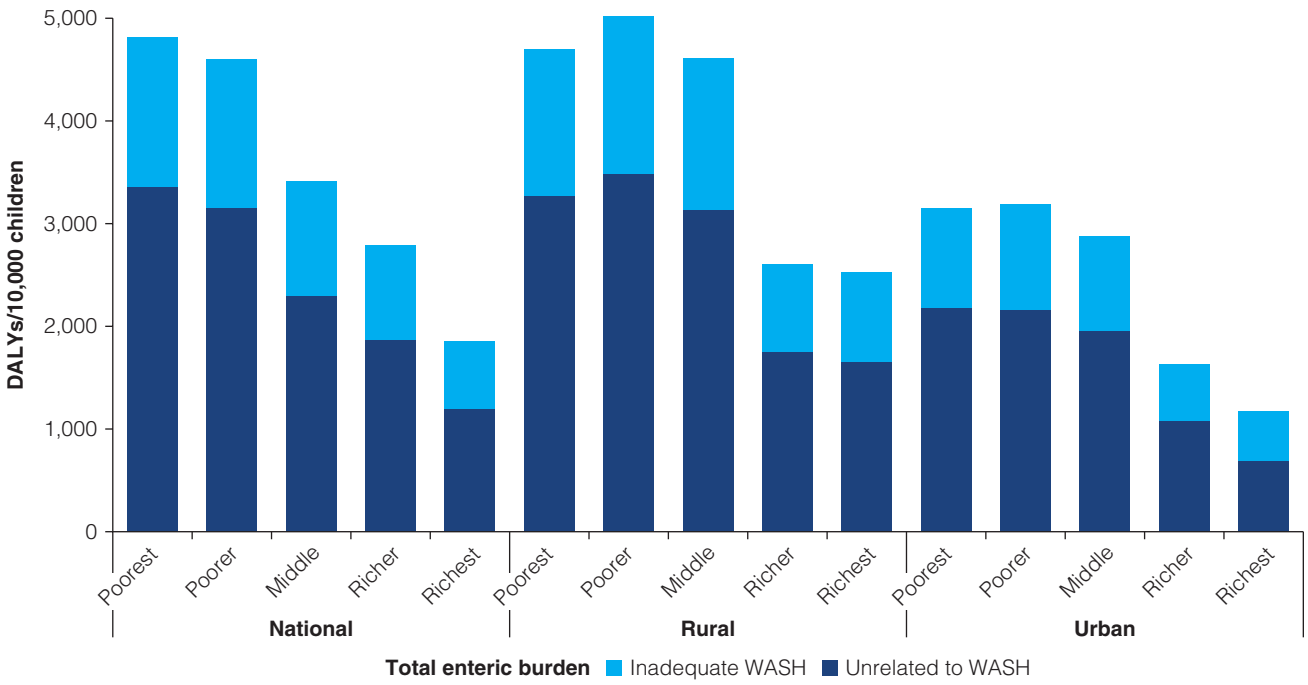


Source: Adapted from UNICEF 1990.

For instance, BWPD computed a risk model to better understand who experiences the greatest risk of contracting diarrheal disease (see box 6.2). The risk index is the product of both exposure and susceptibility indices to diarrheal disease. It was found that within a population that lacks access to safe WASH, some face greater diarrheal risks due to other factors that render them more vulnerable or susceptible to adverse effects. Moreover, wealth seems to have the most significant effect on an individual's risk of suffering from diarrheal disease. Overall, the poorest and most vulnerable live in communities with the highest exposure, susceptibility, and risk. Nationally, poor children have approximately two to three times the diarrheal risk than rich children. BWPD also estimated the enteric burden[1] due to poor WASH in Bangladesh as 2,413 disability-adjusted life years (DALYs) per 100,000 children per year, which is about 70 percent of the total enteric burden estimated for the country. Nationally, the WASH-related enteric burden for the poorest quintile is about three times greater than the enteric burden for the richest quintile as shown in figure 6.3. (Rheingans et al. 2017).

Unlocking the capabilities of WASH is not an easy task, but strengthening the elements of WASH interventions that have proven complimentary effects on other development objectives can help the sector be more impactful in improving capability. Despite nearly universal coverage of improved water, nearly half of all improved water at its source is contaminated with fecal bacteria such as *E. coli* or slow poisons such as arsenic. Moreover, the likelihood of *E. coli* contamination increases by 50 percent from the time it is tapped from the source to the time a household member pours the water into a cup to drink. Using 2013 MICS water quality data, BWPD attempted to see the effects of *E. coli* contaminated drinking water and stunting levels (see box 6.1). In the regression, access to improved water did not have any significant effect on stunting, but access to water highly contaminated with *E. coli* significantly increases stunting by 6 percentage points. Apart from complex issues of water quality, even simpler issues such

Figure 6.3: Enteric Burden, by Wealth Quintile, Bangladesh, 2014



Source: Rheingans et al. 2017.
Note: DALY = disability-adjusted life year; WASH = water supply, sanitation, and hygiene.

Box 6.1: Children Need Clean Water to Grow—*E. coli* Contamination and Stunting

Globally, studies examining the link between water supply and nutritional outcomes are rare, primarily due to the relative absence of reliable measures of water quality as well as anthropometric measures of children (Dangour 2011). As with poor sanitation, it is plausible that water contaminated with *E. coli* could affect nutritional status of children through various possible biological pathways such as repeated episodes of diarrhea, environmental enteropathy, parasites, or other mechanisms that inhibit nutrient uptake and absorption (Humphrey 2009; Ngure et al. 2014). Considering the prevalence of *E. coli* across Bangladesh, analysis was conducted to more specifically assess the effect of this contaminant on stunting in Bangladesh.

E. coli contamination in drinking water was measured at both household and source points as part of the Bangladesh Multiple Indictor Cluster Survey (MICS) 2012–13 data. Overall, 51 percent of source water was contaminated, as compared to 62 percent of water at consumption points. Stunting was measured using height-for-age z-scores for children under five, in which a child is considered stunted when he or she is two or more standard deviations below the median of the World Health Organization (WHO) reference population.

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Box 6.1: Continued

The authors then utilized a logit regression model to more precisely estimate the extent to which *E. coli* impacts stunting. In the overall sample at consumption points, a high level of *E. coli* increases the probability of stunting by 6 percentage points. In addition, improved sanitation and water treatment are strongly associated with lower stunting. Appropriate water treatment decreases the likelihood of stunting by around 24 percentage points, while improved sanitation lowers stunting by 7 percentage points. Similarly, for the overall sample at source points, the presence of *E. coli* in water increases the probability of stunting by 5 percentage points, while higher concentrations increase the probability of stunting by about 9 percentage points. Further, improved sanitation reduces stunting by about 9 percentage points. The role of wealth was also assessed. When children are exposed to *E. coli* in water, the chances of them being stunted increases for all age groups in both B40 and T60 segments of the population. The prevalence of stunting is higher among the children born in B40 households when compared to T60 across the entire age distribution.

These results reinforce not only the clear relationship between *E. coli* contamination and stunting—but also the fact that nearly all Bangladeshi children, regardless of economic status, are impacted by this contaminant. Access to improved sanitation, as well as increased household access to bacterial-free water, are thus needed to counteract *E. coli*'s deleterious effects.

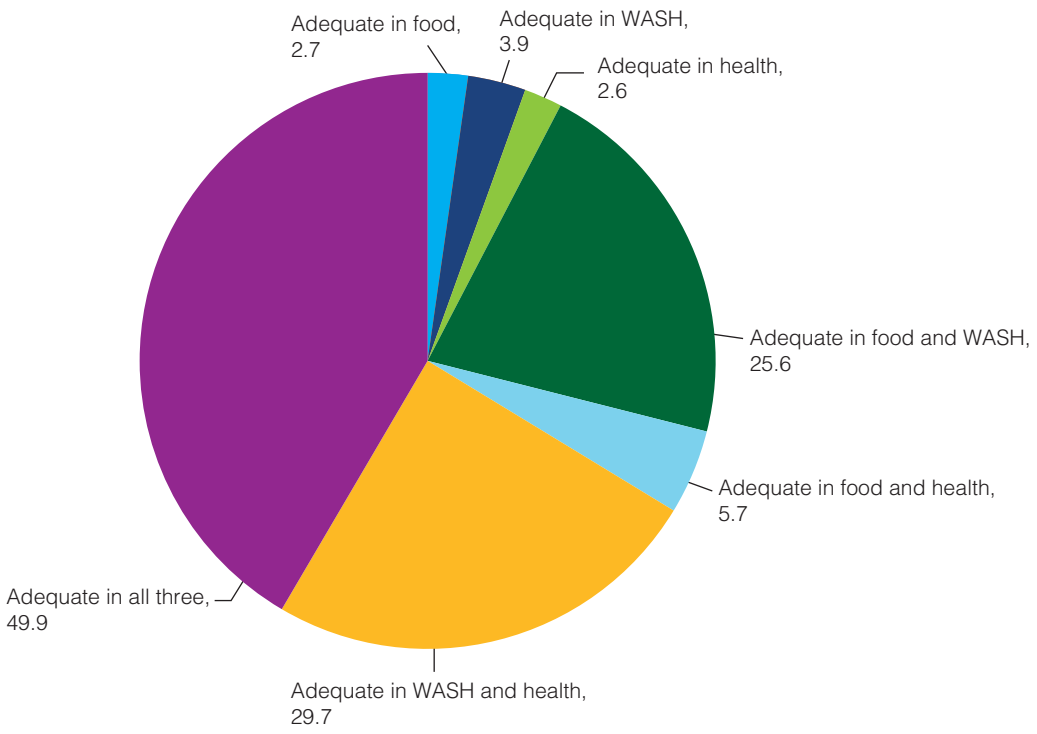
Source: Joseph, Haque, and Moqueet 2017.

as the amount of time it takes to collect water can have large effects on the capability to go to school. In another analysis, BWPD finds that water collection duties are seen to have an effect on school attendance and dropout rates, with the effect most prevalent for adolescent girls (see chapter 4, box 4.1). These effects show that in order for the sector to have even more impact in improving human development, the sector must go beyond building pipes or latrines, but instead take a holistic approach in creating safe WASH environments.

The interlinkages between WASH and disease are sometimes explicit in the scientific evidence, but also sometimes nuanced in the way it affects other issues such as gender inequality or improving human capital. Likewise, operationalizing these interlinkages can be even more challenging. However, prioritizing certain principles such as improving safety of WASH services (e.g., meeting the new SDG water and sanitation targets), considering larger sustainability issues (e.g., water resource management and environmentally-responsible sanitation), and being inclusive in regard to reducing inequities of access between population groups possibly put the sector in the right direction for maximizing impact on capability.

Finally, other sectors will find their interventions more effective in safe WASH environments. For example, BWPD, using household data, attempts to understand the relative importance of WASH in explaining the high stunting rates in Bangladesh using Shapley decomposition techniques, which provides the relative weights of the various factors in explaining the explained portion of stunting. We find that inadequate access to WASH alone can explain up to 4 percent of observed stunting; however, inadequacies[2] in access to WASH, food, and health explain up to 50 percent of observed stunting. And if WASH inadequacy is combined with just one other dimension (e.g., WASH and health or WASH and food), it attributes to 26 percent to 30 percent of observed stunting (figure 6.4). The analysis not only detects a link between WASH and

Figure 6.4: Determinants of Stunting in Bangladesh, 2014



Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).
Note: WASH = water supply, sanitation, and hygiene.

Box 6.2: Who Faces the Greatest Risk of Diarrheal Disease? The Poverty Risk Model

Frequent bouts of diarrhea often lead to undernutrition outcomes—a major problem in Bangladesh. Yet, not all citizens are similarly impacted; significant disparities exist across population groups and geographies in terms of the relative risk of being affected by diarrheal disease. This is because not everyone is equally exposed to WASH-related risks leading to diarrhea. Within a population that lacks access to safe WASH, some face greater diarrheal risks due to other factors that render them more vulnerable or susceptible to adverse effects. As such, we compute the WASH Poverty Risk Index to better understand who experiences the greatest risk of diarrheal disease, and where they reside. The risk index is the product of both the *exposure* and *susceptibility indexes*—which were calculated separately for the purposes of this study.

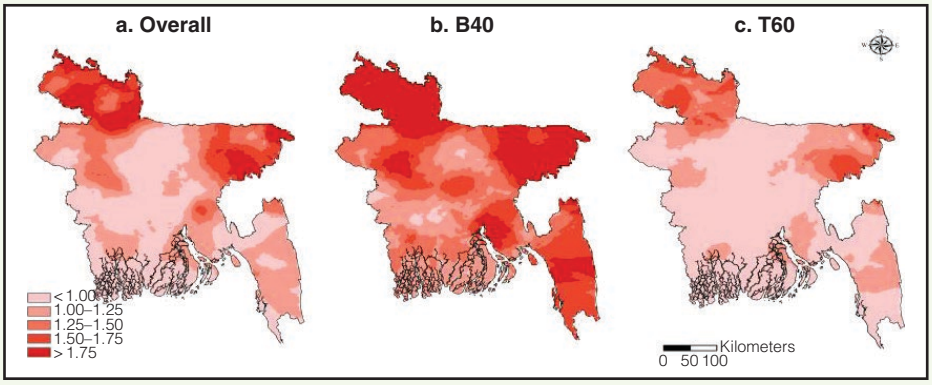
The *exposure index* was calculated using DHS 2014 data, and captures exposure scenarios based on the coverage of water and sanitation service levels. Three

box continues next page

Box 6.2: Continued

exposure scenarios from the DHS are estimated for three types of water source coverage, including unimproved water, off-plot, or community improved water sources, and on-plot improved (including piped) water sources. Also, three exposure scenarios for sanitation are estimated: unimproved sanitation (including open defecation), improved sanitation but no sewerage (on-site), and sewerage connectivity. Other exposure risk factors to diarrhea, such as handwashing, water treatment, child feces disposal, and population density, are not included in the exposure index because of the lack of information in the literature on their relative risk values in causing diarrhea. The *susceptibility index* was calculated using three risk factors related to the susceptibility of diarrheal disease and mortality. These range from the acquisition of susceptibility-related micronutrients (Vitamin A) to effective treatment (e.g., oral rehydration therapy) and undernutrition assessed by child weight-for-age. For undernutrition, relative risks from Caulfield et al. (2004) are used, which estimate the relative risk of cause-specific mortality (including diarrhea) for different levels of stunting (low height-for-age), wasting (low weight-for-height) and underweight (weight-for-age). Subsequently, using these indexes, WASH Poverty Risk Index scores are calculated individually for each child under five years of age, and then aggregated into subpopulation estimates. Map B6.2.1, panels a–c, show fine-scale spatial resolution maps (at 5 square kilometers) of the disease risk index value distribution across children under five in Bangladesh, nationally (overall), and by economic group (B40 and T60).

