Critical levels of contamination in wells and standpipes at household water points in Freetown – A call to Action

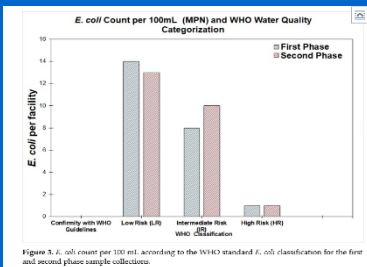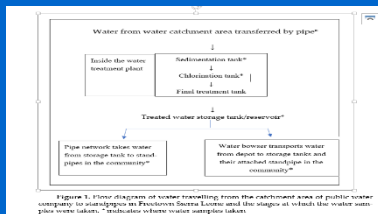Contact: e-mail:

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Key Messages

- All water samples were contaminated with *Escherichia coli* (*E. coli*) at a low level of risk and had high turbidity levels which contravene World Health Organization (WHO) drinking water quality guidelines.
- Antibiotic sensitivity testing showed that none of the bacteria were resistant to antibiotics.
- We recommend two changes to reduce the risk of *E. coli* contamination and make drinking water safe:
    - ❖ Replace un-improved wells with standpipes
    - ❖ Monitor water points to ensure that basic standards of water quality treatment and cleaning are followed.

What is the problem and why is it important?

- In Sierra Leone, about 3 million people still drink water from potentially dangerous sources like unprotected wells and standpipes.
- Furthermore, only 11% of households are reported to use drinking water sources that are free from faecal contamination and only 3% have drinking water free from faecal contamination at point of use.
- About 30% of water points in Sierra Leone are not functional at a specific period of time or are unavailable for use due to minor or major damage.
- In Freetown, some people access drinking water from unprotected water sources, because they live far away from standpipes or water is not available in the standpipes, especially during the dry season.
- In relation to this, antibiotic resistance has become a major public health concern with the presence of resistant microorganisms in wastewater, surface water, and drinking water all being well documented.
- Availability of safe drinking water coupled with improved sanitation facilities are essential to prevent water borne diseases (e.g., cholera, diarrhoea, dysentery, hepatitis A).
- Therefore, we designed a study to review water quality, including the presence of bacteria and antibiotic resistance, within two communities in Freetown that access water through standpipes and wells.

Water quality surveillance can help to reduce waterborne diseases

E. coli is a widely accepted indicator organism for assessing contamination of drinking water and is the only true faecal coliform

Figure 3. Flow diagram of water travelling from the catchment area of public water company to standpipes in Freetown Sierra Leone and the stages at which the water samples were taken. * indicates where water samples taken.

Figure 3. *E. coli* count per 100 mL according to the WHO standard *E. coli* classification for the first and second phase sample collections.

Figure 4. Sources of contamination at a well. Leafy vegetables are washed on top of the well, and that same water may drain back into the well. While the woman washes the vegetables, the man fetches water using a plastic container hung from a rope. The lid or cover is also prone to corrosion as it is made of iron and can be another potential source of contamination.

Sampling well

Figure 6. A typical example of one of the standpipes in Brookfields connected to the pipe network. The tap is closed after use by the people.

Sampling standpipe

How did we measure it?

- We conducted a study focusing on primary drinking water samples, inspecting the physical condition of the water, and taking water samples from five wells and fifteen standpipes in Brookfields and in Wilberforce, and from the public water company that supplies piped water to Freetown.
- We adapted a WHO recommended checklist to systematically assess the physical structures of the five community wells and fifteen standpipes.
- On all samples, we conducted physical tests for acidity or basicity of the drinking water (pH); we confirmed the presence of suspended materials (TDS), drinking water temperature, chemicals and heavy metals (nitrates, lead, zinc, and phosphate); and we analysed for microbial contaminants (*E. coli*) and performed bacterial resistance testing.

What did we find?

- All the wells were poorly set up and badly maintained with issues relating to poor fencing, underground seepage of latrines and poor drainage networks.
- The samples from all five wells showed poor quality water with raised levels of Total Dissolved Solids (TDS) between 33 and 70 Nephelometric Turbidity Units (NTU) (recommended level <10 NTU).
- All the wells had at least a low level of risk from *E. coli* (one to 10 *E. coli* per 100 mL) and one well had a very high level of risk (1600 *E. coli* per 100 mL) (the WHO recommends that E. coli should not be detected in any 100 mL drinking water samples).
- There were 6 out of 15 standpipes (40%) whose fences were damaged, two taps (13%) had their drainage channels destroyed and one standpipe had a latrine less than 30m away.
- In addition, all standpipe water samples were contaminated with *E. coli* with at least at a low risk level (1–10 MPN/100 mL) of *E. coli.*
- The pH of all the standpipes was between 6.0 to 7.5, which was within acceptable levels as specified in the WHO drinking water quality guidelines.
- The rainy season was associated with a higher level of turbidity compared to the dry season.
- In the rainy season 73% of samples were contaminated compared with 7% in the dry season.
- No antimicrobial resistance was found in any of the bacterial isolates from wells or standpipes.

Implications

- This study showed that the wells in these two communities (Brookfields and Wilberforce) in Freetown, Sierra Leone, were much more likely to be contaminated with *E. coli* and/or have elevated Total Dissolved Solids (TDS) compared with standpipes.
- Where *E. coli* was grown from the water samples, no antimicrobial resistance was found.
- We recommend the following actions:
    - ❖ Replace un-improved wells with standpipes.
    - ❖ Monitor water points to ensure that basic standards of water quality treatment and cleaning are followed.
    - ❖ Use household water treatment methods such as filtration, sedimentation, boiling, ultraviolet radiation, use of chlorine compounds and safe storage after collection of water and before drinking.
    - ❖ Prepare and implement water safety plans for the wells and standpipes in those two communities to ensure protection of their drinking water.
    - ❖ Reduce the high levels of TDS for standpipes and wells using distillation, deionization, and reverse osmosis filters, all of which make drinking water safer and more acceptable for consumption.
    - ❖ Demand that the Ministry of Health and Sanitation regularly monitor and survey household water quality at point of use in the two communities that we studied.