

# Reducing Preventable Surgical Cancellations: Improving the Preoperative Anesthesia Interview Process

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**Purpose:** *Thorough and accurate preoperative anesthesia interviews may help improve perioperative efficiency by reducing unnecessary preoperative testing and preventable surgical cancellations, both of which create financial burdens. Standardized anesthesia preoperative interview guidelines and online educational modules for registered nurses (RNs) conducting preoperative interviews may improve this process.*

**Design:** *Pre-design and post-design, retrospective chart review.*

**Methods:** *Online educational modules and standardized preoperative anesthesia interview guidelines were developed for RNs conducting preoperative interviews. A retrospective chart review compared preoperative anesthesia interview record completion rates, compliance with laboratory testing, and the total number of preventable surgical cancellations.*

**Findings:** *Documentation of preoperative anesthesia interview records increased, whereas unnecessary preoperative testing decreased, neither with statistical significance. Preventable cancellation rates decreased significantly from 34.3% to 20% ( $P < .5$ ) contributing to a 3-month post-implementation cost savings of approximately \$30,000.*

**Conclusions:** *A standardized preoperative anesthesia interview guideline and online anesthesia educational modules for RNs conducting preoperative anesthesia interviews improved preoperative record completion rates, reduced unnecessary laboratory testing, and averted surgical cancellations.*

**Keywords:** *surgical cancellation, preoperative, interview, educational modules.*

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**PREOPERATIVE EVALUATION OF PATIENTS** is a critical step in the perioperative process and essential to evaluate a patient's overall readiness for surgery, identify high-risk patients, order appropriate preoperative testing, and optimize pa-

tient health before surgery. The purpose of this project was to improve perioperative efficiency. A specific aim was to reduce preventable surgical cancellations by improving the preoperative interview process. Efforts toward improving interviews

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included increasing the interviewing registered nurse's (RN's) knowledge of critical medical and surgical history that must be obtained from patients preoperatively. A second aim was to reduce unnecessary preoperative testing and establish and adopt clear guidelines for indicated preoperative laboratory and diagnostic tests as this was a major concern for the institution. Targeted interviews and purposeful preoperative testing provide a clinical picture that better allows for preoperative patient optimization. Institution-specific preoperative guidelines standardize the preoperative process, improve communication among the perioperative care team, and ensure all critical components of the preoperative assessment are addressed. Inadequate preoperative assessments may increase perioperative morbidity and lead to negative patient outcomes.<sup>1</sup>

Many medical institutions hire RNs to complete preoperative evaluations. Often, RNs have no formal training in anesthesia and surgical risk, yet baseline knowledge of both is inherent to conducting thorough, well-informed preoperative anesthesia interviews. A lack of formal training can lead to unintentional omissions within preoperative anesthesia interviews and unnecessary preoperative testing. For example, a patient who fails to receive a preoperative electrocardiogram (ECG), according to standardized guidelines, may have their procedure delayed on the day of surgery (DOS) until they receive the testing. In addition, if any abnormalities are found, surgery could then be canceled until a cardiology evaluation is completed. If a thorough and accurate preoperative anesthesia interview has been conducted and indicated testing completed, preventable surgical cancellations could be avoided.

This project took place at a rural community hospital in the southeastern United States, where RNs do not receive any formal training regarding anesthesia or surgical risk, yet are responsible for conducting preoperative interviews. The facility lacked a standardized preoperative guideline to direct critical components of the preoperative process. In addition, preoperative assessments were lacking critical patient information, patients were receiving excessive and unnecessary preoperative testing, and the facility's preventable surgical cancellation rate was 34.3%, creating a significant financial burden for both patients and the hospital.

With a goal to improve perioperative efficiency by reducing preventable surgical cancellations and unnecessary preoperative testing, formal online education was developed and provided to RNs and the preoperative process was standardized to guide the most important aspects of the preoperative interview.

