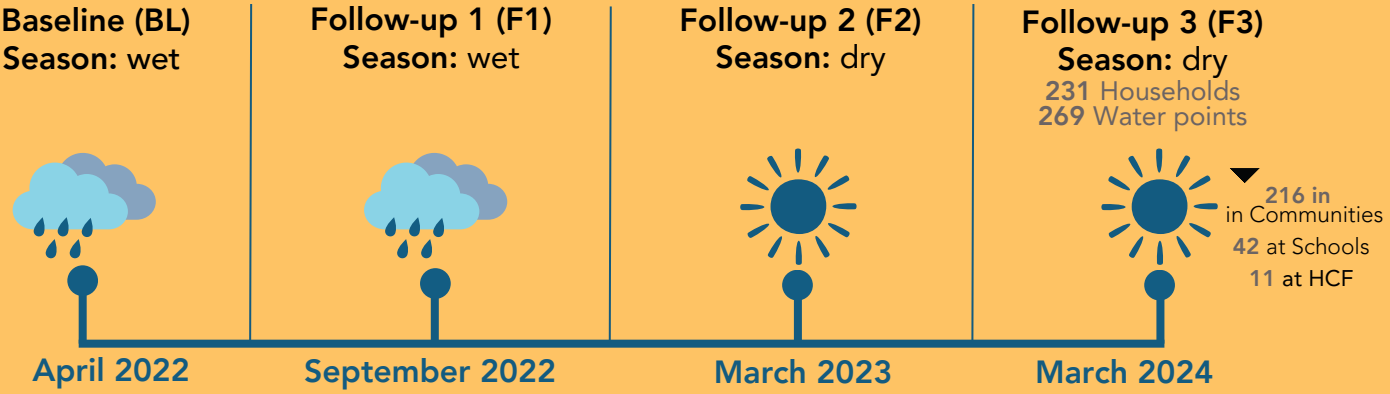

*With funding from the Conrad N. Hilton Foundation, the Aquaya Institute is coordinating longitudinal water quality monitoring in two target districts in Uganda. In March 2024, Aquaya conducted surveys and water quality testing at households, water points, schools, and healthcare facilities in Lira District. This effort builds upon prior monitoring done in 2022 and 2023.*

**WaterTRACS**
*Testing, Research, and Capacity Strengthening Initiative*

# WATER QUALITY IN LIRA DISTRICT, UGANDA

March 2024

## Drinking water samples tested in Lira




## SUMMARY

- Water samples from **improved sources had lower microbial contamination** than those from unimproved sources.
- Although several piped systems had detectable free chlorine residual, **chlorine levels were low.**
- While most households used improved drinking water sources, ***E. coli* was present in many stored water samples.**
- **Wealthier households had safer drinking water** and were more likely to use piped water.

## KEY RECOMMENDATIONS

- Piped water systems should be treated with **higher levels of chlorine.**
- Piped water systems with adequate treatment should be made **more accessible to the poorest households.**
- Education is needed to **encourage safer household storage practices.**

## WATER POINTS

We conducted surveys and tested *E. coli* at 269 water points in February 2024. Over one-third of water samples (38%) were free from microbial contamination, defined as *E. coli* <1 CFU/100 mL, which is consistent with previous survey rounds. **Water from boreholes with hand pumps was safest** (66% free from *E. coli*), and **water from springs and surface water was least safe** (none free from *E. coli*). Across all survey rounds, water from boreholes with hand pumps and piped systems was consistently safer than water from other sources (Figure 1). Water from dug wells was safer in the dry season (F2, F3) than the wet season (BL, F1, Figure 1), while water from piped water systems was safer in the wet season.

