Continuous quality improvement for safe household water storage

Case study

Project background and key drivers

The re-contamination risks during the collection, transport and storage of water, due to the use of contaminated containers or poor hygiene behaviours, is a key challenge for household safe water access. WaterAid Burkina Faso, in collaboration with University of North Carolina Water (UNC) Institute and financially supported by Hilton Foundation, has tested the use of the Continuous Quality Improvement (CQI) methodology to improve household water quality in communities and identify improvements needed in household water treatment and storage.

Location: Burkina Faso

Type of approach: Research

Contributors:
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Continuous Quality Improvement (CQI)

Although established in other sectors, including health, the CQI method had been recently introduced as an iterative methodology to improve water quality in the water, sanitation and hygiene (WASH) sector. It was piloted in 2016 by the UNC.

The CQI method is described as a 'systematic method of using data to improve processes' that uses monitoring data to develop evidence-based solutions. The method then iteratively implements small tests of change followed by uptake monitoring, until outcomes in the programme context are improved.

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Initial assessment of water quality and contamination at source and household

WaterAid Burkina Faso's 2015/16 baseline study assessed the water quality at the water source (a sample of WaterAid's supported new or retaliated water supply) and a sample of household stored water from the same source, to assess the difference in water quality and possible re-contamination.

All high-risk water quality parameters were tested at the water source, while only microbiological contamination was tested in households. The results of the water source microbial analysis revealed **high levels of microbiological contamination**, **both at source and households**: only 52% of all drinking water sources surveyed were in conformity with the World Health Organization (WHO) Drinking Water Standards and with Burkina Faso national standards for microbial contamination (<1 E. coli CFU/100mL).

When disaggregated by source type, 77% and 69% of borehole samples and public tap samples, respectively, were in conformity, however only 4% of unprotected dug well sources were in conformity. Furthermore, 85% of stored household water contained E.coli contamination at household level, of which 42% are considered high risk according to WHO standards.

Results from the baseline study concluded that **water source type and the method of storing household water, especially the type of container used, were the primary reason for high levels of microbial contamination**. In almost 90% of households, water storage tanks were lying exposed on the floor outside buildings or some form of shelter, and had a wide opening.

The opening of the storage tank was only found to be covered in 60% of cases. Less than 5% of households were using a container with a tap (UNC, 2016).

Water quality testing was performed by using the following field test kits:

- Arsenic (Arsenic Econo Quick II test kit).
- Fluoride (Extech FL700 Fluoride metre).
- pH (Hanna Instruments HI 98129).
- Conductivity (Hanna Instruments HI 98129).
- Aquagenx Compartment Bag tests for microbiological contamination risk category testing.

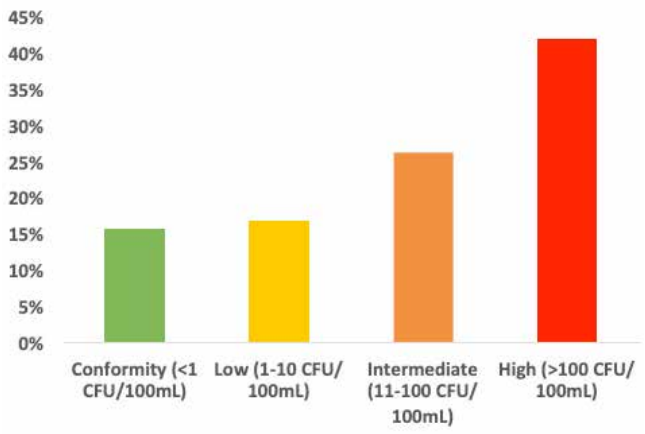

Figure 1: Water quality – E.coli presence in water stored by households categorised by risk category and with conformity in line with National Burkina Faso Standards of 1 CFU/100ml. 42% of household samples were categorised with high risk of microbiological contamination.

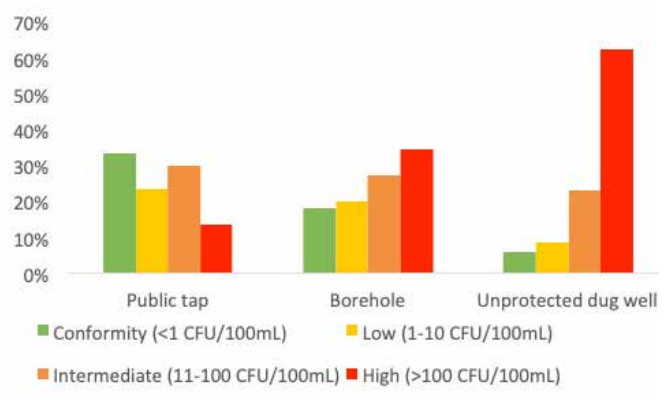

Figure 2: Distribution of E. coli concentration in household water samples by water source type according to WHO microbial risk categories. Data labels indicate the number of samples in each category.

In addition, **the research found correlations between various factors that had an impact on household water safety**:

- The method used for the extraction of water had an impact on its quality – the water that was poured or dispensed was less likely to be contaminated compared to water that was removed by a utensil.
- Household stored water in villages that had a functioning WaSH committee was significantly less likely to be contaminated compared to household stored water in villages without a functioning WaSH committee.
- Higher numbers of household members correlated with higher levels of household water contamination.
- As the age of the woman at the head of the household increased, so did the level of contamination.
- No correlation was found between the education level of the head of the household and water quality.