## Review of the Literature

Most surgical cancellations are preventable.<sup>2-4</sup> Preventable cancellations are those associated with patient-related factors such as violations of nil per os (NPO) status and failure to show on DOS, despite being informed of the date of surgery and expected time of arrival. Preventable cancellations can also be related to process-related factors, which include missing information such as laboratory test results, ECG, cardiac clearance, or any other pertinent preoperative testing. These patient- and process-related factors and inadequate preoperative medical workup are among the most common reasons for preventable surgical cancellations<sup>3,5,6</sup>; however, "patient no show" has been shown to be the most common independent reason for preventable surgical cancellations that can be easily targeted by administration.<sup>3,4,7</sup> Cancellations that are not preventable include surgeon illness, changes in patient medical status, abnormal laboratory values appropriately drawn on the DOS, operating room (OR) equipment failure, or patient refusal of surgery.<sup>3,8</sup> Determining the rates and common reasons for cancellations helps hospitals develop appropriate interventions to prevent avoidable cancellations and improve OR efficiency.<sup>2-4</sup>

Delays and cancellations also lead to decreased patient satisfaction because of travel plans and time taken off of work.<sup>4,7,9</sup> Patient satisfaction can also be affected by mental preparedness for the upcoming procedure. A study of 101 male and female adults attending a preoperative clinic before scheduled surgery evaluated the effect of the preoperative clinic appointment on patient anxiety. A questionnaire was distributed to assess anxiety before and after the preoperative assessment. A statistically significant reduction in patient anxiety levels was identified after the preoperative interview was completed ( $P < .001$ ).<sup>10</sup>

Preoperative clinics led by RNs who receive specific education in performing preoperative anesthesia interviews, including training in airway anatomy, physical examination, and evidence-based preoperative testing, are shown to be more effective.<sup>8</sup> One method to provide this education is through web-based learning. Web-based learning is convenient, offers time flexibility for employees, encourages self-directed learning, and decreases overall costs.<sup>11,12</sup> Implementation of computer-based educational module training on anesthetic and surgical risk for RNs conducting preoperative anesthesia interviews improves consistency of nursing assessment skills, enhances preoperative record completion rates, decreases surgical cancellations, increases patient satisfaction scores, and improves overall perioperative quality and efficiency.<sup>8,11</sup>

Standardized preoperative anesthesia testing guidelines are another essential component of the preoperative process. Anesthesia guidelines detail the critical elements of the preoperative process, including the telephone or on-site interview process, appropriate preoperative testing recommendations, NPO guidelines, and preoperative medication guides. Preoperative guidelines improve communication among surgeons, physicians, anesthesia providers, and patients, while decreasing excess health care costs and improving quality of care and patient safety throughout the perioperative process.<sup>1,13-15</sup>

Preoperative anesthesia guidelines should include clear, evidence-based, preoperative testing recommendations. Excessive preoperative testing is a problem throughout the United States, United Kingdom, and Canada. At least one nonindicated preoperative test will be ordered for nearly 90% of patients, leading to millions of wasted health care dollars.<sup>14,15</sup> Laboratory tests have limited ability to predict adverse outcomes, and instead, a thorough medical history considering the patient's age, comorbidities, type, and invasiveness of surgery offers better predictive value.<sup>1</sup> Adherence to institution-specific preoperative testing guidelines in preoperative clinics is important to improving OR utilization, the preoperative testing process, and will ultimately decrease preventable surgical cancellations.<sup>14,15</sup>

The primary aims of this process improvement project were to develop and provide online education to RNs conducting preoperative anesthesia interviews, with the development of a standardized preoperative anesthesia interview guideline to ensure all critical components of the preoperative process were met. The overall goal of this project was to improve perioperative efficiency by reducing preventable surgical cancellations and unnecessary preoperative testing.

## Setting

This initiative was implemented in a 282-bed rural community hospital in the southeastern United States. The facility has a total of 13 ORs, eight in the main hospital and five in the on-campus ambulatory surgical center. From July 2016 to June 2017, a total of 7,998 surgical cases were performed, 1,688 inpatient and 6,310 outpatient, including minimally invasive to major surgical procedures such as open abdominal, thyroid, spine, and vascular surgery. In addition to general surgery, specialty surgical procedures performed included neuroskeletal, orthopaedic, plastic, bariatric, gynecologic, robotic, ophthalmic, and otorhinolaryngoscopic. The preoperative clinic is staffed by 15 RNs, 10 full time, one part time, and four on a pro re nata basis. All patients scheduled for surgery in the main and ambulatory surgical areas typically have a telephone or on-site interview with anesthesia preoperative clinic nurses before the day of scheduled surgery. In accordance with methods established a priori, 100% of patients had a preoperative interview whether in person or via phone; those who did not complete a preoperative interview were not included in the project.

