Adapting the Bundles Approach to Reduce Medication Errors in Pharmacy Practice

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Abstract

- **Objective:** To describe a pharmacy process improvement program that used a “bundle” approach to reduce medication errors across an integrated network pharmacy system.
- **Methods:** A team of pharmacists, pharmacy managers, and pharmacy technicians developed and implemented a 4-step pharmacy practice bundle that added levels of verification and checking during the computer order entry and dispensing phases of the medication use process.
- **Results:** Medication errors were monitored monthly for the year before and the year following introduction of the bundles project. Following the bundle implementation, rates of medication order entry errors decreased by 48% ($P < 0.001$), pharmacy dispensing errors decreased by 48% ($P < 0.008$), and high alert–related medication errors within these categories decreased by 40% ($P = 0.056$).
- **Conclusion:** The pharmacy practice bundle successfully reduced the rates of medication errors in our network.

Medication safety has become a priority for health care systems seeking to improve patient safety and quality of care. According to the Institute of Medicine, medication errors harm at least 1.5 million persons a year in the United States [1]. Medication errors occur at every phase of the medication use cycle. One study showed that 39% of all medication errors are prescribing errors, 12% are transcribing errors, 11% are pharmacy dispensing errors, and 38% are nurse administration errors [2].

The Albert Einstein Healthcare Network does not have a full computer physician order entry system. Our medication use system comprises components of the electronic medical record with online clinical documentation and a pharmacist-generated medication administration record (MAR). This system was implemented in phases between 2004 and 2006. Prior to the development of the current system, a nurse manually transcribed orders into the MAR. Because the MAR is now populated electronically from the pharmacy, a greater level of critical attention has been placed on the role of the pharmacist, whose failure to perform an accurate order entry task could result in a dispensing or administration error.

By early 2008, the network pharmacy director became aware that medication events were increasing, particularly pharmacist order entry errors, or errors in which a pharmacist failed to interpret and enter an order correctly into the clinical information system. By the first quarter of 2008, pharmacy order entry errors had peaked to 0.42 errors per 1000 patient days, while dispensing errors had peaked to 0.272 errors per 1000 patient days. Examples of order entry errors that were occurring included incorrect product selection for insulin, reversing the dose for a long-acting insulin product with the intended short-acting insulin dose and vice versa, and selecting the wrong formulation of a medication (eg, immediate- versus extended-release). High-alert medication errors, particularly with insulin products, were also on the rise as computer functionality (ie, limitations with the computer design to readily distinguish look-alike, sound-alike products from the computer selection screens) combined with human factors (ie, errors or distractions) periodically resulted in more serious medication errors.

At the same time that pharmacy-related medication errors were increasing, the integrated health care network was involved in organizational transformation and revitalization led by the chief executive officer. During this process, pharmacy leaders learned about “bundles,” or sets of processes that have been proven to work best when implemented together. Used in quality initiatives, bundles link standard critical steps in a process together to ensure that the overall process is done correctly and consistently for every patient. Bundles have been used primarily in critical care settings, where they have been effective in substantially reducing ventilator-associated pneumonia [3] and catheter-related infections [4]. However, there are no reports in the literature describing the use of bundles as an adapted practice in hospital pharmacy. This article describes an initiative that...
adapted the “bundles” concept to hospital pharmacy practice in order to improve medication safety.

Methods
Setting
Pharmacy services radiate outward from Albert Einstein Medical Center, a 650-bed private, nonprofit, tertiary care teaching hospital located in North Philadelphia. The large acute care hospital has multiple pharmacy satellites, including a main pharmacy, critical care pharmacy, medical surgical pharmacy, oncology pharmacy, operating room pharmacy, employee pharmacy as well as a clinical pharmacy component that consists of decentralized pharmacists, specialty role pharmacists, a pharmacy practice residency, and student clerkship program. The pharmacy department operates 24 hours, 7 days per week with over 100 full-time equivalents to support the distributive and clinical functions of the medication use process for patient care.

