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Lean philosophy and the public hospital



Maria Castaldi^{a,b,*}, Dordaneh Sugano^b, Kapri Kreps^a, Anna Cassidy^a, Jody Kaban^{a,b}

^a Jacobi Medical Center, Department of Surgery, Bronx, NY, United States

^b Albert Einstein College of Medicine, Bronx, NY, United States

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ABSTRACT

The Toyota Production System or Lean philosophy has been implemented in many facets of medicine from outpatient areas to critical care units to ancillary services. There has been some doubt about the applicability of this process outside of large private medical centers particularly in relationship to operating room services. We describe the success of the Lean process for the surgical services of a public, inner-city hospital.

Lean methodology was applied to operating room (OR) performance measures of utilization, on-time starts, turn over time, and same day cancellations. Secondary measures of OR minutes used, OR cases completed, individual service cancellations for emergencies, and cross service bumping for emergencies were also evaluated. One years worth of data prior to the start of Lean was compared to one year after the completion of Lean. Improved performance was consistently demonstrated in all measures except same day cancellations.

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1. Introduction

The Toyota Production System or Lean methodology, originally designed to streamline manufacturing, is increasingly being applied to hospital operations. The strategy was embraced by the manufacturing sector, and in more recent years has been successfully applied to improving the provision of healthcare services. The Lean philosophy focuses around the concepts of “value” and “waste,” breaking down a complex production process into individual steps to create a “Value Stream”. A “Value Stream Analysis (VSA)” assesses the value of each step required to bring a product from concept to delivery. Any step that is not valuable from the perspective of the consumer is considered “waste” and eliminated. Using the patient and/or physician as the consumer, Lean philosophy has been used to evaluate efficiency and safety for outpatient,^{1,2} in-patient^{3–5} and emergency department^{6,7} settings. Hospitals utilizing this philosophy have ranged from community based, private practice settings to larger tertiary care academic hospitals. There has been limited reporting of the use of Lean or Six Sigma methodology in municipal or “safety-net” hospitals. In fact, some have questioned how less affluent institutions would

allocate the necessary resources to institute Lean projects.⁸ The Health and Hospitals Corporation (HHC) of New York City, the largest public healthcare system in the country began using Lean methodology in 2007. Our hospital among the largest in the HHC network implemented Lean philosophy with the goal of improving operating room (OR) efficiency without the addition of significant resources.

2. Methods

Our center is a level I trauma center and the largest safety net hospital located in the poorest borough of New York City.⁹ The main OR has ten rooms servicing all surgical disciplines except cardiac surgery and transplantation. Approximately 300 people including network physicians, fellows, residents, nurses and allied care professionals participate in the operating room activities. In cooperation with Simpler Consulting, L.P., a consulting service for lean enterprise transformation, we performed a VSA, identifying 11 areas of possible inefficiency in perioperative services. Multidisciplinary perioperative value stream leadership teams were formed to evaluate and improve on each of these 11 areas in what is known as a Rapid Improvement Event (RIE). Eleven RIEs were completed for the peri-operative value stream in three categories: peri-operative patient processing, physician related issues in the OR, and non-physician related issues in the OR. Each RIE was rolled out with a multidisciplinary team of frontline, as well as support personnel to identify key performance measures and set targets. The RIE team met for 3–5 days consecutively for

* Correspondence to: Department of Surgery, Albert Einstein College of Medicine, Jacobi Medical Center, Room 510, 1400 Pelham Parkway South, Bronx, NY 10461, United States.

E-mail addresses: Maria.Castaldi@nbhn.net (M. Castaldi), dordaneh.sugano@med.einstein.yu.edu (D. Sugano), Kapri.Kreps@nbhn.net (K. Kreps), Anna.Cassidy@nbhn.net (A. Cassidy), Jody.Kaban@nbhn.net (J. Kaban).

investigational work through of new processes and suggested modifications. The reason for action was identified by VSA, gap analysis performed to determine the cause of problems creating gap between initial and target states, and a completion plan generated. Each of the 11 RIE teams analyzed the way a particular process was undertaken, known as the initial state, then devised an improved process that was ready for implementation at week's end. A confirmed state tracked and showed the benefits and results of each RIE. If targets were not reached by agreed upon dates, gap analysis was restudied. Data was collected by the RIE teams at 30, 60, and 90 days using a process control board, visual management board, huddle board, and tracking sheets.

