WHAT IS THE MICROBIAL QUALITY OF DRINKING WATER IN AFRICA?

Monitoring for Safe Water (MfSW) is an action-research program that promotes drinking water safety through improved monitoring. The Aquaya Institute (Aquaya) launched MfSW with a grant from the Bill & Melinda Gates Foundation. Partners have included the African Water Association (AfWA), the International Water Association (IWA), and the World Health Organization (WHO).

INTRODUCTION

The United Nation's 2030 Agenda for Sustainable Development includes a target for achieving universal and equitable access to safe and affordable water for all by 2030. To assess the current state of drinking water quality in sub-Saharan Africa, how it varies by source type, and how institutions respond to contamination events, Aquaya researchers published an analysis of the largest dataset ever compiled on microbial drinking water quality on the continent:

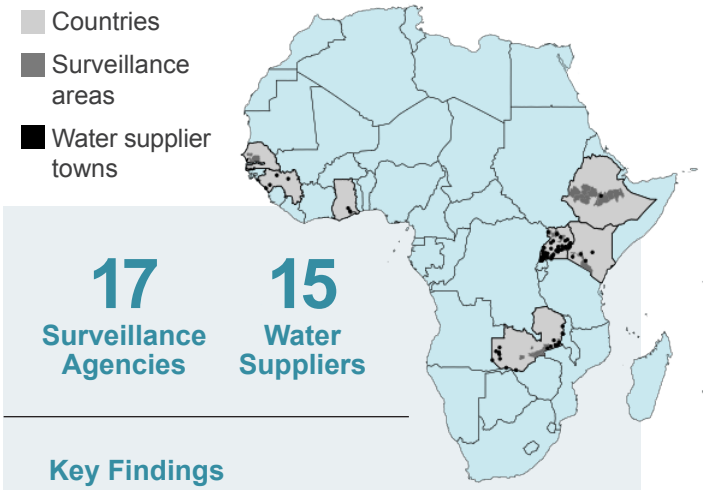
Kumpel, E., Peletz, R., Bonham, M., & Khush, R. (2016). Assessing Drinking Water Quality and Water Safety Management in Sub-Saharan Africa Using Regulated Monitoring Data. Environmental science & technology, 50(20), 10869-10876.

This brief summarizes the results of their analysis.

MONITORING FOR SAFE WATER

In most countries, two types of institutions are mandated to collect drinking water quality data: 1) water suppliers, who conduct operational monitoring to ensure the safety of their treatment and distribution processes; and 2) independent agencies, often responsible for public health, who conduct surveillance monitoring to ensure that all drinking water sources comply with national standards.

The study used 42,926 microbial water quality test results from 32 surveillance agencies and water suppliers across seven sub-Saharan African countries (Figure 1). These tests had been conducted between January 2009 and July 2015. The methods used to quantify fecal indicator bacteria (FIB) included presence/absence, membrane filtration, multiple test-tube, and direct plate counts.



17 Surveillance Agencies

15 Water Suppliers

Key Findings

1. Of all drinking water sources, piped supplies had the lowest level of fecal indicator bacteria.
2. A substantial fraction of improved water sources tested positive for indicators of fecal contamination, with protected dug wells being as frequently contaminated as unimproved springs and wells.
3. Therefore, source type is not a substitute for water quality measurements, although it is still a useful indicator.
4. For water suppliers, remedial actions included flushing and disinfecting pipelines and tanks. In contrast, for surveillance agencies the main remedial action was to educate consumers on household water treatment and storage.

Figure 1: Surveillance agencies and urban water suppliers from which data were obtained

Institutions collected water samples from on- and off-plot piped supplies, non-piped improved water sources, unimproved groundwater sources, surface water, stored water, and bottled/sachet water. Formal water suppliers generally only monitored piped water supplies, while surveillance agencies monitored all source types. Samples were collected at a range of locations, including businesses, non-governmental organizations, refugee camps, educational institutions, food service facilities, government facilities, religious institutions, public spaces, and health centers.

