Evaluation of Outpatient Oncology Services Using Lean Methodology

Deanna Belter, RN, BSN, OCN®, Jennifer Halsey, MS, PharmD, BCPS, Heidi Severtson, MS, Amy Fix, BA, Laura Michelfelder, MT, ASCP, Karen Michalak, MT, ASCP, Patty Abella, BSN, and Angela De Ianni, MBA

The Lean Transformation Process is a methodology created by the Toyota Production System that focuses on the elimination of nonvalue-added operations in the workplace to create flow and quick response to customer demand. The process improvement strategy, when applied to the healthcare setting, can enhance the patient experience by cutting out waste (nonvalue added work) and providing a safer, streamlined visit (Lean Enterprise Institute, 2011). Because providing chemotherapy is a multistep, interdisciplinary process, it is ideal for Lean evaluation. The goal of this application was to improve the overall efficiency of the multidisciplinary chemotherapy process in an oncology infusion center by implementing changes that would decrease patient wait times and improve communication across disciplines.

The Lean initiative was implemented at an oncology infusion center in a suburban Milwaukee, WI, medical center in August 2010. Expectations included improving the overall patient experience by decreasing the patient wait time prior to chemotherapy infusion and enhancing the flow of the patient's experience through the treatment process. The process included check-in, laboratory draw, and doctor visit or RN assessment, followed by the administration of chemotherapy. The Lean methodology is a principle that also is used by the Aurora Health Care organization in the operational improvement department to help increase the value of the patient experience while decreasing the waste that creates redundancy and delays work flow (Kenny, 2011). Time is precious for a patient with cancer, and the oncology staff wanted to make the time spent at the center as valuable as possible.

Lean Methodology in Healthcare Delivery

Lean is a process improvement strategy that focuses on identifying the waste in a process and then applying various tools to eliminate the waste and achieve flow. Since its conception in manufacturing at Toyota Motor Company in the 1980s (Lean Enterprise Institute, 2011), Lean methodology has been applied in various settings and has become an increasingly popular method for improving healthcare delivery. Virginia Mason Medical Center (VMMC) has used the method when implementing changes to their organization, including their cancer center. By implementing a variation of the Lean model, VMMC achieved waste elimination, cost reduction, and improvements in quality and safety.

Aurora Health Care adopted Lean methodology in late 2008. Since then, more than 800 supervisors, managers, healthcare providers, and administrators have been trained in Lean methodology, completing the following three online modules: (a) what is the Lean process, (b) how Lean works to improve processes, and (c) how to perform a Lean event. They also attended an interactive one-day training session where they applied the tools learned in the three online modules. As a result of the training, Aurora Health Care implemented more than 200 Lean improvements in the first year. Aurora West Allis Medical Center's oncology infusion center receives 334 patient visits and provides chemotherapy to 120 patients per month.

Providing chemotherapy services is a multistep, interdisciplinary process that involves multiple handover communications, laboratory monitoring, and chemotherapy processing, production, and administration. As a result, delays, errors, and rework may occur, translating into longer patient wait times, inefficient use of caregiver time, drug waste, and other unrecoverable organizational costs. Therefore, the purpose of the outpatient chemotherapy services using Lean initiative was to evaluate the current process, determine ways to eliminate waste, and improve multidisciplinary coordination and communication, and, in turn, patient flow. In addition, Lean was expected to increase caregiver engagement and patient loyalty scores, optimize patient scheduling and use of caregiver resources, and decrease patient wait times (Lean Enterprise Institute, 2011).

What Is the Lean Transformation Process?

Lean begins with eliminating waste so that the work performed on a daily basis adds value and serves patients' needs. To identify and eliminate waste, the five-step Lean Transformation Process was employed (Lean Enterprise Institute, 2011).

Evaluate the current situation: Before making any process improvements, baseline data are gathered so that any changes can be measured against the pretransformation process. Data are gathered through direct observations and data collection, which are valuable in obtaining the objective information of a process in its current state (e.g., actual wait times for laboratories or patients).

Identify areas of opportunity: The nonvalue added work is identified by looking critically at the task and analyzing the current process using the observations and data collected.