Map B6.2.1: Risk Indexes for Overall, B40, and T60 Populations of Children under 5, Bangladesh



Source: NIPORT, Mitra and Associates, ICF International 2016, calculations using Demographic and Health Survey (DHS) 2014 data.
Note: Maps display 5 square kilometer resolution. B40 = bottom 40 percent of population; T60 = top 60 percent of population.

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Box 6.2: Continued

We find that the risk among the B40 is widespread. B40 vulnerability is concentrated in the north, central, and southeastern provinces. Khulna and Barisal have lower risk while Rangpur is an important high-risk area, overlapping across the T60, B40, and overall maps. Most of the patterns apparent in map B6.2.1 panel a are seen in panel b, with some additional areas of concentrations of high risk. According to the overall map (panel a), the highest risk areas are in the northwest and northeast regions of the country, and lowest risk areas are largely concentrated within the center. For the B40 children population, there are larger areas of the highest susceptibility index values (greater than 1.75), concentrated especially in northwestern, northeastern, and southeastern areas of Bangladesh. The highest risk across the country is found mainly in the B40 populations, following trends that are similar to that of the overall population, with some additional high-risk foci in the center of the country, and in the southeast. The T60 map (panel c) shows some concentrated high-risk areas in the northwest and northeast, but they are substantially smaller than that for the B40 population. From this analysis, it becomes rather evident that wealth has a significant impact on an individual's risk of contracting diarrheal disease. Those who are already impoverished thus face indefinite challenges to their health and well-being, adversely impacting their ability to obtain education, skills, and participate in economically productive opportunities. Policies and programming are needed to specifically target quality WASH expansion in areas where the B40 are most prevalent.

Source: Rheingans et al. 2017.

stunting but also demonstrates the large synergy effects of inadequacies in WASH with inadequacies from other service-delivery failures such as in health access and food security. The health, education, and labor sectors should also prioritize meeting safe WASH standards in their operations. By investing in better WASH, populations can look forward to immeasurable "knock-on" effects that will impact generations to come.

Notes

1. Enteric burden refers to conditions that arise from the transmission of enteric pathogens (e.g., intestinal infections).
2. Adequate WASH indicates that a child is living in a household with access to an improved water source, improved sanitation, and has a handwashing station with both soap and water available. Adequate health services include access to immunizations. Adequate food includes meeting the daily recommended dietary requirements.

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Chapter 7
Binding Constraints and Challenges

Main Points

- **Unclear and overlapping allocations of functions, funds and functionaries are a binding limitation to improving water supply, sanitation, and hygiene (WASH) services in Bangladesh.** Despite its efforts, Bangladesh remains a centralized country, with limited devolution to lower tiers of governance. Though local governments are de jure responsible for planning and budgeting for WASH, Department of Public Health and Engineering (DPHE) plans and budgets on behalf of local government institutions (LGIs). Central departments still also implement a considerable part of capital investment projects in rural and urban areas.

- **Making WASH service providers more efficient and accountable is a prerequisite for meeting the demand for piped water services within premises from a rapidly growing economy and an expanding middle class in Bangladesh.** WASH service providers generally bill for their operation and maintenance (O&M) costs, but subsidized electricity and other subsidies artificially reduce cost figures. Average water losses have reduced from 35 percent to 25 percent in the past decade, but intermittent water remains a huge issue, as is lack of accountability of service providers to their customers.

- **WASH strategy is well defined but the regulatory framework is incomplete.** The Government of Bangladesh (GoB) uses a Sustainable Development Goal (SDG) framework for sector planning, which is anchored in its 2014 National Strategy for Water Supply and Sanitation, providing uniform strategic guidance to the sector stakeholders for achieving sector targets. A lack of national standards and monitoring mechanisms has left gaps in water quality and fecal sludge management practices. There is no formal regulation on service standards and pricing.

- **The share of budget allocation to the WASH sector in national budget is insufficient and has significantly decreased in the past decade.** In 2016–17, the WASH budget allocation was less than half of what it was in 2007–08. Internal and external budgets show similar declines. The estimated budget gap is about 47 percent to meet just the government's envisioned water targets by 2025. WASH budgets are skewed toward urban piped service delivery.

The GoB has taken major steps to meet the SDG water and sanitation targets by 2030. As per the ongoing Seventh Five-Year Plan (2016–21), the target for urban areas includes providing water access and improved sanitation access to 100 percent of the population; coverage of drainage system to be expanded to 80 percent; and ensuring sustainable urban development that supports increased productivity, investment, and employment. The target for the rural sector is to ensure improved water access to 100 percent of the population and improved sanitation access to 80 percent. The Seventh Five-Year Plan also highlights the GoB's initiatives in improving general public services particularly in improving public administration capacity. However, institutional and governance bottlenecks in the WASH sector could affect the eventual achievement of these ambitious goals. The following section provides a brief summary of the policy and institutional landscape for WASH service delivery in Bangladesh as a prelude to a discussion on the major constraints affecting improved provision of services.

Local Government System and Decentralization—The Unfinished Agenda

Similar to most other sectors, the WASH sector in Bangladesh is deeply embedded in the prevailing institutional and governance architecture, thus inheriting many of its positive and negative characteristics. Bangladesh is governed by a parliamentary democracy with a unitary national parliament, with 35 national ministries (LGD 2011). Reflecting the centralized nature of governance structure in the country, national departments and agencies provide public infrastructure assets and services, operating through their territorial units in divisions, *zila* (district), and *upazilas*.[1] Nevertheless, zila and upazilas appear more to be deconcentrated local units of central administration.

Despite its efforts, Bangladesh remains a centralized country, with limited devolution of functions, funds, and functionaries to lower tiers of governance. Over the last two decades, considerable efforts have been made to devolve functional and financial authorities to the local level.[2] The Local Government (Union Parishad and Pourashava) Acts (2009) and the Upazila Parishad Act (2009) were the key decentralization laws that were promulgated to provide for the local government system in the country. LGIs, such as *union parishads* (UPs), *pourashavas*, and city corporations are legally empowered to be local self-governments, satisfying most of the preconditions of decentralized governance. However, legal provisions for local bodies have not been supported with actions that devolve personnel and funds. Therefore, LGIs have limited effectiveness in decentralized governance, decision making, and service delivery. Decentralization of governance still remains an unfinished agenda with significant impacts on service provision (see box 7.1).

Institutional and Policy Arrangements for the WASH Sector

The statutory responsibility for the WASH sector is vested in the Ministry of Local Government, Rural Development and Cooperatives (MoLGRD&C). The MoLGRD&C also shares responsibilities with the Ministry of Planning (MoP) and the Ministry of Finance (MoF), such as policy decisions, sectoral allocation and funding, as well as project appraisals, approval, and monitoring and evaluation. At the national level, MoLGRD&C has two divisions: the LGD and the Rural Development and Cooperative Division (RD&C). The LGD is responsible for the overall development of the WASH sector. It also monitors the implementation of policies, plans, and development programs by the organizations under it. Box 7.2 gives an overview of the organization structure of LGD.

Legally, LGIs are largely responsible for WASH service provision in their respective jurisdictions.[3] In large city corporations such as Dhaka, Chittagong, Khulna, and Rajshahi, the provision of

Box 7.1: Overview of Key Shortcomings of the Local Government System in Bangladesh

Some of the challenges faced by the local government system have immediate impacts on the water and sanitation system in Bangladesh.

Lack of Clarity in the Assignment of Functions. There exists a considerable gap between the de jure and the de facto assignment of functions and expenditure responsibilities of local governments primarily due to the fragmentations in the legal framework and inadequate implementation of subsidiarity principle.

Limited control of Local Administration by the Local Political Leadership. Despite the presence of an elected local leadership at the local level through constitutionally mandated elections, local governments have limited or no control over local level staffing, which is often undertaken at the national level.

Limited Fiscal Autonomy and Financial Management. Moreover, the local governments are given limited fiscal autonomy and revenue discretion, thus restricting their ability to provide improved services. The intergovernmental transfer system generally provides inadequate and unpredictable funding, with little or no meaningful local government discretion over finances.

Limited Local Participation and Accountability. There are limited opportunities for meaningful participation and accountability that exist in the local government system. While many committees exist (especially in rural LGIs) to encourage participation, many of these committees are "paper-based" and lack power over the entities they monitor.

Source: Ahmed et al. 2014.

Box 7.2: Organization Structure of LGD

The organizations under the LGD are of three types: (a) line agencies consisting of the Department of Public Health Engineering (DPHE) and the Local Government Engineering Department (LGED); (b) semi-autonomous organizations, e.g., the Water and Sewerage Authorities (WASAs); and (c) local government institutions (LGIs) in urban and rural areas. The organizational structure of LGD is presented in figure B7.2.1.

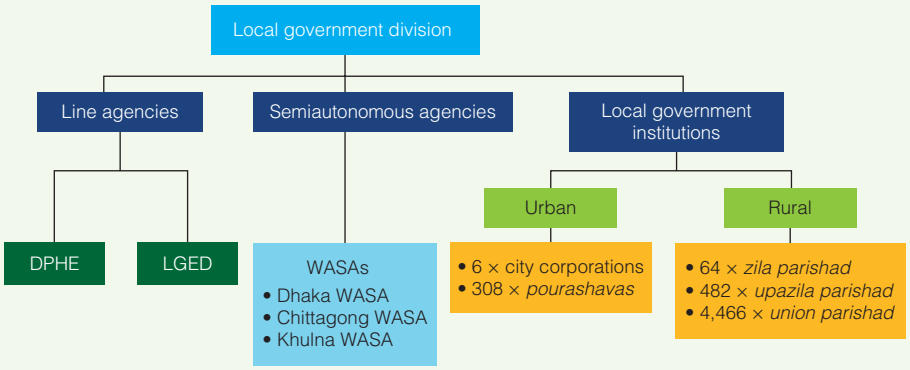
The DPHE and the WASAs are under the administrative control of the LGD. The WASAs are responsible for water and sewerage in the six large urban corporation areas (two added to the four listed in figure B7.2.1), whereas DPHE is responsible for publicly funded water supply and sanitation (WSS) investments in all urban and

box continues next page

Box 7.2: Continued

rural areas except those covered by the WASAs. LGED's main role is of urban infrastructure development comprising roads, culverts, and so on, but it also implements some water and drainage projects as part of the urban infrastructure development projects.

Figure B7.2.1: LGD Organizational Framework in Bangladesh



Source: LGD 2011.
Note: DPHE = Department of Public Health and Engineering; LGED = Local Government Engineering Department; WASA = Water and Sanitation Sewerage Authority.

water and sewerage services is delegated to WASAs under the WASA Act (1996). For rural areas and other urban centers not covered by WASAs, DPHE undertakes the implementation of WASH projects on behalf of the central government. The LGED also implements water and drainage projects in urban areas on behalf of the central government. The Department of Environment is responsible for water quality standards, while service standards are set by the Local Government Division (LGD) based on the advice from DHPE. Finally, the Water Resources Planning Organization (WARPO) is the lead agency for water resource management. Under the legal and institutional framework outlined, the WASH sector is also guided by key policies and strategies (see box 7.3).

Piped Water—Problems in Achieving Scale

With a rapidly growing economy and an expanding middle class in Bangladesh, the demand for piped water services within premises is more likely to increase both in urban and rural areas. Moreover, maintenance of quality standards through centralized treatment of water can be more effectively implemented in piped water supply systems. However, in Bangladesh, the development of piped water supply can be termed sluggish at best. Nationally, only about 10 percent of the total population has access to piped water, while in the urban and rural areas, piped water access is 30 percent and 2 percent, respectively (figure 7.1).

Box 7.3: Key Policies and Strategies in the WASH Sector

National Policy for Safe Water Supply and Sanitation (NPSWSS), 1998, is the most important policy in the sector, which is aimed to bring about changes in traditional service delivery arrangements so as to increase sector capacity and community participation. It sets out coverage targets for rural water supply in terms of average coverage of the number of users per tube well, and the overall coverage in percentages for urban areas. The policy does not address quality issues and a budget or time frame for achievements. It recognizes DPHE as the lead agency for water and sanitation. The policy, however, is deemed to be flexible and can accommodate emerging issues (such as climate-related factors) and key areas that are currently missing, such as disaster preparedness and water safety plans.

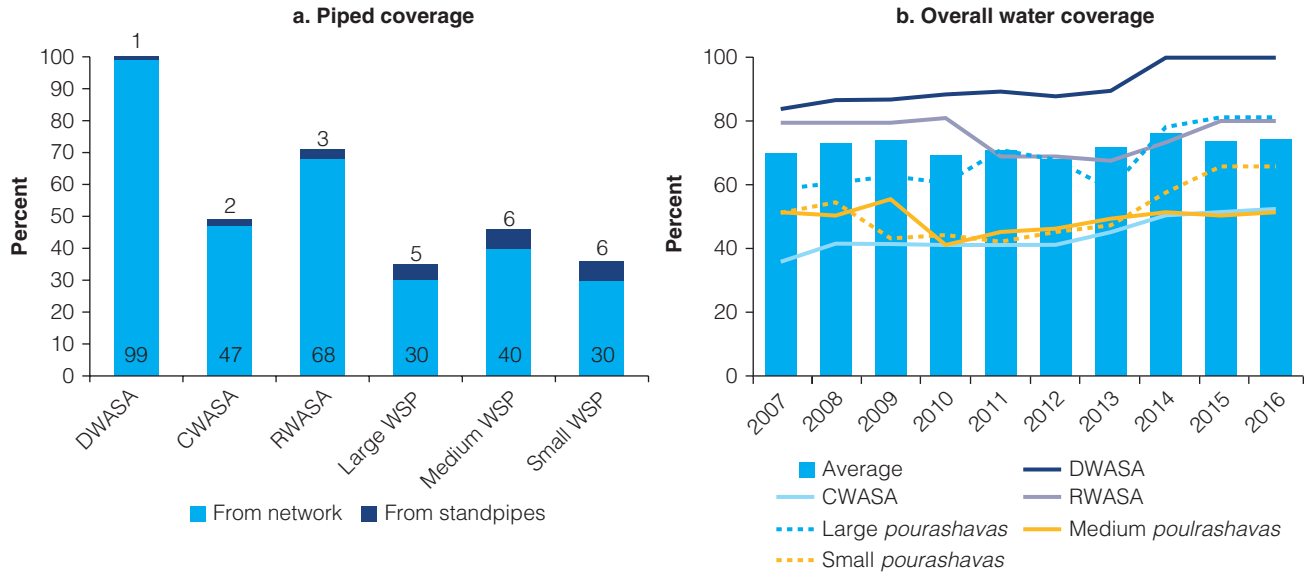
National Policy for Arsenic Mitigation and Implementation Plan (NAMIP), 2004, is specifically formulated to address the arsenic problem, the policy provides guidelines for arsenic mitigation in the drinking water, health, and agriculture sectors. A draft Implementation Plan for Arsenic Mitigation for Water Supply has been developed, and is under the Secretaries' Committee on Arsenic. The creation of an arsenic mitigation fund has also been proposed. Under the above national policies, Bangladesh has prepared and rolled out key sector strategies from time to time that include (a) the National Sanitation Strategy (NSS), 2005; (b) the Pro-Poor Strategy for Water and Sanitation Sector (PPSWSS), 2005; and the National Sector Development Plan for Water Supply and Sanitation (SDP) 2005.

