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RESEARCH BRIEF, SEPTEMBER 2020

FROM DATA TO DECISIONS

WATER QUALITY MONITORING PROGRAMS IN KENYA

INTRODUCTION

Most countries maintain regulatory requirements for testing of drinking water supplies to guide treatment procedures and ensure safe water delivery to consumers. It is unclear, however, whether the water quality test results reliably reach senior institutional managers, the regulators that required such testing, or other stakeholders who could act to improve water systems. Because testing water quality is expensive and time-consuming (Crocker & Bartram, 2014; Delaire et al., 2017; Wright et al., 2014), it is important to maximize the cost-effectiveness of testing programs. This study describes and assesses the formal and informal systems used by institutions with regulatory requirements for testing drinking water quality in six sub-Saharan African countries to organize, analyze, and transmit information about drinking water quality.

METHODS

This study engaged 26 institutions from six countries (Ethiopia, Guinea, Kenya, Senegal, Uganda, and Zambia) as part of The Aquaya Institute's Monitoring for Safe Water (MfSW) research program (2012-2016), which was designed to build capacity for conducting monitoring of water safety in sub-Saharan Africa (Peletz et al., 2013). Institutions in this study included: i) piped water suppliers responsible for performing operational monitoring of the quality of their sources, treatment processes, and distribution systems; and ii) surveillance agencies responsible for monitoring all supplies of drinking water from any source type at the point of consumption within their geographical jurisdiction. The Aquaya Institute provided MfSW participating institutions with financial resources to incentivize the compilation and sharing of microbial data. The incentive-based design of the MfSW program likely influenced information flows; as a result, the data represent a 'best case scenario' of water quality data sharing.

This brief focuses on the seven Kenyan institutions that participated in MfSW: four piped water suppliers and three public health surveillance agencies[1] (Fig. 1). From 2012-2016, we collected qualitative and quantitative data on microbial water quality monitoring activities from the 26 institutions engaged in MfSW. In 2019, we revisited the seven Kenyan institutions to further examine successes and challenges to information flows and data use three years after the completion of the incentive-based study. We additionally interviewed Kenyan county and national stakeholders and regulators.

To analyze the transmission of water quality data, we first defined a data sharing framework and then systematically mapped information flows within MfSW institutions (i.e., water suppliers and surveillance agencies) and national regulatory institutions. Subsequently, we used these maps to evaluate trends, connections, and barriers to the flow

[1] *Kenyan surveillance agencies under MfSW included district public health offices; however, they were renamed sub-County and County Public Health Offices after the MfSW program as part of devolution under the 2010 Constitution of Kenya.*

FIGURE 1:

MAP OF THE 7 PARTICIPATING KENYAN MONITORING INSTITUTIONS.

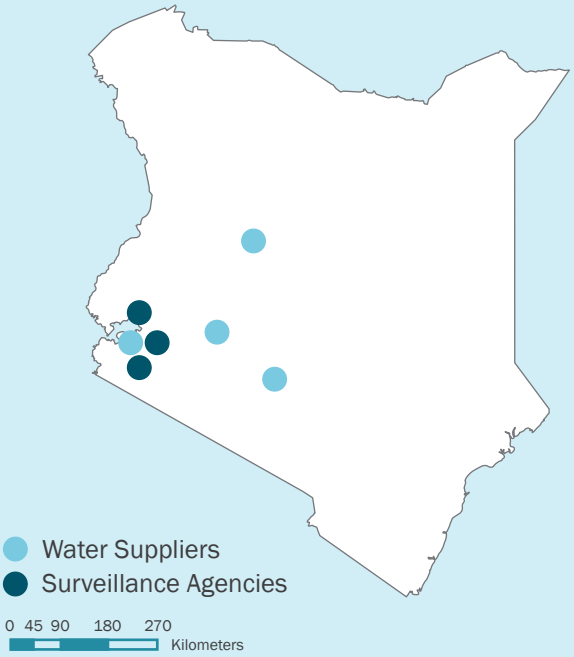
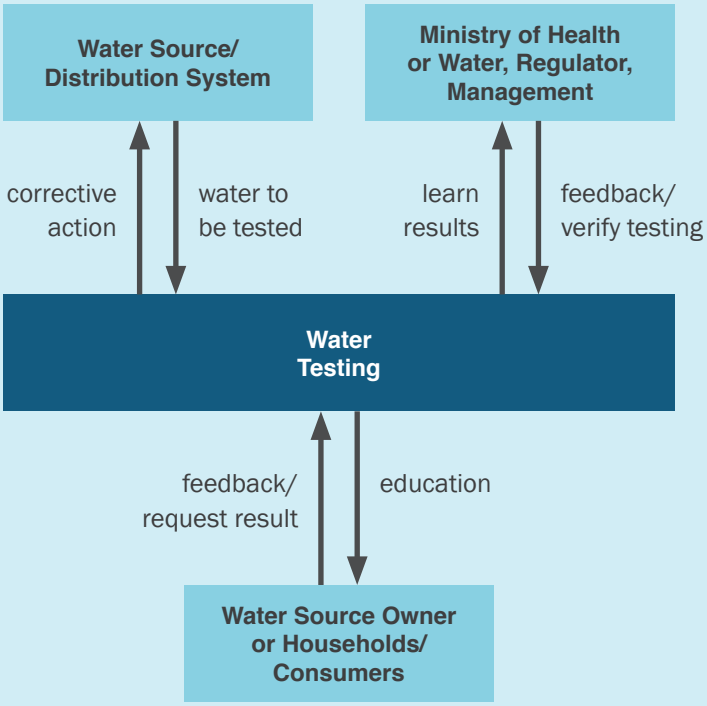