Modify the existing process: The nonvalue added work is eliminated through various countermeasures and ideas. To help combat nonvalue added work or extra steps in skills or processes, several Lean tools are available including the 5S system: sort, simplify, standardize, sweep, and self-discipline, which simply means cleaning, organizing, and sustaining the area, mistake proofing, or balancing the workload. For example, in same-day surgery registration, the Lean initiative allowed caregivers to combine reception and registration into one step, thus reducing patient wait times. Also, by cleaning and organizing an area, caregivers were able to process paperwork faster during patient registration.

Substantiate and enumerate improvements: The ideas and countermeasures are piloted, and the impact of the change is observed. Enumerating the improvements also may lead to expanding original ideas and further improve the process. Savings from improvements such as enhanced revenue, floor space, distance traveled, and patient wait time also are measured. By reducing the time a nurse spends looking for supplies, the time spent caring for the patient is increased, therefore helping to reduce length of patient stay.

Implement new work standards: If successful, the new processes are marketed as the new standard for the department or area. Training is conducted to ensure that all caregivers are familiar with the new process. The changes also are communicated to administration and other affected departments.

Lean methodology identifies seven waste forms that are prevalent in any processes. They are shown in Figure 1 as applied to an oncology infusion center (Lean Enterprise Institute, 2011).

The Lean Team

The following individuals comprised the multidisciplinary Lean project team: regional manager of women's services (team leader), oncology care coordinator, two oncology RNs, pharmacy manager, specialty pharmacy coordinator, clinical pharmacist, pharmacy technician, two medical technologists, and two operations improvement consultants. The Lean team was selected based on their knowledge of front-line staff and people who do the work on a daily basis to ensure all aspects were discussed in detail.

Team members met several times, and meetings consisted of introductory Lean training to ensure all participants were familiar with concepts, terminology, methodology, and the Lean Transformation Process. The operations improvement consultants spent about 15 hours in the chemotherapy infusion center, pharmacy, and laboratory gathering preliminary data through direct observation. The preliminary data included general workflow processes, cycle times, delays, and other issues. A value stream map illustrates workflow within and among departments (see Figure 2).

Pre-Lean Workflow States

A common pre-Lean patient flow scenario is detailed here.

Infusion center: The average time from check-in to initiation of chemotherapy infusion was 88 minutes. The patient arrives, checks in at the admissions desk, and is given directions to the infusion center. The customer service provider then sends a beeper page to the infusion center's nursing station informing them of the patient's arrival. If the patient requires laboratory testing, he or she arrives at the infusion center one hour prior to treatment. The specimen tubes are labeled and manually highlighted pink to indicate that the sample should be processed immediately. The specimen is sent to the laboratory for testing via the pneumatic tube system. The patient then is assessed by the nurse and sees the physician as needed. While the patient waits, the laboratory processes the specimen and the results automatically print at the infusion center nursing station. The results are evaluated and, unless the patient has contraindications to receiving chemotherapy, the nurse sends the chemotherapy orders to the pharmacy (if not already sent the day before) informing them that chemotherapy preparation may occur. The patient is taken to a treatment room where premedication or prehydration, as indicated, is initiated. When the chemotherapy arrives, the nurse begins administration.

Laboratory: After the sample moves through the pneumatic tube system and arrives in the laboratory processing area, the laboratory processor assigns one accession number for all ordered laboratory testing and indicates that the testing be processed as soon as possible. The most frequently ordered laboratory tests prior to chemotherapy are complete blood count (CBC) and chemistry panels. The established turnaround time for a CBC is 30 minutes. The established turnaround time for a chemistry panel is 60 minutes; however, additional laboratory testing (e.g., thyriod stimulating hormone, vitamin B_{12}) increased the turnaround time. After the laboratory testing is complete, results are entered into the computer system and the results automatically print at the infusion center nursing station.