Sector Development Plan (SDP), 2011, for the Water and Sanitation Sector in Bangladesh, 2011–25, provides a framework for planning, implementing, coordinating and monitoring all activities in the WSS sector. It is envisaged that national and sectoral policies and strategies and international commitments will be aligned with this SDP. The plan also provides a road map for the development of the sector and a corresponding sector investment plan.

Bangladesh Water Act, 2013, is aimed to coordinate, develop, manage, extract, distribute, use, protect, and preserve water resource assigning high priority to drinking water.

National Strategy for Water Supply and Sanitation, 2014, seeks to translate the goals and directions set forth in the SDP into action, and to provide a uniform strategic guideline to the sector stakeholders, including the government institutions, private sector, and NGOs, for achieving the sector goal. The goal is safe and sustainable water supply, sanitation and hygiene services for all, leading to better health and well-being.

Figure 7.1: Piped Coverage and Overall Water Coverage, by Service Provider, Bangladesh, 2007–14



Source: World Bank calculations using data from 2014 IBNET.
Note: CWASA = Chittagong Water Supply and Sewage Authority; DWASA = Dhaka Water and Sanitation Sewage Authority; RWASA = Rajshahi Water and Sanitation Sewage Authority; WSP = water service provider.

Urban Piped Water Supply

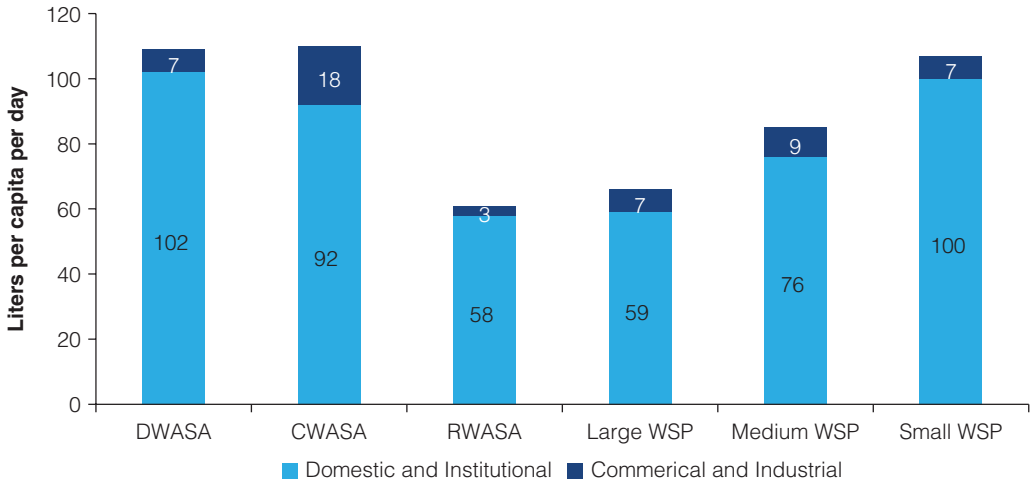
Though every year more than 1.5 million new residents are being connected to water and sanitation services in urban areas around the country, city corporations and pourashavas are finding it difficult to increase the share of population with piped water access.[4, 5] This is primarily because water service development across the city corporations and pourashavas is uneven and often fails to catch up with urban population growth in city corporations and secondary cities. Of the total population, DWASA covers water services for 100 percent of its residents, and RWASA, CWASA, and Khulna Water Supply and Sewerage Authority (KWASA) cover 67 percent, 45 percent, and 24 percent of its residents, respectively. Only 126 of 320 pourashavas have piped water supply systems. In fact, majority of growth in coverage is attributed to DWASA. The average coverage by piped water supply in pourashavas is only 39 percent; hand tube wells and private vendors serve the remaining 61 percent of residents. If the current trend continues, there will be more than 25 million new residents outside of Dhaka that will not be able to get water from municipal water companies by 2020. There are considerable issues facing the urban piped water sector, particularly on quantity consumed, continuity of service, water losses (nonrevenue water), and cost recovery, which have implications for the future expansion of the sector.

Quantity of water consumption is quite high on average, although lower than the global average of around 160 liters per capita per day. There are considerable disparities in the quantity of water consumed across the city corporations and pourashavas. Figure 7.2 shows water consumption trends from 2007 to 2016. Water consumption exceeded 100 liters per capita per day in 2014 at DWASA, CWASA, and small water service providers (WSPs)[6] (figure 7.3). However, about one-third of water utilities provide below 50 liters per capita a day. Between 2012 and 2015, water consumption in per capita per day at DWASA decreased 11 percent mainly due to initiation of the consumption metering program, which made people consume water more judiciously. Intermittent water is a huge issue for a clear majority of service providers.

Figure 7.2: Water Consumption Trend, Bangladesh, 2010–16

Source: World Bank calculations using 2010–16 data from IBNET.
Note: lpcd = liters per capita per day.

Figure 7.3: Water Consumption Trend, Bangladesh, by Category of Provider, 2014



Source: World Bank calculations using 2014 data from IBNET.
Note: CWASA = Chittagong Water Supply and Sewerage Authority; DWASA = Dhaka Water Supply and Sewerage Authority; RWASA = Rajshahi Water Supply and Sewerage Authority; WSP = water service provider.

Only three utilities reported 24/7 service through fiscal 2014/15 to 2015/16, and the weighted average was around 12 hours a day. This is much lower than the global average of 22–23 hours per day.

It is to be expected that an increase in the number of connections per acre and number of pipe breaks per kilometer of network would be associated with a decrease in the number of hours

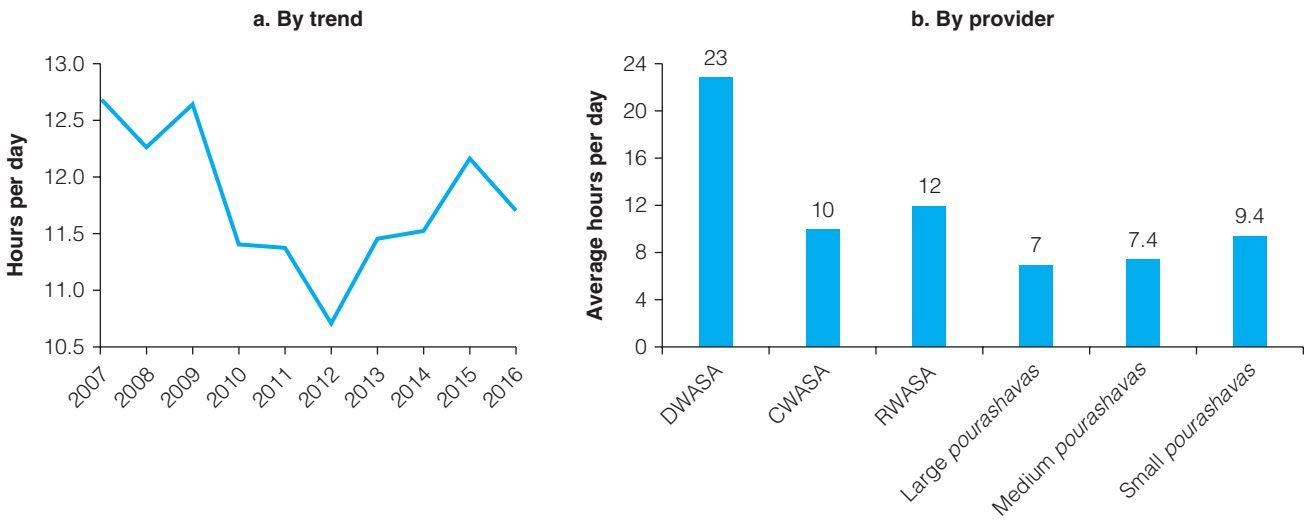
of water supply. This was confirmed by the regression model using *pourashava* data. Pourashavas with metering were also significantly more likely to have an increased number of hours of supply compared to pourashavas with no metering.

Since 2007, water losses are consistently reducing in the majority of utilities. The current rate of water losses is just above 25 percent on the average, which is a considerable improvement from 35 percent in 2007. It is a big issue for Dhaka and Chittagong, but even their water losses are continuing to substantially go down due to technical improvements and renewal of assets. Figure 7.4 panels a and b illustrate the continuity of water services in Bangladesh by year (2007–2016) and by provider (2014), while figure 7.5 panels and b illustrate water losses by year (2007–2016) and by provider (2014).

Only six WSPs meter 100 percent of the water sold. Therefore, the reported nonrevenue water (NRW) percentages should be considered best estimates for each WSP. Except for RWASA, the 2014 reported NRW percentage was less than 30 percent at all the WASAs and each of the three types of municipal WSPs. The nonrevenue water at RWASA was 38 percent. The average NRW for all the other WSPs ranged from a low of 12 percent for the medium WSPs to 28 percent at DWASA. All of the WASAs and the three municipal groups of WSPs reported a trend of annual decrease in the NRW from 2012 to 2016. Figure 7.6 gives total costs and revenues from 2007 to 2016 and figure 7.7 gives cost recovery by service providers in 2014.

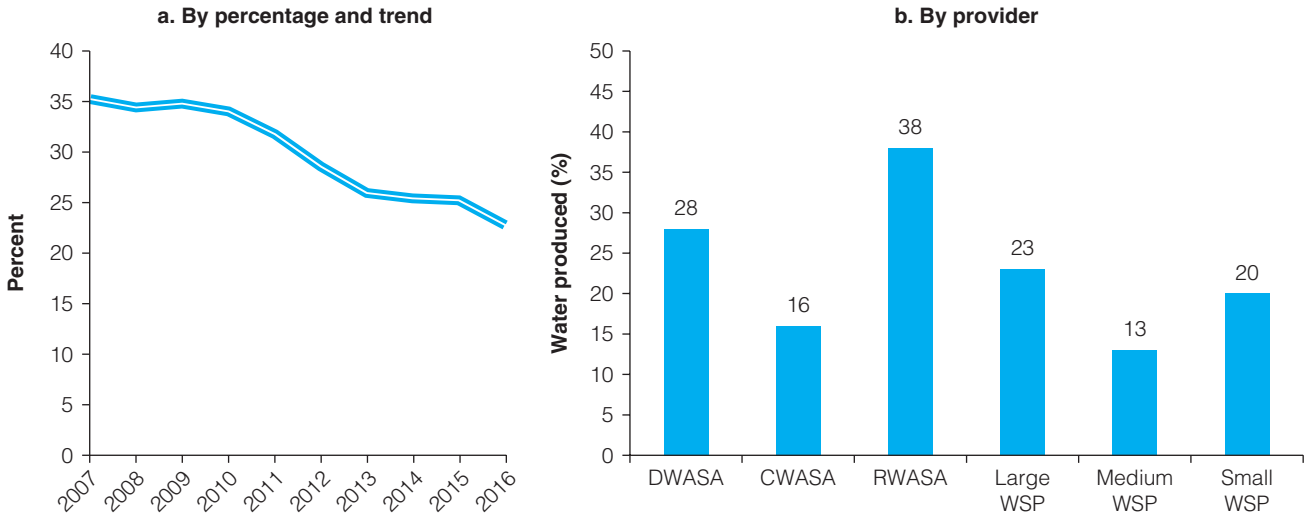
Utilities in Bangladesh are able to recover costs, and the cost recovery ratio is well above 1.2 for all the years under analysis similar to global averages (figure 7.7). However, at the individual utility level, some very large utilities, such as CWASA and DWASA, did not recover costs in 2014. It should be noted that the revenues used to calculate this ratio are the billed revenues, and the actual collections may be well below this amount, thus impacting the cost-coverage ratio. Additionally, the high ratio is also attributable to subsidized electricity tariffs for water services and some direct subsidies to these services essential to their continued operation. Also, pourashavas are allowed to set tariffs, but because it is highly politically sensitive, tariff changes are rare and far apart. In a regression analysis using *pourashava* data, an interaction term of

Figure 7.4: Continuity of Water Services in Bangladesh, by Trend, 2010–16, and by Provider, 2014



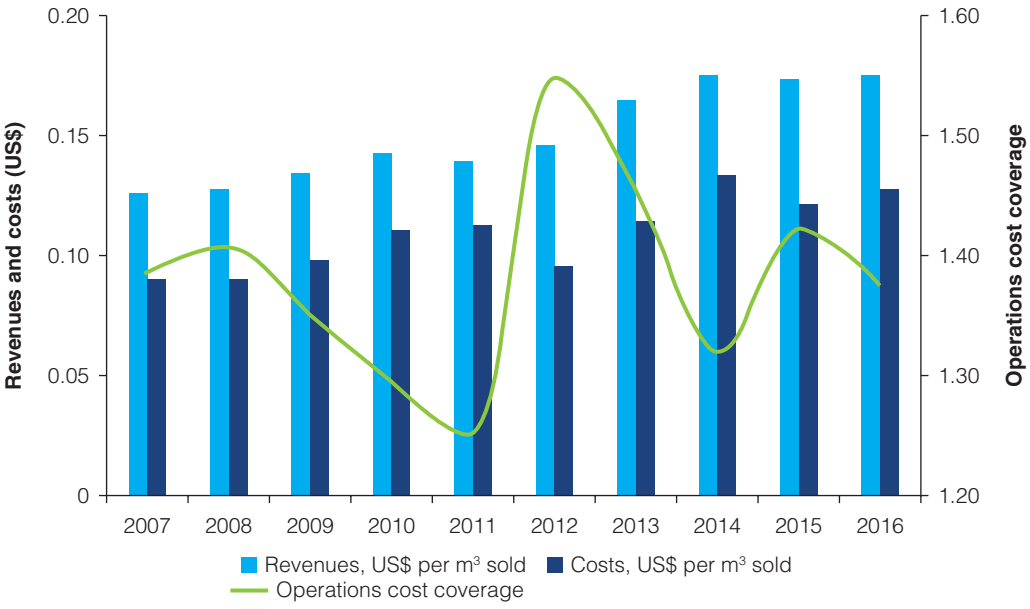
Source: World Bank calculations using 2007–2016 data from IBNET.
Note: CWASA = Chittagong Water Supply and Sewerage Authority; DWASA = Dhaka Water Supply and Sewerage Authority; RWASA = Rajshahi Water Supply and Sewerage Authority; WSP = water service provider.