The overall goal of applying the Lean philosophy to our surgical services was to increase efficiency in the entire peri-operative process with the more specific goal of increasing OR utilization by decreasing "resource waste" or OR down time. Delays in first case starts, prolonged turn over time (TOT), and unused OR time were defined as resource waste. Measures of OR performance include utilization, on-time starts, TOT, and same-day cancellations. OR utilization was defined as all OR time used during standard working hours divided by the total amount of standard working hours (measured in minutes for greater accuracy). On-time start was defined as patient in the room within 15 min of the published start time. TOT was calculated from the time one patient left the

Table 1
Description of the 11 Rapid Improvement Events (RIE) in the VSA, including the reason for improvement, the actions taken to achieve improvement, and the effect of the RIE on peri-operative efficiency and patient care.

RIE	Reason for action	Implementation	Effect
1.Ambulatory Surgery Patient Flow	Delays in processing Ambulatory Surgery patients, impacting our ability to do more cases.	Designate 5 cubicles for ambulatory surgery patients in PACU Enforce post-op huddle Enforce post-op phone communication with PACU	Flow time improved by 50%
2.Packaging of Surgical in-patients to the OR	No standardized format to ensure timely preparation of Inpatients for the Operating Room, resulting in unnecessary cancellations and delays.	Anesthesia to review elective surgery schedule posted the day prior to surgery Standardize work documents for scheduling, holding area Implement peri-operative nursing standards protocol	Cancellations decreased from 48% to 30.4%. Patients reviewed by Anesthesiologist prior to day of surgery increased to 50%. Patient processing forms completion increased from 30% to 82%.
3.Materials Management	Cumbersome approval and delivery process. No standardization of product inventory, directly impacting delivery process for patient care.	Integrate buyer and OR material management Create templates for OR supplies Master Inventory list on all OR products Educate and enforce vendor policy and procedures Create service-specific booking sheets	Inventory accurate for service needs; service specific cards and carts created.
4.Turn Over Time (TOT) of the OR	TOT is too long effecting surgeon, patient, family, and staff satisfaction	Establish RTOR time at end of case. Streamlining of room cleaning process. Establish instant communication upon patient delivery to OR to trigger OR prep	11% improvement in TOT from baseline monthly average of 50 min to 41 min.
5.On-time Starts	Only 13% of surgeons were found to start cases on time, affecting not only their case but also following cases	Establish system to improve first case start time Improve documentation and reporting of delays caused by surgeon, anesthesiologist, nurse, or patient	First case on-time starts have improved from a baseline 54% to 84%.
6.Scheduling Practices	Suboptimal OR time utilization due to insufficient communication and lack of standardization, resulting in loss of revenue.	Establish actual OR time minutes for common procedures in order to create a more accurate OR schedule. Institution of online booking forms.	8% increase in OR minutes 22% increase in OR utilization to > 90%
7.Block Scheduling	The block schedule restricts access to OR for urgent and emergency cases, preventing maximal OR time use	Bring all areas of preoperative services together. Institute online forms. Create "urgent room" for urgent in-house cases which cannot be booked more than 24 h in advance	Near 100% utilization of urgent room. Bumping of cases between services decreased by 75%.
8.Set up of case cart for Orthopedic Service	Existing case cart system for Orthopedic service causes delays.	Formal process to ensure Orthopedic and loaner trays are complete on time.	Orthopedic tray completion increased from 54% to 57%. Loaner tray completion increased from 20% to 62%.
9.Cost of Running an OR	Defined OR related costs not easily identifiable or collectable. Cost reporting is ad hoc and methodology lacks standardization.	Compile, organize, and analyze data on costs from respective services, Refine fixed vs. variable costs	cost of idle time+each minute of TOT cost=\$30/Min. \$32K a month=\$384K annually (average)
10.Optimally preparing the elective patient for the OR (RIE #10)	Current PAT process continues to be fragmented and difficult to navigate for both patients and staff	Early notification to bed board. Bed board huddle. Designated bed assignment prior to admission.	Reduced patient travel distance from 670 feet to 200 feet
11.Referral patterns from outpatient department to OR	Unable to determine what percentage of referrals from primary care providers to surgical subspecialties make it to the OR	Establish standard electronic referral forms with specific guidelines Review referral policies of surgical subspecialties	Consultative service requests with appointment confirmation implemented in the electronic medical record.

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