## Materials and Methods

### *Development of Online Educational Modules*

Three online educational modules were developed, detailing essential components of the preoperative anesthesia interview, including airway assessment, allergies, common medications, anesthetic history, NPO status, head to toe assessment, and appropriate laboratory testing. Module content was based on the American Society of Anesthesiologists' practice advisory for preanesthesia evaluation,<sup>13</sup> reputable anesthesia textbooks, the

National Institutes for Health and Care Excellence,<sup>16</sup> and a retrospective chart review at the implementation site to determine institution-specific inefficiencies in the preoperative process. Modules were developed using Microsoft PowerPoint software and reviewed for face validity by one certified RN anesthetist and one anesthesiologist. In addition, the content was reviewed and tested by the perioperative management team and the educational resource coordinator at the implementation site before uploading into the existing learning management system (LMS). Although these modules were not all-inclusive, they provided the basic competencies required to perform a thorough preoperative anesthesia interview. They could be used in conjunction with other resources and serve as a yearly educational refresher for preoperative RNs. Each module took approximately 20 to 30 minutes to complete and included posttests with an assigned minimum passing score of 80%. All 15 RNs who conducted preoperative interviews were given 30 days to complete the modules once they became available in the LMS.

#### ***Development of Preoperative Anesthesia Interview Guideline***

In addition to the educational modules, a standardized preoperative anesthesia interview guideline was developed to meet the specific needs of the facility. This guideline was developed using practice advisory guidelines for preanesthesia evaluation, published by the American Society of Anesthesiologists,<sup>13</sup> guidelines for routine preoperative testing for elective surgery published by the National Institute for Health and Care Excellence,<sup>16</sup> and guidelines for preoperative testing before noncardiac surgery.<sup>17</sup> The guideline was developed in association with the anesthesiology department and preoperative care team to ensure the guideline met the specific needs of the patient population and hospital preanesthesia expectations.

The guideline detailed which patients were eligible for a preoperative telephone-call screening and which patients needed to present to the preoperative anesthesia interview clinic for evaluation. It detailed critical elements of the preoperative anesthesia interview, including a review of the available medical record, a focused examination of the patient, including a detailed medical history, a review of previous anesthetic ex-

periences, and a physical examination. A preoperative medication guide was included for RNs to educate patients on appropriate medications to take or hold, before the DOS. In addition, it provided clear procedures for ordering appropriate preoperative tests. The guideline was approved by the medical executive and nursing committees within the facility and the management team, then uploaded into the protocol database for staff access.

The preoperative educational modules were implemented during the months of September and October 2017. The preoperative anesthesia interview guideline was not implemented until January 2018, because of unexpected delays in guideline approval at the facility. During the lapse between educational module implementation and guideline approval, laminated guides were distributed to staff highlighting key changes and new information to be included in the preoperative anesthesia interview records (PAIRs).

#### ***Data Collection and Outcomes***

This process improvement initiative used a predesign and postdesign process to examine and compare the percentage of RNs who completed the educational modules, improved assessment components in the PAIRs, and the number of preventable surgical cancellations preimplementation and postimplementation of the project. We examined the percentage of education modules completed by the preoperative RNs within 30 days after module availability, before implementation of the standardized preoperative anesthesia interview guideline. The staff development coordinator generated an electronic report of the educational modules completed by assigned preoperative RNs, which was retrospectively reviewed for completion and verified that all modules were passed with a score of 80% or higher. This report was coded and maintained in a secure database.