Bundle Development
The network pharmacy director organized a team of frontline staff directly involved in providing pharmaceutical care to patients to develop a reliable pharmacy process bundle that would ensure that medications were transcribed and dispensed accurately. The group included pharmacists, pharmacy managers, pharmacy students, and pharmacy technicians most familiar with the pharmacy distribution process. The newly formed pharmacy planning and implementation team included pharmacists, pharmacy managers, pharmacy students, and pharmacy technicians most familiar with the pharmacy distribution process. The pharmacy planning and implementation team organized the steps of the medication use process to identify risk points that were prone to error (Figure 1). The group concluded that the medication distribution system lacked consistent and reinforced levels of checking during the computer order entry and dispensing phases of the process. They identified several specific workflow procedures with a high degree of vulnerability for medication errors (shaded portions of Figure 1). After multiple focus groups and discussions, the group agreed on 4 key steps that must happen each time an order is entered into the system and dispensed to ensure the overall success of the process. They also determined that the process needed to have accountability and checkpoints without introducing additional paper into the process. The group therefore decided to use the existing physician order sheet and pharmacy prescription label to document the action steps of the bundle. Instead of checkmarking a separate checklist, the pharmacy bundle required initials of staff members at the 4 critical juncture points.

During the construction of the pharmacy practice bundle, pharmacy management worked closely with the frontline staff, guiding or coaching to keep the team focused and structured. The network pharmacy director provided the planning team with resources, support, guidance, and time to develop the pharmacy practice bundle.

The Pharmacy Practice Bundle
The bundle that was developed contains 4 steps:

Step 1. After entering the orders into the order entry system, the pharmacist compares the electronic order to the paper physician order, verifying that the electronic order has been accurately entered on the correct patient and matches the physician order. To document that this step has taken place, the pharmacist writes the computer prescription numbers and their initials on the physician order sheet.

Step 2. The pharmacist places the physician order sheet on the work counter to be double-checked by the technician or pharmacist filling the actual medication order. After the label is generated, it is placed on the pharmacy counter to be filled by a pharmacy technician or pharmacist, who compares the label to the physician order sheet as a double check. If the physician order sheet matches the label, the pharmacy technician or pharmacist countersigns the physician order sheet, performing a checking redundancy at the physician order level.

Step 3. A pharmacy technician or pharmacist fills the prescription order with the appropriate medication, verifying that the medication matches the drug description on the label and initialing the label as a confirmation of accuracy.

Step 4. The pharmacist verifies that the technician correctly filled the drug, countersigns the labels, and sends the labeled medications to the patient’s unit.

By the end of the process, 4 sets of initials are present: 2 sets verifying that the physician orders match the prescription label, and 2 sets of initials verifying the drug matches the prescription label. The first and last steps always involve a pharmacist, and a pharmacist or pharmacy technician can handle the middle steps. In practice, a single person may handle all the steps in the process, or 2 to 3 staff members may be involved in the process depending upon which area of the pharmacy they are working.

The safety steps comprising the pharmacy bundle include manual redundancies such as independent double checks, which can be defined as a staff member double-checking another staff member’s performance independently in an error prone process. According to the Institute of Safe Medication Practices, manual redundancies such as independent double checks can detect approximately 95% of errors and can play a role in reducing medication errors [5]. In addition,
Figure 1. Work flow for medication use process—pharmacy computer entry (transcription) and (dispensing). MAR = medication administration record; MCN = medication clarification notice; RPh = registered pharmacist.
the Joint Commission medication management standard MM 08.01.01 requires hospitals to analyze the performance of their medication management system, which includes identifying risk points, reviewing the literature for new technologies and best practices, and taking the necessary actions to improve their medication management system.

**Pilot**

The bundles pilot ran for a 1-year period from April 2008 through March 2009, and during this time medication errors were tracked to determine the impact of the intervention. Two months prior to implementation of the pilot program, the pharmacy staff were trained on the new bundles process in the form of a staff competency. In preparing to implement the pharmacy practice bundle, the team developed a tool to educate and train the staff about the new workflow changes and their purpose. The tool explained the bundles concept and rationale for the project, clearly explained the bundle steps and how compliance would be tracked, and outlined the pharmacists’ and technicians’ responsibilities. The sessions were met with some opposition from staff, who thought that the bundle process would impair workflow and affect the timeliness of the medication preparation process. Some of the staff expressed concern that the process was time consuming and that bundles actually had not been proven to be beneficial in a pharmacy practice setting. The network pharmacy director and pharmacy management team negotiated with staff to try the bundle as a pilot program to determine if it added value to the medication use process.

The pharmacy management team agreed to provide continuous feedback to the staff and to measure medication error rates in key categories of the process during the pilot phase. Medication errors are tracked at the health system through risk management, which uses a voluntary online proprietary reporting system known as the University Health System Consortium Patient Safety Net. Members of the pharmacy management team routinely visited the pharmacy practice sites and pharmacy satellites to observe and communicate with staff soliciting input about the pilot program. Some staff reported that the bundle took longer to do, but also reported that they were catching mistakes before the medications left the pharmacy and they were positively communicating this information to the pharmacy management team.

