Supply Chain-Related Adverse Events and Patient Safety in Healthcare

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ABSTRACT
This research investigates adverse events and patient safety in healthcare due to poor supply chain management practices, and inadequate and disorganized product validation procedures. Focusing on commodity medical and surgical products, this research investigates correct product validation points for maximum patient safety. This study also explores benefits of standard product identifying technologies such as HIBC or GS1 data standards as well as automated validation systems such as barcode or Auto ID to minimize workflow interruptions. Site visits and phone interviews are conducted with six healthcare providers to document common product validation practices and procedures. Based on observations and collected data, a simulation model is developed. Different scenarios are compared for patient safety, care delay, and system efficiency. The results show that validation points during PAR picking or bedside product administration, and warehouse picking operations provide optimal overall system performance. The results also indicate that standard product identifying technologies and automated validation systems significantly impact the efficiency of supply chain.

Keywords: Adverse Events, Healthcare Supply Chain, Inventory Management Policies, Patient Safety, Recall and Outdate Management

1. INTRODUCTION
In healthcare, patient safety is defined as an issue that tries to minimize the occurrence and influence of adverse events and maximizes recovery from them (Emanuel et al., 2008). In the context of this study, an adverse event is considered as harm caused by medical management rather than by an underlying disease or condition of a patient. According to Wen (2008), one in every ten patents around the world experience an adverse event. At a very high level, they can be categorized as: (1) non-preventable adverse events, such as a first time allergic reaction to a drug; and (2) preventable adverse events, such as administering incorrect medical product or incorrect dose of medication. Even though non-preventable adverse events have greater potential for morbidity and mortality, preventable adverse events offer better opportunities to analyze and take corrective actions to reduce the reoccurrence of similar events, and improve patient safety

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Among many types, supply chain-related adverse events are one of the major patient safety issues in healthcare that are caused by inventory discrepancy and performance deficiencies in recall, return, and outdate management at the provider’s level. A Harvard study shows that 19.4 percent of adverse events are caused by medication errors and over 60 percent of them are due to using wrong product or wrong dosage (Jenkins, 2005). Tucker (2004) shows that 9 percent of total nursing time is spent on resolving operational failures and 55% of these failures are linked to supply items. In addition, the U.S. Food and Drug Administration (FDA) reports that a considerable number of medical device adverse events occur each year due to unreliable identification and problem reporting system in supply chain—incident rates as high as 83.7 per 1,000 hospital admissions. FDA also notes that the number of serious outcomes from adverse events have increased steadily since 2005 (Bershteyn & Hamburg, 2012).

In addition to misidentification errors, there are other issues that impact patient safety and quality of care. Product misplacement and mispicking during replenishment operations as well as shrinkage and transaction errors are major sources of inventory discrepancy that lead to product stockouts, delayed care, and emergency replenishment in the supply chain operations (Opolon, 2010). Performance deficiencies and problems in recall, return, and outdate management are significant drivers for supply chain-related issues as well that effect patient safety in healthcare.

This study investigates the impact of supply chain-related adverse events on patient safety by means of increased patient risk, delayed care, and insufficient product availability. The attention is given to supply chain related product administration errors in healthcare as well as inadequate and disorganized recalled, outdated, and incorrect product administration procedures that also increase patient risk. This study also focuses on different methods to minimize these events by incorporating several product validation points in the system as well as using standard product/location identifying technologies and automated validation systems.

2. LITERATURE REVIEW

Adverse event statistics reveal increasing numbers over the years. Jenkins (2005) analyzes hospitalizations in the state of New York and reports that 3.7 percent of patients experience adverse events and 27.6 percent of cases involve negligence. The same study indicates that over 70 percent of adverse events cause disability lasting less than 6 months, 2.6 percent result in permanent disability, and 13.6 percent result in death. Thomas et al. (2000) estimates the incidence and types of adverse events in Utah and Colorado and reports similar results. The study finds that 2.9 percent of hospital patients experience adverse events and 6.6 percent of cases cause death. In Utah, 32.6 percent of adverse events are due to negligence whereas in Colorado it is 27.4 percent. Figure 1 illustrates the number of adverse event reports received by FDA Adverse Events Reporting System (FAERS) over the years (FDA, 2014a).

Most of the supply chain-related patient safety issues occur at point of care (POC), typically during bedside product administration where there is limited time to administer products. Thomas & Petersen (2003) states that majority of these adverse events can be caught by error reporting systems, administrative data analysis, chart reviews, electronic medical record reviews, observation of patient care, or clinical surveillance. Some of these methods require continuous monitoring of products while some may be triggered after an incident. Continuous monitoring of products also helps better product identification and inventory accuracy which also are adding factors to patient safety in healthcare. The greater concern in managing inventory is ensuring the
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