Environmental indicators of enteric infections in a rural area and urban slum of Vellore, India.

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1) Background

• Between 1995-2003, diarrhea accounted for 43% of non-neonatal infant deaths in 4 areas of Vellore, India.
• Transmission of infectious diarrhea is fecal oral with zoonotic and/or anthropogenic cycles depending on the pathogen.
• Major environmental parameters that influence the transmission of diarrheal pathogens include waste disposal, weather, water quality and supply, human/animal interactions, and flies. Flies carry and may transmit enteric pathogens.

2) Objectives

• Provide fly densities and microbiologic analysis of flies in the sites included in the collaborative Tufts University/Christian Medical College study “Environmental indicators of enteric infections in vulnerable populations”.
• Use fly densities with hygiene, living conditions, and water supply as predictors of number and duration of diarrheal episodes in study households.
• Suggest initiatives to combat diarrhea in resource poor settings.

3) Methods

• Number and duration of diarrheal episodes were recorded in an ongoing year-long cohort of 160 urban and 80 rural households with 1274 individuals (27% under 5) in Vellore, India.
• Household questionnaires on living conditions.
• ELISA, light microscopy, bacterial culture, and multiplex PCR were performed on stools.
• Fly densities (flies per trap/day) measured in 2 seasons using fly traps placed in kitchens with a calculation of a weighted average.
• Baited outdoor fly traps were discontinued due to concerns of impact on an observational study.
• PCR for enteric bacteria, viruses, and protozoans were performed on flies.
• Bivariate and Multivariate linear and log-linear models to explore the relationships between diarrhea and fly densities, demographics, hygiene, and human/animal interactions.

4) Results

• 91 episodes of diarrhea occurred (89% in under 5s) from 8/6/2010 to 1/31/2011.
• Stool pathogens isolated in 24 of 77 (31%) of samples: E.coli, Shigella spp., Vibrio spp., Giardia, Cryptosporidium spp., and Rotavirus.
• 631 flies were caught. Fly densities were 2.56 times higher during the dry season (January 2011) compared to monsoon (October 2010) (p<0.001).
• The absence of animals in or near the home, living in RNP (1 of 2 urban slums), and the use of indoor latrines were protective factors for high fly densities, while living in Kattuputhur (1 of 2 rural sites) and the use of firewood for fuel (some correlation with lower income) were risk factors. (Table 1)

5) Conclusions

• Fly densities in household kitchens were a function of season and living conditions.
• Several enteric pathogens were found on captured flies. Of these, Norovirus has heretofore been poorly documented on flies and has a low infectious dose, making one fly capable of transmitting disease.
• Several environmental risk factors for increased diarrhea were identified including water sources, living conditions, hygiene, and high fly densities.
• The seasonality of fly densities and diarrhea should be confirmed by completion of the study.
• The more widespread use of indoor latrines, better water quality, improved general education and hygiene are potential public health targets to combat infectious diarrhea in resource poor settings.