

The facility is testing a real-time location system to track hand-washing, the cleaning of equipment and the visits to patients by staff.

By Claire Swedberg

Feb. 28, 2012—[University Health Network](#) (UHN), which operates three hospitals in Toronto, is testing a real-time location system (RTLS) intended to prevent the transmission and spread of new infections, as well as control any existing infections, by tracking equipment, patients and employees. The solution is currently being tested within three units of UHN's Toronto General Hospital, with plans to permanently deploy it if the technology provides data leading to a reduction of infections. Unlike some RTLS solutions that track individual staff members and their movements around a facility and at hand-washing stations, however, this system—provided by [Infonaut](#), utilizing [Sonitor](#) tags and receivers—is intended to track behaviors that could lead to infections, while simultaneously protecting workers' privacy, by not revealing the identity of individuals who are wearing the Sonitor badges.

The solution has been installed on two of the hospital's floors, in the transplant, transplant step-down and intensive care units (approximately 25 percent of the facility's ICU patients originate in the transplant unit). Equipment—including pumps, wheelchairs and mattresses—are tagged with Sonitor tags, while workers volunteering to participate wear ID badges, and patients who have completed transplant surgery, or who have been admitted into the ICU, wear Sonitor wristbands. Infonaut's Hospital Watch Live software platform, installed on a server at the hospital, tracks the movements of people and equipment based on tag reads, says Niall Wallace, Infonaut's CEO, with an accuracy of less than 12 inches. The software then provides reports indicating if and when those individuals and assets have been in contact with each other, as well as if and when a hygiene procedure has been missed, such as the cleaning of a piece of equipment, or the washing of hands prior to a patient visit. That information is then provided to the hospital unit's management—without naming individual staff members, but rather reporting the overall behavior of a group (such as nurses) within that unit.

The solution was developed by Infonaut in collaboration with [George Brown College](#), Wallace says, and has been tested by the college's faculty and students at several locations during the past two years, including in the school's simulated hospital environment. The system follows the model of the [Positive Deviance Initiative](#), a program intended to encourage the creation of solutions to complex problems (in this case, how to increase the rate of hygiene compliance, such as hand-washing, and how to reduce the rate of infection without violating staff privacy). The Toronto-area health-care community is especially concerned about the hazards of hospital-borne infections, Wallace says, following a severe acute respiratory syndrome (SARS) epidemic that left one percent of the city's hospital staff quarantined. Better data regarding who had been exposed to the virus could have reduced the need for quarantines, the technology providers speculate, and identified more specifically who was at risk.

Toronto General Hospital chose to test the system initially within its organ-transplant units and ICU, says Dr. Michael Gardam, University Health Network's director of infection prevention and control. The project was awarded \$180,000 in funding from the College and Community Innovation Program

(supported by the [National Sciences and Engineering Research Council of Canada](#)) and the [Ontario Ministry of Economic Development and Innovation](#). By using the system, Gardam hopes that he can gain visibility into how well hygiene compliance is being met, both in terms of staff hand-washing and the cleaning of equipment, and to be able to contact individuals in the event that they may possibly have been exposed to infection. By tagging certain assets and biomedical devices, the system enables infection-control practitioners to identify which of these devices may be part of the chain of infection, according to Dick Tabbutt, Sonitor's chairman.

The deployment consists of 600 wireless battery-powered tag readers (receivers) and 16 gateways, all mounted on walls. The gateways forward data to the server, and also act as tag readers. Four hundred of these receivers are installed at the hospital's [GOJO](#) sanitizer dispensers, while the remaining receivers are installed at patients' beds, as well as in hallways and select equipment rooms.

Gardam says his greatest concern, when considering the technology, was that it would appear to be a privacy violation for employees, tracking their movements throughout their workday. "We wanted a kinder, gentler solution," he explains, "not something with a Big Brother feeling."

The software was developed to track each worker by his or her ID number, which was linked to that individual's job description, such as nurse, but not to a name. There is one exception, however, Gardam says: He alone has access to the link between ID numbers and names, and will access those linked names only in the event that there is a risk of an infection being spread (for example, if a nurse has been exposed to a patient who has tested positive for tuberculosis).

Only those staff members who volunteer are expected to participate, and patients also have the option of opting out of the plan if they so request. Each employee volunteering to participate provides his or her name and job title, which are then stored in the Hospital Watch Live system, though only Gardam has access to the names.

Each badge transmits an ultrasound signal encoded with a unique identifier. The tag's signal is picked up by one of the receivers within the area, and that tag's ID number is forwarded by other receivers via 2.4 GHZ RF signals (using an air-interface protocol based on the IEEE 802.15.4 standard) to a gateway, which has a wired connection to the server. Each patient wears a clip-on badge attached to his or her hospital ID wristband. This tag also transmits its own unique identifier, which is linked to that individual's name and specific health details in the Hospital Watch Live software. Similarly, Sonitor badges adhered to assets, such as pumps or mattresses, transmit identifiers that are sent by receivers, along with location data, to the gateway, and are then forwarded to the back-end server.

Hospital Watch Live then provides several functions. It interprets every tag's location (based on the position of the receiver that first detected that tag's signal), and links that location to as much data as is permitted for that tag ID (for example, no name for staff members). The system then creates a record of which individuals and items are in close contact at any given time. The solution tracks when a worker visits a hand-hygiene station or a patient, as well as that patient's identity. It also monitors which

equipment was used with that patient, and where those items were next moved—such as to the cleaning room, or to another patient. If the proper procedure is not completed—such as a piece of equipment not being cleaned—the system also tracks that incident and can flag details for software users (hospital management).

Gardam says he provides the data-collection results to unit managers, but does not isolate information specific to an individual. Staff members are grouped in teams in the software, and information is gathered for a particular team rather than an individual. For example, if one member of a nursing team fails to wash his or her hands, that person lowers the statistics for the entire team, and it is then up to the team's management to re-educate the entire group, and to encourage them to voluntarily raise that number.

Gardam says he does not expect every employee to volunteer to use the system. While there would be an absence of data for those not participating, he says, "it's still a million times better than what we are already doing," such as manually conducting sporadic audits of hand-washing compliance. "It's about improvement," he states, adding that if some staff members volunteer for the system and, as a result, improve their hygiene compliance, they will inspire coworkers to do the same, even if they have not volunteered for the program.

During the week that the system has been available, Gardam says, about 16 of the 200 staff members have signed up, and he expects many more to do so over the coming weeks. "I think the feedback we're going to get from this system will be great," he says. "It will be like lifting rocks and seeing what's underneath. People will go nuts when they see all the data we can collect."