

A collaborative program is helping doctors track and treat the incidence of pneumonia in their patients by scanning NFC-based RFID tags on infants' bracelets.

By Claire Swedberg

Aug. 31, 2009—RFID-enabled cell phones and ID bracelets can help doctors provide infants with better and more efficient care through the sharing of data among several dozen doctors and facilities, according to a study currently underway in Karachi, Pakistan. Thousands of infants in that city have been participating in a study the frequency of pneumonia occurrence and the origins of that pneumonia infection, while their health record is being tracked by health-care workers using phones to scan passive 13.56 MHz RFID tags embedded in ID bracelets.

Currently, Pakistani infants are not given a pneumococcal vaccine. Consequently, the study is intended to measure how often infants contract pneumonia, and how often those infections are the result of pneumococcal disease—a bacterial infection that can invade the lungs. By analyzing the data from the RFID-based study, researchers hope to understand whether a pneumococcal vaccine should be provided to Pakistani infants to reduce the rate of pneumonia infections.

The system, which follows children from the age six weeks to 18 months, will help researchers determine the rate of incidence of pneumonia in Pakistani infants, and whether the cause is pneumococcal disease. When an infant develops symptoms of pneumonia, he or she can immediately be tested for pneumococcal disease. To date, the study has helped make it easier for health-care workers to respond immediately to pneumonia symptoms reported by doctors, by alerting a health-care team to immediately report to a specific office to draw an infant's blood for testing. What's more, the system has afforded doctors access to data if they need it regarding a patient's records and health-care history, via a central server.

The program is known as the Interactive Alerts for Childhood Pneumonia, since it allows health-care workers to respond immediately to the need for pneumonia testing, and can send data to health-care workers if they request it. It has been in the works for the past three years, and bracelets began being distributed to parents of infants in Karachi last year. The program is a collaborative effort launched by the Interactive Research & Development (IRD), a Karachi-based nonprofit company committed to saving lives through improvements in global health, Karachi's [Indus Hospital](#), where some patients are first tagged, and the [Johns Hopkins Bloomberg School of Public Health's Department of International Health](#), which provided initial design of the project, including which technology would be used and how.

The program is being funded by the international nonprofit [Program for Appropriate Technologies in Health](#) (PATH), with a grant from the [Bill & Melinda Gates Foundation](#). MIT Media Lab's Next Billion Network program helped develop the RFID data software and screen display images, proposed the idea of using [Nokia](#) NFC phones, and helped produce the initial design and working prototype, from which the IRD team developed the final product.

Since November 2008, 4,000 children have been supplied with the bracelet—either at Indus Hospital, or at one of 15 government immunization centers—with another 500 expected by October, reaching the total intended number of 4,500 study participants. Bracelets are attached at the hospital or other locations, where six-week-old babies first visit health-care providers for vaccinations. During the visit, the parents are informed of the voluntary program, says Aamir Khan, IRD's executive director and an associate with the Bloomberg School's Department of International Health.

Those participating, though not compensated for their involvement, benefit from the closer scrutiny over their child's health history as it is tracked in a central location. Each child wears a ruggedized, waterproof bracelet consisting of a decorative beaded strap similar to other bracelets commonly worn by babies in Pakistan. Attached to the bracelet is a button-sized RFID tag that complies with the Near Field Communication (NFC) standard, encoded with a unique ID number that is linked to data about that patient, such as his or her name, date of birth and health history.

The child then returns for other visits at the hospital, or approximately 20 other health-care offices in Karachi, for well-baby visits at 10 and 14 weeks, as well as at six, 12, 15 and 18 months. They also can visit one of the same health-care providers for any sick-baby visits. At each location, doctors are equipped with Nokia 6131 phones that scan the ID number on the child's bracelet. Once the doctor has scanned the bracelet's tag, he or she presses a prompt on the phone's screen that corresponds with the child's diagnosis, such as pneumonia. If that child requires further pneumonia testing procedures, IRD's mobile team receives an alert notifying them of the patient's location and identity,, so that they can drive to the location. The project team collects detailed clinical history or additional details related to vaccinations, entering that information on a handheld PDA, and provide the necessary tests, all of which they can also input into the central IRD system.

Following each visit, IRD staff members located at the health-care facility input the patient's ID number into the handheld PDA, and also input other details such as the results of blood tests, vaccinations and well-baby visit results including the infant's weight and length. Both the PDA and Nokia phone transmit data via a GPRS connection to an Internet server hosted by IRD. There, the company's staff tracks a patient's health by viewing the results of well or sick baby visits at any of the 25 participating health-care facilities. Data collected about the patient can then be shared with health-care providers, Khan says.

According to Khan, IRD first began planning the study about three years ago, by researching tracking technology that would be most effective. The group initially considered installing fixed RFID interrogators at health-care facilities that would capture an infant's RFID tag as a mother carried that child past the reader while entering one of the health-care locations. That solution would be expensive, however, with each reader costing approximately \$3,000 and requiring a constant electrical source, Khan says, which would have been inconvenient due to frequent power outages in the city. Fixed interrogators would also require more involvement from the facilities themselves, where permission for the installation would be required.

By contrast, the Nokia NFC-enabled phones and PDAs would require minimal involvement from

health-care providers. Although the use of NFC phones meant doctors would have to be personally involved in the data collection, Khan says their involvement is kept to a minimum by requiring only that they scan the tag and press a prompt indicating the diagnosis. While researchers were initially concerned about depending on health-care providers to use the system properly, they have thus far found that with the proper training, doctors use it correctly.

The IRD team is now collecting data in the centralized server, Khan says—something that was not previously possible. In the past, parents took babies to a variety of locations for health care, and sharing records between the multiple doctors and hospitals simply wasn't possible. "There was just no way of linking all these visits with a unique identifier," Khan explains. To date, he notes, mothers have reported that they liked the added attention children receive because of the program. In some cases, as a baby gets older, patients have asked to remove the bracelet and bring it in with that child during doctor visits. In that case, Khan says, IRD also offers an RFID card that a parent can carry, and have it scanned instead of the bracelet.

The program is expected to be completed by May 2010, Khan says, at which time researchers will evaluate the data regarding the incidence of pneumonia in the participants. He says he hopes the technology will eventually be used in other ways to track the health of those in developing nations, where patients visit multiple facilities, and for medical studies similar to the pneumonia program.