Developing improved household storage solutions

Improving household water safety relied on developing suitable solutions for safe water storage and utensils that would minimise microbial contamination. The CQI method was implemented in a phased approach, piloting the following activities:

- Identification and introduction of a prototype water storage model, suitable for the local context and accepted by communities. Prototypes of possible solutions were discussed with local artisans to confirm the feasibility of making these at a cost acceptable to local households. There was a preference for faster-flowing taps so these were also integrated into the design.
- Consultations with local communities to review the proposed prototypes and compare these with existing water storage tanks.
- Consultation to identify the willingness of communities to pay for new containers.
- Improvements to hygiene behaviours related to water storage and management. For example, placing storage containers inside buildings to protect them against contamination.

The initial water storage prototypes improved water quality. However, it was not accepted by some communities, leading to further adaptation and design improvements using systematic approach.

Figure 3: Water storage containers used by households.

Continuous quality improvement at scale

Building on the experience of the pilot phase, WaterAid Burkina Faso and its partners replicated the process of testing prototype containers – holding community consultations, co-designing a more suitable container, engaging local manufacturers, and testing water quality in all remaining intervention areas. **Each step in the process was repeated until the storage solution met the criteria of community acceptance and water quality performance.** As a result, the final storage solution varied from one community to another. 50% of the communities were targeted with the improved storage design and with trainings to assess impact.

The post-implementation assessment identified that of those households targeted with the intervention, 96% reported using the safe storage container and 88% contained water at the time of visit.

From the comparison of water quality in household containers in intervention and non-intervention households (Figure 4), it was possible to observe how the new storage solution reduced E. coli – demonstrating that **storage design improvements can have a significant impact on the safety of household water**.

However, it was also noted that there was little reduction in households with a high risk of contamination, possibly due to the source water being contaminated.

CQI learnings used during COVID-19 response

During WaterAid Burkina Faso's COVID-19 emergency response, the CQI method was further applied to identify the improvements required to household water storage – to ensure improved water quality, essential in supporting the prevention measures for COVID-19.

Figure 4: Prototypes of household water storage solutions, tested as part of the research.

Changes in microbial risk for stored water in intervention households and non-intevention households

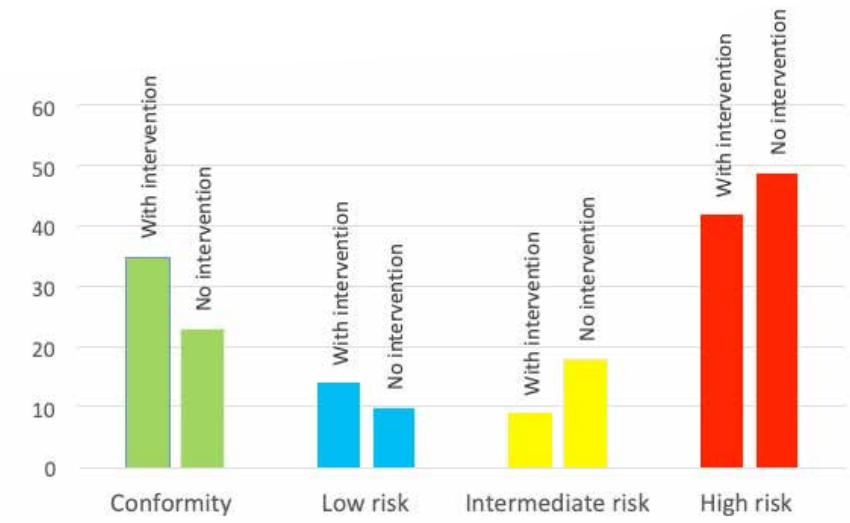

Figure 5: Comparison of water quality contamination in household containers before and after application of the CQI method.

Lessons

- Delivery of improved water supply and hygiene behaviour were not sufficient to ensure safe household water quality. The promotion and provision of safe containers for household water transport and storage has proven an important complementary approach.
- The CQI methodology allowed to iteratively improve the design of water storage containers responding to improvements as identified by communities and artisans.
- The participatory process worked effectively, allowing communities to co-design a household storage solution that could be adapted to suit local contexts. **Co-designing the solution ensured community ownership of the process and product, leading to increased sustainability of household behaviours.**
- Water quality testing was repeated every time a new storage solution was introduced. Training project staff in the **use of simple portable kits for water quality testing minimised the cost** of water quality monitoring and reliance on experts and laboratories, reducing the time needed to obtain results.

Impact

- An increase in water quality was observed in the households with CQI intervention with the risk of microbiological contamination reduced. It is also reported that rural community members have more trust in the safety of their water. Communities reported a greater sense of pride and dignity, and now feel more comfortable welcoming urban visitors.
- WaterAid Burkina Faso shared learnings from the research in regional platforms. As a result, more stakeholders demonstrated interest in addressing challenges of rural water quality. UNICEF has also adopted aspects of the CQI methodology in their programmes.

Resources

- University of North Carolina. *Project d'amelioration continue de la qualite – CQI – Recherche de solutions adaptees au context du Burkina Faso pour la conservation de l-eau a domicile, Rapport de mise en o euvre du cycle 1 d'amélioration de la qualité de l'eau à domicile*.
- University of North Carolina (2016). *WaterAid Burkina Faso baseline study report*. (Unpublished).
- WaterAid (2016). *Amélioration continue de la qualité de l'eau stockée dans les domiciles à partir de l'approche – CQI – (Continuous Quality Improvement*). Presented at the Regional Learning Forum on Water Resources Management and Climate Change, November 21–23, 2016.

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