Freeze-Preventive Vaccine Carriers

Health need
When vaccines are transported from health centers to remote populations, temperatures inside vaccine carriers are often maintained with frozen ice packs, putting the vaccines at risk of freezing.\(^1\) Many vaccines containing aluminum adjuvants are freeze sensitive and costly, including human papillomavirus, pneumococcal, liquid rotavirus, and cholera vaccines. If frozen, these vaccines lose potency and potentially leave vaccinated individuals at risk of disease. Freeze-damaged vaccines can also harm the reputation of vaccination programs and waste valuable health dollars.

To protect vaccines from freezing, World Health Organization (WHO) policy recommends the use of cool-water packs rather than frozen ice packs in carriers. If ice packs are used, they must be conditioned or allowed to warm from -25°C to 0°C. Conditioning is not an exact science, and freezing can occur even when vaccines are stored with conditioned ice packs. Thus, WHO has new Performance, Quality and Safety (PQS) specifications for carriers, requiring freeze-preventive features.

Technology solution
PATH is addressing vaccine freezing at the periphery by redesigning existing carriers to be freeze safe. Even when used with non-conditioned ice packs, the freeze-preventive carriers will protect vaccines from temperatures less than 0°C, preventing freezing. By allowing the use of frozen ice packs, these carriers should simplify preparation and reduce training burden (in the long term).

Current status and results
PATH developed the current freeze-preventive carrier concept being scaled, is transferring it to interested manufacturers, and is ensuring global access. In 2012, PATH and partners field tested a proof-of-concept design that used engineered phase-change material (PCM) as a freeze-preventive barrier to vaccines. Results showed that the modified carrier prevented vaccine freezing during transport, and health workers found the freeze-preventive carrier more convenient as it did not require them to condition ice packs. In 2015, PATH refined the design to use water, a low-cost, readily available PCM, instead of engineered PCM. PATH laboratory tests showed that when used with frozen ice packs, these carriers prevented temperatures from falling to less than 0°C inside the vaccine compartment, preventing vaccine freezing. In 2016, PATH published the concept to Research Disclosure, ensuring its global access.

PATH is collaborating with inventors and manufacturers, helping them to meet WHO PQS freeze-protection specifications and further optimize freeze-preventive designs. These new carriers will need to pass independent PQS laboratory tests and field evaluations.