FIGURE 2:

GENERAL DATA FLOW DIAGRAM FOR SUPPLIERS AND SURVEILLANCE AGENCIES.



of information within and between institutions. Finally, we developed recommendations to improve flows of water quality information and better support water safety management at institutional, local government, and national levels.

RESULTS

Figure 2 generalizes internal and external data flow processes. Institutions generally collect a sample, report results to external entities, and communicate with water source owners or customers and perform corrective actions. All institutions reported compliance or summary data to external entities; however, they only reported general water safety information (i.e., the water is safe/unsafe/contaminated) to water source owners or customers.

1) **Internal data flows.** All Kenyan institutions recorded drinking water quality data in paper-based systems in the field and the lab and eventually digitized microbial data, although they mentioned inefficiencies and challenges with digitization. One institution noted, *"We do not have a dedicated computer for our office so we share with other departments. It would be more efficient to have a computer at the laboratory so that data can be digitized immediately"* (water supplier). Another water supplier similarly noted, *"Hard copies of data are transferred from the lab to the Technical Manager's office [who] spends a lot of time inputting data into Excel."* All seven institutions reported raw data (i.e., direct results of water quality tests) to upper management (i.e., managing directors for water suppliers and County Public Health Officers for surveillance agencies).

2) **External reporting.** All institutions reported to at least one external agency: national-level ministry, regulatory, or management group (Table 1). Water suppliers more frequently reported to centralized institutions, while surveillance agencies sent data to a variety of stakeholders (e.g., health staff, community members, Non-Governmental Organizations, etc.). Only regulators provided feedback to water suppliers, and only upper management provided feedback to both suppliers and surveillance agencies. (Table 1). Upper management's feedback on compliance reports was often in the form of simple approvals, though sometimes they made phone calls to institution staff to advise on mitigating contamination. Though the regulator

TABLE 1:

SUMMARY OF DATA REPORTING TO EXTERNAL ENTITIES IN KENYA, INCLUDING THE NUMBER OF MONITORING AGENCIES SHARING DATA AND THE TYPES OF DATA SHARED[1].

'-' indicates that no institutions reported this practice.

	Suppliers (n=4)				**Surveillance** (n=3)			
	Send	TYPE			Send	TYPE		
Type of Agency		Compliance	Raw	Other		Compliance	Raw	Other
National Administrative Unit								
Ministries	1	-	-	-	3	3	-	1
Independent Regulator	3*	2	-	-	-	-	-	-
Local Government Unit								
Ministries	-	-	-	-	1	-	-	1
Upper Management[2]	3*	3	1	-	3*	-	3	-
Medical Management	-	-	-	-	1	1	-	-
Health Staff	-	-	-	-	1	-	-	1
Other Government[3]	3	1	-	2	-	-	-	-
Non-Governmental Stakeholders								
Local Meetings	-	-	-		2	-	-	2
Outside Organizations	1	-	-	1	2	-	-	2

1 – Other reporting types include different parameters, centralized data, localized data, unique data, source type or accompanying larger report. 2 – Upper Management includes Managing Directors (suppliers) and county PHOs/Directors of Public Health (surveillance). 3 – Other government includes Water Services Boards, epidemic committees, and other county, district and province level committees and contacts. * – Institutions also receive feedback.

can take various enforcement actions, the only feedback reported by water suppliers was the rankings given in an annual impact report where water suppliers are scored on a variety of performance metrics each year.

