# Lean Methodology Improves Efficiency in Outpatient Academic Uro-oncology Clinics

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**OBJECTIVE** To determine if lean methodology, an industrial engineering tool developed to optimize manufacturing efficiency, can successfully be applied to improve efficiencies and quality of care in a hospital-based high-volume uro-oncology clinic.

**METHODS** Before the lean initiative, baseline data were collected on patient volumes, wait times, cycle times (patient arrival to discharge), nursing assessment time, patient teaching, and physician ergonomics (via spaghetti diagram). Value stream analysis and a rapid improvement event were carried out, and significant changes were made to patient check-in, work areas, and nursing face time. Follow-up data were obtained at 30, 60, and 90 days. The Student *t* test was used for analysis to compare performance metrics with baseline.

**RESULTS** The median cycle time before the lean initiative was 46 minutes. This remained stable at 46 minutes at 30 days but improved to 35 minutes at 60 days and 41 minutes at 90 days. Shorter wait times allowed for increased nursing and physician face time. The average length of the physician assessment increased from 7.5 minutes at baseline to 10.6 minutes at 90 days. The average proportion of value-added time compared with the entire clinic visit increased from 30.6% at baseline to 66.3% at 90 days.

**CONCLUSION** Using lean methodology, we were able to shorten the patient cycle time and the time to initial assessment as well as integrate both an initial registered nurse assessment and registered nurse teaching to each visit. Lean methodology can effectively be applied to improve efficiency and patient care in an academic outpatient uro-oncology clinic setting. UROLOGY 83: 992–998, 2014. © 2014 Elsevier Inc.

The high incidence of genitourinary cancers compounded by the aging population has placed a burden on uro-oncologists to manage an increasing demand for outpatient clinics. With finite resources and the already spiraling costs of health care, simply increasing the number of outpatient clinics is not a plausible option. Increasing clinic volumes, however, would add further strain on the health-care team and also negatively impact the quality of care for each patient by increasing clinic wait times and reducing face time with health-care practitioners. To address this issue, measures are needed to streamline clinics and optimize efficiency while still maintaining high-quality care. Patel et al[1] examined possible areas of delay in urology clinics and found that >40% of clinic time was lost in administration and inefficiency. Outpatient clinics at academic institutions pose additional challenges such as teaching, clinical trial coordination, and formalized biobanking that can create more inefficiency. The challenge ultimately is to improve the quality of patient care while reducing clinic visit times.

The Japanese automobile manufacturer Toyota has been able to optimize their workflow and efficiency by developing and implementing the Toyota Production System (TPS).[2] The TPS focuses on identifying and eliminating "muda," the Japanese word for waste or nonvalued activities, which impede the effective flow of services. It considers the expenditure of resources for any goal other than the creation of value for the end customer (or patient) to be wasteful, and therefore a target for removal. Womack and Jones[3] have labeled the TPS principles of value, value stream, flow, pull, and perfection as lean methodologies. Lean uses the 6S principles (sort, set in order, shine, standardize, sustain, and safety) and the creation of a standardized work process to create

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the most efficient and effective flow of services. This allows for the creation of a predictable, controllable, and sustainable process that optimizes value-added steps. Lean methodology has successfully been adapted to other industries, including the health-care system. Examples of which include emergency rooms, outpatient clinics, endoscopy clinics, and operating rooms.[4-13] Entire hospitals have also adopted lean into their organization, notably Virginia Mason Medical Center, ThedaCare, and the University of Michigan Health System.[14] As a corollary of this, financial savings have also been demonstrated,[4,15,16] with ThedaCare, a Wisconsin-based community health system, reducing their total cost of inpatient care by 25%.[14] We set out to determine if lean methods could improve efficiencies and quality of care in a hospital-based high-volume uro-oncology clinic.

## METHODS

The lean initiative was conducted from July to September 2009 in the Surgical GU Oncology clinic at the University Health Network in Toronto, Canada. It involved a 3-day value stream analysis (VSA) in July and a 5-day rapid improvement event (RIE) in September, with the team meeting biweekly during this period. The team consisted of members of all the staff involved in the clinic process: uro-oncologists, registered nurses (RNs), administration, patient flow coordinators, and clinical trial coordinators (CTCs). This was organized under the direction of a member from the hospital's Shared Information Management Services and a hired consultant with expertise in lean methodologies.

