Lean Thinking in Health Care

The lean thinking that led to revolutionary changes in the automotive industry has led to substantial improvements in many other sectors. Lean methodologies bring people, processes, and technology together to improve the quality and efficiency of an organization in reaching its goals, whether it is mass-producing consumable products or providing health care services. Given the tremendous changes in health care economics and the rapidly aging population, innovations in workflow are critical for health care institutions to remain viable.

“Lean is . . . A mindset, or way of thinking, with a commitment to achieve a totally waste-free operation that’s focused on your customer’s success . . .”

David Hogg, High Performance Solutions

Lean thinking can help hospitals and pharmacy departments implement organizational changes consistent with the Pharmacy Practice Model Initiative (PPMI), which sets forth the overall goal of improving patient care. The PPMI was established by the American Society of Health-System Pharmacists (ASHP) and the ASHP Research and Education Foundation and includes specific goals to “significantly advance the health and well-being of patients by supporting futuristic practice models that support the most effective use of pharmacists as direct patient care providers.”

 Lean Thinking: Identify Value

Value must be defined from the perspective of the end customer, the person or entity purchasing the product or service. In a health care setting, the end customer is often the patient, although a model could be developed with the payor as the end customer. While patients generally value some combination of immediate personal benefit such as less pain, fewer symptoms, and improved health, payors are looking at costs over a period of time or number of patients and seek to avoid costs for unnecessary products and services.

Specifying the end customer for a specific product or service must be done carefully, as illustrated by the issue of delayed doses. Delayed doses of medication are a concern for the patient if they suffer pain or discomfort while waiting for their medication. Delayed doses are a concern for the payor if the delay results in a more costly condition to treat. The process of specifying the end customer is further complicated by the fact that nearly $1 billion in Medicare payments may be tied to patient satisfaction assessed by a questionnaire.

 Lean Thinking: Map the Value Stream

The authors of Lean Thinking explain that the value stream must be identified for each product providing value to a defined customer. The value stream includes all the actions involved in bringing about the product or service. Hospital pharmacies have

PART I

Lean Thinking in the Pharmacy and the Role of Omnicell Technology

Omnicell, Inc.

INTRODUCTION Lean thinking has been shown to save time, reduce errors, decrease costs, and improve patient satisfaction in health care settings. This paper reviews lean concepts and explores how pharmacy automation complements lean thinking and supports the lean pharmacy.
complex value streams that flow across multiple departments and different levels of staff. Consequently, a multi-disciplinary team will be necessary to capture observations of each component of a value stream, expose bottlenecks, eliminate waste, formulate improvements, and develop a vision of optimal workflow.2,3

The “5 why’s” is a tool to understanding the underlying reason why an optimal outcome has not been achieved. It consists of asking “why” repeatedly, perhaps five times, in order to work back to the underlying reason for suboptimal results.5

Tunneling down through the value stream can and usually does reveal more than one step of the process that requires attention. Consequently, continuing to search for areas to improve after finding a source of waste is essential to the lean process.

Nurses spend nearly 30% of their time engaged in activities not directly tied to patient care.8,9

In a health care setting, waste tends to occur in three particular areas:
• Medication errors and missing doses;
• Processes (the way work is done) that result in delays or complex workflows that result in confusion; and
• Unused employee potential, which occurs when employees are bogged down with low-level (or low value) tasks and are capable of much more.1,4,10

Sources of Waste in Health Care
• Medication errors and missing doses
• Processes that result in delays
• Complex workflows that result in confusion
• Unused employee potential
• Unlabeled or improperly labeled medications
• Lost time due to medication countbacks and discrepancies
• Compliance issues (unlabeled medication, etc.)
• Long waits for central medication order processing
• Delays in placing medication orders
• Nursing interruptions and distractions
• Nursing fatigue and stress
• Technology improperly implemented
• Staff not properly trained

Lean Thinking: Create Flow
Flow is created when each value-creating step of a value stream flows smoothly into the next step. The five “P’s” that affect workflow are people, provisions (supplies, medications, etc.), procedures, place (environment, location), and patients. Technology can be used to replace or eliminate one or more steps in the workflow.3 Technologies that address some of the sources of waste listed above include an automated dispensing cabinet (ADC), a medication label printer, a single dose dispensing module, and remote medication management software.

A 2011 national survey of pharmacy practice in hospitals found that 89% of 1,400 hospitals surveyed use ADC technology.

