

There has been concern for many years that providing oral cholera vaccine (OCV) may actually have a negative impact on water, sanitation and hygiene (WaSH) activities and other traditional cholera control interventions. The theory is that people may feel protected by the vaccine and thus be less vigilant about hygiene, food safety practices or ensuring that their drinking water is not contaminated. Or communities and governments may feel less of a need to make the required investments to ensure access to safe water and adequate sanitation.

Far from detracting from WaSH and other cholera preventive strategies, however, cholera vaccination must be part of an overall strategy that includes other cholera control activities, such as water and sanitation improvements and increased access to high-quality health care. **WaSH interventions and cholera vaccination especially fit well together, not only because they are two ways of preventing the spread of cholera. They actually act synergistically – with vaccination improving the effectiveness of WaSH and vice versa.** This is due to both how they interact biologically and the logistical efficiency of combining these interventions.

WaSH makes cholera vaccination more effective because the severity of the disease depends on the inoculum size. A person develops cholera by ingesting the bacterium, *V. cholerae*. Most likely this bacteria had spread from another cholera patient whose watery stool was teeming with it. Cholera patients can excrete 20 liters or more of this watery stool during their illness, and each liter contains about a trillion *V. cholerae* bacteria. Because of poor sanitation in cholera endemic areas, these bacteria can find their way into drinking water or food, thereby infecting others, and continuing the cycle.

Many people who ingest *V. cholerae* become infected but do not get sick, or they might have only mild symptoms. If they ingest a huge dose, however, most

people develop severe cholera. When a vaccinated person ingests a huge number of *V. cholerae*, he or she could become ill despite having been vaccinated. This is because the huge inoculum simply overwhelms the immune system. So, whether or not a vaccinated person is protected from cholera illness is determined by the inoculum size. A good WaSH program can prevent people from ingesting a huge inoculum, and while it may not prevent smaller inocula from being ingested, the vaccinated person's immune system should be able to handle this smaller dose and avoid severe illness. Thus, by lowering the level of contamination in the environment, WaSH interventions can shift the balance by making it even less likely that the vaccinated person will get sick.

Cholera vaccination lessens environmental contamination, helping to stop transmission of the disease and improving the effectiveness of WaSH interventions. Imagine that an infected person visits a community and shortly after arrival, develops cholera. He or she consequently contaminates the community water source. This situation can easily lead to an outbreak as successive patients add more and more contamination to the community water supply.

However, if the next “intended victim” has been vaccinated, he/she is much less likely to develop cholera. Not only does this person not get sick with cholera, he/she also does not excrete trillions of bacteria, and thus does not contaminate the environment. Therefore, if the community has been vaccinated, transmission can be stopped, since immune persons will not contribute to further contamination of the environment. The effectiveness of WaSH interventions is dependent on the level of contamination. If many people are excreting *V. cholerae* into the water, the WaSH program may not be able to keep up with the bacterial burden. WaSH programs can reduce the bacterial burden, but may not be able to eliminate it entirely. Thus, the fewer

pathogens to clean up, the more successful WaSH activities will be.

Integrating cholera vaccination with other cholera control interventions and programs. The challenge now is to integrate OCV with WaSH programs and other cholera prevention and control strategies. For example, teams providing WaSH interventions need to reinforce messages about the benefit of cholera vaccination. Conversely, OCV teams need to reinforce messages about safe water and hygiene. Both teams need to insure that patients know where to go for treatment if they develop severe diarrhea.

While cholera vaccination in endemic countries is still relatively new and an integrated approach has not always been used, the evidence so far suggests that if well implemented, OCV campaigns can reinforce WaSH and hygiene promotion activities (see box).^{1,2} Additional experience is needed to identify best practices for integrating cholera vaccination with WaSH and other cholera prevention and control measures.

Integrating oral cholera vaccination with other control strategies: examples from the field

- In the Democratic Republic of Congo the Ministry of Health encourages an integrated approach to fighting cholera. In Kalemie, cholera vaccination was included as a component of a large multi-sectorial effort to control cholera, which included improvements to the water delivery system, the establishment of a control treatment center and strong case management, and enhanced cholera surveillance – all with the assistance of Médecines sans Frontières and the NGO, Solidarités International.
- In refugee camps in South Sudan where living conditions were conducive to cholera outbreaks, oral cholera vaccination was one of several interventions used to reduce the risk of cholera and other epidemic prone diseases. These interventions also included the distribution of soap and chlorinated water, health education, albendazole (deworming medicine) distribution, and vaccination against measles and meningitis.
- In Haiti during a rural OCV pilot project, vaccination teams were encouraged to share key messages about cholera prevention and treatment at every contact with the public before and during the period of vaccination. The messages were disseminated through a variety of media, including, radio shows, sound trucks, town criers, local television, T-shirts and posters. Educational information was provided to at least one member of all enumerated households. The education campaign was associated with significant improvements in knowledge about cholera and practices related to waterborne diseases.²
- Women of reproductive age who were vaccinated with OCV in Forecariah, Guinea in 2012 during an outbreak also received soap and chlorine tablets from the vaccinators, who educated them about the importance of their use to prevent cholera³.

¹ Ivers LC, Farmer PE, Pape WJ. Oral cholera vaccine and integrated cholera control in Haiti. *Lancet* 2012; 379:2026-8.

² Aibana O1, Franke MF, Teng JE, Hilaire J, Raymond M, Ivers LC. Cholera vaccination campaign contributes to improved knowledge regarding cholera and improved practice relevant

to waterborne disease in rural Haiti. *PLoS Negl Trop Dis* 2013 Nov 21; 7(11):e2576.

³ Luquero FJ, et al. First outbreak response using an oral cholera vaccine in Africa: vaccine coverage, acceptability and surveillance of adverse events, Guinea, 2012. *PLoS Negl Trop Dis*. 2013 Oct 17; 7(10):e2465.