Figure 7.5: Average Share and Trend of Water Losses, 2010–16, and by Provider, 2014



Source: World Bank calculations using data from IBNET 2007–16.
Note: CWASA = Chittagong Water Supply and Sewerage Authority; DWASA = Dhaka Water Supply and Sewerage Authority; RWASA = Rajshahi Water Supply and Sewerage Authority; WSP = water service provider.

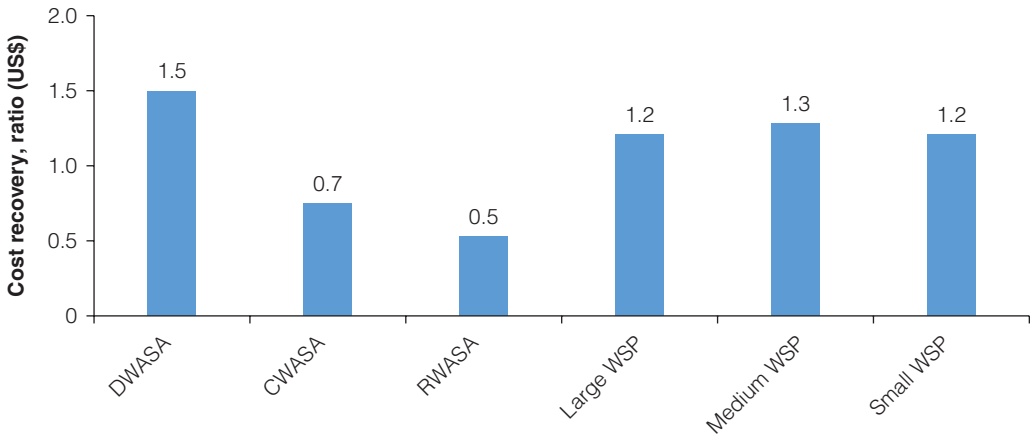
Figure 7.6: Revenue and Operation Costs, 2007–2016



Source: World Bank calculations using 2007–16 data from IBNET.

population density and poverty has a small but positive and significant correlation with cost recovery, implying that poor pourashavas with a higher density are associated with a higher cost recovery compared to poor pourashavas with lower density. This implies that in poorer pourashavas, having a larger revenue base in the form of more customers leads to better cost recovery.

Figure 7.7: Cost Recovery of WASAs and WSPs in Bangladesh, by Provider, 2014



Source: World Bank calculations using 2014 data from IBNET.
Note: CWASA = Chittagong Water Supply and Sewerage Authority; DWASA = Dhaka Water Supply and Sewerage Authority; RWASA = Rajshahi Water Supply and Sewerage Authority; WSP = water service provider.

Rural Piped Water Supply

Despite the relatively impressive level of improved water coverage in rural areas, only a tiny fraction of the rural population is being served by piped water supply to their premises (1 percent). In most of rural Bangladesh, tube wells, especially shallow tube wells, were mostly installed by the community, and deep tube wells were mostly installed by DPHE and cared and operated by the community. Development of piped water supply in rural Bangladesh was in part as a response to the widespread arsenic contamination, which was revealed in the late 1990s. This required a transition from shallow tube wells to deep tube wells and piped water schemes. However, due to technical complication, small customer base and large investment requirements, the ability of the communities to run rural piped water schemes by themselves is limited.

Nevertheless, a limited number of schemes and models have been put in place, mainly through government agencies, e.g., the DPHE, the Social Development Foundation (SDF), the Rural Development Academy (RDA), and the Barind Multipurpose Development Authority (BMDA) with government or donor funding. These generally include various arrangements for local communities and private parties to partly finance, implement, or operate the schemes. Given the limited success of community management models as experienced in GoB-4, GoB-Danida, and DPHE-UNICEF in rural piped water supply, the build-operate-transfer (BOT) approach appears to be the best option for mitigating the impact of arsenic at scale and providing safe water at affordable cost.

The Bangladesh Water Supply Program Project (BWSPP), supported by the World Bank, piloted innovative service delivery models between 2005 and 2010, including rural piped water supply schemes with private sponsor involvement. The project set out to demonstrate rural piped water supply schemes involving partnerships between community and local private sponsors. Project implementation included funding of about US$23 million for 21 innovative public–private partnership (PPP) village piped water schemes that were designed to serve over 100,000 people, and the installation of about 13,000 water point sources in arsenic- and cyclone-affected districts serving close to 1 million beneficiaries. The results of this innovation for financing and management of piped schemes, however, have not been very successful. A recent evaluation of experiences with private sector delivery under the BWSSP finds that of the 21 schemes set up,

ten are nonfunctioning or badly mismanaged and only four of the remaining functioning schemes have any likelihood of recovering private investment by the end of their contract terms (World Bank 2015). The evaluation highlights a number of lessons, including program management challenges, the higher than expected costs for potential investors, challenges with tariff collection and unpredictable local politics, and the lack of professional and entrepreneurial capacity to successfully operate and manage schemes once built.

Ensuring private sector participation, particularly by large investors in the rural piped water sector, is a challenge due to several reasons. The participation of formal private sector (professional engineering firms and private companies) in PPP of rural piped water supply is also discouraged by risk factors including volatile community demand, user reluctance to pay tariffs low profitability, liability of long-term investment, closed option for exit, unfavorable local politics, and lack of trusted local partner to protect interest of the firms and companies. Through desk review conducted by the World Bank Water and Sanitation Program (WSP), as part of preparing an advisory note for the government on private sector participation in rural piped water supply, it was revealed that private operators' BOT model is more viable in peri-urban and rural water stress areas in which more efficient and quality service are needed and the user communities are willing to pay comparatively high tariffs for accessing piped water supply. However, this model is less profitable in rural poverty prone areas, and the scheme might fall sick once it is out of order (World Bank 2015). Management contract[7] and a package deal clustering 20–30 schemes might be the feasible PPP option for attracting formal private sector in rural piped water supply. In short, with technically sound private operators that can handle O&M and community management commiteees that are actively involved with scheme implementation, rural piped water supply schemes can smoothly function. Such favorable conditions are emerging in rural and peri-urban Banglasdesh.

Key Policy and Institutional Constraints Affecting WASH Service Delivery

Unclear and Overlapping Mandates—Misalignment of Functions, Funds, and Functionaries

Though the prevailing legal framework assigns functional roles and responsibilities for WASH service delivery, roles and responsibilities have not been clarified vertically or horizontally in practice. For instance, while pourashavas and UPs have been assigned the responsibility for the provision of water and sanitation services as per the decentralization legislations, DPHE, which is a part of the LGD, is assigned as the "lead agency" for the WASH sector (in non-WASA areas), entrusted with several responsibilities, including asset creation, regulation and policy support. However, DPHE has transformed virtually into the primary service provider in non-WASA areas. Even the respective roles of the national institutions under LGD (e.g., DPHE and LGED) may sometimes overlap in practice in some project investments.

Though LGIs should be responsible for planning and budgeting for WASH services, in reality, the DPHE plans and budgets on behalf of LGI.[8] Both UPs and pourashavas are dependent on government grants for financing infrastructure since they struggle to collect revenues to pay for routine O&M expenditure. They have untrained and inadequate personnel, poor financial management capacities, and inadequate systems and processes to deliver on their mandate of WASH services delivery at the front line. Thus, LGIs rely almost entirely on DPHE for resources, including finances and human resources and technical expertise. At the center of such duplication lies the inability of the government to devolve funds and redeploy personnel to the LGIs as envisaged in the decentralization legislations. This necessitates a restructuring of the role, personnel, and budgets of the DPHE, but there is a reticence to commence thinking on these lines.

LGIs have limited control over their senior level staff in charge of WASH service delivery, which in turn affects accountability. LGD is the regulator for all LGIs and hence, and wields considerable control over the general organizational structure and personnel in LGIs, in consultation with the Ministry of Manpower. LGD determines the personnel strength of the DPHE, LGED, and WASAs and approves the posts and carries out cadre management. These personnel are deployed in functional and territorial divisions spread across the country. In most LGIs, Class I and II officers are appointed by the LGD, while only the Class III and IV personnel are selected at the local level. Class I and II officers with powers and competencies may be deployed under the jurisdiction of the local bodies, but are always accountable to the LGD.[9] Further, DPHE is suffering from significant human resource shortages when compared to the sector's needs. As per the DPHE Annual Report 2014–15, DPHE has unfilled vacancies of 60 percent, 37 percent, 25 percent, and 15 percent, respectively, at the Class I to IV levels, indicating considerable shortage of high skilled technical staff.

Deficiencies in Regulation and Standards

Bangladesh lacks appropriate regulations in water quality maintenance and integrated water resources management. Currently, the organizations with regulating authority in the water supply and sanitation sector do not have incentives to fulfil their responsibilities. At present, LGD through DPHE performs a number of regulatory functions in WSS, at the same time it is the policy maker as well as the key institution for sector development.

Moreover, the regulatory system limits the ability for regular water quality surveillance. Water quality issues have not been accorded priority, beyond routine treatment approaches and separate budgetary allocations, to be tackled systematically at national, regional and local levels. The Department of Environment, Bangladesh Standards and Testing Institution (BSTI), and DPHE are responsible for water quality surveillance. However, their capacity (human resources, lab facilities, and logistics) is unequal to the magnitude of the problem. Arsenic contamination issues still pose a challenge particularly due to lack of regular testing and monitoring of tube wells in arsenic-contaminated areas, as well as the lack of alternative drinking water options devoid of microbiological contamination.[10]

There are a number of agencies involved in the development, management, and use of groundwater in Bangladesh, but effective and integrated water resource management of groundwater and surface water is limited. In the context of competing demand for water resources, there is limited attention placed on the regulation of groundwater abstraction for irrigation and municipal uses by WASAs as well as the private sector. There is also a lack of systematic monitoring of water resource abstraction and use and consequent changes in groundwater levels and quality over time that can guide decision-making for resource allocation. Being on the front-line of climate change and a lower riparian country with water abundance during rainy season and water shortages during dry season, the nation needs long-term planning and management of surface and ground water.

Furthermore, the absence of regular and systematic monitoring of WSS provision and quality presents bottlenecks toward tracking progress toward achieving sector targets. In most rural areas, water supply is managed by households, largely through tube wells constructed by private households, DPHE, NGOs, or other private entities. No recent comprehensive statistics are available on the number of tube wells in the country or their functionality status. There is no systematic approval process for licensing in the construction of new tube wells, particularly in arsenic-prone areas and areas with low ground water tables. The absence of an integrated sector information system that tracks spatial and intertemporal changes in the supply (both surface water and ground water) and demand for water (from various agencies that use water, such as agriculture, industry, and households) is a basic limitation that affects operational monitoring, furnishing improved information for assessing the effectiveness of policy, and establishing a more credible system for leveraging more resources for the sector (Fisher 2005).

Bangladesh also lacks the development and implementation of proper standards, such as with respect to water quality, technical, and service provision standards for water and sanitation systems. Water quality standards were published in 1997 under the provision of the Environment Conservation Act (1995) and Environmental Conservation Rules (1997), based on the 1993 WHO Guidelines for Drinking Water Quality. Addressing water quality issues due to *E. coli* and microbial contamination are not given prominence even in policies or strategy papers pertaining to the sector. Moreover, some of the existing guidelines for water quality differ widely from the current WHO international guidelines. For example, the Bangladesh arsenic standard is 50 parts per billion when compared to current WHO standard of 10 parts per billion.

LGD is responsible for setting technical standards for the construction of water and sanitation systems and processes based on the advice of DPHE and the experience of WASAs. However, technical standards do not appear to have been codified at the national level, nor have they been specified by any technical agency for use in different rural and urban settings. This has a strong bearing on the design and performance of water supply systems including the construction of tube wells and piped systems. Similarly, sewerage systems and wastewater treatment processes and systems need formal codification to meet environmental standards. The practice of fecal sludge management (FSM) is evolving in the country at present, and will also need standards for process and outputs.

Absence of standards of services levels and O&M management of water and sanitation systems is another issue affecting service quality and functionality. Again, the project of ensuring reliable water supply of adequate quantity and safe quality standards (chemical as well as microbiological) will critically depend on the codification of service standards at the distribution and retail levels as well as a competent agency for their monitoring. For FSM, this will be necessary to ensure periodic emptying and safe disposal using proper handling practices and treatment processes.

There is no national level policy for tariffs. Norms for cost sharing by individual households are recommended by DPHE for different types of installations (e.g., for different types of public tube wells). Pourashavas and city corporations are expected to levy water tariffs for piped water schemes from user households, and these may or may not cover the costs of service provision. For tube wells in both rural and urban areas, user tariffs are not charged, nor are nominal contributions when there is a need for repairs. The absence of protocols for tariff setting and periodic revision significantly affects the financial sustainability of water and sanitation providers and inhibit the new entry of private sector in the field.

Inefficient Coordination

Since WASH comes under the purview of several departments and agencies, there is need for enhanced interagency coordination to ensure improved service quality. Several institutional mechanisms currently exist to facilitate and promote interagency coordination from the central to the local government levels.[11] However, due to the proliferation of such committees at multiple levels and their capacity constraints, institutional coordination is less effective in practice. In city corporations, the Department of Environment and city corporations have to work with WASAs to ensure water quality standards and coordinated city-level planning. Similarly, there is a need to separate water and sanitation functions in WASAs while maintaining collection of charges and potential cross-subsidization across subsectors. In view of the poor quality of WASH services, LGIs need to have close relationship with service providers (e.g., WASAs, irrespective of their form or mode of provision) accountable for the safety and reliability of the services that they deliver to their consumers. Further sector-wide coordination beyond WASH is required for improved overall effectiveness. In order to improve WASH services in schools, health centers, workplaces, and community establishments, better coordination between LGIs, health, education, and other relevant departments is required. In the area of water resources, several ministries (Water Resources,

Agriculture, Environment, Energy and Minerals, and LGD, to name a few) are involved in the abstraction and use of water resources with limited coordination among them to be more effective.