A retrospective chart review of 105 PAIRs was completed. The 52 records reviewed preimplementation were randomly selected from the 8-month period preimplementation (January to June 2017). After implementation of the educational modules and preoperative anesthesia interview guideline, 53 records were randomly

selected and reviewed in the 2-month period post-implementation (January to February 2018). Using G\* Power software, a sample size of 54 was calculated to achieve statistical significance, based on  $\alpha$  of 0.05 and power set to 0.80. The study sample size of 105 was adequate to achieve statistical significance according to a priori sample size estimates. These records were reviewed for multiple assessment criteria including surgical and anesthesia history documentation, NPO teaching, drug and alcohol use, and assessments related to neurologic, cardiac, pulmonary, gastrointestinal, endocrine, and renal disease. Improvements in documentation preimplementation to postimplementation were compared. These records were also reviewed for compliance with preoperative testing recommendations, established by the preoperative anesthesia interview guideline, and were compared preimplementation and postimplementation of the guideline.

Preventable surgical cancellation rates were assessed using monthly data compiled by a university system-wide initiative aimed at improving operational efficiency, enhancing the quality of system processes, and strengthening financial stability throughout the affiliated institutions. The monthly data reports were obtained by the directors of perioperative and surgical services, stored in a secure database, and retrospectively reviewed for preventable surgical cancellation data. These reports listed the total number of and documented reasons for surgical cancellations each month.

Cancellations were categorized as preventable or nonpreventable. Preventable cancellations included patient-related factors such as violations of NPO status and failure to show on the DOS, despite being informed of the date of surgery and expected time of arrival. Cancellations also included process-related factors, which included missing information such as laboratory test results, ECG, cardiac clearance, or any other pertinent preoperative testing. Cancellations that were considered nonpreventable included surgeon illness, changes in patient medical status, abnormal laboratory values appropriately drawn on the DOS, OR equipment failure, weather-related events, or patient refusal of surgery.

Exclusion criteria eliminated patients currently admitted to the hospital or those patients

admitted for medical optimization within 24 hours before the DOS. Those undergoing urgent or emergent surgery were excluded in addition to non-English speaking patients and patients who did not receive an interview from the preoperative clinic. Patients undergoing total joint replacement surgery were also excluded as these patients underwent a different preoperative process, receiving a brief telephone interview before a mandatory on-site interview and joint class. The patient information was not fully captured within the available electronic health record (EHR), which excluded these patients from the data collection process.

### **Data Analysis**

Educational module completion rates were evaluated using descriptive statistics. Fisher's exact tests were used to compare preimplementation and postimplementation PAIRs and appropriate preoperative testing percentages performed preimplementation and postimplementation. The percentage change of DOS cancellations preimplementation and postimplementation was also calculated. Analysis of the data was performed using IBM Statistical Package for the Social Sciences (SPSS) Software (Version 24; IBM, Armonk, NY) with  $\alpha$  set at  $P < .05$ .

### **Results**

Within 30 days of educational module availability, 100% of the preoperative nurses completed one of the educational modules. Twenty-one of 22 preoperative RNs (95%) completed the other two modules during the implementation phase. All modules were completed with a pass rate of 80% or higher. Postimplementation chart review excluded records performed by the one RN who did not complete the modules.

After reviewing 53 postimplementation records, there were improvements in certain components of the preoperative interview. There was a statistically significant increase in compliance with assessment and documentation of alcohol and drug use assessments ( $P = .028$ ) and documentation of cardiac clearance ( $P = .04$ ). Other areas of improvement included continuous positive airway pressure use documentation, at-home diabetic monitoring, improved documentation of

diabetic deficits, and dialysis treatment, although these did not meet statistical significance.

Before implementation, 25 patients (48%) received a phone screen or interview that did not comply with the standard guidelines. After implementation, this was reduced to 18 patients (34%) ( $P = .167$ ), albeit this difference did not meet statistical significance. There were reductions in unnecessary preoperative testing including preoperative chest x-ray ( $P = .052$ ), glucose testing ( $P = .093$ ), echocardiogram ( $P = .243$ ), human chorionic gonadotropin ( $P = .123$ ), complete blood count ( $P = .555$ ), and urinalysis ( $P = .670$ ), albeit not statistically significant (Table 1). Unnecessary serum chemistries decreased 1% from preimplementation to postimplementation ( $P = .999$ ), with ECG testing ( $P = .999$ ) and coagulation studies ( $P = .840$ ) slightly increasing in the postimplementation phase, although these findings were not statistically significant (Table 1).

