This article presents the case study of a hospital nursing unit that has evaluated and approved a two-bin “e-kanban” replenishment system based on passive high frequency radio-frequency identification (RFID) technology.

Implementing the e-kanban RFID solution, in conjunction with the redesign of the ward floor and of staff roles and functions, can substantially improve business and operational performance. The most important benefits for the hospital spring from the time saved from non-value-added activities transferred to patient care activities, and the significant reduction of on-hand inventory at distributed storage locations. The solution requires less initial investment than RFID-enabled cabinets used in the replenishment of consignment and high-value supplies.

Reducing waste in healthcare and improving its efficiency is a global challenge. With approximately 80 per cent of expenses tied to patient care activities, healthcare institutions can certainly garner substantial savings while improving their clinical practices by better managing their labour, supplies, equipment, and facilities.

New automation technologies such as radio-frequency identification (RFID) equipment are amongst the latest technological solutions proposed to increase healthcare efficiencies. RFID is emerging as the standard for hospitals and healthcare centres to track valuable and strategic mobile assets in medical facilities, identify and locate patients and manage staff. With 30-40 per cent of US hospitals indicating that they expect to purchase real-time location systems (RTLS) to perform asset tracking within the next one to two years, there is no doubt that RTLS is still the most popular emerging application in the healthcare sector. However, other uses of RFID technology can also contribute to generate substantial savings, particularly those pertaining to supply chain management (SCM). Indeed, since most clinical decisions involve managing products and medical supplies, supply chain activities have an important role in effective and efficient service delivery in hospitals.

RFID in the healthcare sector

Hundreds of healthcare facilities across the world are improving their asset utilization and maintenance by using RTLS to track mobile devices and assets, improve patient and staff workflow, improve patient safety by ensuring correct drug dispensation, and improve patient billing through the automatic capture of performed services and the automatic creation of itemized billing. The key driver for all these benefits is the highly automated tracking of the identity, location, and movement of products, people, assets and sometimes a combination of each.

Not only does a large functional range of RFID applications in healthcare exist, but also implementations, trials, and pilots evaluating these applications are already in existence and are becoming widespread. In fact, its expected that RFID spending in the healthcare sector will increase dramatically. The healthcare sector will account for a large portion of the overall RFID industry.

RFID technology is a wireless automatic identification and data capture (AIDC) technology. It is used to track and manage products, people, and assets with minimal human intervention. An RFID system is a multi-layer system, composing:
• Tags – containing encoded data (e.g. identification number) onto an integrated circuit and an antenna;
• Readers that use radio signals to communicate with the tags;
• A middleware system that interprets the information and routes it to; and
• A host system, which receives and manages the relevant information generated by the RFID infrastructure.

In the case of the healthcare sector, the host system is referred to as the hospital information systems (HIS).

SCM RFID applications in healthcare

RFID applications in healthcare are classified as:
• Asset and maintenance management
• SCM
• Condition monitoring
• Patient and staff safety
• Workflow management
• Security and access control

Although RFID shows tremendous potential to enhance the efficiency of healthcare SCM activities by securing the medical supply chain and increasing the safety and efficiency of healthcare processes, it is an often-neglected activity in this industry. It is viewed as tactical, and as providing no strategic input to the overall management of the hospital. This view contrasts with a recent report that indicated that the logistic function (purchase and supply of goods and services) represents 20 per cent of a hospital's total operational budget, thus representing hundreds of millions of dollars per year, and which suggests that financial priorities should be re-evaluated. Indeed, initiatives such as an enterprise resource planning (ERP) system, e-commerce transactions, AIDC or business intelligence reporting systems clearly contribute to modernizing key elements of the hospital’s supply chain and can generate substantial benefits, including improvement of patient care and service levels.

Additionally, advanced information systems including ERP, SCM, e-commerce, and now RFID are part of a continuum of business process improvements that not only serve specific business functions but also contribute to organizational capability.

