

Clean Water for Liberia: Statistical Analysis

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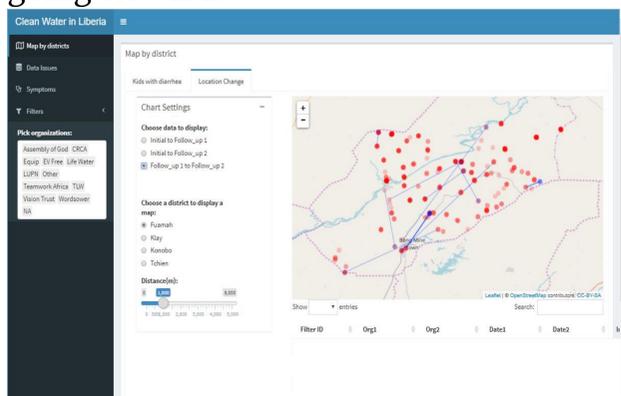
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Introduction

Sawyer Products and Liberian NGOs are partnering with students and faculty from Calvin College in statistics, geography, and public health for a **four-year project studying the efficacy of distributing water filters to households in Liberia**. Diarrheal disease is one of the leading causes of death in children under 5 years in Liberia [1]. The **overall goal of this project is to provide clean drinking water to approximately 100,000 households in Liberia**. A study in Bolivia using similar Sawyer filters resulted in an 85% reduction in diarrheal disease among children under 5 [2]. At the time of distribution, Liberian NGOs are conducting surveys with basic questions on demographic information and health-related issues. More data are collected at follow-up visits about two and eight weeks after the installation of the water filters to determine their efficacy.

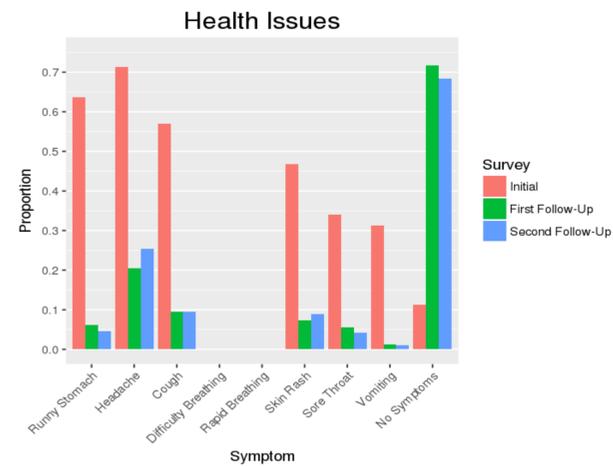
Data Preparation

Our team created a **Shiny App in R Studio** to detect issues in the raw data. Where possible, errors were corrected. Data collection protocols were modified to improve data quality going forward.



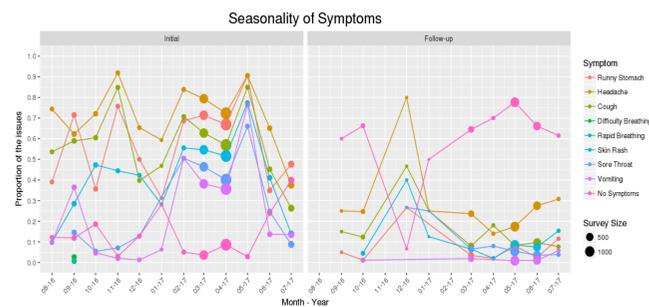
Data Visualization

Prevalence of Symptoms



The figure above shows the proportion of households that reported experiencing the various symptoms in the month prior to the initial, first follow-up, and second follow-up visits. Households could report more than one symptom. Reports at the first and second follow-up visits were similar, but differed substantially from reports at the initial visit.

Seasonality of Symptoms

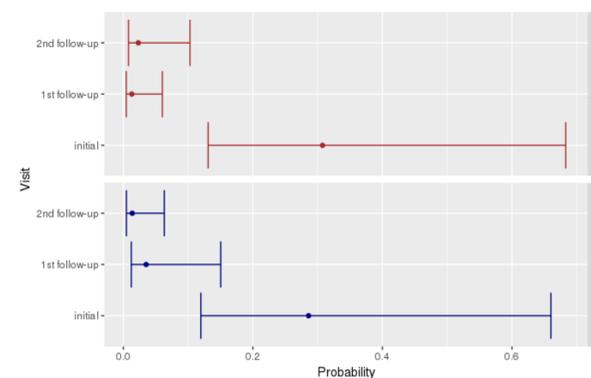


The graphs above display the proportion of households that reported each symptom by month. The goal was to investigate seasonal trends in the data. The size of the point represents the number of surveys conducted that month. The larger the point, the more surveys that were conducted.

Modeling Health Improvement

Our team created preliminary statistical models to determine the effect of the Sawyer filters on the proportion of children with runny stomach.

- **Logistic regression model**
- **Response variable:** probability of a child (under 5 years old) getting runny stomach
- **Predictors:** visit, season, water source, age group, household size, education level of women, and random effect of filter given the district
- We found that the **odds of having runny stomach were reduced by about 95%** after the placement of a Sawyer filter (with no important difference detected between the first and second follow-up visits).
- We found **no important effects of median years of education** (for women, surveyed at the district level) **or household size**.
- We found that **seasonality and water source are not strong predictors** for runny stomach, except for a few specific water sources, such as open well and river.



Distribution of water filters in a Liberian village
Photo Credit: Darrel Larson, Sawyer Products, Inc.

Ongoing and Future Work

Ongoing work will include refining the preliminary models and examining the effects of Sawyer filters (and other important factors) on other aspects of public health, such as days of school and work missed due to illness.

References

[1] World Health Organization. (2015). Liberia: WHO statistical profile.

[2] Lindquist, E. D., George, C. M., Perin, J., Calani, K. J. N., Norman, W. R., Davis, T. P., & Perry, H. (2014). A cluster randomized control trial to reduce childhood diarrhea using hollow fiber water filter and/or hygiene-sanitation education interventions. *The American Journal of Tropical Medicine and Hygiene*, 91(1), 190-197.