

Consortium Uses Radiowaves To Track Blood From Donor To Patient

BloodCenter of Wisconsin



A consortium of academic institutions, healthcare organizations and commercial partners would like radiofrequency identification (RFID) technology to do for the blood supply chain what it has done for other industries in tracking and inventory control such as auto parts, apparel and even casino chips.

The group has created [iTraceTx](#), a suite of Web-based and mobile applications that uses RFID to identify and track individual blood units as they move from the donor to the patient's bedside. The solution promises greater visibility and efficiency throughout the entire blood supply chain, as well as safer blood transfusions.

"If we're able to ship anything anywhere within 24 hours, why are we at this point in healthcare today?" asks Ram Venkatesh, founder and CEO of the software developer [S3Edge](#). "The items we can track with iTraceTx have a high value and they are perishable."

Improving Transfusion Safety

According to the [Centers for Disease Control and Prevention](#), more than 14 million transfusions are performed each year. A transfusion is a common hospital procedure in which whole blood or its parts — including red blood cells, white blood cells, platelets or plasma — is administered to a patient to replace blood lost during surgery or as a result of injury or illness.

To meet the demand, independent blood banks across the country collect donations at both fixed and mobile sites. According to the 2011 National Blood Collection and Utilization Survey Report, blood collections totaled 15.7 million units in 2011, 13.7 million of which were transfused.

Despite efforts to reduce the rate of mistransfusion — in which a patient receives the wrong blood type — such errors occur in approximately 1 of every 14,000 transfusions. Half of all transfusion-related deaths are the result of mistransfusion.

To prevent such errors, a handful of hospitals across the country have added barcoding technology to the blood bags. But according to Venkatesh, the majority of U.S. hospitals still use a manual verification system, in which two nurses witness and sign off on the transfusion documents.

“Studies have shown that barcode scanning is up to 26 times safer than the dual-nurse verification system and the Food and Drug Administration has approved its use.

Ram Venkatesh

Moving Blood from Donors to Hospitals

For blood banks, collecting and processing blood donations is a labor-intensive process, and it is further complicated by the continuously changing inventory needs of hospital customers.

In addition to storing blood in the emergency room to have on hand for trauma patients, hospitals order specific blood types and volumes to accommodate their daily surgery schedule.

“Blood collection is unique in that the product is free but the testing, blood component production and logistics involved quickly push up costs,” says Venkatesh. “Labor accounts for 40 percent of a blood center’s costs.”

RFID for Blood Bags?

Staff at [BloodCenter of Wisconsin](#), including Rodeina Davis, former chief information officer, CEO Jackie Fredrick and the current Vice President of Information Services Lynne Briggs, began to question whether RFID technology could help both in the management of the blood supply chain and in reducing mistransfusion rates.

RFID systems use radio signals to automatically identify and track objects. An RFID system consists of a tag — a microchip with an antenna that can read, write and store data — and a two-way radio transceiver device comprising both a transmitter and a receiver that sends and receives signals from the tag, enabling an exchange of data.

Longtime industry experts at the BloodCenter of Wisconsin knew RFID systems had the potential to expand on barcodes, which are static and provide minimal information.

“An RFID-enabled solution could be used to continually update data to reflect critical information such as the location of the unit or how long it has been out of refrigeration,” says Briggs. “And while barcodes have to be optically scanned one at a time, multiple RFID tags can be read simultaneously, without being in the line of sight of the reading device.”

Withstanding the Freezer, Radiation

With seed money from the [Foundation for Americas Blood Centers](#), Rodeina Davis and Lynne Briggs turned to the [University of Wisconsin-Madison RFID Research Lab](#) for help in assessing the potential of RFID for the health care industry.

“We needed to determine if an RFID tag could withstand being irradiated and frozen and just survive all the handling a blood bag goes through,” says Briggs. “We also needed to know that the radio waves wouldn’t adversely impact the blood product.”

Given that the nation’s blood supply is heavily regulated by the U.S. Food and Drug Administration (FDA), Alfonso Gutiérrez, director of the RFID lab, knew the bar would be set high for the technology.

“This was a great idea that needed to work not 80 percent of the time, but over 99 percent of the time,” he says. “We ran test after test in order to satisfy FDA requirements demonstrating that this technology was not only safe for the blood supply, but capable of improving efficiencies in the supply chain.”

Joining forces with the information technology company [SysLogic](#), BloodCenter of Wisconsin and the University of Wisconsin-Madison won a \$250,000 Small Business Technology Transfer (STTR) grant from the National Institutes of Health (NIH) to conduct a preliminary assessment and ROI analysis.

Meeting the Needs of the Industry

To ensure a solution would be universally applicable within the industry, Davis formed the Transfusion Medicine RFID Consortium, which includes the University of Wisconsin RFID Lab, Syslogic, S3Edge, Carter BloodCare, Mississippi Blood Services, the University of Iowa Hospitals and Clinics, Baptist Health Systems, and Mediware.

“The consortium members were able to help us establish the process flows that would be most useful in the blood center and hospital settings,” says Briggs. “Our solution also needed to integrate with existing barcoding and labeling standards and blood transfusion systems already in place.”

The group received \$1.5 million as part of the second phase of the STTR-NIH grant, which enabled S3Edge to develop, build and test prototypes of two software solutions, iTraceTx for Blood Centers and iTraceTx for Hospitals.

Each consists of a server-based software application, RFID tags and mobile or fixed RFID/barcode readers. iTraceTx for Blood Centers tracks the movement and information about blood products from the point of donation through shipment to a hospital. iTraceTx for Hospitals tracks blood products from the moment they are received from the blood center to the point of transfusion at the patient bedside.

“What we accomplished as a group could not have been done by any one of us individually,” says Briggs. “Putting an academic research institution together with subject experts, commercial partners and the end-customer resulted in a phenomenal experience and outcomes. We achieved an international standard in short order.”

Initial Results in the Blood Center

The iTraceTx for Blood Centers solution was piloted for a five-month period at BloodCenter of Wisconsin, yielding an 87 percent reduction in errors or misplaced products during the check-in process and a 63 percent efficiency increase in inventory check-in times.

Briggs and Venkatesh say such improvements can have a dramatic effect on a blood center’s bottom line both by increasing efficiencies and reducing waste.

“About 4.3 percent of blood collected is wasted due to it expiring before it can be used,” says Venkatesh. “Platelets account for about two-thirds of that because they have the shortest shelf life of just five days.”

Improving Transfusion Safety

In a four-week pilot of iTraceTx for Hospitals at the University of Iowa Hospitals and Clinics, results included a 95 percent improvement in product visibility within the hospital and a perfect bedside transfusion match rate for a total of 144 transfusions. Using iTraceTx, a nurse uses a handheld reader to obtain a three-way match between the patient’s wristband, the transfusion order and the blood bag.

S3Edge, which obtained the commercialization rights for the technology, is currently preparing to market iTraceTx for Blood Centers, which received 510(k) market clearance from the FDA in May.

Venkatesh says the time was right for iTrace.

“With WiFi, electronic records and barcodes on patient wristbands, all the enabling technologies were in place,” he says. “As a small company, we can’t engineer those technologies but we can leverage them.”

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