Water supply and sanitation in small towns

Partnership Programme for Water and Development

MAY 2021 – POLICY BRIEF

WATER SAFETY MANAGEMENT IN SMALL TOWNS

LESSONS LEARNED FROM UGANDA AND MOZAMBIQUE

PROJECT SMALL (2016-2021) was an interdisciplinary research project focused on water and sanitation services management in small towns of Uganda and Mozambique. These towns are at the intersection between urban and rural settings, where the existing coverage of basic water supply and sanitation services is lagging behind, hindering the achievement of United Nations Sustainable Development Goal 6. A better understanding of the needs and characteristics of small towns is crucial to achieve water and sanitation for all. The project sought to assess how every element composing the service modality (infrastructure, management and finance) influences service level outcomes (accessibility, affordability, availability and quality).

Project SMALL prioritized the documentation of the main processes affecting the quality and quantity of water supplied by the National Water and Sewerage Corporation (Uganda) and Collins (Mozambique) to the local population in selected small towns. In a bid to support measures that may lead to improved drinking water quality, the project focused on:

- **understanding the implementation of water safety management strategies (e.g., Water Safety Plans and sanitary inspections);**
- **studying the effects of changes in operational strategies (e.g., chlorination regimes) on water quality in intermittent supply systems;**
- **identifying the challenges of implementing utility management practices originating from urban settings to the small-town context, where technical and financial resources are not always sufficient to meet national or local service level targets.**

Risk assessment and risk management is a preventive approach for identifying, prioritizing, and mitigating risks within the entire water supply system - from catchment/ source to consumer.

Photo Sara J. Marks

KEY FINDING

1 The implementation of risk management strategies should be sustained in order to yield improvements in cost efficiency, water quality, water conservation, regulatory compliance, operational performance, and public health.

RECOMMENDATIONS

- Risk assessment and risk management implementation can be improved and institutionalized by enhancing staff capacity through training, budgetary provision, management commitment, and awareness about the risks associated with poor water quality [1, 2].
- In order to foster ownership, water operators should lead and incorporate the adaptation (e.g., simplification, translation into the local language) of risk management strategies and tools in their daily routines [1].
- During the implementation of risk management strategies, it is crucial for water operators to 'walk the system' and not to only rely on the documented infrastructure design. Often the materiality and functioning of the infrastructure change considerably over time and this may or may not be documented. Asset holders should also be involved in this process through periodic evaluation workshops, because they may be the most lacking in up-to-date information about their systems.
- The use of sanitary inspections (SI) can complement or substitute other more complex risk assessments and risk management approaches [3].
- SI forms should not replace but rather complement water quality monitoring activities as part of a comprehensive risk management strategy [3].

Photo Giuliana Ferrero

KEY FINDING

2 Even when the water leaving the treatment works complies with the national drinking water quality standards, faecal contamination is often detected in the water distribution network and in household water storage containers.

RECOMMENDATIONS

- In Uganda and Mozambique, the mean free residual chlorine (FRC) concentration in piped water that was stored in the home was below the recommended target range of 0.2 mg/L [4, 5]. FRC increased with dose and pH, and decreased with distance and temperature [5]. Increasing chlorine dosage at the treatment works, along with frequent verification monitoring throughout the system, can improve compliance with microbiological water quality standards and chlorine levels at the point of consumption. However, attention should be paid in optimizing FRC in the water distribution network and not exceeding national regulations; booster chlorination may be a suitable solution for increasing FRC in large water distribution networks.
- Changing the number and duration of water supply cycles (i.e., interruption of supply followed by a period of supply) per day showed mixed results for water quality in intermittent supply systems (i.e., positive impact on microbial water quality at the sampling point closest to the water treatment plant and negative impact at the sampling point furthest away). Therefore, in areas affected by water scarcity and considerable water losses, the priority should be improving the infrastructure and reducing the contamination pathways, rather than modifying the duration of supply cycles (assuming that consumers have access to a sufficient quantity of water).
- Contrary to published literature, the effect of the first flush – discharge of the water initially present in the pipes after an idle/no supply period – on the microbiological water quality at the tap was not statistically significant in this study [5]. It is not recommended to perform a first flush, particularly in areas affected by water scarcity.
- Correct interpretation and timely communication of laboratory results of water quality analysis is critical for successful adjustment of key operations, such as chlorine dosage.

