

The University of Tennessee, Knoxville

Implementation of Radio-Frequency Identification in Hospitals

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I. Executive Summary

Radio-frequency identification for hospitals is a resource focused improvement policy aimed at reducing the spend and inefficiencies in hospitals across the Knoxville metropolitan area. Specifically, this initiative aims to reduce costs that are passed down to the patient and improve the visibility of information for doctors and other medical staff. RFID technology has been around since the 1980s and an RFID system is comprised of RFID tags, antennas, scanners/data readers, and a software application to process the information. RFID usage has steadily increased and is “forecasted to rise to \$13.2 billion in 2020” (Das, Harrop 2015). Hospitals are behind the times with regards to efficiency, proper utilization, and allocation of resources which affects everyone in the system including the patient. However, there are hospitals that are at the forefront of implanting RFID technology. For example, Memorial Sloane-Kettering Cancer Center in New York has adopted “active RFID technology, used for asset inventory applications” and has expanded the usage to “locate wheelchairs and stretchers for escorting patients, as well as all of the hospital’s infusion pumps” (Degaspari 2011 46). The cost of said infusion pumps ranges from \$2000 to \$6000 per pump, so tracking these expensive assets is imperative. The potential for massive cost savings and increased information flows becomes very possible in a hospital environment with RFID technology. RFID for Hospitals aims to bring this technology to the Knoxville area hospitals and put them at the forefront of technology adoption that will make a difference both in the short and long term. RFID for hospitals is a real solution to a real problem in today’s healthcare world where costs are increasing year by year. Our initiative is scalable and adaptable to hospitals across the country

and will reduce the amount of inventory spend, increase information flows across the supply chain, and improve patient quality care and satisfaction.

II. Problem Statement

The United States has the privilege of housing some of the best medical facilities in the world which provide advanced care to treat the most serious types of illnesses and diseases. However, hospitals are generally regarded as being behind the times when it comes to technology. This results in unneeded costs to hospitals across the country with “Industry estimates point to more than \$11 billion of waste each year due to inefficient processes, rework, order and invoice errors and outdated information technology. At the core of these problems is bad supply chain data” (Pleasant GS1 2009 6). This waste is derived primarily from lost, stolen, or mistreated inventory which is very expensive to procure and hold. This translates into costs that add up to over “\$4000 per bed” and “That figure doubles when misplaced and inefficiently used equipment is factored in” (Davis 20). As you can see, there are major improvements to be had within hospital supply chains but the hospitals seem hesitant to pounce on the opportunity. For example, only “16 % of healthcare materials processes currently use bar codes, and 10% have fully or partially implemented radio frequency identification systems” (Rardin 2011). From this data, we can see that even the most basic tracking technology (bar codes) is just six percentage points above RFID. This may seem like a problem but take into account “The US national health expenditure is expected to reach \$4.2 trillion with hospital expenses accounting for **\$760.6 billion** or **18.9** percent of the GDP by 2019” (Coustasse, Tomblin, & Slack 2013 1). As hospital expenses encroach on one trillion dollars, it is time for the Knoxville area hospitals to adopt RFID and help patients in the Tennessee see an improvement in their care. RFID has been around for over 40 years yet, most hospitals have ignored the benefits. RFID for

Hospitals proposes a small investment that will show how the hospitals in the Knoxville area can become more agile and improve the quality of patient care.

Radio-frequency identification is an electronic device of a small chip and antenna that can transmit different information. RFID has been mostly used in the supply chain world as companies are attempting to focus on costs and how to reduce them. RFID has a significant advantage to other type of methods of scanning. Barcodes are another way that many companies work to keep track of inventory. RFID has the advantage of being able to be read from a distance, opposed to being directly aimed at a particular scanner (Technovelgy).

