Title:

The Role of Environmental Parameters in Characterizing Exposure to Enteric Pathogens in Urban and Rural Settings in South India

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Abstract:

Bacteriological quality of drinking water plays an important role in characterizing the risk of enteric infections. This research conducted in partnership with the Christian Medical College (CMC) in Vellore, India aims to examine the relationship between meteorological parameters, water quality and the rate of enteric infections in three rural villages and two urban slums. 2287 water samples from public taps and households were collected regularly over a 12-month period. Daily meteorological data were obtained from a local station. Harmonic regression models (HRM) adapted to time series data and implemented in R statistical software were used to assess the temporal pattern in water quality (WQ) and the effect of meteorological parameters (ambient temperature, precipitation, and relative humidity) on describing this temporal pattern. The spatial relationships between household and tap WQ were assessed using Geographical Information Systems (GIS). The likelihood of bacteriological contamination increase from tap to household was further modeled as a function of water, sanitation and hygiene (WASH) covariates and meteorological parameters using mixed effects regression models that account for clustering at the household level. Our study found that the physicochemical water quality parameters do exhibit a stable seasonal trend while bacteria are too variable to show seasonality. Overall, HRMs that incorporate meteorological data show promise in the forecasting of seasonal changes to pathogen exposure in drinking water. The mixed effects regression models showed that meteorological parameters have more bearing on the likelihood of bacteriological contamination increase at the household level than do WASH covariates. Further work is suggested to examine this pattern while accounting for storage times and including laboratory controls which may allow for isolating the effect of meteorological parameters from those of WASH covariates and natural growth and attenuation of bacteria. This research demonstrates the utility of routinely collected meteorological data in predicting exposure to enteric pathogens. Meteorological data may play a role in decision making related to drinking water storage practices, especially in low resource settings.