Freeze Protected Vaccine Cold Box for Off-Grid Locations, Year Three

Dorminy, Susanna (School: Sola Fide Home School)

Temperature sensitive vaccines such as polio and measles must be maintained at a 2-8 degrees Celsius temperature range to avoid spoilage and insure potency. Vaccine Cold Boxes (VCBs) carry monthly vaccine supplies from district stores to local health facilities and to remote villages, making VCBs the most important link in the cold chain. The World Health Organization (WHO) requires VCBs to have a minimum 48-hour cold life, the time 10-0 degrees Celsius is maintained at 43 degrees Celsius externally. To maintain this range, standard VCBs use coolant packs which must be conditioned/warmed at room temperature for 1-2 hours if they are frozen. This is not routinely followed, leaving an estimated 75-100% of vaccines exposed to freezing temperatures according to previous studies. The researcher created a large capacity, freeze-protected VCB cooled with thermoelectric coolers (TECs) controlled by an Arduino Nano. For vaccine freeze-protection cold life testing, the 5 liter Vaccine Cold Box prototype was tested with frozen (-25 degrees Celsius) coolant packs in 43 degrees Celsius conditions for 48-88.8 hours. A removable temperature logger provided data. Upon activation, the refrigeration unit's internal temperature reached the 10-0 degrees Celsius range in 12.0 minutes and maintained the range for temperature sensitive vaccines for maximum of 71.5 hours in external temperature conditions of 43 degrees Celsius. The goal of the project was to create a large capacity freeze protected Vaccine Cold Box with a 2-8degrees Celsius range for a minimum of 48 hours in compliance with WHO standards. This new, large, freeze-protected prototype maintains 2-8 degrees Celsius with 43 degrees Celsius external temperatures using frozen coolant packs for over 71 hours.

Awards Won:

Fourth Award of $500

U.S. Agency for International Development: USAID Science for Development First Place Award of $5,000.