III. Cost Analysis

The price of RFID technology has fallen dramatically over the past decade which has made the mass affordability and use of it increasingly prominent. Since 2003, the price has fallen from \$.50 per unit, to \$.07 to \$.15 per unit when at least one million units are purchased. This is a 70% decrease in price, which are projected to fall to about \$.03 per unit in the next few years (Das, Harrop 2015). These costs may seem large at first but they can provide hospitals with savings from removal of waste and extra work. "It has only been recently that the ability to manufacture the RFID devices has fallen to the point where they can be used as a "throwaway" inventory or control device. Alien Technologies recently sold 500 million RFID tags to Gillette at a cost of about ten cents per tag (Technovelgy). This can have large implications for hospitals in the Knoxville area as they may want to use these tags to follow the use of disposable goods. They have the ability to provide real time inventory of these goods so that hospitals are more effective and maintaining stock of everything from a box of cotton balls, to the exact stock of a certain medication. Research of hospitals with approximately 200 beds found that, "58% of IV pumps are not even being used; they are being repaired or in storage, etc. In addition, such

pumps were only found 36% of the time, often accounting for up to 30 minutes of nurses' time searching for such items. Bon Secours Richmond implemented an RTLS system and saved more than \$5 million dollars in equipment costs, wasted time on the clock, and staff efficiency (Dirksmeier 2011). St. Mary's Hospital raised their utilization of IV pumps to 92% and can prepare a room for surgery 25 minutes quicker than they used to" (Dirksmeier 2011). This all can lead to reductions in operating costs if implemented on a large, standardized scale. For example, a study done in 2013 found that a 200 bed hospital could save "\$600,000 each year from decreased shrinkage, fewer rentals, deferral of new purchases, improved staff productivity, and enhanced quality improvement" (Coustasse, Tomblin, & Slack 2013 4). They initially invested just \$100,000 to track their most critical assets. A larger hospital such as Fort Sanders Regional Medical Center, with 541 beds, could see a savings of over a million dollars each year.

IV. Barriers to Implementation

There are some obstacles that have arisen from implementing the use of these chips in a number of different perspectives, from initial costs and upkeep, to resistance from employees. The initial cost of tags, training, and software implementation alone can be an enormous expense. This cost may not make sense for smaller hospitals that do not have the throughput that larger urban hospitals have. The upkeep can include the alignment of sensors that actually do the long range readings. A hospital with 600+ beds in the Midwestern United States reported that they have many problems with the layout of their antennas. They were not able to receive coverage in all functional areas of their facility (Cho 2013 7). This problem can hopefully be solved with future innovations with the technology. Another hospital uses the RFID tags to track their nurses. They used the technology to track the productivity of each nurse and made sure that they were administering the proper care and committing to a certain level of customer service.

This original rule received a negative response when first implemented, but the hospital has seen a large return on this investment. “If a nurse makes \$40/hour and she spends 15 minutes of every hour looking for lost equipment, that could save \$80 per day. Now imagine that the same situation is happening to 10-12 nurses in the hospital. The savings could be significant” (Cho 2013 8). This is a very real, trackable metric that hospitals could see savings immediately as they apply RFID to their hospital.

V. Benefits of Implementation

The amount of data that can be put onto a single RFID chip is approximately two kilobytes according to RFID Journal which is equivalent to holding a short email message. This is superior to barcodes because RFID has the ability to be written on and changed at will (Technovelgy). Barcodes must be set in a specific position in order to be read, while RFID chips must just be in a general area to be scanned. This increases productivity because as hospitals are processing different goods, they are able to freely verify. “For example, you could just put all of your groceries or purchases in a bag, and set the bag on the scanner. It would be able to query all of the RFID devices and total your purchase immediately” (Technovelgy).

Patient safety is at the forefront of why putting an RFID system into place is being discussed right now. “At least 44,000 people, and perhaps as many as 98,000 people, die in hospitals each year as a result of medical errors that could have been prevented” (Kohn 2000 6). The application of these tags will ensure that hospital employees are administering the right care to the right patient. Pharmacy dispensing will be more accurate as it is run through the information system. An information system can set up checks on its processes that are verified by the RFID tag to reduce the amount of human-made errors.

Until recently, inventory management has not been a strong suit for hospitals. Supplies ranging from inexpensive ointments to surgically implantable hardware costing thousands of dollars commonly hit their expiration dates while sitting on shelves in stockrooms. In fact, it is estimated that “between 10 percent and 15 percent of all hospital supplies wind up expiring before they are used, leading to waste-related losses of about \$5 billion a year” (Shinkman 2015 29-30). Implementation of RFID technology as inventory management has already begun to take place at about 100 U.S. hospitals over recent years, and the benefits have been immediately apparent. On average, hospitals can expect to see “a return on investment within six to nine months of installation” (67). Additionally, inventory carrying costs are usually reduced by “20 percent to 25 percent within the first year, which doesn’t even account for inventory-related costs such as transportation costs caused by stockouts” (69). While only about 100 hospitals and healthcare systems in the U.S. have implemented RFID technology, that number is expected to grow rapidly as these investments begin to prove to be incredibly profitable.