Before the VSA, a qualitative patient survey and baseline data were collected on patient volumes, wait times, cycle times (patient arrival to discharge), nursing and physician assessment time, patient teaching, and physician ergonomics (via spaghetti diagrams). This was completed over the course of 1 week in July.

The VSA workshop entailed reviewing the qualitative and quantitative baseline data to identify the principal areas in which improvements in the clinic process were needed. This involved the creation of a value stream or process map, which is a visual representation outlining all steps currently involved in a patient's clinic visit, from arrival to exit (Supplementary Fig. 1A). This allowed the team to more easily recognize and classify each step as either value added or non—value added. In lean, a value-added step is a component that the customer, or in our case the patient, would be willing to pay for. In considering a patient's perspective, face-to-face time with a health-care provider would be value added, whereas the wait time to see them would not be. The process map allows for an objective evaluation of the clinic to identify all obstacles and challenges. From this process, an "ideal state" value stream map, representing the ideal clinic process, was created (Supplementary Fig. 1B). At this point, specific project goals were identified (Table 1), and each was assigned to a team member to "champion." A 2-phased approach focusing on both the front and the back end of the clinic process was undertaken.

To improve the clinic space, a 6S RIE was carried out. Based on the 5 pillars of the visual workplace in the TPS, this is typically the starting point for clinic transformation. It provides a methodology for organizing, cleaning, developing, and sustaining a productive and efficient work environment. This allows one to standardize the examination rooms and office workspace. One aspect of this is a "red tagging event." This is a decluttering exercise in which all equipment and supplies are audited for their usefulness. After this, the clinic workspace was arranged and organized through the use of visual controls and indicators so as to help eliminate the time wasted searching for supplies (Supplementary Fig. 2). The sixth pillar of 6S is considered safety, which is an added outcome of implementing the first 5 pillars. The second aspect of lean involves improving the process flow. An RIE was conducted, which is a team event focused on evaluating the current work process to optimize workflow and efficiency. The RIE led to an action plan for improving the clinic process.

**Table 1.** Project goals identified at the value stream analysis

1. Better patient satisfaction
2. Improve efficiency
3. Seamless integration of research
4. Better accessibility to laboratories and better reporting of laboratories
5. Diminished clutter
6. Improved flow for staff and patients
7. Greater patient confidentiality
8. Better check-in and checkout processes
9. Improve staff morale
10. Enhancing the role of nursing

Follow-up data were obtained at 30, 60, and 90 days. This was done by observing clinics on a weekly basis, involving 1 of the 4 uro-oncologists. Each clinic was scheduled for 3 hours and was run by a team including the attending, resident or fellow, clinical nurse, and CTC. A typical clinic consisted of 70%-80% of patients attending for follow-up visits or hormone treatment, 5%-15% for early postoperative care or surveillance of low-grade prostate cancer or small renal masses, and <5% for a surgical consult or positive biopsy result. To obtain the performance metrics, 12 patients in each surgical genitourinary clinic during this period were randomly captured, always including both the first and the last patient. All recorded patients were followed throughout their clinic visit by a research coordinator, and metrics were recorded using a stopwatch. Data for each 30-day interval were aggregated together from the previous 30 days. The Student *t* test was used for analysis, and changes in baseline were compared with baseline, with probability values <.05 deemed significant.

## RESULTS

Table 2 depicts the clinic metrics before and at 30, 60, and 90 days after the lean initiative. The median cycle time was 46 minutes at baseline and 46 minutes at 30 days but improved to 35 minutes at 60 days ($P$ <.001 vs baseline) and 41 minutes at 90 days. During this time, the average clinic volume remained stable, ranging from 30 to 32 patients. Both the wait time to being roomed and for the nursing assessment improved during the process. The initial average wait time for the nursing assessment was 23 minutes and decreased to 5 minutes at 30 days, 10 minutes at 60 days, and 5 minutes at 90 days (all $P$ <.001 vs baseline). This extra time allowed for