Assessing the Impact of Sanitation on Transmission of Helminthes in China – *Schistosoma japonicum*

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Abstract

**Background:** Schistosomiasis remains an important contributor of morbidity in various parts of the world. As current morbidity controls are increasingly portrayed as unsustainable, the need for novel, effective, and economic methods of schistosomiasis control becomes more evident. Therefore, our specific aims included: 1) to assess effectiveness of different sanitation facilities in the control of helminth (including *Ascaris*, hookworm, *Trichuris*, and *Schistosoma*) ova, and 2) to assess and quantify the impact of overall sanitation coverage on transmission of schistosomiasis on a community scale within a Chinese region. **Methods:** Inlet and outlet samples (n=208) were previously collected from sanitation facilities in Xichang, Sichuan Province to assess for the presence and inactivation of helminthic ova. *Ascaris* egg counts (as a proxy for *Schistosoma* presence) were compared across sanitation facility types among outlet samples. Historical data of 16 villages from 1995-2012 was also utilized from the Sichuan CDC to assess effect of sanitation on a community level. Historical data was collected from a stratified random sampling frame as a part of routine surveillance for schistosomiasis in Sichuan, China. Multivariate analyses were conducted through Generalizing Estimating Equation models. **Results:** Concerning the sanitation experiment data, on average, biogas digesters (β=-3.26, p-value= < 0.0001) and triple compartment facilities (β=-3.76, p-value= < 0.0001) were associated with fewer *Ascaris* eggs in comparison to simple latrines. In assessing the association on a community level, moderate increases in prevalence were noted from 1999 to 2003 among several villages. However, general decreases in prevalence were then noted from 2003 to 2009, where prevalence then remained at 0% for all villages. When adjusting for temporal autocorrelation and possible confounders, on average, increased prevalence of biogas digesters was associated with a decrease in the log of prevalence of schistosomiasis (β= -0.01, p-value=0.04). Other improved sanitation coverage was not significantly associated with decreased prevalence (p-value=0.61). After controlling for the prevalence of biogas digester systems in the current year and year prior, the effect of biogas coverage two years prior continued to remain statistically significantly associated with decreased prevalence of schistosomiasis in the current year in the fully adjusted model (β range: -0.11 to -0.06; p-value: <0.0001 to 0.0025). **Conclusion:** Increasing access to improved sanitation, such as the biogas digester systems, may be an effective and practical means of continued schistosomiasis control, with lasting benefits carrying into years to come.
**MPH Competencies Strengthened:**
Through working on this project, I was able to assess the effectiveness of health-related devices, both from an individual and community-centered standpoint. Also, I have been able to address a public health need that is relevant and pertinent to the individuals living within schistosomiasis endemic regions, utilizing an ecological framework of assessing environmental, governmental, and behavioral factors associated with disease. Informing the local Chinese public health officials of the results of this data provide an opportunity to empower these communities to take effective steps toward continued control of schistosomiasis. I have also engaged in interdisciplinary activities and meetings, working alongside statisticians and spatial analyses experts, and meeting numerous Chinese public health officials.

**Concentration Competencies Strengthened:**
Through the process of my internship, I received ample opportunities to partake in data cleaning, variable classification and coding, utilization of numerous statistical tests, and interpreting epidemiological data and subsequent results as I worked with unused data from the field. Opportunities to work with longitudinal data have greatly expanded my quantitative abilities, working and understanding conceptual frameworks associated with temporal models. I have also been able to expand my understanding of data collection methods, being able to witness how other countries conduct public health activities and surveillance of parasitic diseases. I have been provided with extensive experience of fulfilling the IRB process of study approval, particularly with international research. Additionally, I have greatly grown in communication as I worked with foreign colleagues and have the wonderful privilege of communicating my results back to the staff at the Sichuan CDC.

**Public Health Relevance:**
Our results demonstrate that on a population-scale, the increased coverage of biogas digesters among households was significantly associated with the decreased prevalence of schistosomiasis. These findings and supporting literature collectively exhibit the considerable potential for sanitation to be utilized as an effective tool for schistosomiasis control. With reports suggesting there is continued need for sanitation improvements within China, providing access to safe and sufficient alternatives for human waste control may be a vital fundamental step for sustained schistosomiasis control. Given that analyses were conducted with data aggregated to a community scale, these results are directly applicable for policy-makers, for they provide information on population-level effects that can aid cost-effective decision-making.