Field testing the Smart Electrochlorinator 10,000

Improving access to chlorine solution for infection prevention in health centers

Hundreds of millions of people each year acquire infections while receiving care in health facilities. These infections are especially common in low- and middle-income countries and can lead to prolonged hospital stays, disability, and even death.

Health facilities often use an inexpensive chlorine solution to sanitize surfaces and medical equipment to prevent infections. To create the chlorine solution, workers typically mix a powder called high-test hypochlorite (HTH) with a measured quantity of water. Unfortunately, HTH is often out of stock at facilities in low-resource settings because of poor supply chains, inadequate demand forecasting, and other problems. Without the means to make chlorine solution, ward attendants often clean surfaces with only soap and water or just water, leaving patients more vulnerable to infection.

POTENTIAL BENEFITS OF ON-SITE GENERATION OF CHLORINE STOCK SOLUTION

In April 2013, PATH, VillageReach, Cascade Designs, Inc., and the Malawi Ministry of Health began a nine-month field test of a new device for generating chlorine stock solution on-site at health facilities. The Smart Electrochlorinator 10,000 (SE10K) uses table salt, water, and electricity to produce a concentrated stock solution that can be used for water treatment and infection control. The pilot in Malawi sought to determine whether the SE10K:

- Was acceptable and usable in a health care setting.
- Increased use of chlorine solution for disinfection.
- Decreased the cost of solution for health facilities.

By avoiding problems with the supply of HTH, on-site generation of chlorine stock solution may increase a health center's access to high-quality, low-cost disinfectant and ensure clinic staff can consistently follow infection-prevention protocols.

INTERVENTION AND EVALUATION METHODS

The Balaka District health office selected two health centers for pilot use of the SE10K. Ward attendants and community health workers at the intervention sites were taught how to use the device, as well as how to add sodium hydroxide to stabilize the resulting chlorine solution for long-term use. They learned how to run the device either by plugging it into an electrical outlet or by using a 12-volt battery (for use when the electrical power supply is unreliable). They were then asked to track the number of times they used the SE10K as well as their daily access to water, electricity, and HTH.

PATH/Jesse Schubert

Demonstrating use of the SE10K in Malawi.

VillageReach staff visited intervention sites monthly to provide technical assistance and answer questions. At each visit, they collected data on the types of sanitation activities conducted the day before the visit and on HTH stocks. They also observed health center staff using the SE10K, interviewed them about their experiences with the device, and conducted focus groups with users at the end of the project.

Two health centers similar to the intervention sites were chosen to be comparison facilities. Water treatment and disinfection practices at these facilities, which relied only on HTH, were monitored and compared with those at intervention facilities.

PATH/Jesse Schubert

Health center staff during training session.

RESULTS OF PILOT USE

Workers at intervention sites found the SE10K easy to use and successfully incorporated it into their work flows. Staff preferred using the SE10K over HTH because it was consistently available and less odorous and hazardous than using HTH, and the device made it easy to get the correct chlorine concentration.

Staff also noted, however, that a disadvantage of the SE10K is the limited amount of chlorine solution it produces. They said they would prefer a device that could make 5 to 20 liters of solution per batch instead of only 2 liters. Having larger quantities of the solution would allow them to keep more on hand for disinfection at the health center and have a supply to distribute to the community for treatment of drinking water. Other suggestions from workers included extending the training period to give them more time to practice the process and providing more training and written materials on troubleshooting and repairing the device.

Site visits found that sanitation activities were completed more consistently at intervention sites than at comparison sites. Floors were mopped with chlorine solution in advance of 13 of 14 visits to intervention facilities (93 percent), compared with 9 of 16 visits to comparison sites (56 percent). The one time the floors were not mopped with chlorine solution at an intervention site was not due to a lack of chlorine solution but to the lack of a mop.

HTH stockouts occurred frequently at both intervention and comparison sites, with stockouts being recorded during more than half of all site visits. Stockout rates at individual facilities ranged from 33 percent to 83 percent.

The estimated cost of producing chlorine stock solution using the SE10K ranged from US$0.03 to $0.44 per liter, depending on the volume generated and other cost variables (excluding transportation costs, which were not considered in the analysis). In comparison, the cost of using HTH is typically about $0.05 per liter of stock solution, though frequent stockouts mean health centers may go months without a supply. When operating at maximum capacity—one run per hour, eight hours per day, five days per week—the SE10K could be a cost-effective way to provide health centers with consistent access to chlorine solution for infection prevention.

NEXT STEPS

VillageReach, PATH, and Cascade Designs plan to modify the SE10K to increase production capacity and then conduct larger-scale testing in additional health centers in low-resource settings. The SE10K has the potential to significantly increase the availability and use of chlorine solution for preventing infections in health facilities, which could ultimately benefit millions of people around the world.

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