Pharmacy: The pharmacist prints off the next day's chemotherapy schedule and writes the available information on the morning chemotherapy communication worksheet (see Figure 3). The pharmacist processes the orders and evaluates and confirms that the regimen, dose, route, and frequency of the chemotherapy medications are correct and whether premedication or prehydration is needed. If clarifications are needed, the pharmacist calls the oncologist. If order clarifications cannot be obtained the day before service, the pharmacist indicates that an outstanding issue exists on the chemotherapy communication worksheet. The pharmacist performs all necessary calculations and enters the chemotherapy, premedications, and hydration information into the computer system. A second pharmacist confirms the indication, regimen, and order entry. The premedications and

Delays: patients, products, or caregivers waiting for service or information (e.g., laboratory results)

Defects: additional work or rework caused by errors

Inventory: excess supplies and products waiting for processing

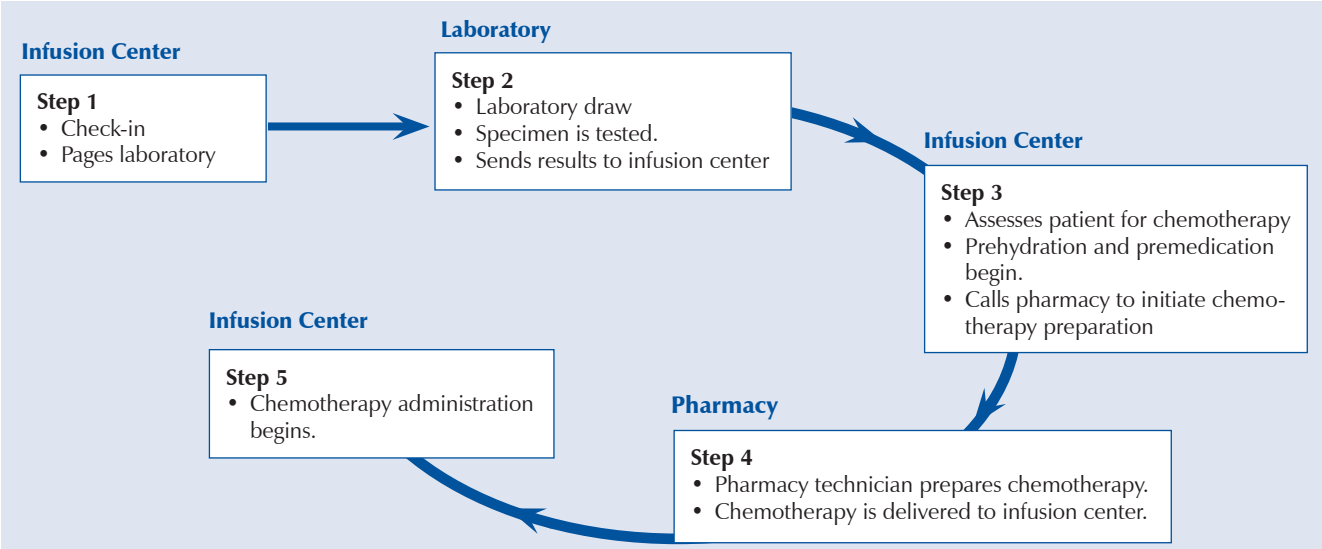
Motion: movement of the caregiver (i.e., searching, walking, gathering supplies)

Overprocessing: providing more service than needed or redundant efforts

Overproduction: providing more than the next operation needs or earlier than needed

Transportation: movement of the patient or product; chemotherapy drugs moving from the pharmacy to the oncology department

Figure 1. Potential Nonvalue-Added Work in an Oncology Infusion Center



Note. Total time from patient check-in to chemotherapy administration is 88 minutes.

Figure 2. Pretransformation Value Stream Map

hydration solutions are prepared the night before service and delivered before the infusion center opens on the day of service. Carboplatin doses are calculated on the day of service because they are dependent on renal function.

The patient is then evaluated and deemed appropriate for therapy and, if the orders were processed a day prior, the infusion center nurse calls the pharmacist to initiate chemotherapy preparation. If the orders were not processed the day before service, the orders are scanned to the pharmacy, and the chemotherapy pharmacist begins processing the orders according to policy. The pharmacist completes the chemotherapy communication worksheet, the chemotherapy technician prepares the drugs needed, and the pharmacist checks the preparation. After the product is ready, the chemotherapy technician delivers the chemotherapy to the infusion center.

