



Making water safe for maternal & neonatal care in Bangladeshi hospitals



Story of change: Key findings & emerging impacts

Summary

- REACH's work on improving water safety in hospitals in Bangladesh focuses on the role of environmental hygiene, water systems design and maintenance on water quality in maternal and newborn care areas.
- Investment in maternity and neonatal healthcare units will not fully address infection risks if water quality remains unmanaged.
- REACH research demonstrated that water quality in hospitals is compromised by poorly maintained water systems in hospitals, as well as poor environmental hygiene, placing patients at risk of hospital acquired infections.
- Exclusively monitoring drinking water overlooks the risks of contaminated water for healthcare use.
- Water quality deteriorates from the source to the point of use highlighting the need for proactive water safety plans for healthcare facilities, to deliver on infection prevention goals.
- Sensitisation of health stakeholders in water quality and environmental health risks led to improvements in medical waste management and water systems.
- On-going collaborative action research with UNICEF is expanding water safety planning approaches for hospitals in Bangladesh.

 Bangladesh



Introduction

Public hospitals are crucial for providing emergency and specialist care for the poor in Bangladesh. There are only 254 government-owned hospitals serving a population of 169.4 million. However, the environmental condition in the public hospitals is poor due to overcrowding, and inadequate medical waste management and environmental hygiene services to meet the over-burdened facilities. Since the Millennium Development Goals, health programmes driving the expansion of maternity services and childbirth in health facilities have not been matched with investments in essential water, sanitation and hygiene (WASH) services leaving mothers and babies at risk of healthcare-associated infection. Healthcare-associated infections are the leading cause of adverse harm to patients globally. The negative consequences of healthcare infections are multifaceted – from prolonged treatment and hospitalisation, incurring greater financial burden, physical and mental toll from the pain and disability and even death. Critically with the rise in antimicrobial resistance globally, patients affected by drug-resistant infections are at greater risk of treatment failure and death.

Lack of adequate WASH services in healthcare facilities threatens the health of patients and staff, and can erode public confidence in the health service, influence care-seekers' decision making as to what services to access, and be detrimental to HCF staff morale and work efficiency. Globally, up to 10–25 % of deaths among pregnant or mothers who have recently delivered and babies are associated with infections they acquired in the hospital. Unfortunately, many HCFs in low-resource settings lack the diagnostic capacities and active surveillance systems to identify these healthcare-associated infections. Consequently, preventable infections or outbreaks caused by contaminated environmental sources, including water for healthcare use, go undetected and are not appropriately intervened.

The vital role of water services to support the various aspects of infection prevention and control practices such as hand hygiene, decontamination of work surfaces and medical equipment, thereby disrupting the pathogen transmission, is irrefutable. However, investment in WASH infrastructure alone is insufficient to address the infection risk. The water supply for use in delivering care must also be safe. Hospital water systems can be contaminated with waterborne pathogens, and be transmitted to patients during treatment and care, causing wound, bloodstream and urinary infections, and pneumonia. Patients with underlying health conditions and weakened immunity, such as newborn babies, those undergoing surgery, and mothers in childbirth, are most susceptible to harm from unsafe water.

Insights into water quality for healthcare facilities in Bangladesh

Currently 77% of Bangladesh healthcare facilities have improved on-premises water supply, but there is no systematic data on the quality of the water for drinking or providing care. In partnership with UNICEF Bangladesh, the REACH programme undertook a pilot study to examine water quality in 14 rural public hospitals across eight districts, for both drinking and use in care giving. An initial water quality and WASH system assessment for two hospitals was funded by REACH (with leveraged funding from the University of Oxford) – Kurigram District Hospital (district population served ~2.1 million) and Shaheed Ahsan Ullah Master General Hospital, Tongi (district population served ~3.4 million). The methodology was then adopted in the FCDO-funded 'Baseline Facility Readiness Assessment of Upazila Health Complex and District Hospitals in eight districts' and used in a further 12 hospitals, located across different geographical locations and the primary point of access for the health care needs of all ages including in-patient care, surgery, maternal and newborn services.

Each of the 14 hospitals selected for water quality analysis achieved the JMP definition of basic water service for healthcare facilities i.e. all had access to improved water source on their premises.

Figure 1: Hospital water systems had multiple risks to water quality from poor management of solid waste, poor source protection, and lack of maintenance systems, and poor hygiene around sinks and non-clinical areas.



Water samples were systematically collected across the distribution systems, at the source, in storage tanks, and finally from taps in various clinical and non-clinical areas, between February to September 2021. They were tested for the drinking water indicator, *E. coli*, and a panel of bacteria known to cause healthcare-associated infections. The isolated bacteria from the water samples were also tested for their ability to resist essential and emergency antibiotics in the treatment of infection, also known as antimicrobial resistance.