Free chlorine residual protects water from recontamination during transport and storage. In the most recent survey, 41% of samples from piped systems had at least some free chlorine, and none were above the minimum recommended level of 0.2 mg/L. *E. coli* levels were only marginally better in chlorinated versus unchlorinated samples (30% of samples with any free chlorine were free from *E. coli*, compared to 23% of samples with no chlorine). **Higher chlorine levels could be more effective at protecting piped water against microbial contamination.**

**Image 1.** A research assistant measures a water sample at a spring in Lira, Uganda.

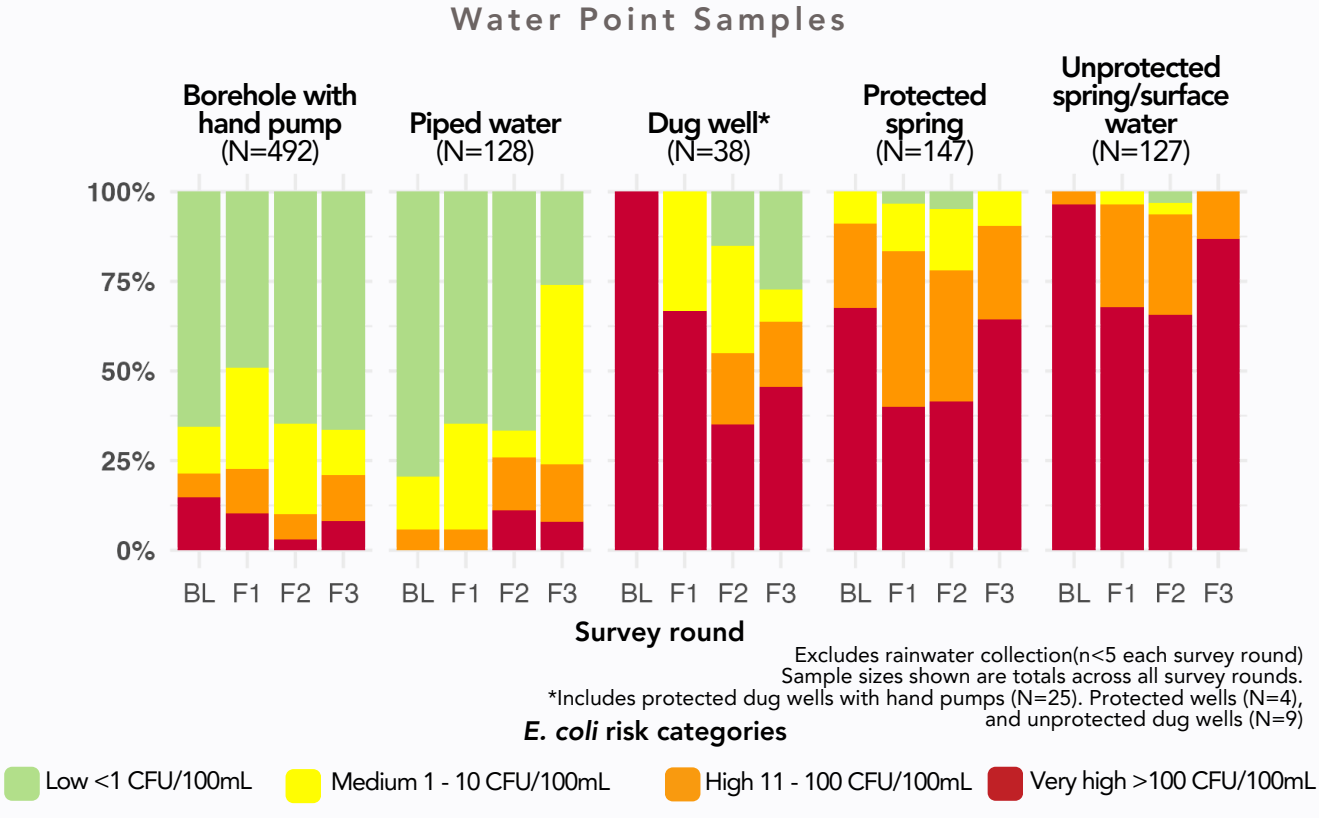



**Figure 1:** *E. coli* risk levels from water point samples collected at BL (N=223), F1 (N=184), F2 (N=250), and F3 (N=269) survey rounds.