KEY FINDING

3 Pathogens of public health relevance (e.g., vibrio cholerae) were often detected in the entire drinking water supply chain, from catchment to consumers, in conventional surface water treatment systems [6].

RECOMMENDATIONS

- The Ministry of Health (or the agency with jurisdiction over drinking water supply) should practice yearly surveillance of pathogens and chemicals that are of health concern in small systems. The same agency should notify water operators on the priority pathogens in a specific area.
- While it is not advised to monitor pathogens as a routine practice (not feasible, expensive), private water operators may outsource sampling and analysis of priority pathogens on a yearly/6-month basis to gain better knowledge of how they are curbing the threats associated with the systems they are operating.
- Based on the occurrence of pathogens, strategies to minimize risks should be designed, implemented and validated. For example, in the presence of vibrio cholera, free residual chlorine at the tap should be > 0.5 mg/L, and awareness-raising campaigns for safe handling and storage practices should be implemented.
- Poorly built sanitation infrastructure, unsafe faecal sludge management and/or lack of wastewater treatment are likely to contaminate the environment. These issues endanger public health and the environment; therefore, priority attention by key authorities in the water sector, appropriate legislation and enforcement are required.
- Political, technical and financial support for non-sewered sanitation options, especially for safe and financially viable excreta management across the sanitation value chain should be increased.
- Pathways of contamination other than sanitation (e.g., pathogens carried via bird droppings) should be evaluated and minimized using risk assessment and risk management methodologies. For example, reservoirs should be monitored to ensure that their top covers are intact, including access/manholes for maintenance.

KEY FINDING

4 Irrespective of the water source, water quality deteriorates during storage at household level.

RECOMMENDATIONS

- Stored water samples collected from households with piped water on the premises were no cleaner than stored water originating from other sources, indicating the vulnerability of piped water supplies to recontamination when storage was necessary (e.g., when services were intermittent or unreliable) [4].
- Service models that promote universal access to safely managed water supply at the rural–urban intersection must prioritize not only piped water services on consumer premises, but also sufficient reliability in order to minimize household level storage of drinking water.
- Where household storage is a common practice, water operators and the Ministry of Health (or the agency with jurisdiction on drinking water supply) should strengthen awareness-raising campaigns on how to safely handle water at the household level and support efforts to expand availability of safe storage options.

Photo Harold van den Berg

THIS BRIEF IS BASED ON THE FOLLOWING SCIENTIFIC PUBLICATIONS:

[1] Ferrero, G., Setty, K., Rickert, B., George, S., Rinehold, A., DeFrance, J., Bartram, J. (2019). Capacity building and training approaches for Water Safety Plans: a comprehensive literature review. International Journal of Hygiene and Environmental 222 (4), 615-627 https://doi.org/10.1016/j.ijheh.2019.01.011

[2] Kanyesigye, C., Marks, S.J., Nakanjako, J., Kansiime, F., Ferrero, G. (2019). Status of Water Safety Plan Development and Implementation in Uganda. Int. J. Environ. Res. Public Health, 16, 4096. https://doi.org/10.3390/ijerph16214096

[3] Daniel, D., Gaicugi, J., King, R., Marks, S.J., Ferrero, G. (2020). Combining sanitary inspection and water quality data in western Uganda: lessons learned from a field trial of original and revised sanitary inspection forms. Resources 9, 12: 150. https://doi.org/10.3390/resources9120150

[4] Marks, S.J., Clair-Caliot, G., Taing, L., Tayebwa Bamwenda, J., Kanyesigye, C., Namanya, E.R., Kemerink-Seyoum, J., Kansiime, F., Batega, D.W., Ferrero, G. (2020). Water supply and sanitation services in small towns in rural-urban transition zones: The case of Bushenyi-Ishaka Municipality, Uganda. Npj Clean Water, 3 (21). https://doi.org/10.1038/s41545-020-0068-4

[5] Van den Berg, H., Quaye, M.N., Nguluve, E., Schijven, J., Ferrero, G. Effect of operational strategies on microbial water quality in small scale intermittent water supply systems. The case of Moamba, Mozambique. Submitted to the International Journal of Hygiene and Environmental Health.

[6] Taviani, E., Nhassengo, F., Nguluve, E., Jussa, P., van den Berg, H., Ferrero, G. Occurrence of waterborne pathogens and antibiotic resistance in water supply systems in a small town in Mozambique. *In preparation*.

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