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Invited Perspective: Beyond National Water Quality Surveys: Improving Water Quality Surveillance to Achieve Safe Drinking Water for All (Sustainable Development Goal 6.1)

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Escherichia coli (*E. coli*) contamination is the primary reason safely managed drinking water criteria have not been met globally. This is a key finding of the new paper from the Joint Monitoring Program team (Bain et al. 2021). The paper presents an analysis of the wealth of data from implementation of the United Nations International Children's Fund (UNICEF) Multiple Indicator Cluster Survey (MICS) water quality module in 27 low- and middle-income countries, including nationally representative samples of fecal contamination (*E. coli*) in drinking water at the point of collection (PoC) and the point of use (PoU).

The results demonstrate the scale of the water quality challenge. At the PoC, the proportion of the population with access to drinking water without detectable *E. coli* ranged from 10% in Sierra Leone to 84% in Mongolia and Algeria. In 9 of the 27 countries, at least a third of the population are using very high-risk drinking water sources (>100 *E. coli* colony forming units/100 mL). Contamination was even higher at the PoU; in 17 of 27 countries, less than a third of the population had access to PoU water without *E. coli*. For PoU contamination, risk factors included animal ownership, poor sanitation, and rural locales. Although there are limitations to the use of grab samples for *E. coli* (Charles et al. 2020), the authors have undertaken detailed sensitivity analyses to provide a high degree of confidence in these associations.

MICS water quality data are able to elucidate the situation in individual countries and, through the analysis by Bain et al. (2021), at an aggregate level. However, MICS water quality surveys do not provide the data that water managers need to inform improvements in water safety in order to achieve the United Nations Sustainable Development Goal (SDG) 6.1 (https://unstats.un.org/sdgs/report/2021/goal-06/). As the authors state, "A single measurement of water quality, often during a season when weather is favorable for fieldwork, is not a substitute for routine monitoring by the responsible authorities in each country." Without routine monitoring we will not understand the true burden of fecal contamination in drinking water.

Bangladesh is the first country for which two MICS water quality sampling campaigns have been completed (2012–2013 and 2019). Analysis of progress across the two data sets exemplifies one of the limitations of these data sets—the impact of weather during sampling on results. Bain et al. (2021) have explored this issue in their analysis, identifying a link between season and PoU water quality, but in-country comparisons better illustrate the impact. In Bangladesh, despite progress across all areas of water access, sanitation, and hygiene, the measured water quality results did not show similar improvements, with very minor gains at the PoC and a large deterioration at the PoU (Bangladesh Bureau of Statistics and UNICEF Bangladesh 2021). Analysis by month to account for weather changes told a different story: Much more substantial gains were achieved for microbiological water quality at the PoC when month of sampling was considered, improving by ~10–20 percentage points between the campaigns, with no large deterioration in water quality at the PoU. The difference? Sampling for the 2012–2013 campaign occurred under cooler and drier conditions, conditions associated with less *E. coli* contamination, whereas the 2019 campaign was undertaken around 2 months later as temperature and rainfall increased.

MICS water quality sampling has huge value in identifying risks and inequalities. However, water supply managers and authorities need access to water quality data on a more regular basis (i.e., more frequently than every 5 y), and data that accounts for seasonal risks, to support improvements in drinking water safety. In Bangladesh, owing to these limitations in the MICS methodology for tracking change and the lack of data generated for water managers, one of the recommendations is to strengthen surveillance of water quality by regulatory authorities through a longitudinal water quality monitoring program (Figure 1). There are manifold challenges in implementing effective routine water quality monitoring to fill the existing data gap, ranging from financial resources to capacity to coordination (WaterAid 2021). Bangladesh's proposed approach provides data for international monitoring as well as advancing water safety in-country, but its success will rely on Bangladesh's good existing level of capacity.

To advance water safety toward achieving SDG 6.1, which aims to secure safe and affordable drinking water for all, we recommend three key areas in which capacity needs to be strengthened to support improvements at a country level. First, better information obtained through increased risk-based monitoring by national agencies and water service providers of water safety issues is needed to increase the visibility of the hazards, including climate-related hazards, such as salinity and heavy rainfall. Second, improved institutional clarity on roles and responsibilities is needed to ensure that the data get to the people who can respond and act on water safety evidence. Third, more investment is needed in mainstream water safety planning, including climate resilience, at all scales, including in rural areas.

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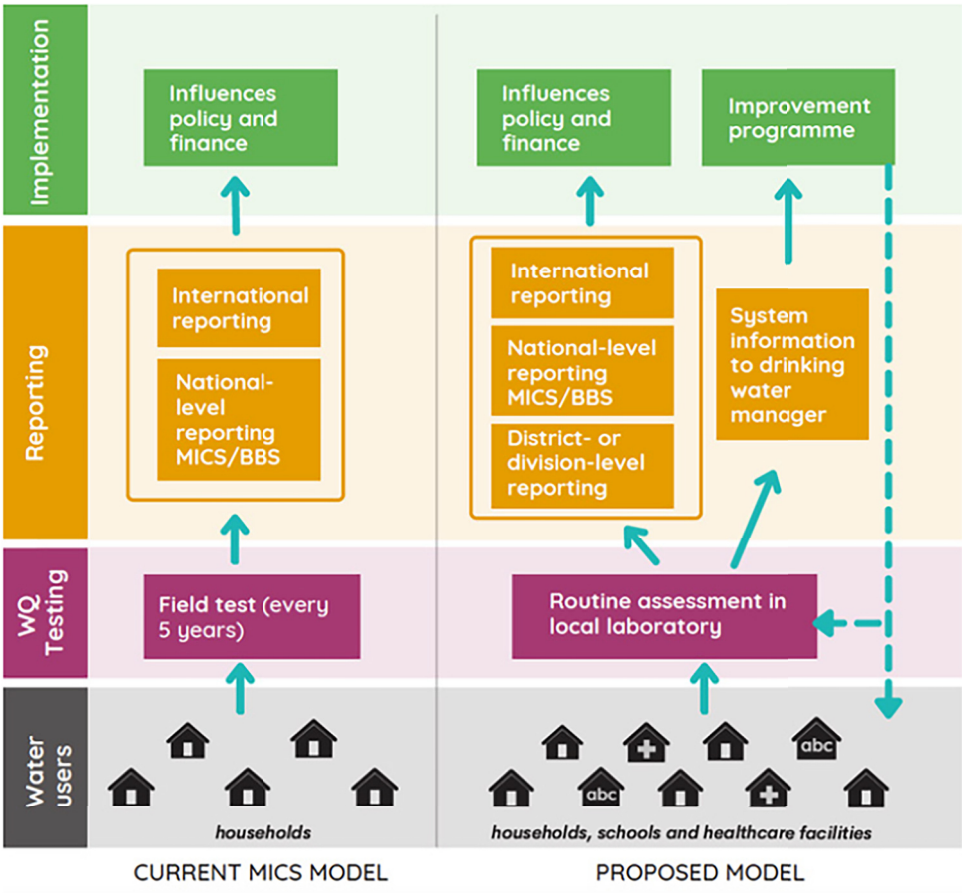

Figure 1. Proposed model for national, longitudinal water quality monitoring for Bangladesh (Bangladesh Bureau of Statistics and UNICEF Bangladesh 2021). Note: BBS, Bangladesh Bureau of Statistics; MICS, Multiple Indicator Cluster Survey; WQ, water quality.

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