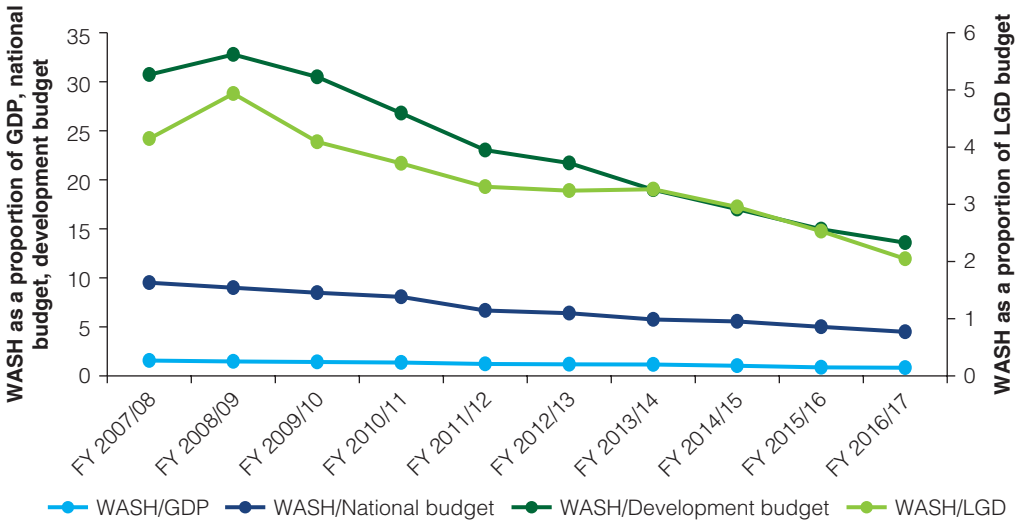
Financing Gaps and Biases Allocations

In Bangladesh, the share of budget allocation to the WASH sector in national budget has been falling over the last 10 years. In fiscal 2016/17, it was less than half of what it was in fiscal 2007/08 (figure 7.8). However, the total allocation in absolute numbers on WASH in the annual development program has nearly doubled from US$330 million to US$620 million during the period from fiscal 2007/08 to 2016/17 (Poddar et al. 2017). A similar declining pattern is visible for WASH allocation as a share of development budget as well as LGD budget. This reflects the reduced importance the sector is receiving from among the other development priorities. This further suggests that absolute monetary increases in the National Development Budget does not necessarily translate to increases in the WASH component of the budget, calling for ring-fencing of sector budgets based on sector priorities based on a long-term plan.

Subsectoral budget allocations reveal that between fiscal 2007/08 to 2016/17, there has been consistent growth in budgetary allocations toward water, and that hygiene remains the subsector receiving the lowest budgetary allocation. As seen in figure 7.9, subsector allocations for water supply have increased from 35 percent to 75 percent of total WASH (from US$115 million to US$466 million, respectively), while hygiene allocations as a share of the WASH budget have decreased from 6.6 percent to 0.5 percent between fiscal 2006/07 to 2016/17, which incidentally is also a sharp decline in absolute allocation from US$22 million to US$3 million, respectively. It is worth emphasizing that the allocation in each of the subsectors has fluctuated dramatically over the years. Sanitation, for example, has fluctuated between 12 percent and 30 percent of total budgetary allocation (US$51 million to US$202 million, respectively). This indicates that WASH allocations tend to be ad hoc and unconnected with long-term planned investment strategy, but more as a response to immediate needs.

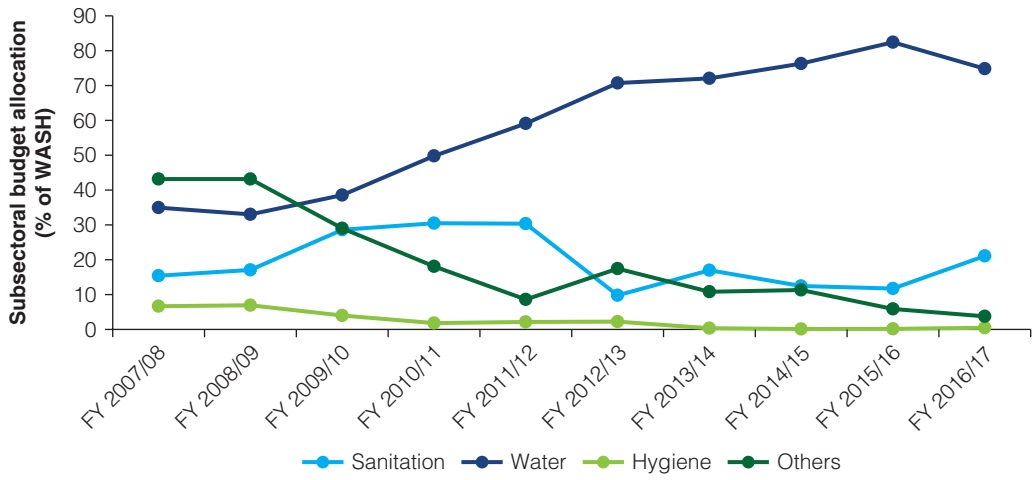
Location analysis of the WASH allocation in fiscal 2016/17 demonstrates a strong urban bias, particularly toward Dhaka and the other city corporations. Rural areas, where three-quarters of the population reside, receive less than 13 percent of the total WASH allocation, and

Figure 7.8: Proportion of WASH Allocations in GDP, National Budget, LGD Budgets, Bangladesh, FY 2007/08 to FY 2016/17



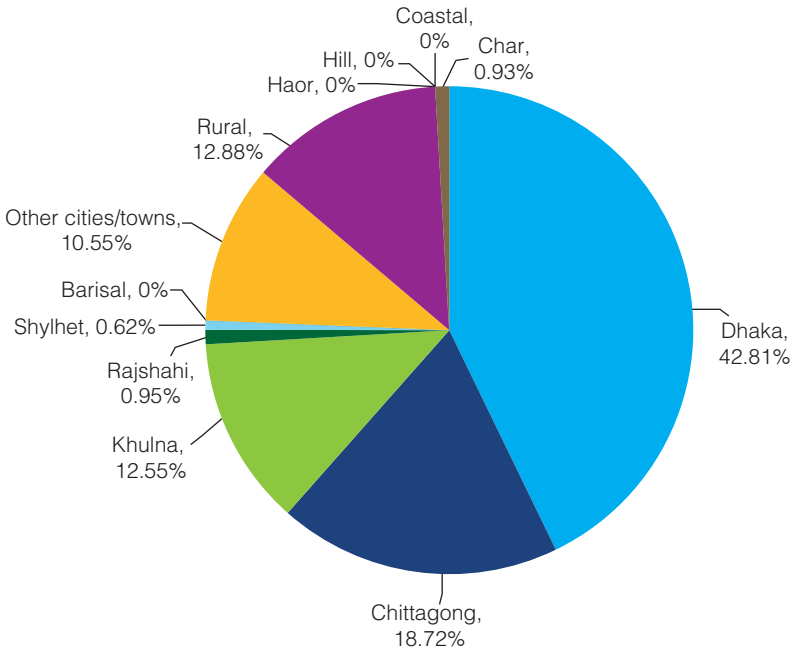
Source: World Bank calculations using WaterAid 2017 data.
Note: GDP = gross domestic product; LGD = Local Government Division; WASH = water supply, sanitation, and hygiene.

Figure 7.9: Share of Subsectoral Budget Allocation of WASH in Bangladesh, FY 2007/08 to FY 2016/17



Source: World Bank calculations using WaterAid 2017 data.
Note: WASH = water supply, sanitation, and hygiene.

Figure 7.10: Share of WASH Allocation in Bangladesh Based on Location, FY 2016/17



Source: World Bank calculations using WaterAid 2017 data.
Note: WASH = water supply, sanitation, and hygiene.

hard-to-reach areas such as hilly, *haor* (wetlands), *char* (estuary), and coast together receive less than 1 percent of the WASH allocation. Meanwhile, over 75 percent of the total allocation is made for cities with WASAs; Dhaka alone gets nearly 43 percent of the total WASH allocation (figure 7.10). Finally, it is worth mentioning that the budget does not mention any exclusive allocations in favor of low-income communities living in urban areas, indicating limited attention towards the WASH needs of those populations.

Box 7.4: Unlocking the Potential of Microfinance in Water and Sanitation in Bangladesh

The effectiveness of approaches such as CLTS and sanitation marketing is limited by inadequate access to finance. Households often will need to construct improved sanitation facilities with better quality superstructures, and microfinance provides the financing to meet such needs. Despite the impressive achievements of microfinance in Bangladesh, microfinance institutions (MFIs) in sanitation are relative latecomers. Many MFIs tend to offer loans for water and sanitation facilities under the auspices of their other loan products, such as housing loans and disaster loans. Until recently, Grameen Bank was the only MFI that offered a specific water and sanitation loan product for basic toilet construction, but that product was discontinued in 2012 after the country achieved substantial progress in reducing open defecation. Bangladesh Rural Advancement Committee (BRAC) has also provided financial support to local entrepreneurs and consumers for improving sanitation facilities. At the end of 2014, the Association for Social Advancement (ASA) introduced a sanitation loan product in a number of districts based on its experiences of the pilot program with WSP. The World Bank, under the Global Partnership for Output Based Aid (GPOBA), has developed a microfinance program with Palli Karma Sahayak Foundation (PKSF) and ASA in 2015 to provide credit support to (a) rural consumers, for the purchase of materials and the construction of completed hygienic latrines, and (b) small-scale local sanitation entrepreneurs, who will provide products and construction services. Although such support from MFIs is encouraging for sanitation improvement, more needs to be done for the systematic involvement of the MFIs in the WASH sector.

Based on a moderate planning scenario of achieving goals by 2025 in the WASH sector,[12] the SDP (2011) estimates a total investment requirement of US$20,936 million (BDT 1,465,520 million) in 2010 prices. Of the total investment requirement, the urban subsector dominates with a share of requirement of 84 percent of the total, reflecting the comparatively high unit cost of the urban WSS services, such as piped water supply, sewerage, and drainage. According to the SDP, even in the short run, investment has to increase by twofold to meet the investment needs after accounting for the linear trends in budget allocations for WASH as well as development assistance.[13] This total budget gap of about 47 percent is substantial (of which 69 percent in the urban subsector and 31 percent in the rural subsector). Therefore, there is an urgent need to raising finances from development partners as well as the private sector to meet sector goals. Box 7.4 explores the use of private sector and microfinance intuitions as one innovative approach for supporting household provision of improved sanitation facilities.

Poor Enabling Environment for the Private Sector

Though the private sector potentially could fill service gaps, the current environment does not incentivize the private sector participation. The SDP (2011) has highlighted the potential benefits of private sector participation in the WSS sector which include "(i) mobilizing private resource for the sector to meet growing investments needs; (ii) competition because of the entry of more investors; (iii) increased innovation and efficiency; (iv) lower prices; and (iv) universal coverage" (LGD 2011, page 81). In Bangladesh, the private sector plays an

important role in expanding water supply and sanitation service, particularly in the rural areas. A large majority of the hand pump tube wells and toilets have been installed by private households, and a small-scale hardware market has developed for the necessary goods and services, including a host of local masons and other technicians. DPHE and other development partners, including the World Bank WSP, have played a major role in creating an enabling environment for the private sector. A small-scale service market (e.g., piped water supply in rural areas run by NGOs or the DPHE, or communities and LGIs; provision of sludge management in rural areas; and semi-formal and informal water supply provision in low-income settlements in urban areas by community-based organizations [CBOs], NGOs, and private entities) currently exists, but it lacks an enabling environment, including regulation, to ensure service quality and tariff options to cater to the increasing needs of the sector. Bangladesh has been experimenting with introducing private sector participation in the provision of piped water supply in the rural areas. Creating packages of several schemes bundled to achieve economies of scale and ensure a reliable client base will be needed to attract large investors in the sector that have the capacity to introduce high-quality piped water provision in rural areas.

In the large-scale urban utilities market, private sector participation for service provision in segments of the market such as O&M, complaint redressal facilities, and decentralized wastewater management needs to be further encouraged. Larger management contracts (of a build-own-operate-transfer [BOOT]) in small towns for piped water supply provision have not been explored in collaboration with the LGIs. Though BPSIG (2004) and the Finance Ministry (2009) have selected WSS sector for foreign direct investment and PPPs, clear guidelines and on institutional and regulatory framework have not been come into force so far.

Lack of Public Demand and Civic Engagement

In Bangladesh, despite increasing per capita incomes and a fast expanding middle class, the demand for improved public services and environmental quality seem relatively limited. A high preference for current consumption due to low income levels as well as high marginal cost of regulation could be credited for a relatively low demand for improved WSS provision with higher order quality dimensions (Greenstone and Jack 2013). Due to limited public demand, there is limited incentive for the government or political establishment to improve the conditions of public service since such actions do not necessarily lead to electoral gains. In a national survey of the UP and pourashava secretaries, representative at the upazila and district levels, it was found that nearly in 62 percent of the elected representatives in pourashavas and 41 percent of elected representatives in UPs did not have "improving water and sanitation services" in their political manifesto during local government elections (figure 7.11).

As seen in several instances across the world, including in Bangladesh, increasing awareness of the public on the quality of services they receive can improve accountability (World Bank 2009). For instance, despite established water supply issues in Bangladesh, there is a lack of understanding at local government levels of the importance of contaminants. As per the above survey, in areas with higher than national average contamination of arsenic and *E. coli*, elected representatives do not recognize water supply as more of a priority issue than those in areas below national average contamination levels (only a 0.2–0.5 percentage point difference, respectively, between their survey responses). Further, even in areas with arsenic or other severe water quality challenges, the most frequently cited challenges to water supply are insufficient financial resources or households not being able to afford the services (about 33 percent and 13 percent of the time, respectively). Insufficient technical capacity for installation but management and lack of physical water resources are cited as subsequent top challenges but water quality issues were not highlighted as priorities.

