

Study on sanitation improvement for a slum in Bangladesh

by an exposure analysis of fecal indicator bacteria

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1. INTRODUCTION

Sanitary improvement is crucial matter in slums as there potentially exists high health risk. Slum dwellers live in a different manner from those in other areas; they are likely exposure to fecal bacteria regularly through various transmission pathways. As a case study in a slum of Khulna city, Bangladesh, this study identified water consumption patterns of the dwellers and contamination level of environmental media to transmit bacteria to human, and assessed major exposure pathways and health risk from fecal bacteria.

2. METHODOLOGY

Water consumption pattern was surveyed with 30 households by diary method. Total coliform and *Escherichia Coli* were tested with home stored water ($n=24$), well water ($n=31$), soil ($n=5$), pond water ($n=3$), hand surface ($n=30$), and eating devices ($n=7$). Probability distribution functions were defined based on the results of water consumption survey and *E. Coli* test. Exposure was calculated based on Monte Carlo simulation using Crystal Ball 11 (Oracle) with 10,000 trials. Infectious risk was assessed by Eq. (1) and (2) (Haas et al., 1999).

$$P(d) = 1 - \left[1 + \frac{d}{N_{50}} \left(2^{\frac{1}{\alpha}} - 1 \right) \right]^{-\alpha} \quad (1), \quad P_{annual} = 1 - [1 - P(d)]^{365} \quad (2)$$

3. RESULTS AND DISCUSSION

Well waters and home stored water, which was originally obtained from well, contained coliform bacteria and *E. Coli* as well (Fig.1). The results indicated an increase of bacteria concentrations during home storage by app. 23 time for coliform bacteria and app. 3 times for *E. Coli*. Since fecal bacteria were detected from hand surfaces, water was contaminated by hand during home storage.

Playing with water was the largest pathway of a boy, and soil intake (Adult) was the largest pathway of male. Together with drinking water quality improvement, direct discharge of wastewater, especially toilet wastes was suggested as a crucial measure to reduce risk in the site.

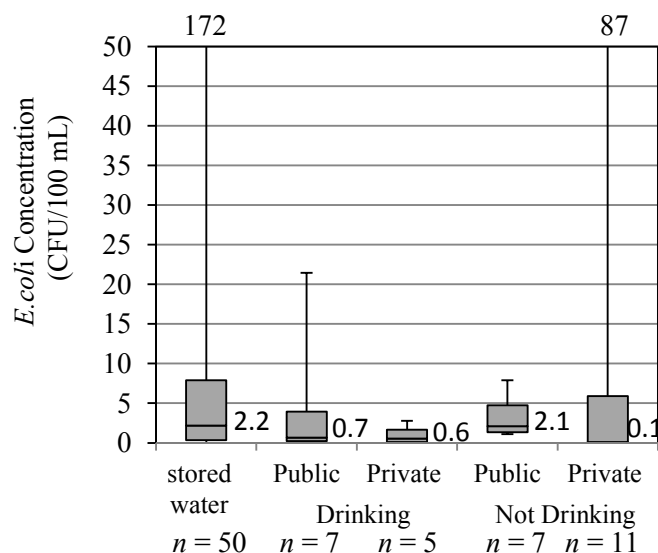


Fig.1 *E. Coli* concentration of stored water and well water

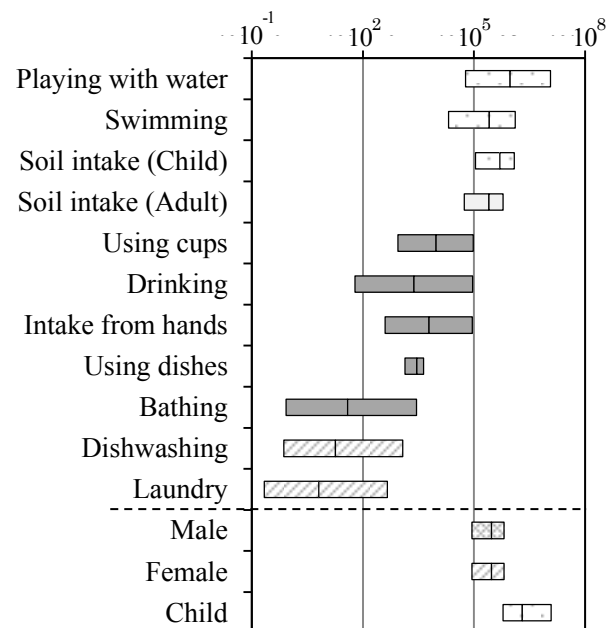


Fig.2 Annual Exposure amount (CFU/cap./year)