

Assessment of water, sanitation and hygiene interventions in response to an outbreak of typhoid fever in Neno District, Malawi.¹

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Presentation Overview

- What is the paper about?
- What is the study design?
- Who are communities & impacts?
- What are statistical methods used?
- Why is this paper interesting?
- What is its public health significance?
- What are its strengths & weaknesses?
- Additional thoughts and observations?

PLOS ONE

RESEARCH ARTICLE

Assessment of water, sanitation and hygiene interventions in response to an outbreak of typhoid fever in Neno District, Malawi

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Abstract

On May 2, 2009 an outbreak of typhoid fever began in rural villages along the Malawi-Mozambique border resulting in 748 illnesses and 44 deaths by September 2010. Despite numerous interventions, including distribution of WaterGuard (WG) for in-home water treatment and education on its use, cases of typhoid fever continued. To inform response activities during the ongoing Typhoid outbreak information on knowledge, attitudes, and practices surrounding typhoid fever, safe water, and hygiene were necessary to plan future outbreak interventions. In September 2010, a survey was administered to female heads in randomly selected households in 17 villages in Neno District, Malawi. Stored household drinking water was tested for free chlorine residual (FCR) levels using the N,N diethyl-p-phenylene diamine colorimetric method (HACH Company, Loveland, CO, USA). Attendance at community-wide educational meetings was reported by 56% of household respondents. Respondents reported that typhoid fever is caused by poor hygiene (77%), drinking unsafe water (49%), and consuming unsafe food (25%), and that treating drinking water can prevent it (68%). WaterGuard, a chlorination solution for drinking water treatment, was observed in 112 (56%) households, among which 34% reported treating drinking water. FCR levels were adequate (FCR > 0.2 mg/L) in 29 (76%) of the 38 households who reported treatment of stored water and had stored water available for testing and an observed bottle of WaterGuard in the home. Soap was observed in 154 (77%) households, among which 51% reported using soap for hand washing. Educational interventions did not reach almost one-half of target households and knowledge remains low. Despite distribution and promotion of WaterGuard and soap during the outbreak response, usage was low. Future interventions should focus on improving water, sanitation and hygiene knowledge, practices, and infrastructure. Typhoid vaccination should be considered.

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Paper Topic: Typhoid Fever Outbreak

- 2009 – Typhoid fever outbreak – 748 illnesses and 44 deaths – outbreak represented a 340% increase in reported cases over a 2-3 month span in a rural area in southern Malawi
- Multiple water, sanitation and hygiene (WASH) interventions were implemented, but typhoid fever cases continued
- Post-outbreak, research was conducted into the rate of implementation for different types of WASH interventions
- Researchers discuss challenges with achieving successful implementation of WASH-related initiatives

Study Design

- In 2010 (18 months post-outbreak) researchers conducted a household knowledge, attitudes and practices (KAP) survey in 17 villages within the Neno district of Malawi
- Survey was as a questionnaire developed by CDC, the Neno District Health Office and an NGO partner organization
- Survey was designed to assess:
 - whether typhoid fever prevention programs (“Typhoid Talks”) had impacted KAP in the affected communities
 - whether new strategies could be identified to inform/ improve household KAP
- Survey conducted in the local language by locally-trained personnel

Study Design (cont).

- In households with stored drinking water, water was analyzed for free chlorine residual (FCR)
- In villages with improved drinking water supply (wells or community taps), water samples were collected for analysis of total coliform bacteria and *E. coli* (indicator organism for likely water contamination with fecal material)
- Interventions conducted between outbreak (2009) and survey (2000):
 - community meetings about causes and prevention of typhoid fever
 - community demonstrations of good hygiene practices
 - free distribution of soap and WaterGuard (drinking water chlorination)
 - infrastructure improvement (wells and/or latrines) for some villages

Communities & Impacts

- Communities in 17 villages impacted by the typhoid fever outbreak
- Villages all within a 14-km radius
- Households within villages chosen at random for survey
- 12 households chosen per village
- Female heads of household identified as key respondent for KAP survey; most knowledgeable about household WASH practices.

Statistical Methods

- Response frequencies from questionnaires were computed for questions regarding KAP for prevention of typhoid fever
- Results stratified by whether household members attended a community “Typhoid Talk” between 2009-2010
- Results analyzed statistically by a design-adjusted chi-square test
- Statistical significance determined at $\alpha = 0.05$ level.

Interest in this Topic

- I'm an environmental and public health engineer and am interested in water-borne diseases and how best to implement WASH-related programs/interventions
- Have worked on this issue in various capacities and find that behavioral change IS the challenge – actual water treatment is fairly straightforward in most instances
- I believe that behavior is a function of what we are taught AND what we are not taught – it's important to not make assumptions about what we think of as 'common knowledge'

Public Health Significance

- There's no such thing as an intuitive "everybody should know this" connection between the environment and behavior (nobody is an 'empty vessel' with respect to the environment in which they live)
- If it is possible to identify **why** WASH-related behaviors aren't adopted, it may be possible to help lower barriers to adoption of more health-positive behaviors
- Barriers **can** be financial, but aren't always; IF barriers are financial, costs associated with water treatment and hygiene products are low compared to costs of managing disease outbreaks and supporting communities in other aspects of health needs

Example from Survey Results

- Among all household respondents (n = 202), the most commonly reported causes of typhoid fever were **poor hygiene (77%)**, drinking unsafe water (49%), and consuming unsafe food (25%)
- While **77%** of households were observed to have soap; among households with soap, **51%** reported using it to wash hands
- So: $0.77 \times 202 = \underline{155}$ respondents linked poor hygiene to typhoid fever, but only $0.77 \times 0.51 \times 202 = \underline{79}$ respondents out of 202 (39% of households) had and used soap for handwashing.
- What strategies could be tried to increase this percentage?

Strengths and Limitations of the Study

- Strong discussion section makes key points:
 - “Typhoid Talk” educational activities did not reach 50% of households
 - Underlying local skepticism about waterborne transmission of typhoid fever and effectiveness of WASH interventions to prevent transmission.
- Research limitations noted by authors:
 - Significant household respondent unavailability (for education or survey)
 - No pre-2009 outbreak intervention baseline to allow comparison
 - Recognition that KAP-related activities (“Typhoid Talks”) were unevenly distributed and were on-going in some villages during the study period in which questionnaires were conducted

Additional Thoughts and Observations

- Underlying local skepticisms in how typhoid fever is transmitted were identified through a qualitative study being conducted concurrently:
 - Good understanding that typhoid fever is dangerous and very easily spread
 - The cause of typhoid fever attributed to curses, witchcraft and 'bad air'
- This local understanding of causative agents is important contextual information for thinking about WASH-related interventions to reduce typhoid fever-related mortality
- Specifically: the question becomes how to support or encourage adoption of a sanitation-related behavior in the context OF local beliefs (versus via the need to CHANGE these beliefs)?