Case Report ■

Overcoming Barriers to the Implementation of a Pharmacy Bar Code Scanning System for Medication Dispensing: A Case Study

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Abstract Technology has great potential to reduce medication errors in hospitals. This case report describes barriers to, and facilitators of, the implementation of a pharmacy bar code scanning system to reduce medication dispensing errors at a large academic medical center. Ten pharmacy staff were interviewed about their experiences during the implementation. Interview notes were iteratively reviewed to identify common themes. The authors identified three main barriers to pharmacy bar code scanning system implementation: process (training requirements and process flow issues), technology (hardware, software, and the role of vendors), and resistance (communication issues, changing roles, and negative perceptions about technology). The authors also identified strategies to overcome these barriers. Adequate training, continuous improvement, and adaptation of workflow to address one's own needs mitigated process barriers. Ongoing vendor involvement, acknowledgment of technology limitations, and attempts to address them were crucial in overcoming technology barriers. Staff resistance was addressed through clear communication, identifying champions, emphasizing new information provided by the system, and facilitating collaboration.

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Introduction

Patient safety has become a hot-button topic in research and media during recent years. Patient injuries are most commonly due to adverse drug events (ADEs), which occur at a rate of 6.5% or approximately 1,900 ADEs per hospital per year.[1–3] Many of these ADEs are caused by medication errors and are by definition preventable. These errors may occur during any stage of the medication use process including ordering, transcribing, dispensing, administering, and monitoring. Most of the solutions to medication errors, such as computerized physician order entry (CPOE) systems, have focused on reducing errors at the medication ordering stage.[4,5] However, dispensing errors are estimated to occur at a rate of nearly 4%, of which only 80% are intercepted. In a large hospital, these error rates can translate to more than 45,000 undetected dispensing errors annually.[6–8]

Pharmacy bar code scanning technology offers a new strategy to address medication errors in the hospital setting. It seeks to ensure that the correct medications are dispensed to patient care units and that they carry a bar code for nurses to scan before administering the dose to a patient. The successful implementation of this technology has been shown to reduce medication dispensing errors alone by 85%.[7,9,10] In addition, emerging evidence indicates minimal impact on nursing workflow,[11,12] and a positive financial return on bar code scanning technology[13] from the hospital's perspective.

Despite these promising results, few hospital pharmacies have implemented bar code scanning technology. In general, problems that occur during implementation have led to complete halt of the project,[14] staff revolt,[15] or even poor patient outcome.[16–19] The literature documents success factors for the implementation of hospital information systems[2,20–34] such as organizational leadership, the availability of capital, and product/vendor maturity. Successful pharmacy bar code scanning system implementation must address not only these considerations, but also the high dispensing volume in a hospital pharmacy and the role of pharmacists as consultants to other clinicians. The literature on pharmacy bar code scanning technology is sparse[9,10,35] and focuses on clinicians' use of these systems after they have been implemented[36–38] rather than on the implementation process itself. We present this case report to capture our lessons learned during a recent successful implementation of a pharmacy bar code scanning system at a large academic center.

Case Description

The case site is a 750-bed tertiary care Academic Medical Center in Boston, MA, where approximately 5.9 million doses of medications are dispensed per year from the central inpatient pharmacy. The hospital pharmacy employs sixty-one full time equivalent pharmacists and 45 full time equivalent pharmacy technicians. In Nov and Dec 2003, the

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hospital pharmacy converted to a bar code–assisted medication dispensing process. This pharmacy initiative occurred as part of the implementation of bar code scanning systems at the bedside, and the project was a major joint initiative between the pharmacy and the nursing staff.

The initial implementation of the pharmacy bar code scanning technology required a dedicated pharmacy-based medication repackaging center, which affixed two-dimensional bar codes onto the lowest unit dose of every medication that did not already have a bar code from the manufacturer.[7] As the medications were picked from inventory, pharmacy technicians scanned each bar code to match the medication, strength, and dose with the pharmacist-approved physician order. The medications were then sent to the patient care areas and rescanned by nurses at the point of care to further reduce medication administration errors.