During sampling, each water system was inspected for infrastructural risks and environmental contaminants, and the field team recorded information on the operation and maintenance of the water systems, such as water treatment. Notably, across the study hospitals, drinking water was often sourced directly from hand-operated tube wells, separated from the main water system network supplying water for patient care and use in hygiene.

Drinking water quality alone is not enough

Our assessment identified significant threats to water quality from poor water system installation and exposure to environmental contaminants such as medical waste and sanitation systems. Maintenance of water systems was not routinised, resulting in the varied usability and poor conditions of taps and sinks observed (Figure 1). There were three notable findings (Figure 2):

1. Water systems with poor sanitary or infrastructure condition had poorer water quality, with water quality deteriorating from the source through storage tanks and piped networks to the final point of use.
2. Sources used for drinking water, often separate boreholes not connected to a piped system, were often of higher quality. Exclusively monitoring drinking water will overlook the risks of using contaminated water for healthcare use in care giving and hygiene practice (Figure 2).
3. Despite investment to improve high risk areas (maternity and neonatal units, operating rooms), a range of bacteria (such as *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Klebsiella pneumoniae*, *Legionella spp*) were isolated in the water from the hospital water system used in the care of vulnerable patients (Figure 3). Critically, the recovered bacteria harbored antimicrobial resistance to first-line and reserve (last-line) antibiotics for treating infections in mothers and newborns.

Figure 2: Water quality for care giving and hygiene deteriorates across hospital water systems, while separate sources are used for drinking water.

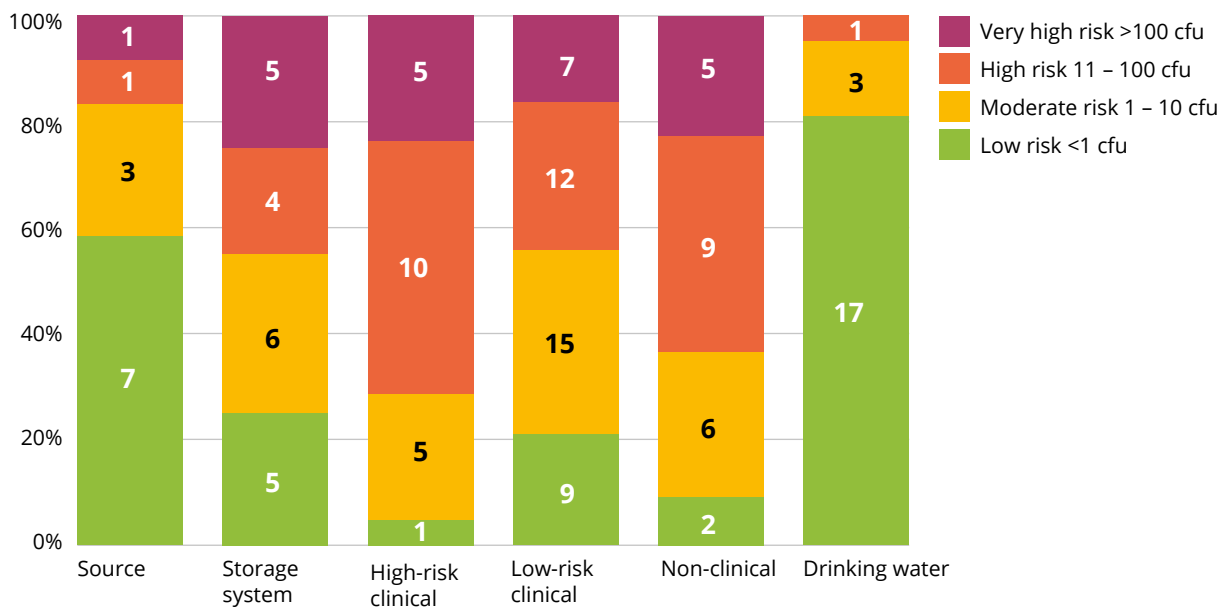
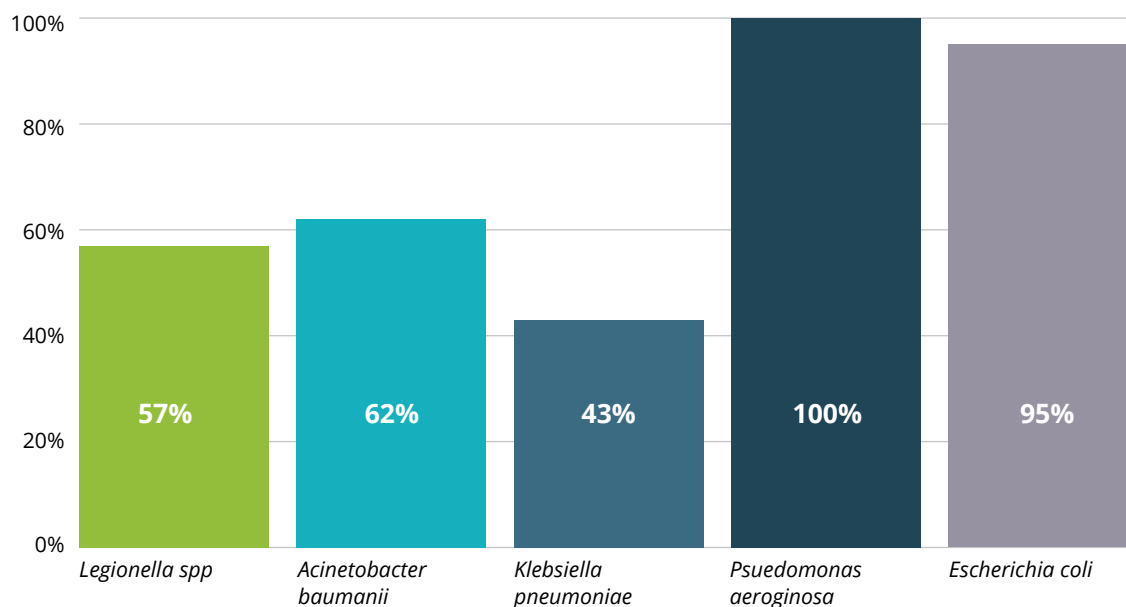