In addition to the benefits related to inventory cost savings, RFID technology implementation has also led to greater efficiency in various other areas. Hospitals such as Wake Forest Baptist Medical Center have attached RFID tags to permanent equipment such as x-ray protection vests in order to more easily locate them throughout the facility. This feature allows for records to be more accurate and equipment to be easier to find (Baum 2013 47-48). Other uses of RFID technology in hospitals have led to greater safety initiatives. At Texas Health Harris Methodist Hospital, RFID tags are deployed to all patients and staff in order to identify those that come into contact with patients exposed to dangerous infections such as tuberculosis (50-2). This feature alerts administrators as to when certain individuals need to be screened. Additionally, Sanraku Hospital, located in Tokyo, uses a matching system between

RFID codes located in patients' wristbands and RFID tags on prescription drugs to ensure that patients receive the proper medications (39-42). Benefits like these add to the cost savings created by RFID technology by reducing wasted time as well as reducing malpractice lawsuits by improving patient safety.

One local hospital that has begun to implement RFID technology in the Knoxville area is the University of Tennessee Medical Center. In April 2015, a product developed by DeRoyal Industries known as "Continuum OR", which resembles a garbage receptacle and contains a built-in computer screen, was implemented in five UTMC operating rooms as a way to identify and track medical supplies as they are discarded (Marcum 2015 4). The information provided by these devices has served a variety of benefits, including providing detailed supply lists for more accurate inventory, streamlining operating room procedures, and preserving a sterile environment by making sure that medical personnel do not leave and reenter the room to retrieve necessary supplies. The device catalogues items with 99 percent accuracy, which is an incredible improvement from the previous methods, where up to "70 percent of items gathered for medical procedures were not used" (Marcum 2015). UTMC plans to eventually introduce Continuum OR units into all their operating rooms, but the high short-term fixed costs make this implementation a gradual process. However, the long-term cost savings created by the vastly superior inventory management are certain to make it a worthwhile investment.

VI. Action Plan

Because of the dramatic cost savings, increased patient safety, and higher quality healthcare that result from implementation of RFID technology, it is advisable for all Knoxville-area hospitals to begin planning to implement such a system. Over a five-year timespan, the implementation process will include introducing Continuum OR units to all operating rooms,

RFID tags for all medical personnel, and RFID labels for all disposable and perishable medical supplies. RFID tags can cost up to \$0.15 per unit but are expected to decrease to \$0.03 per unit over the next five years, so while the expenditures can be significant for large hospitals, over the long-term, expenses will be manageable. Hospitals should expect to begin to see a return on their investments by the end of the first year. By the end of the implementation process, inventory carrying costs will be reduced by as much as 25 percent, inventory lists will be 99 percent accurate, idle times will be reduced, worker productivity will be increased, and patient safety will be improved. RFID usage should become a prominent trademark for Knoxville hospitals as we improve the quality of our care and health care system.

The first steps of implementation would be to meet with hospital administration. Every hospital has different needs which will make this process happen on a case by case analysis. We need to meet with the administration to understand their goals for the system. They may want to track big equipment that is not used often, or they may want to track items with high throughput that see a high amount of movement throughout the day. After this meeting, we would begin the process of researching different RFID packages and selecting the one that best fits with the hospital's needs. From there we would want to do a trial period to collect data and configure the system. This time would give the hospital the opportunity to give us feedback and analyze the effects of the implementation. We would be the integrators and would not require a staff member to be heavily involved. We then hope to see the full implementation within 12 to 18 months. It is a long process that will take time to construct a system that is tailored to them. Initially the funding will be used for a starter kit, which ranges from \$3000 to \$6000, and can be provided partially by us. We believe that RFID for Hospitals presents a very realistic solution to the problems that hospitals and their patients are facing in today's world of increasing costs.

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