## HOUSEHOLDS

Overall, 12% of the 231 household drinking water samples were free from *E. coli*, and one-third (32%) were in the highest risk category (>100 CFU/100 mL *E. coli*). Most households (92%) provided drinking water samples from improved water points, including piped systems, boreholes with hand pumps, and protected springs. Samples from improved sources were marginally safer than samples from unimproved sources such as surface water and unprotected springs (14% free from *E. coli* compared to 0%).

**Water collected directly from water points was safer than stored household drinking water.** Across all survey rounds, household stored samples had significantly worse microbial water quality than samples collected directly from the households' reported water points (9% of household samples were free from *E. coli* versus 46% of samples taken directly from the same water sources). This deterioration was particularly striking for piped water and boreholes with hand pumps (Figure 2). Very few (3%) stored piped water samples had any free chlorine residual, and few households (6%) stored water safely in a covered container with a narrow opening, likely resulting in contamination during transportation and storage.

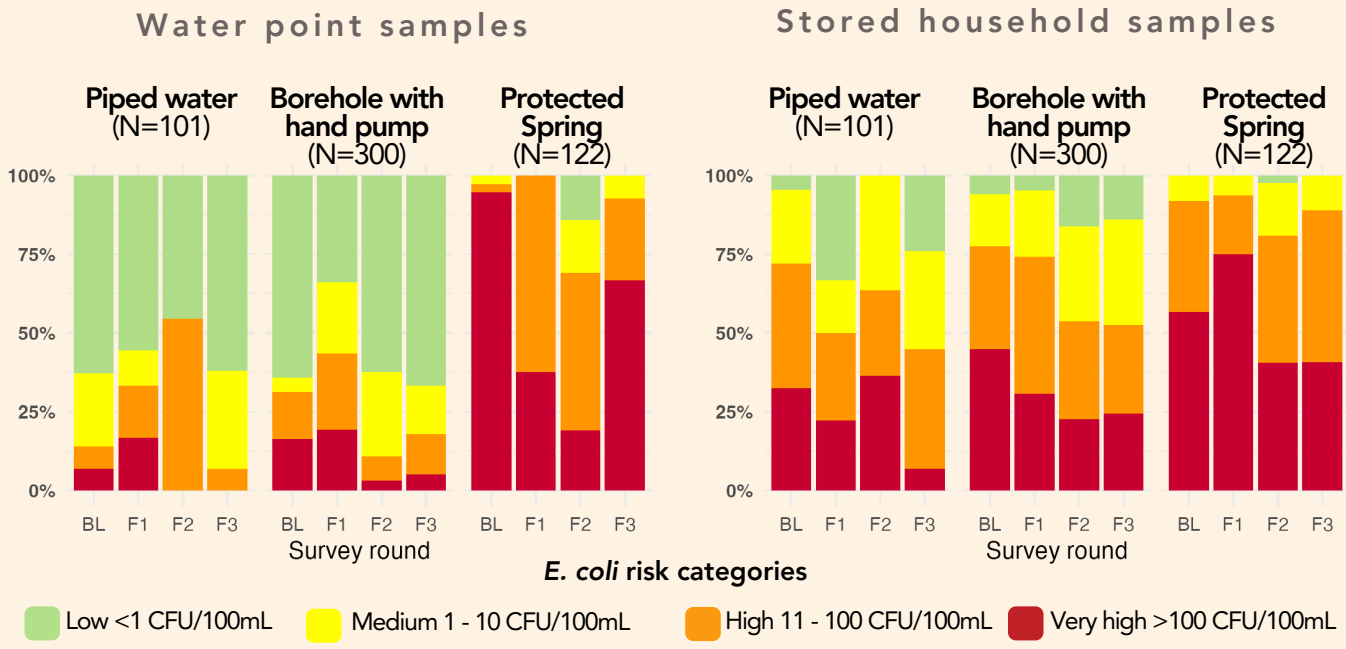



**Figure 2:** *E. coli* risk levels from water point samples (left) where sources could be matched to household stored water samples (right). These data were collected at BL (N=147), F1 (N=96), F2 (N=146), and F3 (N=134) survey rounds. Note that water point sample results have been recorded multiple times, once for each household reporting using that same source. This allows direct comparison of aggregated results from the point-of-collection (at the water point) to the point-of-use (at the household).