Lean Thinking: Establish Pull
Pull must be established between steps when possible so that each step is ready to run when the previous step is complete.7 Buildup of resources may occur when one step of a value stream is complete and the next step is not primed to continue the flow. This concept fundamentally changed automobile manufacturing by eliminating large stockpiles of parts and finished products that had to be pushed onto the next stage of manufacturing or ultimately the consumer. In pharmacy operations ADCs have eliminated the need to have inventory stockpiled in nursing units.

Lean Thinking: Pursue Perfection
The last significant part of lean thinking within the pharmacy setting is to review the steps above periodically in order to remove steps that do not add value and to improve workflow processes, which may involve incorporating new technologies.

The 5 Why’s Applied
The first dose of medication was given to a newly admitted patient 3 hours after the admitting physician wrote the order.

• Why? The written order wasn’t submitted to the pharmacy for 30 minutes.
• Why? The doctor batches the orders when a nurse is not available to submit the order.
• Why did the first dose take 2.5 hours after reaching the pharmacy? The pharmacy orders are filled in sequence.
• Why? There is no process for sorting the orders when Pharmacist A is not at work. The order was processed and filled after 30 minutes.
• Why did the first dose take 2 hours after being filled?
PART II
The Role of Pharmacy Automation
Pharmacy automation can play an important role in lean thinking because it provides new ways to cut steps from or improve conventional processes. Some of the solutions from Omnicell that have supported lean processes are described below.

The Omnicell medication dispensing system consists of automated dispensing cabinets (ADCs) that include a variety of innovative options that are described in this section. Open shelving and locked drawers can be configured as needed based on security needs and the patient care area in which the cabinet is placed.

Improving Timing of Dosing
Ward, et al., conducted a retrospective chart review to evaluate the timing of dosing (vancomycin) before and after an ADC was implemented in the Emergency Department. Prior to use of the ADC, no patient received vancomycin within 1 hour of the medication order. After implementation of the ADC, 15% of patients who received vancomycin were dosed in less than 1 hour (p=0.04).11

A time and motion study conducted by Omnicell found that the use of an ADC for first doses saved nearly 20 minutes over pharmacy preparation and delivery by a pneumatic tube.12 Thus, an ADC removes a bottleneck from the value stream and improves value for the customer (patient) by helping to ensure medications are administered in a timely fashion.

Labeling Medications
Since 2011 Omnicell has provided the option to incorporate a medication label printer within the ADCs that can automatically print patient-specific labels when items are removed from the cabinet. This function addresses issues concerning medications that are not immediately administered to patients. For example, nurses can print a label for each IV medication bag removed from the ADC. Pharmacy can configure the cabinets to automatically print labels when high-risk and multi-use items are issued. The labels can be configured with bar codes to support bar code medication administration (BCMA).

Without the medication label printer the only option for nurses is to create a handwritten label, which is an error-prone solution. Following the introduction of the label printer, a survey of 44 nurses found that:

• 84% of nurses used the label printer instead of handwriting for 75% of labels.
• 91% of nurses agreed that the label printer had a noticeable time-saving impact during their shift.
• 81% of nurses agreed that the label printer provided a noticeable increase in peace of mind regarding patient safety and compliance with Joint Commission regulations.

The label printer helps eliminate waste from the medication use process—both time spent handwriting labels and material waste caused by mislabeled or unlabeled open multi-use medication.

Reducing Medication Errors
Nurses are interrupted approximately once every six minutes.14 Every time a nurse is interrupted, the chance of a clinical error occurring increases nearly 13%.15

The Savvy™ mobile medication workstation wirelessly links in real time to the Omnicell ADCs and, using the Anywhere RN™ remote medication management software, allows nurses to remotely manage medications in quieter areas where they are less likely to be interrupted.

A 2007 survey by the American Nurses Association revealed that 97% of nurses worried about medication errors and that only one-third (37%) reported that they always labeled the syringes, while one in four nurses (28%) never labeled the syringes.13

Following implementation of Anywhere RN at a 262-bed hospital in New Jersey, a survey found that 54% of nurses reported reduced interruptions in the medication administration process16 and 77% of nurses were able to double check medications due to time savings with Anywhere RN.17

With its individually locking drawers that are automatically assigned to patients, Savvy allows nurses to make a single trip to the ADC for multiple patients, reducing steps and leaving more time for patient care while ensuring medication security.

