



Improving Perioperative Performance: The Use of Operations Management and the Electronic Health Record

Robert P. Foglia*, Adam C. Alder, Gardito Ruiz

Children's Medical Center Dallas, Department of Pediatric Surgery, University of Texas Southwestern

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Abstract

Purpose: Perioperative services require the orchestration of multiple staff, space and equipment. Our aim was to identify whether the implementation of operations management and an electronic health record (EHR) improved perioperative performance.

Methods: We compared 2006, pre operations management and EHR implementation, to 2010, post implementation. Operations management consisted of: communication to staff of perioperative vision and metrics, obtaining credible data and analysis, and the implementation of performance improvement processes. The EHR allows: identification of delays and the accountable service or person, collection and collation of data for analysis in multiple venues, including operational, financial, and quality. Metrics assessed included: operative cases, first case on time starts; reason for delay, and operating revenue.

Results: In 2006, 19,148 operations were performed (13,545 in the Main Operating Room (OR) area, and 5603, at satellite locations); first case on time starts were 12%; reasons for first case delay were not identifiable; and operating revenue was \$115.8 M overall, with \$78.1 M in the Main OR area. In 2010, cases increased to 25,856 (+35%); Main OR area increased to 13,986 (+3%); first case on time starts improved to 46%; operations outside the Main OR area increased to 11,870 (112%); case delays were ascribed to nurses 7%, anesthesiologists 22%, surgeons 33%, and other (patient, hospital) 38%. Five surgeons (7%) accounted for 29% of surgical delays and 4 anesthesiologists (8%) for 45% of anesthesiology delays; operating revenue increased to \$177.3 M (+53%) overall, and in the Main OR area rose to \$101.5 M (+30%).

Conclusions: The use of operations management and EHR resulted in improved processes, credible data, promptly sharing the metrics, and pinpointing individual provider performance. Implementation of these strategies allowed us to shift cases between facilities, reallocate OR blocks, increase first case on time starts four fold and operative cases by 35%, and these changes were associated with a 53% increase in operating revenue. The fact that revenue increase was greater than case volume (53% vs. 35%) speaks for improved performance.

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* Corresponding author. Department of Pediatric Surgery, Children's Medical Center Dallas, Dallas, TX 75235, USA.

E-mail address: robert.foglia@childrens.com (R.P. Foglia).

There is wide interest in improving the efficiency of health care with an emphasis on reduction of costs and maintenance of the quality of care. This interest comes from patients, payors, government, regulatory bodies, patient advocates and physicians [1].

For many patients, their care involves operations and specialized procedures in the perioperative setting, a relatively contained area. However, there are diverse patient populations (e.g., Elective, Add-on, and Emergent) requiring services from multiple caregiver groups (e.g., Surgery, Nursing, Anesthesiology, Supply) in varying locations, including Perioperative Setting, Operating Room, and the Post Anesthesia Care Unit. Orchestration of patient and perioperative data is essential to provide the best possible outcomes for patients.

At Children's Medical Center Dallas in 2006, operational metrics in the Main OR area were as follows: 1) 13,545 operations, 2) first case on time starts were 12%, 3) case cancellation rate was 14%, and 4) block utilization was 47%. Our aim was to identify whether the implementation of both the principles of operations management and the Electronic Health Record (EHR) could improve perioperative performance at our tertiary children's hospital.

1. Methods

We compared fiscal year (FY) 2006, prior to operations management and EHR implementation, to FY 2010, after operations management and EHR (EPIC Systems, Verona, WI) implementation. Application of operations management principles in our environment consisted of: 1) clear and consistent communication regarding the mission and vision of care provided as well as metrics which would be evaluated, 2) obtaining credible data about OR times, 3) implementation of current perioperative processes and endpoints for analysis, and 4) implementation of performance improvement initiatives such as opening a preop clinic, block reallocation, smoothing functions, and shifting of low acuity ambulatory cases from the Main OR area to other locations. The EHR allowed us to create menus to categorize relevant causes for first case delays and the accountable service or person (e.g., surgeon, anesthesiologist, nurse, other), and gather multiple data points for analysis. Metrics assessed included: 1) number of operations, and location; 2) first case on time starts without a grace period; 3) reason for delays by accountable service and person; and 4) perioperative services operating revenue.

In response to these metrics, in February 2007, a process improvement team composed of more than 80 representatives from all perioperative areas participated in a collaborative redesign of the OR based on operations management principles. This operations management redesign had multiple areas of focus including developing and opening a perioperative clinic, changing the perioperative phone call to parents, implementing better communications and signage, instituting processes to improve patient flow and family satisfaction, and making all participants aware of perioperative goals and individual's responsibility and accountability. Univariate statistical analysis was performed using the Chi Squared test with Graph Pad software (La Jolla, CA).

2. Results

The operations management plan was implemented throughout 2007, and by 2009 first case on time starts had increased to 30%. The case cancellation rate decreased almost 3 fold to 5%, and block utilization increased to 65%. In May of 2009, the EHR was implemented in our hospital's perioperative environment allowing us an opportunity to examine the affect of this particular addition to our system. From FY 2006 to 2010, we experienced an overall 35% growth in operations from 19,148 to 25,853 operations ($P < .001$) (Fig. 1). This growth included a 3% increase in operations in the Main OR and a 112% increase ($P < .001$) in operations at other sites. In 2006, there were 18 ORs in the Main OR area, and 6 ORs in our Ambulatory Surgery Center. In 2008, we opened a second hospital with 4 ORs. In 2010, we performed 25,853 operations at these three locations utilizing 28 ORs. This increase is an improvement of cases: OR room ratios of 797.8 in 2006 in 24 rooms vs. 923.3 in 28 rooms in 2010, a significant increase in space utilization.

In April of 2009, first cases on time starts in the Main OR were 33%. At this time, we implemented an EHR in the perioperative area. First case on time starts decreased to 18% in the first 6 months after implementation. By mid 2010, this metric rose to 46% (See Fig. 2). All first case on time starts are recorded without a grace period.

In FY 2010, the EHR allowed us to track relevant causes for first case delays by reason, service, and individual. Delays were ascribed to nurses 7%, anesthesiologists 22%, surgeons 33%, and other (patient, hospital) 38%. Furthermore, 76% of surgical delays were attributed to the surgeon being late to the OR, or having an incomplete or missing consent; 56% of anesthesia delays were attributed to the anesthesiologist being late to the OR, or being late ordering pre-op medication (See Table 1). We also were able to identify that five surgeons (7%) accounted for 29% of all surgical delays, and four anesthesiologists (8%) accounted for 45% of all anesthesia delays.

In 2006, total monthly perioperative operating revenue was \$9.6 M \pm \$1.1 M, and Main OR monthly perioperative operating revenue was \$6.5 M \pm \$0.62 M. In 2010, total monthly revenue was \$14.8 M \pm \$1.2 M ($P < .001$), and Main OR monthly revenue increased to \$8.5 M \pm \$0.8 M ($P < .001$). From FY 2006 to 2010, we experienced a 53% increase in overall operating revenue from \$115.8 M to \$177.3 M. In addition, operating revenue in the Main OR rose 30% from \$78.1 M to \$101.5 M during this time period.

3. Discussion

Operations management describes a set of principles focused on establishing stable processes, which produce expected results built on a foundation of data rather than supposition or belief. Specifically the principles are: 1) clear

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