**Wealthier households had safer drinking water and more often relied on piped water.** About half of households in the wealthiest quintile reported using piped water compared to none in the poorest quintile. Overall, 25% of households in the wealthiest quintile had water free from *E. coli*, while only 4% households in the poorest two wealth quintiles did. This was consistent across all survey rounds.

## INSTITUTIONS

We surveyed 48 schools and 11 healthcare facilities and tested *E. coli* from their primary and secondary drinking water points when water was available. All schools and healthcare facilities used improved water points, and most (85%) had basic water service (i.e., an improved water point on premises with water available). **Most primary water points (79%) were free from *E. coli*,** which is slightly better than the previous two survey rounds when only two-thirds of water points were free from *E. coli*.

Nearly all institutions (94%) reported using boreholes with hand pumps as a primary drinking water source, which is consistent with previous survey rounds. A quarter of schools and over half of healthcare facilities reported having a secondary water point. Nearly all secondary water points were also boreholes with hand pumps, and most were located off-premises. Institutions mainly used these secondary sources when their primary source was broken or unavailable.

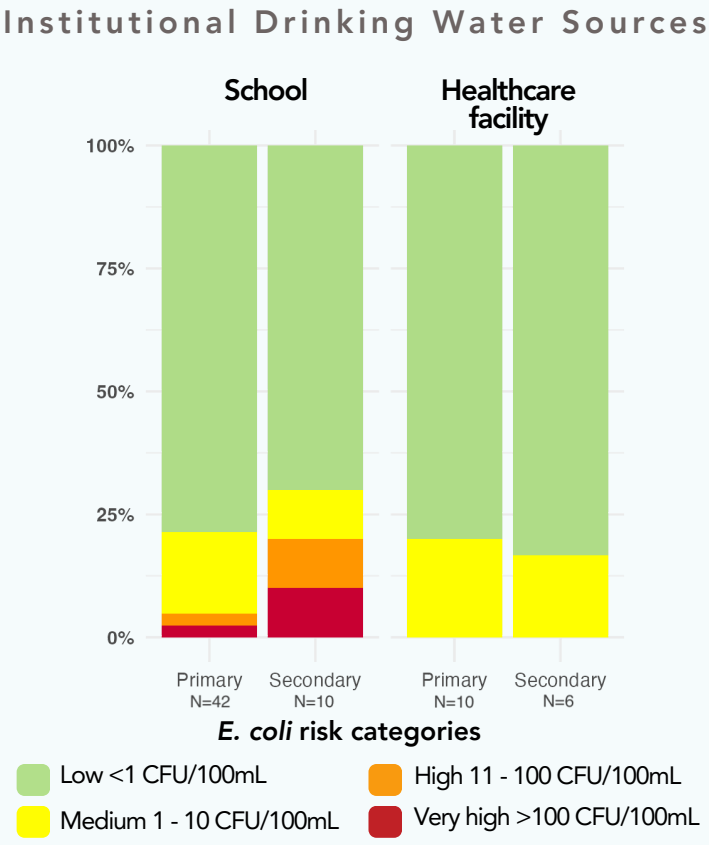



**Figure 3:** *E. coli* risk levels in primary and secondary drinking water points used by schools and healthcare facilities.

## RECOMMENDATIONS

**1** **Piped water systems should be treated with higher levels of chlorine** to maintain a residual of >0.2 mg/L or higher at all tap stands in the water distribution system. This could improve water quality at both the point of collection and the point of use.

**2** Piped water systems with adequate treatment **should be made more accessible** to households with the lowest socioeconomic status. This may include the provision of reduced tariffs.

**3** For households, education is needed to **encourage safer household storage practices.**

**4** Institutions should have **back-up water sources on site** to maintain safe and accessible water when water from the primary source is unavailable.