3) **Responses to contamination.** All institutions typically took some action to respond to water quality contamination. All water suppliers in Kenya reported verifying contamination (e.g., resampling or investigating sources of contamination) and/or mitigating risks (e.g., increasing chlorine, checking for breaks, flushing the line, closing water supplies, or calling management) when test results were positive for fecal indicator bacteria. Surveillance agencies instead focused on engaging with consumers (e.g., advising household water treatment, supplying chlorine tablets, and holding public and household meetings), with at least one institution verifying contamination (Fig. 3). No institution or national stakeholder synthesized data to understand water quality trends, geographic variability, or other use of data for long-term or large-scale planning.

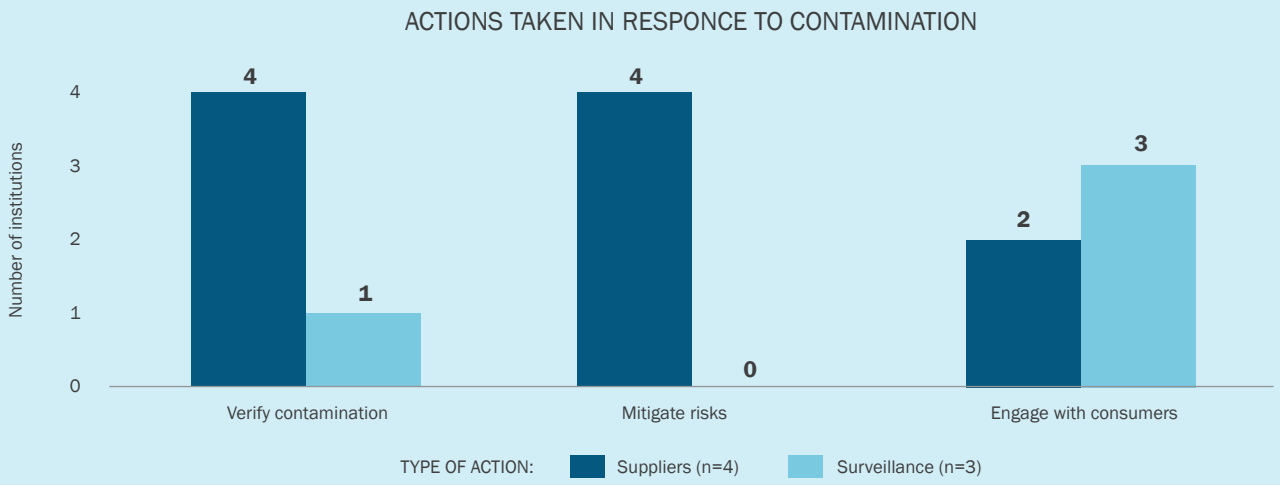
4) **Data sharing.** To improve data sharing, all three surveillance agencies suggested a regional database or integrated national database to capture water quality data. One institution noted that an online reporting system would standardize water quality data reporting across counties, though internet access can be a challenge: *"There should be a national database or reporting tool that captures water quality data from the ground"* (surveillance agency). Institutions also recommended regular WASH stakeholder meetings to prioritize water quality and discuss any issues that arise.

CONCLUSIONS

In Kenya, we found that reporting structures for data sharing exist for both water suppliers and surveillance agencies. However, when institutions conducted water quality testing, they often acted on the results of single samples; none of the institutions synthesized water quality data. Our results suggest substantial opportunities for improving the use

FIGURE 3:

NUMBER OF MONITORING INSTITUTIONS REPORTING VARIOUS ACTIONS IN RESPONSE TO CONTAMINATION.



of water quality data generated by regulatory programs to manage water safety. We determined that the key challenges to information flows were the limited aggregation and analysis of data and the poor enforcement of data sharing requirements. Potential routes to support better synthesis include increased digitization of data (e.g., using simple spreadsheet software) and guidance for summarizing data and generating descriptive statistics and graphs. These additional analyses can improve information flows to recipients who do not have the expertise or time to digest raw data, and who currently only see basic statistics such as number of tests or percent compliance. More broadly, stricter enforcement of water quality testing and reporting regulations (e.g. build accountability) in Kenya could increase demand for information and promote the sustainability of data collection systems. In addition, building staff capacity, both within institutions with monitoring responsibilities and within national ministries and regulators, on data use (e.g., analyzing changes in water quality over time and geographies) could also increase demand for accurate and timely data. Finally, layering the collection and analysis of water quality data with other types of data is important for improving water services. Other relevant data includes water supply performance, affordability, and access to sanitation (safety, equity, affordability, and waste management). Water quality management should be increasingly linked to other functioning information systems to bolster overall water safety.

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