WATER QUALITY MEASUREMENTS

Figure 2 shows the levels of fecal contamination by source type. Piped water (on plot or at public taps) had the lowest levels of FIB, followed by rainwater, tubewells/ boreholes, bottled/sachet water, and protected springs. Dug wells (protected and unprotected), unprotected springs, and surface water were the most contaminated with FIB. Unimproved sources were generally more contaminated than improved sources. However, a non-negligible fraction (approximately 7%) of samples from improved sources had some level of fecal contamination (FIB ≥ 1/100 mL).

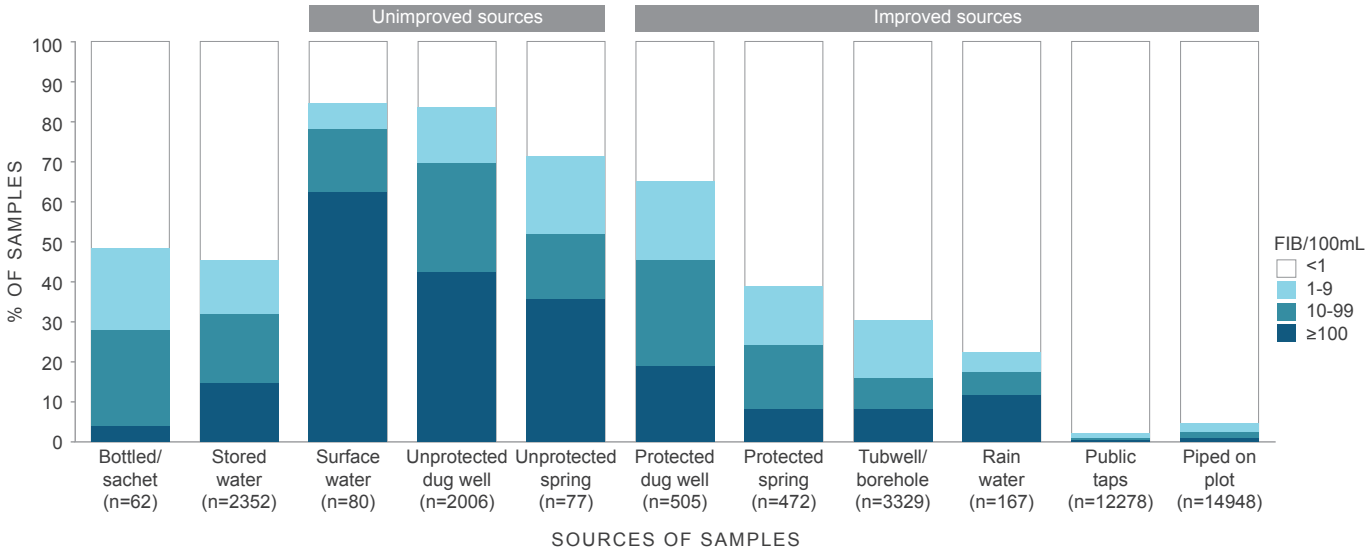


Figure 2: Fecal contamination levels in samples collected from improved, unimproved, and stored sources. Dark blue represents the highest level of fecal contamination; white the lowest level. N indicates the number of samples per source type.

Levels of fecal contamination varied substantially within countries. For example, in Senegal, approximately three-quarters of samples from unprotected dug wells in one region had more than 100 FIB/100 mL compared to about only a quarter in two other regions.

Remedial actions were taken in response to 77% of contaminated samples. For water suppliers, remedial actions included flushing and disinfecting pipelines and tanks. For surveillance agencies, the main remedial action was to educate consumers on household water treatment and storage.

CONCLUSIONS

While the WHO/UNICEF Joint Monitoring Programme (JMP) has classified protected dug wells as improved water sources, in this study they were frequently found to be as contaminated as unimproved water sources. Water from protected dug wells was consistently of poor quality across the countries and within regions. Water tested from rainwater catchment systems, boreholes, and protected springs also contained non-negligible levels of contamination. This illustrates that source type is not an adequate substitute for water quality.

Regulated water monitoring provides an important contribution for evaluating progress toward universal access to safe water. It is therefore necessary to increase monitoring and risk management, particularly of non-piped improved water sources such as dug wells, as these are the sources most commonly used by Africans while posing potential microbial risks to health.

The full text can be found at: http://pubs.acs.org/doi/abs/10.1021/acs.est.6b02707

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