Allegheny
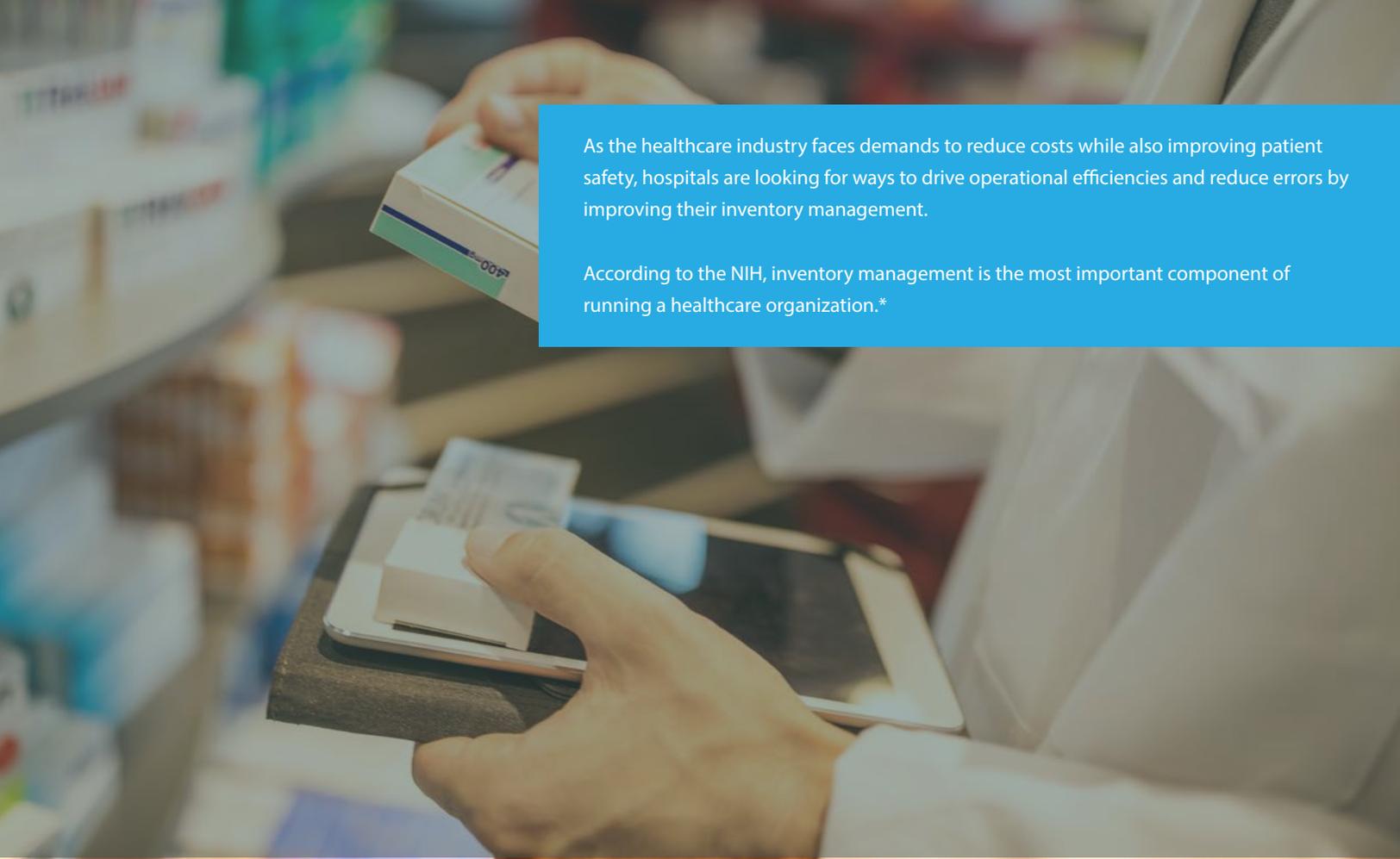## Health Network

HOSPITAL INVENTORY MANAGEMENT

Comparing RFID and Barcode Technology for **Hospital Inventory Management** Solutions

As the healthcare industry faces demands to reduce costs while also improving patient safety, hospitals are looking for ways to drive operational efficiencies and reduce errors by improving their inventory management.

According to the NIH, inventory management is the most important component of running a healthcare organization.*

Introduction

As technology continues to drive innovation in hospitals, inventory management systems are increasingly leveraging more automated identification solutions like RFID and barcode tagging. These systems offer a much faster and more accurate alternative to manual data capture and can power more advanced tasks that would otherwise require significantly more staff hours. Through automated identification solutions, hospital pharmacies can maintain visibility of all items as they move through workflow processes, while capturing all trackable events in a centralized database.

Barcode and RFID systems have already been effectively implemented in industries like manufacturing, agriculture, and retail, and are growing in popularity in healthcare.

Within healthcare, these technologies have been used for tagging and tracking patients, blood products, newborns, medications, equipment, and more. Implementing an automated inventory management solution is a significant decision for hospital leaders, with cost and process implications spanning multiple departments. The two primary technologies, barcodes and RFID systems, both have benefits and barriers to adoption that should be evaluated closely.

Materials & Methods

The purpose of this report is to compare the advantages and adoption barriers of barcode and RFID tagging systems for medication in hospital pharmacies. It aims to provide an overview of both technologies, along with a general recommendation and suggestions for successful implementation.

The literature referenced throughout was sourced from the NIH, HIMSS, PubMed, & Google Scholar. The collection phase leveraged search terms related to the following and their combinations: barcode, RFID, medication, tagging, hospitals, pharmacy, inventory, and management. This non-systematic review includes studies that span both experimental designs & existing literature.