The policy and legal infrastructure may not provide sufficient space to promote vigilance and monitoring from the side of citizen and community groups. Despite the Right to Information Act's (2009) achievements in advancing accountability to citizens, the Water Act does not have complimentary provisions for strengthening the relationship between

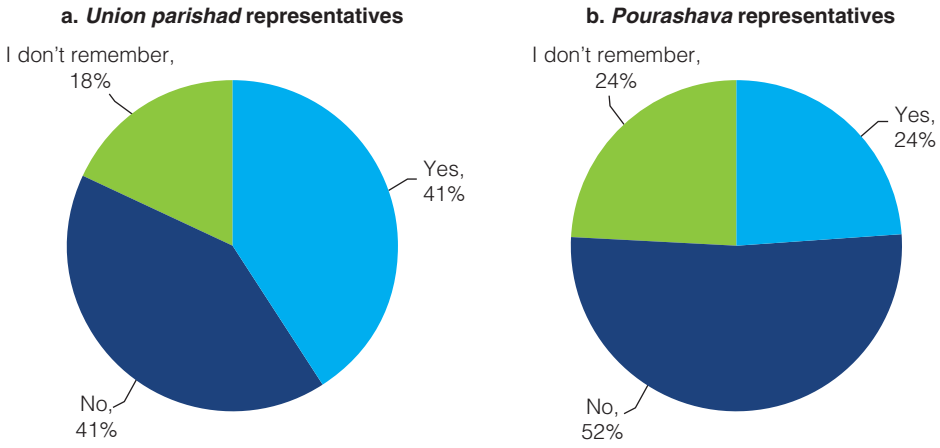
the consumer and service provider. A major drawback of the Water Act is that no court can accept a lawsuit aimed at enforcing the provisions of this act without a written complaint from the director general of the Water Resource Planning Organization or his or her appointee. The act thus undermines the power of citizens and NGOs by stating that no individual or organization will be allowed to file a lawsuit against other individuals, organizations, or government authority for violating the provisions of the act.

In Bangladesh, as with most other LICs, even in the presence of better policies and programs, there are often gaps between policies and implementation that lead to poor service delivery. This is essentially because of limited capabilities the state has in implementation, primarily emanating from the "overuse of best practices"[14] that are not conducive for the country context. However, in the WASH sector in particular, there are a number of local "best fit" practices that have made considerable improvements in the sector. For instance, DWASA's adaptation of DSK's provision of WSS in Dhaka's Korail slum shows that the effectiveness of several community- and NGO-led initiatives can be scaled up with state support. There are several other instances of "best fit" practices in Bangladesh that need to be studied and adapted for improved and sustainable performance in the sector.

Persistent Knowledge Gaps

Research and development (R&D) is not well coordinated in the sector. Recognizing the special challenges faced by Bangladesh in the WASH sector due to its geohydrological and population dynamics, several national policies in the WASH sector, such as the NPSWSS (1998), have called for "improvement of the existing technologies and conducting of continuous research and development activities to develop new technologies" (LGD 1998, page 5). However, research in the sector remains fragmented and limited to only few organizations or departments such as DPHE in the public sector; a handful of universities and research institutes in the academia, such as International Training Network (ITN) and Bangladesh University of Engineering and Technology (BUET); and NGOs, such as Bangladesh Rural Advancement Committee (BRAC), NGO Forum, and Dushtha Shasthya Kendra (DSK). Limited financial support for research and institutional support for effective coordination and creating an enabling environment for disseminating the developments in R&D for public consumption have effectively created a

Figure 7.11: Share of Politicians in Bangladesh Mentioning WASH Services in Manifestos, 2016



Source: Bangladesh WASH poverty diagnostic primary data.
Note: Question asked of elected representatives of each group: "Was there any WASH in the manifesto?" WASH = water supply, sanitation, and hygiene.

stifling environment for advancing research in the sector. Even from the side of the government, limited government support to this area is reflected in the negligible budget provision and the low priority attached to the R&D in the government agencies including the DPHE. Particularly in the context of the global transition from MDGs to SDGs which calls for a shift in focus from infrastructure to services delivery with better measurable indicators, there is a need to develop appropriate tools and capacity for collection, curation and dissemination of information at lower administrative levels.

There are a number of pressing knowledge gaps in the WASH sector. In water supply, appropriate and low- cost technologies for arsenic treatment and locally manufactured arsenic testing kits are required. Also much less is known about the patterns of the dynamics of arsenic contamination in deeper aquifers in dry season in areas with high groundwater extraction. Development of alternative technologies in salinity affected coastal areas and hard to reach areas such as the Chittagong Hill Tracts to reduce drinking water shortage, possible causes for the high fecal coliform contamination in piped water and methods to reduce it, appropriate improved sanitation and fecal sludge management for densely populated urban areas, decentralized waste water treatment options, sanitation guidelines for areas with high water table, improving behavioral change, and alternative approaches to improve private sector participation and financing are all areas where more research is required to steer the sector to reach WASH goals. It is also necessary to closely examine the available financial resources in the sector to understand how appropriately and cost effectively public expenditure is utilized as well as to come up with the estimates of necessary resource requirements to reach the SDG goals in a time bound manner.

Notes

1. Bangladesh has been divided into seven territorial divisions that are in turn, organized into 64 districts (zilas). There are 482 subdistrict units (upazilas) and 4,498 union parishads, the lowest tier of governance in rural areas. The urban areas of the country are organized into 11 city corporations for metropolitan and larger cities, and 324 municipalities or *pourashavas*. The 31 large pourashavas have populations of more than 1 million each, and the balance of small to medium pourashavas have populations of 30,000 people or more.
2. This section is based on Ahmed et al. 2014.
3. These responsibilities were given under the Local Government (Union Parishad) Act (2009); Local Government (Municipality) Ordinance (2009); and Local Government (city corporation) Law (2009).
4. Data taken from IBNET.
5. Urban areas in Bangladesh can be divided into three tiers: (a) Dhaka and Chittagong, which have populations of several millions; (b) 11 other cities with populations between 0.5 million to 1.5 million; and (c) 320 pourashavas with populations in the range between 0.05 million and 0.5 million. The total urban population, estimated to be about 27 million, is expected to be 50 million by the end of 2020.
6. Small, medium, and large WSP correspond to pourashava size.
7. The national government and LGIs could build schemes and contract them out to professional firms that would operate and maintain the systems, but be paid directly by government instead of through user fees.
8. At the national level, the Planning Commission reviews, appraises, and approves sector plans, programs, and projects received from the line agencies and includes those in five-year plans and Annual Development Plans (ADP). It may be noted that resources from the Annual Development Plan and other schemes (GoB, or externally assisted) intended for water and sanitation in the rural and urban local government areas are routed through the DPHE, and not devolved to the local bodies.
9. According to the Union Parishad Act 2009, the sub assistant engineers and mechanics of DPHE and their activities are supposed to be handed over to UP: they are supposed to work under UP jurisdiction, but this does not happen in practice because there is no union-level setup of the DPHE. Instead, subassistant engineers and assistant engineers

of DPHE work at the upazila level, and they provide support to the upazila administration. On the other hand, DPHE mechanics provide support to the UPs for maintenance of the tube wells installed at the union level.

10. DPHE has developed a Water Quality Surveillance Protocol, and a three-layer surveillance system has been proposed, but this is awaiting implementation.
11. The National Forum for Water Supply and Sanitation (NFWSS) (with representatives from relevant ministries, agencies, and the DPs, and chaired by the secretary, LGD), the National Sanitation Task Force, the Local Consultative Group, and the Union WATSAN Committee chaired by the UP chairman are a few examples.
12. As per the government's target, by 2025, 100 percent population would be provided with improved water supply and sanitation facilities. Piped water supply further expanded with the city corporations with 100 percent; large pourashavas, 90 percent; small *pourashavas*, 85 percent; urban centers, 40 percent; and rural areas, 10 percent to 20 percent coverage. The sewerage coverage would be increased to 60 percent in Dhaka, 30 percent in Chittagong, 25 percent in Khulna, and 10 percent in city corporations. Sewerage systems would be introduced to the large pourashavas covering about 10 percent of the population. One hundred percent population would be provided with sanitation facilities ranging from sewerage systems to pit latrines with about 10 percent use of septic tanks in rural areas.
13. For the initial short-run phase (2011–15), the investment requirement is US$5,434 million.
14. Referred to as isomorphic mimicry, as explained in Andrews and Woodcock 2017.

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Chapter 8
Going Forward in the Sector

In the Sustainable Development Goal (SDG) era, Bangladesh must address the "unfinished business" of increasing water supply, sanitation, and hygiene (WASH) coverage and improving the quality of access with a focus on the poor and the bottom 40 percent (B40) of the population. Future WASH programs therefore need to prioritize safety, inclusion, and sustainability. The country has made tremendous achievements in the sector, including meeting the Millennium Development Goal (MDG) water target, nearly eliminating open defecation, and pioneering innovative sanitation methods for itself and other low-income countries (LICs). Yet extreme inequalities persist in basic access. Poor, geographically remote areas have the worst coverage, notably the disaster-prone coastal areas of Bangladesh. In city corporations and *pourashavas*, growing populations are placing new upward pressure on water systems that are already overburdened, and many people share sanitation facilities. This is particularly true for the population in low-income settlements, who face multiple deprivations. Fecal exposure is quite high for both urban and rural populations due to virtual lack of sewerage systems and fecal sludge management (FSM). Too many hospitals, schools, and workplaces lack reliable basic access to improved water supply and sanitation (WSS). Contamination of water sources both from microbial and arsenic remains a hazard for tens of millions of people.

The cost of meeting the next generation of challenges will be substantial, but Bangladesh can look forward to broad multiplier effects from its investment. Better WASH conditions are key to basic human development outcomes, including better health, nutrition, and education. The energetic, skilled workforce that will drive future prosperity in Bangladesh needs clean water and modern sanitation, thus helping to break themselves from the vicious cycles of intergenerational poverty. Improvement in this sector will be welcomed by the entire population, rich and poor, urban and rural, because the problems affect virtually everyone to a greater or lesser degree.

To achieve WASH goals, Bangladesh will need to overcome multiple shortcomings in its implementation and institutional frameworks. Deeply embedded constraints concerning political will, administrative efficiency, state capability, and regulation have helped prevent water and sanitation from advancing in parallel with the country's laudable economic progress. In crafting its future strategies, Bangladesh will also need to close some serious knowledge gaps, including monitoring and implementing effective interventions that can meet the rigorous standards of SDG-6.

Priority Areas for Action

Bangladesh can be proud of its advances in the sector to date, but the task remaining will be challenging because it not only involves delivering higher quality WASH services but also delivering such services to those populations and areas that are often left behind. The Bangladesh WASH Poverty Diagnostic (BWPD) outlines six priority areas of action (in no order of ranking) based on the study's findings.

Priority 1: Improving Quality of Water Services

Despite having high access to water infrastructure, the population has low access to clean drinking water available on household premises. Bangladesh's baseline access level to the new SDG target for "safely managed water" is likely lower than 39 percent. According to previous MDG standards, 98 percent of the population have access to a technologically improved water source. However, the SDG water target for "safely managed water" includes dimensions of water quality, continuity of service, and proximity of water sources. At this time, national data on continuity of service are unavailable. Nevertheless, when considering contamination and location of water sources, about 39 percent of the population have access to an on premise improved water source that taps water free of *E. coli* or arsenic.[1] When considering clean, on-premise piped water service, the figure drops even lower. Less than 2 percent have access to on premise piped water that is also free of contamination.

Recommended Actions for Addressing Issues of Quality of Water Services

Rely less on tube well infrastructure and move to piped water systems that can be more easily accessed, regulated, monitored, and treated. Close to 95 percent of rural water access and about 70 percent of urban water access are provided through tube wells. Since tube well-based service provision is atomized, monitoring of water quality is quite challenging. Of the population consuming tube well water for drinking, more than 13 percent are consuming arsenic-contaminated water as per Bangladesh standards of greater than 50 parts per billion (28 percent as per World Health Organization [WHO] guidelines of greater than 10 parts per billion), while about 38 percent of households are consuming water with *E. coli* contamination. Moreover, water collection and storing leads to unhygienic handling practices thus exacerbating the *E. coli* contamination substantially. Moreover, overdependence on groundwater sources is challenging for water security. In several areas of Bangladesh, due to competing demands from irrigation and urban sprawl, groundwater levels are rapidly falling, posing a threat to sustainable drinking water supply based on groundwater. This is particularly problematic since there is emerging evidence of arsenic contamination in deep aquifers due to over abstraction of groundwater (Shamsudduha et al. 2011). There is a need to transition to centrally treated surface water for drinking water provision, while increasing reliance on surface water-based irrigation.

As the country goes through economic progress with a middle class that is fast expanding, demand for the convenience and comfort of piped water in homes is likely to increase. Nationally, only 7 percent can access piped water on their premise. Transitioning toward piped water supply with resilient infrastructure also provides opportunities for monitoring water quality, centralized treatment, and diversifying water resources, especially in areas in which groundwater issues will persist.

Rehabilitate existing piped water systems to ensure the delivery of clean water. Despite the possibility of centralized water treatment, piped water supply systems in the urban areas deliver water with high levels of *E. coli* contamination. Public taps have a 55 percent contamination rate, while on-premise piped water taps have an 82 percent contamination rate. Illegal connections, frequent pipe breaks, and delayed repair—as well as low water pressure due to intermittent service—may have led to contaminated water from drains to seep into piped water. Water Supply and Sewerage Authorities (WASAs) and other piped water service providers need to prioritize rehabilitating existing damaged piped systems while ensuring more resilient new piped supply infrastructure for new systems. Making WASH service providers more efficient and accountable is a prerequisite for meeting the demand for piped water services within premises. WASH service providers generally bill for their operation and maintenance (O&M) costs, but subsidized electricity and other subsidies artificially reduce cost figures.

Nonrevenue water (NRW) was reduced from 35 percent to 25 percent in the past decade but remains a huge issue.

Improve the monitoring and regulation of water provision by local service providers with a focus on ensuring good water quality. Though Bangladesh has either standards or guidelines on water quality, the country needs to take steps to implement regulation measures across all localities. Rules and enforcement-based approaches to regulating water services at the retail level may face several challenges in Bangladesh, given weak institutional capacities and willingness, as well as poor public awareness. In the short-term, strengthening incentives and simple rule-based provisions may be first attempted by empowering local government institutions (LGIs) to own and deliver on the mandate for assuring safe water for all. In the medium-term, surveillance needs to be extended to both public and private installations, which requires investment in a feasible monitoring methodology for priority biological and chemical contaminates. Identifying an appropriate consumer for monitoring data is also needed. The Water and Sanitation Regulatory Commission proposed by a recent bill prepared by the Ministry of Local Government could serve as the main consumer for surveillance data to create a national database and plans for conducting improvements and replacements of poor performance systems.

