Characterization of Microbial Health Risk at Water Abstraction Points along River Njoro, Kenya

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Abstract

U.S. based models for recreational water quality were applied to characterize the potential health risk (PHR) of infection with gastroenteritis (GI) and highly credible gastroenteritis (HCGI) illnesses from single exposure at several water abstraction points (WAPs) along the River Njoro in rural Kenya. Ambient geometric mean densities of *Escherichia coli* (EC) and intestinal enterococci (IE) were generally high (2–4 log units of cfu/100ml) and risk levels were grossly in excess of acceptable health risk (AHR) levels for bathing and drinking. PHR was 2–3 times higher with the Cabelli (IE) model compared to the U.S. EPA (EC) model. Risk levels varied among WAPs in concomitance to the spatial and seasonal variability of ambient EC and IE densities. With the Cabelli (1983) IE model, PHR of HCGI illness on single exposure to the dry weather 95th percentile IE density for bathing was 2.5% of the exposed population at Logoman compared to 5.2% at Turkana Flats, 4.9% at Kenyatta or Nessuit and 4.6%, 4.5% and 4.2% at Treetop, Segotik and Njoro Bridge, respectively. PHR was ≥ 5% on exposure to the wet weather 95th percentile IE density at all WAPs, excepting Treetop with 4.3%. Relative risk levels increased by at least 30 and 70 times for GI and HCGI illnesses, respectively, from drinking (250ml) raw stream water, rising erratically in wet weather by > 80% of the dry weather risk at Logoman, > 30% at Njoro Bridge and Kenyatta and 10–15% at Segotik, Nessuit and Turkana Flats. By stipulating freshwater bathing water quality guidelines of 126 and 33 cfu/100ml for EC and IE, respectively, U.S. EPA upholds maximum AHR levels at 0.7% and 1.9% for EC and IE, respectively. Hence, reducing current PHR levels at the WAPs to the U.S. EPA bathing AHR levels would require at least 2–4 log reductions of IE and EC densities with even further log reductions to achieve the WHO recommended drinking water AHR level of 0.1%. This would necessitate specialized treatment, in particular point-of-use treatment at the household level, as well as the implementation of comprehensive catchment management measures to protect the stream and the WAPs.

Keywords: Microbial health risk; OAEL approach; water abstraction; water quality