After reviewing the university, system-wide, data repository for surgical cancellations, it was determined that 105 surgical cancellations occurred in the preimplementation period (October to December 2017) and 95 cancellations occurred in the postimplementation period (January to March 2018). Of these cancellations, 34.3% were considered preventable in the preimplementation phase. This number was significantly decreased to 20% postimplementation ( $P < .05$ ) (Table 2). Preventable cancellations as a result of NPO violations significantly decreased from 50% preimplementation to 10.5% postimplementation ( $P < .01$ ). No-show cancellations accounted for 22% of prevent-

able cancellations in the preimplementation and 52.6% in the postimplementation period (Table 2).

## Discussion

The purpose of this process improvement project was to improve perioperative efficiency by reducing preventable surgical cancellations and unnecessary preoperative testing. Formal online education was provided to RNs, and the preoperative process was standardized to guide the most important aspects of the anesthesia preoperative interview. Before the development of this process improvement project, it was determined that this facility lacked a guideline that detailed critical elements essential to the preoperative process. In addition, RNs working in the preoperative anesthesia interview clinic at this institution were not formally trained to conduct preoperative anesthesia interviews. Institution-specific standardized guidelines and thorough, accurate preoperative anesthesia interviews, and testing are essential for identifying and optimizing high-risk patients and decreasing DOS cancellations.

A 95% compliance rate was achieved for completion of educational modules within the 30 days after module availability. With the help of the educational resource coordinator, the modules were uploaded into the current LMS available to staff. Using a system that staff were comfortable accessing and navigating, assigning the modules as a mandatory education requirement, and using email reminders may have improved compliance with timely module completion.

**Table 1. Summary of Unnecessary Preoperative Testing**

Preoperative Test	Preimplementation Number (%)	Postimplementation Number (%)	Significance <i>P</i>
Chest x-ray	8 (15.4)	2 (3.8)	.052
Echocardiogram	2 (2.8)	0	.243
Electrocardiogram	6 (11.5)	7 (13.2)	.999
Glucose	7 (13.5)	2 (3.8)	.093
Human chorionic gonadotropin	8 (15.4)	3 (5.7)	.123
Complete blood count	23 (44.2)	20 (37.7)	.555
Urinalysis	16 (30.8)	14 (26.4)	.670
Serum chemistries	20 (38.5)	20 (37.7)	.999
Coagulation studies	18 (34.6)	20 (37.7)	.840

**Table 2. Summary of Preventable Surgical Cancellations Preimplementation and Postimplementation**

Months	Total Cancellations	Preventable Cancellations Number (%)	Nil Per Os	No Show
Preimplementation				
October	44	9 (20)	7	2
November	30	13 (43)	5	3
December	31	14 (45)	6	3
Total	105	36 (34.2)	18 (50%)	8 (22%)
Postimplementation				
January	35	2 (5.7)	0	1
February	27	6 (22)	1	4
March	33	11 (33)	1	5
Total	95	19 (20)	2 (10.5%)	10 (52.6%)
Significance <i>P</i>	—	.027	.007	.034

Telephone screening compliance was improved in the postimplementation period, although not significantly. The observed improvement in telephone screening compliance is important although additional factors must be considered. Patients who meet criteria for an on-site interview are typically higher acuity patients with more involved disease processes and potentially require greater preoperative optimization. Patients who meet criteria for an on-site interview, yet were inappropriately interviewed via telephone screen, may not receive appropriate medical optimization, have an increased risk of perioperative morbidity, and a greater chance of a DOS cancellation.

There were statistically significant improvements in certain components of the PAIRs, supporting similar findings by Rankin et al<sup>11</sup> and Smeekens et al<sup>12</sup> that web-based learning is convenient, offers time flexibility for employees, encourages self-directed learning, and improves accuracy of assessment skills by RNs. Originally, the goal was to modify the current EHR to include check boxes that would provide a prompt and simple tool to document additional required information that is not currently included in the preoperative anesthesia assessment. Unfortunately, the facility was under contract with another EHR company to transition in late 2018, which eliminated the possibility of making changes to the current system.