Another source of medication errors and missing doses involves patient-specific items not stored in the ADC, which must be handled and tracked manually.
ally. This issue can be avoided by using the Omnicell SinglePointe™ patient medication management software, which enables nearly 100% of a patient’s medications to be managed via the ADC. Savvy, Anywhere RN, and SinglePointe enable more optimal “lean” workflows for nursing.

Managing Controlled Substances
A time and motion study conducted by Omnicell in 2012 found that for a typical 3- to 4-site hospital system* managing approximately 3,900 controlled substance doses per day, nurses would spend a significant amount of time conducting countbacks. Each countback takes an average of 10 seconds per controlled substance issue, which becomes 10.8 hours per day when multiplied by 3,900 doses.17 This challenge can be resolved through the OmniDispenser™ single dose dispensing module for the ADC. This module stores medications in a separate, secured location in the ADC and dispenses each dose individually, virtually eliminating the need for countbacks. Implementing OmniDispenser eliminates a process that holds little value for the patient and frees up time for nurses to perform clinical work that more fully uses their potential.

Visibility of Medication Management
To aid the health care facility in more effectively optimizing inventory and preventing drug diversion, Pandora® analytics extracts key data from the medication and supply dispensing systems and provides a comprehensive picture of usage and inventory throughout the facility. The Pandora dashboard provides at-a-glance views of key metrics and trends.

The Pandora Financials application supports supply chain decisions by providing visibility to financial information such as total inventory costs, item location, inventory turns, and costs per case or patient visit. It has been proven to reduce time spent on managing drug shortage item inventory from hours to minutes. Pandora Clinicals provides a more targeted approach to diversion detection that also saves time for nurse managers and pharmacy.

By providing continual insights and trends, and showing consequences of actions taken, Pandora aids the quest for continuous improvement—a tenet of lean thinking.

Discussion
As discussed earlier, changes related to people and changes related to technology are key areas to target for reducing waste in a lean environment. One of the earliest applications of lean thinking in a health care setting occurred in 2002 in the pharmacy for the Community Medical Center in Missoula, Montana. The value stream analysis demonstrated that the process of filling an inpatient medication order was complex and could follow multiple pathways. The analysis revealed that the two pharmacists were constantly interrupted with as many as 10 telephone calls per hour, a quarter of which were related to missing doses.

An evaluation of timing of the process from receiving an order to delivering an order (by vacuum tube) showed that the process required 2 minutes of actual work but an average took 38 minutes to complete.

The pharmacy modified its approach to drug order fulfillment through a division of labor and realized a 32% improvement in order processing time.18 In this case, the reorganization of people increased flow in the value stream.

Utilizing technology can also create a high flow value stream. The time and motion study conducted by Omnicell demonstrated that substantial improvements to the value stream could be achieved by simply increasing the number of line items stocked in an ADC by 5%. A typical 350-bed hospital managing 4,000 doses per day could realize the following results:

- Save 35 hours of staff time per week on medication distribution activities—totaling 7% or more of labor hours, an annual savings of over $64,000.
- Save 267 labor hours (pharmacists, technicians, and nurses) per 1,000 missing doses due to a reduction in missing doses.
- Save 31 hours of labor time (pharmacists and technicians) per 1,000 first doses due to a reduction in time spent on first dose distribution.

Changes focused on people and technology cannot be looked at in a vacuum—they are intrinsically

*Assumes each site has approximately 350 beds
connected. The successful implementation of technology in a health care environment relies on the attitudes and training of health care professionals.\textsuperscript{19}

\textit{Training and coaching is the most frequently mentioned factor associated with the successful introduction of a technological innovation (referred to by 56.3\% of the respondents) in a survey of 685 nurses in Holland.}\textsuperscript{20}

In addition to providing adequate training support, health care facilities are encouraged to foster an environment without blame so that people don’t hide their mistakes. Mistakes provide an opportunity to further refine the process or workflow, which is the last step in lean thinking—continuous improvement.

\textbf{Conclusion}

Lean methodologies provide the tools to identify value and expose and eliminate waste in a value stream. Lean thinking can bring people, processes, and technology together to improve the effectiveness of an organization in reaching its goals. Omnicell products are designed to automate and optimize the pharmacy and play an important role in reducing waste in the health care value stream. ■
References