Build public awareness and demand for clean water and design behavior change campaigns for improved water handling and treatment at the point of collection and at the household level. Since a significant amount of *E. coli* contamination happens due to improper and unhygienic water handling practices, appropriate and focused behavior change campaigns will be needed across various segments of the population. Currently, just 10 percent of the population practice safe water treatment in the household. Improving awareness of the importance of clean water can go a long way in increasing the uptake of hygienic handling and treatment practices at the level of the point of water collection as well as at the point of consumption in the household. Besides advanced filtering options, household water treatment for arsenic contamination may not be possible, but testing and awareness of arsenic contamination of wells can incentivize households to switch to safer sources that are assured to be available.

Priority 2: Reducing Shared Sanitation, Fecal Contamination of the Environment, and Poor Hygiene Practices

The population relies heavily on shared sanitation facilities that most likely lack proper fecal sludge management. Bangladesh's baseline access level to the new SDG target for "safely managed sanitation" is estimated to at most be 63 percent. The baseline access level to basic hygiene (e.g. handwashing station with available soap and water) is 28 percent. BWPD makes the "safely managed sanitation" estimation by only considering access to improved sanitation facilities that are at household levels and are unshared between households. Though 92 percent of the population has access to sanitation facilities, this figure drops to 64 percent when excluding those facilities that are shared. Moreover, fecal sludge management practices, where excreta is disposed in situ or transported and treated off-site, are most likely lacking. Some studies have estimated that 1 to 2 percent of all fecal sludge is safely managed in urban cities, but little data exists in rural areas. (Blackett, Hawkins, and Heymans 2014; Gunawan, Schoebitz, and Strande 2015; Kabir and Salahuddin 2014; Ross et al. 2016). Aside from the infrastructural and regulatory mechanisms needed to reduce pollution in the environment, proper hygiene practices are also needed. Though handwashing with soap is a person's first line of defense for preventing the transmission of disease, many people lack even basic knowledge of when to wash hands and 28 percent have access to an observed handwashing station with available soap and water in their household.

Recommended Actions for Reducing Shared Sanitation, Fecal Pollution of the Environment, and Poor Hygiene Practices

In the urban areas, prioritize providing alternative on-site sanitation options and safe fecal sludge disposal and treatment. While majority of low-income settlements have shared sanitation facilities, it is important that safe containment, collection, disposal and treatment will help in reduction of fecal contamination. Both centralized and decentralized wastewater treatment options need to be explored based on the population pressures and city plans. Providing sewerage networks should also incorporate behavior change campaigns to promote households connecting to such networks. Where feasible, particularly with availability of land and tenural status, the thrust would be to shift from shared facilities to household sanitation.

In the rural areas, moving up the sanitation ladder by transitioning from unimproved to improved sanitation options is the next major challenge Bangladesh is facing. Moreover, options for safe containment and FSM in rural areas need to be explored to prevent fecal matter from being disposed in water bodies and fields. Encouraging construction of improved toilets with community involvement and facilitating finances to liquidity-constrained households could be appropriate. Monitoring at the community and local government levels can enhance safe fecal sludge disposal and treatment to a large extent. However, such efforts should be combined with campaigns for awareness raising, behavior change and availability of financing.

Promote handwashing and hygienic behaviors through systematic behavior change campaigns in multiple settings including communities, schools, and health settings. Handwashing with soap and water has proved to be a main deterrent of infectious diseases, but the availability of handwashing stations with soap in households is merely 28 percent with considerable difference between the top 60 percent (T60) and B40 of the population. Child feces disposal in the proper manner is quite low in the country, which needs to be changed to reduce fecal exposure in the environment. Promoting menstrual hygiene practices have the potential to increase girls' school attendance, but such practices are relatively limited in the country particularly in the rural areas. Implementing effective behavior change interventions is probably the most difficult task and will require significant involvement from multiple sectors. However, Bangladesh's past successes in behavior change, such as ending open defecation, are encouraging.

Priority 3: Bringing Services to the Poor and Other 'Left-Behind' Populations

There are substantial inequities in WASH service levels, which hinder strategies to promote shared prosperity and meet universal WASH coverage. Those who are left without or with low-quality WASH access are in the B40 of the wealth distribution, including in remote and hard-to-reach villages, disaster-prone areas, and crowded urban slums. Household wealth alone explains 70 percent to 75 percent of whether a child will have access to improved water or improved sanitation infrastructure. Households living in some remote areas of the country are outliers to national access rates, with more than half of the population remaining without access to improved water sources or any fixed place to defecate in some hard-to-reach districts. Coastal regions and other disaster-prone areas deal daily with the impacts of climate change and need resilient water infrastructure that can adapt to issues of salinity intrusion or frequent flooding. In urban areas, the rapidly growing population places further stress on utilities as evidenced by stagnant coverage rates and increasing intercity disparities in access between the rich and the poor.

Recommended Actions for Priority 3

Consider geographical targeting of interventions to reduce the regional disparities in service delivery by channeling resources through the neediest LGIs. Special support is needed to

reduce the regional inequalities in WASH access across districts. This can be implemented through dedicated programs and projects, direct support and technical assistance and through a combination of conditional block grants and performance grants from the central government based on a well-defined and transparent allocation formula.

Consider household level targeting of the poor by the identification of beneficiaries through LGIs or existing targeting platforms. Since local governments are better informed about the economic conditions of the households in their jurisdiction, LGIs should identify beneficiaries who are poor for full or partial subsidization in transparent way, as is the case in many other centrally sponsored schemes. Ongoing social protection programs may also have appropriate targeting platforms that can be used. Further, microfinance institutions (MFIs) can play a major role in providing credit to liquidity constrained consumers for water and sanitation investments, which is already happening in several parts of the country.

Use of dedicated funds to narrow service delivery gaps in hard-to-reach and coastal areas in which the provision of WSS services tend to be expensive, particularly in the last mile. Such dedicated funds should be decided based on investment needs and need to be allocated based on well-established criteria. Specific focus on programmatic support for WSS service delivery in urban low-income communities can be explored by building on the successful experiences in the sector, such as in Korail slums in Dhaka, which scaled up WSS with community participation.

Designate agencies responsible for serving WASH to low-income populations and hard-to-reach areas. These vulnerable populations can especially be left behind in planning and implementation when there is no clear mandate to serve them. For instance, urban low-income settlements (e.g. slums) have a higher than average concentration of informal service providers. Forging partnerships, coordination with local governments, and developing policies to serve these communities as part of utilities' responsibilities, especially to address issues of legality and tenure ship of land. A mandate can also justify building capacity to implement appropriate technology innovations that are designed to surpass unique geographical or social barriers these communities face.

Priority 4: Implementing WASH Beyond the Household

Community establishments such as healthcare facilities, schools, and workplaces overlook safe WASH services. Overall, data are sparse on WASH coverage beyond households. In primary schools, access to improved water sources is 80 percent, with 85 percent access to at least one sanitation facility. Yet the average student to toilet ratio is 100 to 1, double the national standard. About a third of healthcare facilities experience routine water shortages; in addition, the convenience of access is poor, with only 27 percent and 52 percent of healthcare facilities in rural and urban areas, respectively having access to piped water. Moreover, access to handwashing stations with soap and water in many healthcare facilities is lacking. Among manufacturing enterprises with over five employees, only 52 percent have access to at least one toilet.

Recommended Actions for Priority 4

Ensure that specific allocations are made by the Ministries of Health and Family Welfare and Ministry of Education for the construction and maintenance of improved water access and improved toilets in schools. Currently, such allocations are absent, and construction and maintenance of drinking water and sanitation facilities are undertaken with financial support from school management committees or the LGIs. Such resources are often

irregular and inadequate considering the requirements. Earmarked funds for improved water and sanitation facilities and hygiene promotion would ensure public health benefits.

Coordinate with other sectors for monitoring and implementation. Ensure monitoring of water and sanitation facilities in schools and health centers—particularly on whether there are separate facilities for females—and proper maintenance and cleanliness. Most often, even if facilities are available, they are unusable due to lack of proper maintenance, cleanliness, and so on. In the case of schools, monitoring can be best achieved by entrusting the responsibility to school management committee. Interagency coordination and regular monitoring and assessments would yield results on the ground.

Priority 5: Addressing Binding Institutional Constraints and Challenges

Despite its efforts with WASH strategy and well defined legal framework, Bangladesh remains a centralized country, with limited devolution of functions, funds and functionaries to lower tiers of governance. Improper assignment, mixed roles, warped accountability and poor capacities thus combine to produce a policy and institutional setting that is unlikely to be responsive to the emerging challenges of scaling up access—especially for the poor—to water systems that ensure quality and reliability, and sanitation systems that address the full chain of safe excreta management. A lack of national service or pricing standards and monitoring mechanisms have left gaps in water quality and fecal sludge management practices. Apart from deficiencies in the governing structure, financial allocation for the overall sector development is insufficient. The estimated total budget gap is about 47 percent to meet just the government's envisioned water targets by 2025. An appropriate mix of policy changes, gradual and time bound institutional changes, implementation of regulations and effective citizens participation to ensure improved water quality and maintain service standards is needed to overcome many of these constraints to achieve the goal of safe universal access. It is pertinent to make WASH service providers more efficient and accountable for meeting the demand for piped water services within premises from a rapidly growing economy and an expanding middle class in Bangladesh. In addition there is an urgent need to raising finances to meet sector goals.

Recommended Actions for Priority 5

Policy and institutional changes are needed to clarify roles, functions, funds, and functionaries in WASH service delivery. This is a larger and difficult task since all sectors have been impacted by the consequences of incomplete decentralization. Reforms are needed to transition in the LGIs as the primary water service provider, with the Department of Public Health (DPHE) and Local Government Engineering Department (LGED) gradually moving toward being purely technical and sector facilitator agencies for the client LGIs. Given the low capacity of the LGIs, the transition needs to be gradual but timebound. As a first step, a tripartite agreement among LGED, DPHE, and various LGIs on the process and timeline of implementation need to be established. In addition, steps should be undertaken to improve the capacity of the LGIs (both the elected representatives and the staff) for planning, decision making, budgeting, and fiancial management, which will lead to improved service delivery across the sectors, including the WASH sector.

The sector needs to ensure that budget allocations are in line with long-term goals, give dedicated funding to priority populations, and explore additional financing options to close financing gaps. Financing reforms should focus on expanding the existing resource envelope by (a) leveraging private finance, (b) attracting private sector investment, and (c) improving the efficiency and accoutability in the use of available resources to increase its effectiveness. The Sector Development Plan (SDP) (2011), which provides estimates on the expenditure requirements, budget allocations, and budget gaps in the short to medium period needs to be

updated to reflect SDG goals for the sector and changes in costs. Since large budget gaps exist, innovative approaches to raise resources and leverage private finance, including the use of policy-based guarantees, need to be explored. In the short run, financial allocations should be ensured to meet the pressing WASH services needs for the hard-to- reach and coastal areas and low-income communities in rapidly urbanizing cities.

Priority 6: Harnessing Complimentary Effects of WASH to Improve Human Development

WASH has a catalyzing role in improving human development outcomes. Beyond the scientific linkages of WASH and human development outcomes, addressing WASH issues is a fundamental component for any program that aims to reduce poverty and meet the 17 goals of the SDG agenda. Bangladesh has special incentives to implement higher quality WASH services, because they have broad multiplier effects in improving health, nutrition, education, and early childhood development outcomes. They improve public health and facilitate, directly and indirectly, a collection of other important development and poverty reduction goals that improve the capability of populations, such as increasing educational attainment, reducing stunting, and creating a healthy and skilled work force. However, gaps in WASH service delivery including poor water quality, inconvenient access, and high fecal pollution of environments are holding back the effectiveness of investments in the sector. The poor, in particular, feel the greatest burdens of inadequate WASH because of its synergies with other life deprivations such as little income, poor access to health services, food insecurity, and low levels of education. Nationally, the WASH-related enteric disease burden for the poorest quintile is about three times greater than the burden for the richest quintile. Those who are already impoverished thus face indefinite challenges to their health and well-being, adversely impacting their ability to obtain education, skills, and participate in economically productive opportunities. Policies and programs are needed to specifically target quality WASH expansion in areas where the B40 are most prevalent.

Recommended Actions for Priority 6

Future WASH programs can be designed with a "nutrition-sensitive" lens. Bangladesh's stunting rate of children under five is about 36 percent, making it a priority country for the Scaling Up Nutrition (SUN) global initiatives. Nutrition specialists are advocating for multi-sectoral strategies in reducing stunting (Alderman et al. 2013; Shekar et al. 2017), recognizing that no one intervention can solve the malnutrition problem. Given the numerous determinants of stunting, a diverse set of actors will need to commit to the nutrition agenda. For the WASH sector, it is important to understand which interventions have the most impact in reducing risks of fecal contamination. Additionally, it could be warranted to focus closely on immediate fecal-oral pathways (e.g., food, play areas, caregiver contact) during a child's first 1,000 days, which is one of the most critical growth period in life. Water and sanitation practitioners can also aim to be more "nutrition-sensitive" in practice by monitoring WASH indicators most related to enteric infections (e.g., water quality, hygiene behaviors) as opposed to just access to water and sanitation infrastructure. For those practitioners who are not in the position to fully integrate interventions from multiple sectors, convergence of different nutrition-specific and -sensitive interventions could be enough (Chase and Ngure 2016). A common targeting approach for different sectors could be to simply target areas with high prevalence of stunting or poverty since these two populations commonly overlap.

Evaluate the effectiveness of WASH interventions in improving intermediate outcomes related to better human development. The government, donor agencies, universities, and international agencies must continue to generate knowledge that aids policy makers in monitoring strategies and choosing interventions that can meet the rigorous standards of the new SDGs. While substantial investments will be needed to achieve the goals, limited resources and

competing development priorities will require policy makers to discern the most effective WASH interventions for large-scale implementation and identify the most deserving populations for public programs. There are a number of areas in the WASH sector in which knowledge generation and innovation can go a long way in addressing persistant barriers to achieving better human development outcomes such as on water quality, enviornmental sanitaiton, climate change impacts, and behavior change.