The infusion center should submit the following to the pharmacy.

- ❑ Patient name
- ❑ Medical record number
- ❑ Signed orders
- ❑ Current height and weight
- ❑ Actual versus adjusted body weight
- ❑ Serum creatinine
- ❑ Time expected
- ❑ RN (responsible for patient)
- ❑ Comments
- ❑ Chemotherapy regimen
- ❑ Call time
- ❑ Estimated time needed for next chemotherapy in regimen

Figure 3. Chemotherapy Communication Checklist

Identifying Areas of Change

The first day of the event, the Lean team analyzed the value stream map and, by analyzing the multistep chemotherapy process as a group, highlighted areas of opportunity to eliminate waste. Other opportunities were identified after the team completed a Genba walk of each department (pharmacy, laboratory, and chemotherapy departments) to learn more about each of the areas. A Genba walk involves the team traveling to each work area to identify visible waste (Lean Enterprise Institute, 2011). After the team identified process waste and areas of opportunity, they created an improvement plan for each of the listed opportunity items (see Table 1).

Implementation of New Work Standards

Changes to workflow were communicated to caregivers at the outpatient chemotherapy infusion center and were to be implemented by all caregivers immediately. The largest improvement was the enhanced communication between the oncology infusion center, pharmacy, and laboratory. By providing the oncology nurses with a consistent contact person in the laboratory, a real-time communication now exists if problems arise with sample processing, resulting in faster resolutions. Improved communication within the laboratory regarding the expected turnaround time of laboratory analysis and the increased staff education regarding time-sensitive specimens resulted in a significant reduction in patient wait times. In the laboratory, specimen result turnaround time improved by 13 minutes, allowing for scheduling changes that decreased patient wait times. Previously, patients requiring laboratory testing prior to treatment were scheduled to arrive 60 minutes before treatment. After the improvement, patients are now scheduled to arrive 45 minutes before treatment.

Process improvement among nursing and pharmacy staff included designating a resource nurse to coordinate communication to the pharmacy in the event of simultaneous patient arrivals for treatment; conducting a daily meeting between the chemotherapy pharmacist and nurse to discuss the workflow for that day; limiting the chemotherapy pharmacist pool to three to four pharmacists to increase their familiarity with workflow and processes; improving the communication regarding chemotherapy production prioritization; and creating a carboplatin dose autocalculator. Those interventions,

among others, resulted in a 12-minute decrease in the pharmacy's chemotherapy process time.

The impact on patient satisfaction was of significant concern to the Lean team throughout intervention implementation. Therefore, a handout was created to educate patients about the steps being performed to ensure efficiency, accuracy, and safety in their treatment, and to illustrate why wait times exist.

Sustainability

Sustainability requires a control plan specifying who continues to evaluate the process and what types of monitoring should be performed to ensure performance declines are detected early. If a significant performance decline is detected, the control plan specifies what actions must occur to improve metrics (Murphree, Vath, & Daigle, 2011). A subgroup of the Lean team meets on a routine basis to discuss the results of cycle and turnaround time measurements. Cycle times are evaluated on a monthly basis. Deviations from the new turnaround time standards are identified and analyzed to determine the cause. Reinforcement of new process standards occurs as needed.

Summary

After the Lean methodology intervention, average overall patient wait time from arrival to chemotherapy infusion decreased from 88 minutes to 68 minutes. Staff members who implemented the Lean model learned better interdepartmental communication, found new respect for other departments, and saw how working together can bring down barriers to optimal patient care.

The streamlined workflow has translated into greater productivity, more patients receiving care because of time saved, and increased patient satisfaction because of decreased wait time. As the number of patients receiving chemotherapy grows, attention to quality and safety, productivity maximization, and improved patient loyalty are paramount to planning for current and future needs. The overall value of Lean for a patient with cancer is a faster turnaround time while cutting out waste and providing chemotherapy in a safe, efficient manner. In turn, patients are provided with more time spent outside of the waiting room.

