A Strategy to Eliminate Waterborne Diseases in Lower Nyakach, Kenya

Robert Metcalf
Biological Sciences, California State University, Sacramento
(E-mail: rmetcalf@csus.edu)

Introduction

Achievement of MDG 7C still left ~800 million people without improved water sources, like the 70,000 people in Lower Nyakach, near Lake Victoria in Kisumu County, Kenya. Their drinking water sources are highly contaminated rivers, streams, ponds, and shallow wells, resulting in a chronically high incidence of waterborne disease.

A unique strategy to eliminate waterborne disease in Lower Nyakach was developed in 2012 by a community-based organization, the Friends of the Old (FOTO) and funded by the International Water and Health Alliances, Davis, California.. FOTO's strategy has three components:

- use of practical field methods to test the bacterial quality of drinking water;
- sharing test results with communities and educating them about the relationship between fecal contamination of water and disease;
- provision of practical household water treatment and storage (HWTS) methods, using chlorine or heat, to kill the germs and make water safe to drink.

Methods

Water quality testing was performed using two commercially-available tests specific for *Escherichia coli*: the Colilert 10 ml presence/absence test (IDEXX, Westbrook, ME) and the *E. coli*/Coliform Count Petrifilm™ (3M, St. Paul, MN), a quantitative test for 1 ml.

Lower Nyakach is divided into 12 locations, each with a FOTO staff member as the link to the location. FOTO staff members were trained in basic microbiology, how to perform and incubate the two microbiology tests, and how to correlate next day results with WHO disease risk categories: low (<10 *E. coli*/100 ml, moderate (10-99 *E. coli*/100 ml, high (100-1000 *E. coli*/100 ml), or very high (>1000 *E. coli*/100 ml).

Two HWTS methods were used. The main method used a commercially available 1.2% solution of sodium hypochlorite that comes in a 150 ml bottle. A capful, 3-3.5 ml, is used to treat water in the commonly used 20 liter jerry can One bottle will treat 850-1,000 liters of water, sufficient to last most families at least two months. The second method is to use a simple Cookit solar cooker that uses sunshine to heat water to the pasteurization temperature of 65−C. A wax-based, reusable water pasteurization indicator (WAPI) verifies that the pasteurization temperature of 65−C has been reached.

Water testing items: *E.coli* Count Petrifilm & spreader, Whirl-Pak, sterile pipette, 10 ml Colilert test, UV light

FOTO staff member with pipette, Whirl-Pak, Petrifilm and Colilert tests.

1.2% sodium hypochlorite bottles

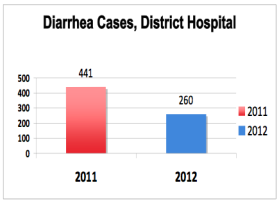
Pasteurizing water in a Cookit solar cooker

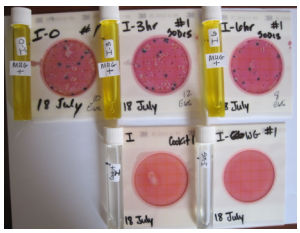
Results

The dramatic visual results of Colilert and Petrifilm tests on drinking water sources before and after treatment led to a community understanding that drinking water sources were contaminated and that heat or chlorine kills the germs and makes the water safe to drink (center photo).

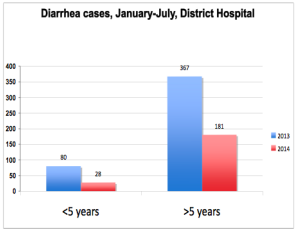
In February, 2012, FOTO started distributing chlorine bottles at no charge to 9,600 families over two months. Lower Nyakach clinics reported a 41% decrease in diarrhea cases (441 to 260) from January, 2012 to January, 2013 (Chart on left). In August, 2013, the number of chlorine bottles distributed was increased to 14,400, in an effort to provide each family with a bottle of chlorine every other month. At the District Hospital there was a 53% decrease in diarrhea cases from January-July, 2013 to January-July, 2014 (Chart on right).

On a smaller scale in 2013-March, 2014, 600 families received a Safe Water Package that included a Cookit, Water Pasteurization Indicator, and ceramic safe storage container, enabling solar water pasteurization of ~10 liters on sunny days.





Evidence-based microbiology that drinking water is contaminated, and heat and chlorine kill the germs and make water safe to drink



Discussion

- The Colilert and Petrifilm tests enabled FOTO staff to bring evidence-based microbiology to communities in Lower Nyakach.
- Testing replaced myths about water being safe to drink and demonstrated that chlorine or solar heating to 65°C made the water safe to drink.
- As the number of families receiving free bottles of chlorine every other month increased from 0 in 2011 to 9600 in 2012, and to 14,400 in August, 2013, diarrhea cases at the District Hospital decreased.
- Distribution of 3,000 FOTO calendars in 2014 reinforced the message that **The Goal is Zero** water-borne diseases in Lower Nyakach. This goal has been embraced by District officers, village chiefs and elders, and communities.

Conclusions

Water testing with Colilert and Petrifilm tests at the community level educated communities in Lower Nyakach that drinking water sources were contaminated and must always be treated. Since 2012, community education and regular provision of free chlorine bottles to most all of the 14,000 families, and providing a Cookit solar cooker to solar pasteurize water for 600 families, resulted in a dramatic reduction of water-borne disease in Lower Nyakach with the goal of zero. This project provides a roadmap for governments and non-profits to decrease the scourge of water-borne disease among the poorest people in the world.