Sanitary risk assessment and water quality of community-managed water supplies in the low land and mid-hills of Nepal

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Sanitary risk assessment and water quality of community-managed water supplies in the low land and mid-hills of Nepal

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Communities in the mid hills of Nepal are dependent more on gravity piped water supplies connected to the protected springs with a piped system or even with no piped system. While on the low land, ground water connected with mechanised deep boreholes and shallow tube wells fitted with hand pumps and dug wells are the major drinking water sources. A study was carried throughout different elevations in Nepal including rural to semi-urban setting communities. A study of 18 rural community managed protected spring water sources connected with a piped system in the mid hills was assessed. Similarly, for a semi-urban community in a low land region, 11 mechanised deep boreholes, two protected springs with gravity-fed piped supplies, one protected spring without a piped system and 10 shallow tubewells were assessed over a period of 18 months. Seasonal water quality trends were studied where microbial contamination of *E.coli* and physical parameters (pH, temperature, turbidity, electronic conductivity and total dissolved solids) were measured. Comparison of sanitary inspections score (WHO, 2020) with the WHO fecal indicator bacteria index (FIB) was done to identify potential risks and actions required. Moreover, we compared the total sanitary inspection risk score and *E.coli* results to assess whether a relationship existed. Rainfall data was collected from weather stations at each research area to investigate associations between weather and source water quality. The relationships between rainfall within 24 and 48 hours of sampling, individual sanitary risk factors and water quality was studied using contingency tables.

The raw microbiological water quality data was transformed into two dummy variables – *E. coli* < 1 CFU/100 ml and ≤ 10 CFU/100 ml. Statistically significant ($p < 0.05$) correlation was found between the presence of *E. coli* and exposed mains for gravity-fed piped water systems and leaks at the sampling site, and cracked or leaking reservoir tanks for piped systems from mechanized deep boreholes. *E. coli* levels were correlated with the presence of a sewer or latrine within 30 meters of the sampling site for piped systems with boreholes, and damaged fencing and permeable pump house floor for mechanized deep boreholes.

The sources were further categorised as per the Sanitary Hazard Index (SHI), using analysed microbial results and sanitary inspection scores. Sanitary inspection scores of shallow tube wells fitted with hand pumps to FBI were found to be 5.26%, 63.15 % and 10.52 % categorised under low action priority, high action priority and urgent action, respectively. Similarly, in case of mechanized boreholes 72.73 %, 22.73 % and 4.55 % lies in the category of low action priority, high action priority and urgent action priority, respectively. Protected springs with no pipe systems were found to be 80% at high action priority and 20 % at urgent action category.

References

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