Table 1. Identified Nonvalue Work Items and Improvement Opportunities in an Outpatient Oncology Service

Item	Improvement Opportunity
Necessity of laboratory tests conducted prior to chemotherapy administration	Investigate the cost and process times for each piece of the chemistry panel versus the entire chemistry panel.
Patients may not understand the overall time and processes required in chemotherapy preparation and safety.	Update patient education documents to better inform and set appropriate patient expectations.
Lack of communication among nurses and laboratory technicians regarding the order in which specimens should be processed	Create a labeling system (e.g., colored labels for time-sensitive specimens) and educate staff accordingly.
Nurses unable to directly contact the laboratory	Establish a direct line to call if laboratory results are not back in 30 minutes for a complete blood count or 45 minutes for a chemistry panel.
The long wait time for patients requiring laboratory testing prior to chemotherapy administration	Schedule appointments 45 minutes prior to chemotherapy administration.
Lack of communication among nursing and pharmacy staff regarding schedule changes	Send updated scheduling notes to all departments the afternoon before and, again, the morning of service.
No system to streamline the pharmacy workflow of order processing and compounding chemotherapy if patients arrive simultaneously or a patient requires multiple chemotherapeutic medications	Appoint a resource nurse to evaluate whose orders to process or whose chemotherapy to compound first and inform the pharmacy technician.
When the pharmacy calls the infusion center, the nurse may not be available.	Oncology infusion nurses will carry text pagers.
An insufficient communication checklist for pharmacy workflow	Modify checklist to include medical record number, the nurse taking care of that patient, what time the nurse called for the chemotherapy, and the times that the other chemotherapy medications are needed.
Making sure that all issues have been addressed	Always use preprinted order sets to prevent errors.
Errors in patient weight on day of service	Measure, relay, and document all weight in kilograms.
Multiple pharmacists rotating infusion center duties	Appoint two pharmacists to service the infusion center.
Calculating carboplatin dosing is time intensive.	Create a carboplatin calculator using Microsoft® Excel®.
Pharmacy technicians leaving the IV room to inform the pharmacist that the chemotherapy preparation is ready to be checked	Install a doorbell or other alert system.
Delays in pharmacy turnaround time occur because of overall hospital pharmacy workflow	A text page will be sent to the nurse informing him or her of the delay.
A nurse from the infusion center and the chemotherapy pharmacist meet every day to discuss workflow.	Use a checklist to make sure all the necessary information is covered.

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Deanna Belter, RN, BSN, OCN®, is an oncology care coordinator; Jennifer Halsey, MS, PharmD, BCPS, is a specialty pharmacy coordinator; Heidi Severtson, MS, and Amy Fix, BA, are operations improvement consultants; Laura Michelfelder, MT, ASCP, and Karen Michalak, MT, ASCP, are medical technologists, Patty Abella, BSN, is the regional manager of women's services; and Angela De Ianni, MBA, is the pharmacy manager, all at Aurora West Allis Medical Center in Wisconsin. No financial relationships to disclose. Belter can be reached at deanna.belter@aurora.org, with copy to editor at ONFEditor@ons.org.

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Leadership & Professional Development

This feature provides a platform for oncology nurses to illustrate the many ways that leadership may be realized and professional practice may transform cancer care. Possible submissions include, but are not limited to, overviews of projects, accounts of the application of leadership principles or theories to practice, and interviews with nurse leaders. Descriptions of activities, projects, or action plans that are ongoing or completed are welcome. Manuscripts should clearly link the content to the impact on cancer care. Manuscripts should be six to eight double-spaced pages, exclusive of references and tables, and accompanied by a cover letter requesting consideration for this feature. For more information, contact Associate Editor Judy A. Schreiber, RN, PhD, at judy.schreiber@louisville.edu or Cindy Rishel, PhD, RN, OCN®, at Rishelmom@gmail.com.

References

Kenny, C. (2011). *Transforming health care: Virginia Mason Medical Center's pursuit of the perfect patient experience.* New York, NY: Productivity Press.

Lean Enterprise Institute. (2011). *Principles of Lean.* Retrieved from http://www.lean.org/whatslean/principles.cfm

Murphree, P., Vath, R.R., & Daigle, L. (2011). Sustaining Lean Six Sigma projects in health care. *Physician Executive Journal, 37,* 44–48.