Sophisticated Yet Simple: PATH Technologies Tackle Global Health Problems

by Marita Graube

Grasping what looks like an unusual toy gun, Bill Van Lew pumps a foot pedal, and then fires a hydraulic blast of watery mist into the air. The thin spray hisses from the nozzle like a quick puff of steam from an iron.

Van Lew is demonstrating a jet injector, a device for rapid, needle-free vaccinations. It promises to improve injections by safely and quickly immunizing without creating large amounts of medical waste.

The device is one of the many innovative health technologies that designers like Van Lew are developing at PATH, the Program for Appropriate Technology in Health. Headquartered in Seattle, PATH strives to advance worldwide health by creating appropriate technologies to improve vaccinations, disease prevention, reproductive health, and nutrition.

"Appropriate technologies are sophisticated in design but simple in use," explains Peggy Morrow, PATH's vice president of resource mobilization. These technologies are considered "appropriate" because they are affordable, accessible, and culturally acceptable.

Since PATH's beginning in 1977 as a contraceptive technologies program, the nonprofit organization has expanded into several areas of global health in dozens of countries. Launched with funds from the Ford Foundation, and with recent funding from the Gates Foundation, PATH is unique for its Northwest location, since most U.S. public health programs are based on the East coast.

Recently, PATH has enlarged its staff and has seen its technologies hit the global market. "Now we're looking to innovative technology solutions that fit into existing health systems," says Morrow.

The solutions first take a physical form in PATH's product development shop among the various machines and woodworking tools. Model maker Bill Van Lew reveals the methodology behind the development process.

Van Lew shows off a syringe, called SoloShot™, and points out a small metal barb within its plastic cylinder. After an injection, the barb locks the plunger of the syringe, thus preventing its reuse. Asimilar technology, called Uniject™, is a single-use shot, pre-filled with a vaccine or a medicine.

An Indonesian newborn receives a Hepatitis B shot with Uniject, a single-use device, pre-filled with the proper amount of vaccine. The local midwife can carry Uniject in her pockets while she goes from home to home to insure that all newborns in her village are vaccinated.

The spread of AIDS and Hepatitis B can be blamed partly on the reuse of dirty needles, so single-use needles were a practical solution.

Yet single-use devices brought up the question of waste disposal. Syringes in disposal containers take up landfill space and can occasionally infect health workers. If the contaminated part—the needle—were removed from the syringe, the waste and the health risks could be reduced.

So the PATH team started to analyze existing needle-removing technologies. "We like to make existing technology better, with less expense and fewer parts, if possible," explains Van Lew. He pointed out all the different prototypes, some as basic as a soda can with a special needle-snapping hole in it.

The gun-like jet injector—another example of an enhanced technology—eliminates needles altogether. Laid-off Russian missile scientists developed the first version of this jet injector, says Van Lew, but the design was so unwieldy that PATH redesigned the device to improve its ergonomics.

Other variations of the jet injector technology are also in development with manufacturers, partly due to threats of bioterrorism.

While the high-pressure spray of a jet injector is strong enough to penetrate skin, there is some risk of spreading disease with multiple uses. Therefore, PATH designers are working with an outside manufacturer to create a disposable plastic membrane that attaches to the nozzle of the jet injector to keep the device sterile.

The jet injector may also bring ease to those who fear injections. But unfortunately, needle-free doesn't necessarily mean pain-free. "Some say that it doesn't hurt as much. Some say that it hurts more," shrugs Van Lew.

Once prototype technologies are perfected, PATH must choose the appropriate device for a certain country, considering its location and available resources. "The best thing is to find a manufacturing partner in a developing nation," says Van Lew. In India, for example, PATH located a medical device manufacturer who can produce the needle removers for local distribution. PATH designers also consider cultural differences, as they did when designing a Nepalese birthing kit for women who lack access to health professionals.

PATH employees consider short-term, mid-term, and long-term solutions. "When confronting a health problem, PATH considers whether or not a technology can solve the problem," says Janet Vail, senior program advisor at PATH. The devices also go through usability testing, where actual users give their input on the safety, ease of use, and acceptability of the product.

At a Senegal clinic, local health workers tested needle removers for PATH. A plastic container successfully captured the used needles but the device seemed too messy for busy clinical settings. In addition, the clinicians "didn't like the idea of throwing the plastic container away," says Vail. "This is common in a resource-poor country."

While the usability testing has helped PATH design an array of useful technologies, introducing them into the developing world is an entirely separate undertaking. "The world resists change," says Michael Free, vice president and senior advisor for technologies at PATH. "It is quite a complex task to introduce a new technology into developing world practice." It requires a joint effort between industries, policy makers, and health professionals.

PATH at a Glance

Total projects (ongoing and completed):
950 projects in over 100 countries

Projects include:
Vaccine development for meningitis and malaria
HIV/AIDS education
Family planning
Cervical cancer prevention

Offices in:
Washington D.C., Kenya, Thailand, Cambodia, France, India, Indonesia, Uganda, Ukraine, Viet Nam, China, Philippines, Senegal, Nicaragua

Source of Funding (percent of total):
Foundations (63%)
U.S. Government (27%)
Investments/Corporations (5%)
Individuals (2%)
Other (3%)

Established: 1977

Seattle Employees: 180

Washington D.C. and International Employees: 260

Free points out vaccine vial monitors as an example of a typical difficulty with technology introduction. A vaccine vial monitor is a small temperature-sensitive sticker on a label that changes color when a vaccine is damaged by heat. Because vaccines frequently spoil in developing nations, which often lack proper refrigeration, the monitors are highly valuable. The technology was developed in the early 1980s, but today vaccine vial monitors are only at the initial stages of adoption.

The jet injector delivers rapid, needle-free vaccinations. PATH and an outside manufacturer are creating a plastic shield to keep the device sterile.

Why the delay? Vaccine manufacturers were reluctant to place the monitors on their vaccine vials and public health decision-makers have been slow to enforce the new health policy, says Free. "Manufacturers don't want to put a new process into their line if it's not going to make any more money."

Changing public health policy is also an arduous and bureaucratic task. Even with field studies and research with potential users, the final choice is often made by high-level decision makers.

"Research alone doesn't influence health policy change," says Free. "And it doesn't arise spontaneously out of evidence." Therefore, PATH takes the evidence of a technology's benefit and advocates it in many different forums.

Despite the challenges, Free seems optimistic. Today's manufacturers are more interested in becoming good corporate citizens by showing support for global issues. PATH also hopes to create markets for manufacturers, thus decreasing the monetary risks. With the current research, testing, and advocacy, PATH's future technologies may enter the public health arena quicker than ever. ■

Marita Graube recently received a bachelor's degree in technical communication at the University of Washington.