RFID-enabled cabinets

Several hospitals are adopting RFID-enabled real-time inventory management systems for high-value products, including the UMASS Memorial Medical Center (sic) (UMMC) in Massachusetts, and the Heart Hospital Baylor Plano and the University Of Texas Southwestern Medical Center (sic), both in Dallas.

However, a very high percentage of hospital medical supplies do not justify item-level tagging. An alternative tagging approach would be to tag the container in which the items are stored instead of the item itself. This solution, in which automated replenishment is achieved, combines an RFID tagged bin with an “e-kanban” item replenishment system.

RFID-enabled e-kanban replenishment solution

Kanban is a Japanese term meaning “signal”. Pioneered by Toyota, a kanban system signals the authorization to move material/products from the supplying location to the consuming location. Under the RFID-enabled kanban system, the replenishment signal is captured automatically when the bin is empty, and then material/products are delivered to the required location upon request. This approach changes material/product flow from a “push” to a “pull” system. In open-loop supply chain applications with data shared among its members, this signal can also trigger the authorization to produce or acquire additional products.
Business and operational performance improvement

Many common sources of inefficiencies in the healthcare sector, such as hospital overprocurement of medical supplies, storage location multiplicity, losses due to outdated products and nursing staff spending valuable time on non-value-added activities, have pressed the hospital administrators to look for SCM solutions. The key respondents identified business and operational performance improvements as the main objective when adopting RFID technology. The “time” variable was clearly identified as strategic which is quite understandable in an environment with scarce qualified resources. This preoccupation ties in with recent research that identifies drivers of inefficiency in nursing work processes and nursing unit design. The research suggests that changes in technology, work processes, and unit organization and design may allow for substantial improvements in the use of nurses' time and the safe delivery of care.

Productivity gains from logistics processes

The RFID two-bin replenishment system facilitates the transfer of responsibility for item ordering from the nursing staff to the materials management clerks for non-stock items. Additionally, it almost completely eliminates backorder situations in the nursing units.

More specifically the proposed solution helps to eliminate counting stock and facilitates the evaluation of stock and non-stock item needs at different storage locations, which is particularly useful in limited access areas.

The “time not spent on logistics processes” is another dimension of performance improvement that has to be considered when quantifying the impact of the RFID two-bin replenishment system.

Furthermore, “impact on nursing staff” is another category of potential gain that benefits from improvements to personnel movement and the retrieval of products from storage locations. These are “soft savings” because it is difficult to reallocate the few saved minutes to other more productive tasks. However, these timesavings have a direct impact on patient care as nurses can use this time to treat patients instead of looking for products. In addition to improving the replenishment response time and almost eliminating stock outs, the proposed RFID two-bin replenishment system thereby also improves the overall service level of the nursing staff.

"Inventory shrinkage” deserves special emphasis as it represents a particularly challenging aspect of inventory management.

Essentially, the quantifiable benefits gained from the “optimization of inventory levels” are based on the improved visibility of consumption offered by the RFID two-bin replenishment system. The replenishment is triggered automatically and at a calculated level rather than based on human experience and interpretation. This helps to:

- provide better control over ordered quantities and reduces inventory levels;
- ensure (built in) stock rotation activity, thus reducing the amount of expired items; and
- reduce shrinkage.

Roles and function redesign

Using the RFID two-bin replenishment system automates the supply replenishment process and transfers its responsibility from the nursing unit to the materials management personnel for most product categories. This redesigned process improves the service level and has a direct impact on the level of patient care.

The “killer app” for the healthcare sector

In recent years, RFID has emerged as a powerful technology that can have a major impact on organizations by changing the way core processes are designed. With other ubiquitous
and pervasive technologies such as sensors, microcomputers and networks, RFID will enable the design of more effective IT systems into “need driven highly dynamic personalized interventions” (i.e. around the patient).

While RFID technology has been heralded as “the killer app” in the healthcare sector, the promised impact and benefits are only starting to be confirmed. Many potential adopters are thus awakening from “wait and see” mode.

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