Target high-risk populations most susceptible to burdens associated with inadequate WASH. Targeting poorer households with WASH programming could be the most obvious strategy; however, other populations can also significantly benefit from improved WASH. For instance, geography as opposed to poverty status is more likely to determine whether a household faces arsenic-related water quality issues. Moreover, chronic exposure to arsenic during the early stages of life could have the most detrimental consequences on cognitive development and health later in life. Targeting arsenic mitigation strategies to children and pregnant mothers in arsenic-affected regions could be one way to reduce arsenic-related health burdens. Evidence also shows that females are more likely to be responsible for water collection or to miss class due to a lack of gendered-specific sanitation facilities in schools. Taking a gendered approach that relieves these types of burdens might be beneficial.

Considering the shortcomings detailed in the BWPD—as well as the fact that addressing deficiencies in this sector will improve human development outcomes and aid in poverty reduction—it is imperative that such recommendations are considered and acted upon in a sustainable fashion.

None of the WASH challenges that Bangladesh faces is easily met. But in view of its past successes, the country can achieve the new targets in the next decade and a half and meet the SDGs through a combination of well-crafted investment, strengthened institutions, and innovation.

Note

1. Water is considered to be contaminated when sample has greater than 1 colony-forming units per 100 milliliters *E. coli* or greater than 50 parts per billion arsenic (Bangladesh standard).

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Appendix A
Drinking Water and Sanitation Trends by Tier

Table A.1: Drinking Water Trends, by Tier, Region, and Data Source, Bangladesh, 2006–14

Percent

	Urban					Rural					National				
Source	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4
MICS 2006	0.8	99.2	76.2	54.4	22.4	3.1	96.9	95.6	64.1	0.2	2.4	97.6	90	49.1	6.6
DHS 2007	0.5	99.5	n.a.	n.a.	26.2	3.7	96.3	n.a.	n.a.	0.2	3	97	n.a.	n.a.	6
MICS 2009	0.5	99.5	n.a.	n.a.	32.5	2.5	97.5	n.a.	n.a.	1.4	2.1	97.9	n.a.	n.a.	7.6
DHS 2011	0.6	99.4	98.7	82.2	36.2	1.8	98.2	97	67.6	1.2	1.5	98.5	97.4	61.9	9.7
MICS 2012–13	0.8	99.2	98.4	82.9	25.2	2.4	97.6	95.9	71.9	0.9	2	98	96.5	64.4	5.6
DHS 2014	0.9	99.1	97.5	78.4	22.3	2.9	97.1	95.7	73.5	1.5	2.4	97.6	96.2	65.1	7.1

Sources: World Bank calculations using Demographic and Health Survey (DHS) data and Multiple Indicator Cluster Survey (MICS) data.
Note: Tier 0 = use of unimproved water technologies; Tier 1 = use of improved water technologies; Tier 2 = use of improved water technologies within 30 minutes of access; Tier 3 = use of improved water technologies available on household premises; Tier 4 = use of piped water supply available on household premises; n.a. = not available.

Table A.2: Sanitation Trends, by Tier and Data Source, 2006–14

Percent

	Urban					Rural					National				
Source	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4
MICS 2006	2.6	46.6	81	53.4	n.a.	9.5	53.7	70.2	46.3	n.a.	7.5	51.7	73.3	48.3	n.a.
DHS 2007	1.7	49.1	80.2	50.9	6.0	9.1	49.5	79.3	50.5	0.2	7.5	49.5	79.3	50.5	1.5
MICS 2009	1.3	45.7	86.4	54.3	n.a.	6.9	43.6	79	56.4	n.a.	5.8	44.1	80.5	55.9	n.a.
DHS 2011	0.8	45.6	87.9	54.4	6.8	5.2	42.8	85.9	57.2	0.2	4.2	43.4	86.4	56.6	1.8
MICS 2012–13	1.6	41.9	92.5	58.1	n.a.	5.2	39.5	87	60.5	n.a.	4.4	40.1	88.2	59.9	n.a.
DHS 2014	0.9	41.5	93.0	58.5	6.7	4.2	34.9	91.3	65.1	0.2	3.3	36.7	91.8	63.3	2.0

Sources: World Bank calculations using Demographic and Health Survey (DHS) data and Multiple Indicator Cluster Survey (MICS) data.
Note: Tier 0 = use of unimproved water technologies; Tier 1 = use of improved water technologies; Tier 2 = use of improved water technologies within 30 minutes of access; Tier 3 = use of improved water technologies available on household premises; Tier 4 = use of piped water supply available on household premises; n.a. = not available.

Appendix B
Drinking Water and Sanitation Tiers by Wealth

Table B.1: National Drinking Water Tiers, by Wealth and Region, Bangladesh, 2014
Percent

		Tier 1	Tier 2	Tier 3	Tier 4
		Improved water	Improved water within 30 minutes	On-premise improved water	On-premise piped water
National		97.6	96.2	74.9	7.1
Bottom 40	Total	95.7	93.7	62.2	0
	Rural	95.4	93.4	62.2	0
	Urban	98.4	96.6	62.9	0.1
Top 60	Total	98.9	97.9	83.5	11.9
	Rural	98.8	98.1	85.1	2.9
	Urban	99.2	97.6	81.0	25.5

Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).

Table B.2: National Sanitation Tiers, by Wealth and Region, Bangladesh, 2014
Percent

		Tier 1	Tier 2	Tier 3
		Improved sanitation, including shared	Improved sanitation, unshared	Private sewer connection
National		**91.8**	**63.3**	**2.0**
Bottom 40	Total	84.7	54.8	0
	Rural	84.2	54.4	0
	Urban	89.8	59.0	0
Top 60	Total	96.5	68.9	3.3
	Rural	98.5	75.8	0.4
	Urban	93.5	58.4	7.7

Source: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016).

Appendix C
Clean Water Access by Tier

Table C.1: Clean Water Access Tiers, by Region and Wealth Quintile, Bangladesh
Percent

		Tier 1	Tier 2	Tier 3	Tier 4
		Clean improved water	Clean improved water within 30 minutes	Clean on-premise improved water	Clean on-premise piped water
National		**52.3**	**51.5**	**39.0**	**1.5**
Region	Rural	54.5	53.6	40.8	0.6
	Urban	43.3	42.5	31.4	3.7
Division	Barisal	67.0	62.5	27.4	0.8
	Chittagong	41.6	39.7	26.4	1.8
	Dhaka	43.9	43.2	360	20
	Khulna	51.1	51.2	33.7	0
	Rajshahi	64.0	64.2	51.5	0.5
	Rangpur	71.1	71.1	67.9	0.0
	Sylhet	32.6	32.2	22.8	1.8
Wealth Quintiles	B40	55.9	54.9	36.1	0
	T60	49.5	48.8	40.7	2.3
	Poorest	55.8	54.8	33.9	0
	Second	55.9	54.8	38.4	0
	Middle	52.3	51.9	41.3	0.3
	Fourth	53.5	52.7	44.6	1
	Richest	42.6	41.8	36.3	5.3

Sources: World Bank calculations using Demographic and Health Survey (DHS) 2014 data (NIPORT, Mitra and Associates, and ICF International 2016) and Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: Contamination rates were estimated using MICS 2013. Access levels were estimated using DHS 2014. Clean access levels were calculated by multiplying contamination rates by access levels. B40 = bottom 40 percent of population; T60 = top 60 percent of population.

Appendix D
Improved Water, Clean Water, and Improved Sanitation, by District, 2013

Table D.1: Improved Water, Clean Water, and Improved Sanitation for the B40 and T60 Populations, by District, 2013

	Improved water (T1)			Clean water (T1-adjusted)			Improved sanitation (T2)		
District	B40	T60	Total	B40	T60	Total	B40	T60	Toal
Bagerhat	50.5	83.7	63.5	19.7	31.5	24.3	24.8	61.9	39.4
Bandarban	37.9	80.9	45.9	2.7	12.5	3.7	7.8	61.0	17.7
Barguna	88.6	93.6	90.6	59.0	75.8	64.6	33.6	73.0	48.9
Barisal	99.4	100	99.7	41.2	30.6	36.7	22.6	59.8	41.8
Bhola	100	100	100	82.6	86.1	83.7	27.2	73.8	40.3
Bogra	100	100	100	72.5	68.1	70.5	41.0	69.5	58.0
Brahmanbaria	100	100	100	0.0	33.9	28.0	12.9	61.7	48.0
Chandpur	94.9	99.0	97.5	94.9	86.5	89.0	52.0	86.0	74.0
Chittagong	96.1	99.4	98.5	46.2	38.1	40.8	15.1	64.3	50.4
Chuadanga	100	100	100	43.9	55.6	51.1	49.4	67.4	61.5
Comilla	99.4	100	99.9	30.7	23.1	24.4	54.6	81.8	76.6
Cox's Bazar	99.6	100	99.8	65.8	78.9	71.5	36.7	75.4	51.7
Dhaka	100	99.9	99.9	0	8.6	7.9	31.0	56.5	55.2
Dinajpur	100	100	100	66.4	39.1	52.7	62.0	93.7	80.1
Faridpur	99.6	100	99.8	31.7	44.9	40.1	51.3	84.8	70.3
Feni	100	100	100	0.0	30.1	24.9	45.6	74.8	69.2
Gaibandha	100	100	100	68.5	73.8	70.5	63.1	93.0	77.6
Gazipur	100	100	100	0.0	23.1	21.2	42.6	46.8	46.2
Gopalganj	100	99.4	99.7	6.9	16.6	11.8	62.4	84.5	74.0
Habiganj	98.6	100	99.2	29.5	45.0	34.2	33.9	74.3	52.0
Joypurhat	100	100	100	27.9	64.4	43.4	35.9	66.2	52.2
Jamalpur	99.9	100	100.0	97.3	94.9	96.4	23.5	58.2	39.1
Jessore	100	100	100	47.0	63.9	58.5	53.8	72.1	66.0
Jhalokati	91.3	95.8	93.9	91.3	95.8	93.9	53.3	79.4	68.1

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Table D: Continued

District	Improved water (T1)			Clean water (T1-adjusted)			Improved sanitation (T2)		
	B40	T60	Total	B40	T60	Total	B40	T60	Toal
Jhenaidah	100	100	100	29.3	38.0	34.9	45.2	74.9	65.9
Khagrachhari	57.6	98	69.8	16.5	56.7	26.7	10.4	64.8	26.9
Khulna	87.6	97.6	93.7	58.9	78.2	71.0	19.0	49.5	37.6
Kishorganj	100	100	100	64.7	61.0	62.9	21.1	59.2	41.1
Kurigram	99.1	100.0	99.4	82.5	55.6	75.6	39.5	72.5	51.1
Kushtia	100	100	100	82.7	51.9	59.8	46.1	69.9	61.9
Lakshmipur	100	100	100	54.9	20.7	36.8	47.3	80.7	65.2
Lalmonirhat	99.4	100	99.7	80.5	78.0	79.4	37.7	70.9	52.7
Madaripur	99.3	100	99.7	19.1	11.2	16.2	73.7	87.3	81.3
Magura	100	100	100	60.8	40.7	49.6	47.0	77.4	64.1
Manikganj	99.6	99.2	99.3	53.4	47.4	49.8	55.3	79.9	71.5
Meherpur	99.1	100.0	99.7	49.7	70.6	62.8	42.9	62.9	57.5
Maulvibazar	98.2	99.3	98.9	37.5	64.0	53.6	43.7	82.8	66.7
Munshiganj	99.9	100	100.0	99.9	85.1	86.3	26.0	52.9	48.6
Mymensingh	100	100	100	36.9	34.5	35.6	28.6	67.8	48.1
Naogaon	99.5	99.8	99.6	64.1	68.4	66.2	12.1	55.0	32.5
Narail	99.2	100	99.7	44.1	51.2	48.0	58.6	76.2	69.1
Narayanganj	100	99.91	99.9	100	86.8	88.9	28.9	47.6	45.9
Narsingdi	100	99.76	99.8	33.8	68.1	58.6	28.3	63.8	54.7
Natore	100	100	100	72.9	60.3	66.5	28.6	61.9	47.9
Nawabganj	97.4	97.3	97.3	58.0	61.4	59.7	25.6	62.0	45.6
Netrakona	100	100	100	40.2	20.5	31.6	27.1	67.9	41.7
Nilphamari	100	100	100	59.9	73.9	63.3	38.9	65.4	49.5
Noakhali	100	99.8	99.9	62.9	58.8	60.7	42.5	79.5	63.3
Pabna	96.4	99.1	97.9	60.0	58.6	59.4	43.2	60.5	52.6
Panchagarh	99.6	100	99.7	85.2	75.4	82.3	28.7	54.8	36.4
Patuakhali	99.6	100	99.8	70.0	86.7	77.8	41.6	81.4	59.1
Pirojpur	72.5	80.3	76.3	36.0	59.6	48.2	71.0	82.7	76.8
Rajshahi	99.2	99.6	99.4	55.6	67.6	62.6	46.0	69.5	60.2
Rajbari	100	100	100.0	60.3	56.4	58.0	51.0	76.7	64.7
Rangamati	43.3	89.6	60.7	6.5	52.3	22.4	11.1	68.9	32.8
Rangpur	99.9	100	99.9	75.8	77.5	76.5	29.1	64.3	43.9
Shariatpur	100	100	100	100	92.8	96.8	68.9	82.0	75.6
Satkhira	87.9	93.1	90.5	26.0	31.3	28.6	52.2	75.3	63.6
Sirajganj	100	100	100	72.8	68.1	70.8	45.7	73.0	60.1

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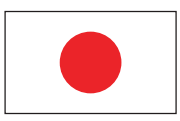
Table D: Continued

	Improved water (T1)			Clean water (T1-adjusted)			Improved sanitation (T2)		
District	B40	T60	Total	B40	T60	Total	B40	T60	Toal
Sherpur	99.4	99.02	99.2	68.2	74.0	69.7	22.5	55.2	37.7
Sunamganj	99.0	100	99.5	22.2	10.4	17.1	24.8	78.3	50.8
Sylhet	69.5	90.4	83.8	6.7	32.6	24.1	32.0	78.1	63.4
Tangail	100	99.8	99.9	37.2	69.4	60.0	39.5	74.1	64.9
Thakurgaon	100	100	100	82.7	100.0	89.2	24.5	57.7	35.6

Source: World Bank calculations using Multiple Indicator Cluster Survey (MICS) 2013 data (UNICEF and BBS 2015).
Note: B40 = bottom 40 percent of population; T = tier; T60 = top 60 percent of population.



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