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

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Key Messages (up to 200 words, up to 6 bullet points)

- All water samples were contaminated with *Escherichia coli* (*E. coli*) at a low risk level and high turbidity levels which contravenes WHO drinking water quality guidelines
- Safe drinking water is water that does not represent any significant risk to health over a lifetime of consumption including at different sensitivities that may occur between life stages
- Sensitivity test was done to determine which antibiotics are effective in killing *E. coli*
- We recommend two changes to reduce the risk of *E. coli* contamination:
  - ❖ 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? (up to 150 words)

- In Sierra Leone, about 3 million people still drink water from unimproved sources like unprotected wells and standpipes
- Furthermore, 11% of households reported to use drinking water sources that are free from fecal contamination, of which only 3% have drinking water free from fecal contamination at point of use
- About 30% of water points in Sierra Leone are not functional at a specific period or are unavailable for use due to minor or major damage
- In Freetown, some people access drinking water from unprotected water sources, because they may live far away from standpipes or water is not available in the standpipes, especially during the dry season
- Relatedly, antibiotic resistance has become a major public health concern with the presence of resistant organisms in wastewater, surface water, and drinking water being well documented and of concern.
- Availability of safe drinking water coupled with improved sanitation facilities are essential to prevent water borne diseases (cholera, diarrhea, dysentery, hepatitis A etc.)

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 fecal coliform

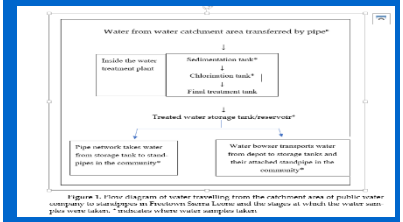

Figure 1. Flow diagram of water travelling from the catchment area of public water company to standpipes in Freetown Sierra Leone and the stages at which the water samples were taken. * indicates where water samples taken

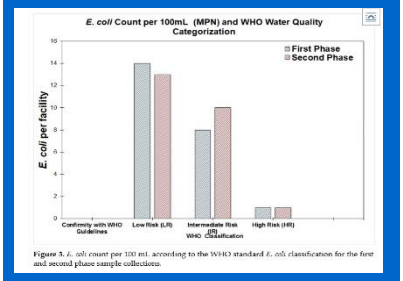

Figure 3. *E. coli* count per 100 mL according to the WHO standard *E. coli* classification for the first and second phase sample collections.

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

- Therefore, we designed a study to review water quality, including antibiotic resistance, within two communities in Freetown, which access water through standpipes and wells

How did we measure it? (up to 150 words)

- We conducted a study focusing on primary drinking water sample collection, inspecting the physical condition of, 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 fifteen standpipes and five community wells.
- Physical test to determine the acidity or basicity of the drinking water (pH), confirmed the presence of suspended materials (TDS), drinking water temperature, chemicals and heavy metals (nitrates, lead, zinc, and phosphate), microbial contaminants (*E. coli*) and bacterial resistance test were conducted on all samples collected

What did we find? (up to 150 words, no more than 3 bullet points)

- All the wells were poorly set up and badly maintained with issues on poor fencing, underground seepage of latrines, and poor drainage networks
- The samples from all the five wells all 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 have 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) (WHO recommended that E. coli should not be detected in any 100 mL of drinking water sample)
- There were 6 out of 15 standpipes (40%) fence damaged, two taps (13%) drainage channel destroyed, and one standpipe with a latrine less than 30m away
- In addition, all standpipes water samples were contaminated with *E. coli* at least at a low risk level (1–10 MPN/100 mL) of *E. coli*
- The pH of all the standpipes were 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
- There were about 73% of samples contaminated in the rainy season as compared to 7% in the dry
- No antimicrobial resistance was shown in any of the isolates

Implications (up to 200 words, no more than 6 bullet points)

- This study has shown that the wells in these two communities Brookfields and Wilberforce in Freetown, Sierra Leone, are much more likely to be contaminated with *E. coli* and/or have elevated Total Dissolved Solids (TDS) than standpipes
- Where *E. coli* was grown from the water samples, no antimicrobial resistance was found
- We recommend that:
    - ❖ Replace un-improved wells with standpipes;
    - ❖ Monitor water points to ensure that basic standards of water quality treatment and cleaning are followed
    - ❖ Household water treatment methods such as filtration, sedimentation, boiling, ultraviolet radiation, use of chlorine compounds and safe storage can be used after collection of the water and before drinking
    - ❖ Water safety plans be prepared and implemented for the wells and standpipes in those two communities to ensure protection of their drinking water
    - ❖ The high levels of TDS can be reduced for standpipes and wells using distillation, deionization, and reverse osmosis filters, all of which make drinking water safer and more acceptable for consumption
    - ❖ Regular household water quality monitoring and surveillance at point of use should be conducted by the MoHS in the two communities studied