While this technology has significantly reduced medication dispensing errors[7] and produced a positive return on investment for the hospital,[13] the implementation team initially encountered significant challenges, which they ultimately overcame. To capture some of the lessons learned, we interviewed pharmacy leaders, pharmacists and pharmacy technicians about their experiences during the implementation process. We conducted a qualitative analysis of the barriers to, and facilitators of, the pharmacy bar code scanning system implementation, taking a close look at sources of resistance and how to overcome them.

Methods

To understand the barriers to and facilitators of this implementation, we conducted interviews of pharmacy staff, supplemented by a review of project documentation.

Interview Instrument

Based on prior work related to the implementation of both CPOE[2,24,39,40] and the bar code scanning system, we developed a semi-structured interview instrument to elicit the pharmacy staff's perceptions of barriers to, and facilitators of, the bar code scanning system implementation in the hospital pharmacy. Interviews took place during a 1-year period following system implementation. Each interview lasted approximately one-half hour and was conducted by at least one investigator who recorded field notes during the interview.

Identifying Informants

We contacted pharmacy personnel who were either using the bar code scanning system or involved in its implementation. The initial set of interviewees was selected by pharmacy leaders from a total of 150 potential informants. As the interviews progressed, we asked our informants to help identify other staff members who were knowledgeable about the process. We continued the interviews until we were no longer gaining new information or insights from successive informants. Written consent was obtained from all participants with the understanding that they were able to withdraw from the study at any time. Institutional review board approval was obtained at the study site.

Ten interviews were conducted by two investigators between Dec 2004 and Aug 2005. Two interviewees were pharmacy leaders, four were pharmacists and four were technicians. We presented our findings to the pharmacy leaders to verify our results.

Code List

We analyzed the interview notes for common themes with the aid of ATLAS.ti software (Scientific Software Development, Berlin). Through five iterative readings of the field notes, we developed a code list to characterize the factors that influenced the system implementation. Using this code list, two independent reviewers iteratively coded a subset of three transcripts, modifying the code list and the code definitions as necessary, until they reached 89% reliability, defined as the fraction of phrases that were coded in an identical manner by both reviewers.[41] One reviewer subsequently coded the entire set of field notes. The reviewer met regularly with coinvestigators to discuss emerging themes, organize the code list under these themes, and further delineate the relationships among these themes. Meeting minutes of weekly implementation team meetings from Jan to August 2004 were also reviewed to confirm the themes and to clarify relationships between themes.

Findings

We identified three main barriers (Fig 1) to pharmacy bar code scanning technology implementation at our hospital and strategies to overcome them.

Process

Training

As with any system implementation, training must be initiated early on. In an effort to get the pharmacy technicians familiar with scanning, the pharmacy implemented bar code-assisted dispensing for medications destined for the neonatal intensive care unit (NICU) 1 year before full deployment of the bar code scanning system. As there were usually expert system users available, and the volume of medications requiring scanning during the NICU-pilot was low, training was on-the-job, without formal classes. However, the volume of drugs requiring scanning increased dramatically after full system deployment. Even though most technicians were familiar with scanning and were given additional informal training, this was a challenging period.

Certain pharmacy technicians thought that they were not adequately trained and identified this as an obstacle to system implementation. Although the addition of formal training may have helped, limited computer literacy and language barriers made this challenging. Increased time and resources would have been required to ensure that the training was appropriate for a range of skill sets and tailored

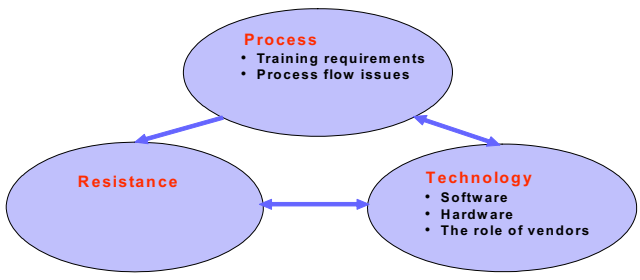

Figure 1. Barriers to Barcode System Implementation.