

The Goal is Zero: A Strategy to Eliminate Water-borne Disease in Lower Nyakach, Kenya

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BACKGROUND

In 2000, the United Nations established Millennium Development Goal 7, target C, which aimed to reduce by one-half the proportion of the world's population without access to safe drinking water and sanitation by 2015. Because MDG 7C does not strive for universal access to safe drinking water, achievement of MDG 7C would still leave ~800 million people without access to safe drinking water. This population will continue to be plagued with most of the annual ~4 billion cases of diarrhea and ~1.8 million preventable deaths from water-borne diseases.

Lower Nyakach is a Division in Nyakach District, Nyakach Constituency in Kisumu County, near Lake Victoria in western Kenya. It has a population of ~69,000, with ~60% of the population in absolute poverty. The main sources of water are highly contaminated and consequently there has been a high incidence of water-borne disease in Lower Nyakach. This very poor area was not among the beneficiaries of improved water sources in MDG 7C.

Friends of the Old (FOTO) is a community-based organization working in the 12 locations of Lower Nyakach. FOTO has a special focus on helping economically disempowered senior citizens who take care of grandchildren orphaned by HIV/AIDS. The top priority of FOTO is to eliminate water-borne disease in Lower Nyakach. To accomplish this, FOTO has taken a three-pronged approach of: 1) using practical field methods involving community members to assess the bacterial quality of drinking water sources; 2) educating communities, including schools, about the relationship between fecal contamination of water and disease using evidence-based bacterial tests; 3) introducing readily available household water treatment and storage (HWTS) methods. In addition to improving the health of citizens in Lower Nyakach, this project aims to be an example of what can be accomplished by a community-based organization, at low-cost, to significantly decrease water-borne disease.

METHODS

Water quality testing was performed using two commercially-available tests for the fecal indicator bacterium *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. These tests were combined with sterile pipettes and collecting bags, and a long-wavelength ultra-violet light for the Colilert test in a gallon-size zip lock plastic bag to make a Portable Microbiology Laboratory (PML) that could be taken to the field to perform water tests (Metcalf and Stordal). After inoculation and incubation for 12-18 hours, the presence of *E. coli* is indicated by a fluorescent blue color in the Colilert tube, and by a blue colony with a gas bubble on the Petrifilm.

The FOTO staff includes** a woman from each of the 12 locations in Lower Nyakach. They are the link to their communities. They were trained in basic microbiology, the choice of *E. coli* as the best indicator of recent fecal pollution, how to perform the two PML tests, how to incubate them and correlate the 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) (WHO, 1996).

Two HWTS methods were used. The first was the commercially available WaterGuard, a 1.2% solution of sodium hypochlorite that comes in a 150 ml bottle. A capful, 3 ml, is used to treat water in a 20 liter jerry can. A bottle of WaterGuard will treat 1,000 liters of water, sufficient to last most families at least two months. The second method was the use of a simple Cookit solar cooker to use sunshine to pasteurize water. A wax-based, reusable water pasteurization indicator verifies that the pasteurization temperature of 65°C was reached (Safapour and Metcalf).

RESULTS

Colilert and Petrifilm tests performed by FOTO staff repeatedly demonstrated that the main drinking water sources in Lower Nyakach, rivers, streams, and ponds, were contaminated and posed a high or very high disease risk. When contaminated water was treated with WaterGuard (3 drops/liter), subsequent Colilert and Petrifilm tests most often were negative for *E. coli*, except with highly turbid water sources, when a reduction in counts was obtained, but not complete inactivation of *E. coli*. When water was heated in a Cookit solar cooker to melt the WAPI wax, all subsequent Colilert and Petrifilm tests were negative for *E. coli*.

The visual nature *E. coli* positive Colilert and Petrifilm tests before and after chlorine or heat provided striking evidence-based microbiology in an understandable way that water sources were contaminated and that treatment eliminated the contamination.

In February, 2012, FOTO started distributing WaterGuard at no charge to 4,800 families. Starting August, 2013, 7,200 families were given WaterGuard every other month, providing almost all families with the ability to treat their contaminated drinking water sources. Local clinics and hospitals have reported a 40% decrease in diarrhea cases a year into WaterGuard distribution, and many people now will not drink an untreated water source. On a smaller scale, 50 families per month receive a Cookit, WAPI, and ceramic safe storage container, enabling solar water pasteurization of ~10 liters on sunny days.

SIGNIFICANCE OF WORK

The strategy of involving communities in evidence-based microbiology testing of water sources, and providing inexpensive treatment options to impoverished families has reduced the burden of water-borne disease in Lower Nyakach. This could be replicated throughout Kenya and in other developing countries to reduce the disease burden of ~800 million people not affected by MDG 7C.

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Albums of water testing and solar pasteurization in Africa are at: <http://imageevent.com/bobmetcalf>
International Water and Health Alliances website: www.waterinternational.org
Kenya project on Facebook = Friends of the Old - FOTO

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