Technology Overview

BARCODES

A barcode encodes information into a visual pattern that can be read by a barcode scanner. Traditional barcodes contain a combination of printed, parallel bars and spaces of varying widths that represent letters or numbers. In this sense, barcodes can be considered a type of font.

More recent barcodes have evolved into other geometrical shapes, including squares and QR-Codes (Quick Response Codes) which offer larger data storage capacity than the linear version. Barcode scanners emit light that is reflected off the barcode and captured by an internal sensor that translates the reflected light into text.

Using a scanner requires a direct line of sight to the barcode and each barcode must be read one at a time. In a hospital pharmacy setting, barcodes can be placed on medications and individually scanned with a handheld reader for managing inventories.

RFID TECHNOLOGY

RFID, or radio-frequency identification, is a system that uses radio-frequency electromagnetic fields to transmit information from RFID tags to RFID readers. In the case of hospital pharmacies, microchips with antennas (RFID tags) can be attached to medications and programmed to include specific information including contents, location, dosage information, expiration date, batch number, and more.

Using an RFID reader, or an entire management platform (e.g. Kit Check), the information stored in the RFID tag can be transferred to a computer or centralized inventory management system through radio waves.

This allows for multiple tags to be scanned at once without a direct line of sight between the reader and the tag. RFID technology can help build a powerful inventory database for hospitals, providing an accurate and real-time view of medications.

Why Choose Them?

Lower Upfront Cost

Barcodes are less expensive than RFID tags as they are optical tags that are printed directly on product surfaces. With hospitals facing pressures to reduce overhead costs, the lower on-boarding cost of barcodes is appealing for many.

Commonly Used

Barcode medication administration (BCMA) is a common application of barcodes in hospitals. Through BCMA, medications can be individually scanned by a handheld barcode reader, which verifies that the correct medication was ordered and administered, while also documenting the actual administration.

Why Avoid Them?

Best For Simple Processes

Barcodes in hospitals are often used to address simple workflows with limited variability. They're commonly applied at the department level rather than an enterprise level where inventory management systems should operate. Multiple department-level solutions within the same hospital often results in increased costs and confusion as staff try to adopt multiple systems and readers. Experts predict that barcode growth in hospitals will be limited until there are standards in place to minimize barcode reader duplication.

Disrupting Workflows

In hospitals where barcode systems have been implemented, employee workarounds have been a common source of errors. Workarounds occur when technology processes do not align with typical workflows and inadequate organizational planning has failed to establish the necessary commitment from staff. For hospital pharmacies, this can lead to less flexibility when stocking & restocking medication, as staff is required to scan medications individually while ensuring that all barcodes are visible. RFID tags, on the other hand, have the ability to capture information with minimal human intervention.

Why Choose Them?

👁 Increased Visibility

Through radio waves, RFID tags can be read from greater distances than barcodes, without the reader requiring a direct line of site to the tags. Multiple RFID tags can also be read simultaneously, which speeds up the scanning time significantly.

Compared to barcodes, RFID therefore eliminates the need to manually scan each individual item at every tracking event. For hospital pharmacies, this can translate to time savings and decreased operating costs.

🧠 More Intelligent Medicine

RFID tags have the capacity to store and transmit more information at faster speeds than barcodes. They also have both read and write capabilities, which means that additional or updated information can be sent to the tags. This also allows tags to be rewritten and reused for cost savings.

RFID tags are also considered more secure than barcodes, as they can be encrypted and password protected. Additional information, even barcodes, can also be printed onto RFID tags to facilitate integration with other systems.

Why Avoid Them?

Larger Upfront Investment

The primary barrier to implementing RFID systems is the cost, which varies according to many factors including tag types, frequency range, and read range. Tags can range from $0.04 per tag to upwards of $50 per tag, while RFID readers can range from $1,000 to $3,000 each.

Patient safety, patient satisfaction, and overall operational efficiency improve as RFID systems get implemented.

For staff, RFID has been shown to decrease time spent on administrative tasks and ultimately increase time spent with patients.

RFID As The Clear Choice

THE MORE ADVANCED TECHNOLOGY OF RFID
While barcode and RFID systems can both be effective for automated inventory identification, RFID tags are generally considered a technological leap from barcodes. The ability to read multiple RFID tags simultaneously without a direct line of sight to the tag, make RFID tags much more efficient in practice.

THE GREATER EFFECTIVENESS OF RFID
Studies on both systems have shown RFID to have greater effectiveness and larger potential to drive enterprise-level change. RFID systems have proven to considerably reduce costs, time, drug diversions, misidentification issues, and human errors.

THE LONGER-TERM COST SAVINGS OF RFID
While the initial investment required for RFID remains higher than barcodes, studies have shown that RFID systems will pay for themselves within 6 years through improvements in operational efficiency. In fact, experts suggest that cost is the only reason that RFID has not entirely replaced barcodes.

IMPLEMENTING AN RFID SOLUTION
Hospital leaders should engage multi-disciplinary team members to evaluate the best options, as it's critical that any new solution fits the needs and the established processes of all parties involved in its success.
Educating staff on the operational benefits of RFID can also help alleviate any staff resistance or perceptions. Once up and running, an ongoing monitoring system should be established for continued policy adherence and improvements. Studies that surveyed nurses, physicians, pharmacists, IT professionals, and administrative staff have found high levels of satisfaction with RFID technology for medication traceability.

Overall, RFID technology offers many benefits over other solutions and has the ability to deliver on hospital pharmacist's greatest needs: improving both operational efficiency and patient safety.

Authors

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Caitlin was involved with the implementation of Kit Check at Allegheny General Hospital starting with emergency kits and trays and eventually expanding to ancillary Anesthesia areas throughout the hospital.

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