**Statistical Methods**

Using monthly data, the rates of pharmacy medication errors per 1000 patient days during the 12-month post-bundle period were compared with the corresponding rates in the 12-month pre-bundle period using Poisson regression with robust standard errors. $P$ values are two-sided. Analyses were performed using Stata version 11 (College Station, TX) and Excel 2003.
Results
There were 12 pre-bundle monthly measurements (April 2007–March 2008) and 12 post-bundle measurements (April 2008–March 2009). The health system collected monthly data for medication order entry errors, dispensing errors, and high-alert medication errors within these categories from the Patient Safety Net reporting database. Each type of medication error peaked in the final quarter of the pre-implementation period and declined substantially after the bundles intervention was implemented (Figure 2, Figure 3, and Figure 4). During the pre-bundle period, the order entry error rate was 0.385 errors per 1000 patient days. In the post-bundle period, the order entry error rate declined to 0.201 errors per 1000 patient days, a decrease of 48% from the pre-bundle period ($P < 0.001$). The rate of pharmacy dispensing errors also decreased by 48% from 0.166 to 0.086 errors per 1000 patient days ($P < 0.008$). Finally, the rate of high-alert medication errors decreased by 40% from 0.142 errors to 0.086 errors per 1000 patient days ($P = 0.056$).

Lessons Learned/Future Directions
Bundles have been shown to improve patient care outcomes in the critical care setting by reducing the incidence of catheter-related bloodstream infections and ventilator-associated pneumonia [3,4]. We successfully applied bundles in a pharmacy process improvement project. Positive continuous feedback and ongoing communication about the benefits of the bundles process can lead to acceptance of the practice and perception that it is the “standard of care” in pharmacy practice. It is important to note that the steps of the pharmacy bundle were custom designed based on the pharmacy distribution process for our institution. Medication delivery systems vary greatly across organizations in terms of the type and level of services they provide. When designing a pharmacy-related medication safety improvement project, it is essential that organizations include staff representatives most familiar with the medication process as they are best able to dissect the current work process and identify the risk points of their individual process.

In addition to data measurement, the pharmacy management team performed unannounced audits of staff member’s compliance with executing the pharmacy practice bundle. Independent spot checks revealed a compliance variability of 45% to 95% in staff accurately performing all 4 steps of the bundle. This suggests that despite only partial adherence, applying a bundle in the medication use cycle in the pharmacy has benefits in improving the overall reliability of the pharmacy process. Achieving better pharmacy bundle
compliance could possibly reduce the error rate even further. Future efforts could focus on training staff on the importance of following through on the entire bundle and motivating the group to continue the pharmacy process bundle.

Future efforts also may focus on analyzing the types of medication errors that still are occurring despite institution of the pharmacy process bundle. It is possible that the bundle does not address other risk points involved in the pharmacy transcription and distribution process. On review of the medication errors that were reported during the pilot program, some errors revolved around the failure to communicate the correct patient identity rather than the medication identity, an issue that was not addressed by the pharmacy process bundle. Another type of error involving communication is failure to discontinue a medication order from the clinical information system, which is a risk factor that the bundle cannot mitigate.

Aside from the patient care and safety impact, the medication safety improvement has benefited the caregiver at the bedside by reducing nursing time spent with pharmacy in reconciling medication errors or omissions. A better operating medication distribution cycle translates to increased customer satisfaction with nurses, who are the direct customers of the pharmacy. When nurses spend less time addressing medication-related issues, they have more time to spend with their patients. Nursing was an integral part of this project and was supportive of the pharmacy’s efforts to improve its level of service and responsiveness to their needs and their patients’ needs.

The pharmacy practice bundle initiative also demonstrates that enormous resources and manpower are not required to implement innovative ideas. This pharmacy bundle required no real start-up costs. Resources were needed for staff to define the actual bundle and time was needed to fully communicate the bundles process and train staff.

**Conclusion**

The development of a pharmacy practice bundle should involve the staff that is most familiar with the current workflow process at their prospective organizations. Depending on the type of medication distribution process, the actual bundle should be designed to safeguard the vulnerable steps of the process. The bundle must be simple in nature and should address the most critical and essential steps that need to happen each and every time for overall success in the process. Once the bundle is developed, additional time should be allotted to measure the process improvement and to provide feedback and recognize staff for their efforts in improving patient care. Continuous feedback to existing staff is imperative in sustaining continuous participation with the new practice;
incorporating the bundles process into new staff orientation is recommended.

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References