Figure 3: Co-prevalence of target pathogens from water samples collected from high-risk clinical areas.



Transformative WASH improvement: impact of research-practitioner collaboration

Findings from this pilot study of hospital water quality has been instrumental in informing an ongoing action research partnership between REACH and UNICEF, Bangladesh. UNICEF work closely with the Government of Bangladesh to deliver national health and WASH strategies and were integral to the development of the National WASH in healthcare facilities strategy for Bangladesh (2019–2023). The impact of the collaborative pilot research cuts across sectoral boundaries, creating transformative change at the facility level and informing care policy at the national level.

Observable and reported improvements included:

- **Sensitisation of healthcare stakeholders to environmental hazards impacting the WASH services**

During water system inspections and sampling, the field team directly engaged with hospital stakeholders to discuss study objectives and share preliminary assessments.



This led to discussions on the threats of environmental hazards compromising the safety and functionality of the WASH services. Following the initial visit and feedback, hospital stakeholders undertook remediation of the WASH facilities including relocation of the hospital water systems. The hospitals identified and implemented locally actionable strategies to improve environmental hygiene, including an effective medical waste and cleaning protocol.

- **Improved morale and pride for hospital staff and local NGO partners**

Prior to this project, many of the WASH facilities in the survey hospitals were in dilapidated condition. Working with hospital stakeholders (administrators, medical, nursing and maintenance staff) and local NGOs, we employed a systems approach to assessing the WASH services, using the WASH-FIT tool in Bangla. Contextual informed assessments were integral to informing the risk prioritized rehabilitation of the WASH infrastructures by UNICEF. At facility level, the improvement in the quality of WASH facilities and environmental hygiene has positively bolstered the morale of hospital staff.

- **Prospective research collaboration to inform national policy on WASH in healthcare and health services quality improvement**

This research highlighted the critical need to address water quality in healthcare facilities to ensure safety of patients, particularly vulnerable patients in maternal and neonatal services. Preliminary findings have been instrumental in steering the next phase of collaboration with UNICEF and the government of Bangladesh, to develop and implement context-driven and actionable Water Safety Plans for Bangladesh hospitals. With the escalating burden of antimicrobial resistance globally, including Bangladesh, this work has also sensitized health stakeholders to the risk of unsafe water services as a vehicle in spreading antibiotic resistant bacteria in the hospital environment and to patients. Consequent response undertaken by UNICEF include the advocacy for integration of WASH services into quality improvement frameworks for hospitals, with an emphasis on the vital importance of quality of WASH services to support infection prevention goals.

Conference paper

[The utility of E. coli in characterising hazards in healthcare facility water systems: Evidence from Bangladesh.](#) Ong, L., Mahmud, Z.H., Alam, M., Ferdous, J. and Charles, K. Water Safety Conference 2022 in Narvik, Norway.

Figure 4: Upgrades to the water system following sensitisation of the health stakeholders at Kurigram District Hospital.



Figure 5: Environmental hygiene improvements observed at Shaheed Ahsan Ullah Master General Hospital, Tongi.



Key contacts



Li Ann Ong
School
of Geography and the
Environment, University of
Oxford

li.ong@ouce.ox.ac.uk



Md Moniral Alam
UNICEF Bangladesh
malam@unicef.org



Prof Katrina Charles
School of Geography and the
Environment, University of
Oxford, UK

katrina.charles@ouce.ox.ac.uk

REACH is a global research programme to improve water security for the poor by delivering world-class science that transforms policy and practice. The REACH programme runs from 2015–2024 and is led by Oxford University with international consortium of partners and funded with UK Aid from the UK Government's Foreign, Commonwealth & Development Office. Project code 201880.

Story of change themes



Groundwater



Land



Coasts



Gender



Schools



Services



Health



Climate



Cities



Basins