Reductions in unnecessary preoperative testing occurred with preoperative chest x-rays, echocar-

diograms, glucose testing, human chorionic gonadotropin, complete blood count, and urinalysis. Reduced unnecessary preoperative testing saves patients and the hospital money, averts invasive blood draws, and can reduce unnecessary radiation exposure. A slight increase in ECG testing and coagulation studies was observed in the postimplementation period. This suggests that the guidelines may need review and revision and additional teaching may be necessary to educate providers of the current guideline recommendations for preoperative testing. Improved education and communication to the surgical teams is also required. During postimplementation data collection, it became evident that specific surgical specialties and individual practitioners continued to order unnecessary testing, despite evidence-based guideline recommendations.

When comparing the 3 months preimplementation and postimplementation data, there was a statistically significant reduction in preventable surgical cancellations, from 34.3% preimplementation to 20% postimplementation ( $P < .05$ ). It is important to highlight the statistically significant decrease in preventable cancellations resulting from NPO violations. In the preimplementation phase, there were 18 cancellations for NPO violations, which accounted for 50% of total preventable cancellations. In the postimplementation period, this number was decreased to two violations, accounting for only 10.5% of total cancellations ( $P < .01$ ). NPO recommendations were

covered extensively in the educational modules and were included in the new guideline, validating the importance of standardizing guidelines and providing education to preoperative RNs about the importance of NPO teaching to patients. Patient no-show on the DOS accounted for 22% of total preventable cancellations preimplementation and 42% postimplementation. This initiative did not specifically target methods to reduce patient no-shows, but the data demonstrate that this inefficiency leads to a significant number of cancellations each month for this facility. An additional suggestion is to target this source of preventable cancellations to further reduce unnecessary costs and improve overall perioperative efficiency.

In addition, the financial burden that preventable surgical cancellations place on hospitals is significant. A 2009 study conducted in the Veterans Health Administration system estimated the cost of unused OR time to be approximately \$600 per hour. They determined this number by dividing the total OR cost divided by work hours minus material costs.<sup>18</sup> The article describes a larger private hospital loss of \$1,700 to \$2,025 per case cancellation.<sup>18</sup> Therefore, a reduction of 17 cancellations in the postimplementation phase of this project amounted to an estimated cost savings of \$28,900 to \$34,425 in this 3-month period. Cost-impacting factors to consider include resources involved in rescheduling cases and costs of resterilizing and cleaning multiuse equipment that was opened and unused because of case cancellation, among other confounding factors, which could overestimate or underestimate costs. Cost was not a major outcome measure for this project, yet this initiative offers potential cost savings and supports further initiatives to reduce preventable surgical cancellations.

### **Limitations**

All preoperative nursing staff were responsible for documenting the reasons for DOS cancellations in the EHR. The RNs document the reason for cancellation in a free-text box within the EHR. This could be viewed as a potential limitation because of the lack of documentation consistency or potential for omission of detail for each cancellation reason. This may limit the ability to determine the root cause of the cancellations and effectively institute

interventions to reduce specific preventable cancellations.

Another identified limitation for this project was the inability to modify the current EHR, because of a hospital contract with a new EHR company, to include check boxes to document additional required information that is not currently included in the preoperative anesthesia assessment. The RNs would be required to enter additionally requested information as free text, which was not intuitive with the current system and would have significantly increased the time required to complete the PAIR. This may have hindered the strength of the results and created frustration among staff. Before implementation of the new EHR, the anesthesia team and preoperative RNs may choose to collaboratively develop a comprehensive preoperative assessment to fit the specific needs of this institution and improve documentation of important components of the PAIRs.

A significant limitation, which may have impacted the strength of PAIR improvements, was the unexpected delay in securing approval for the preoperative anesthesia interview guidelines. Once the educational modules were available to staff, the goal was to simultaneously have the guidelines approved and available for use. The guidelines required approval by the medical executive committee, the nurse practice council, and management. Guideline revisions were necessary before securing approval, which, with meetings limited to a monthly basis, took longer than expected. The preoperative staff also voiced concerns about certain aspects of the guidelines, which had to be discussed among the anesthesia team and subsequent revisions made. A period of 3 months from educational module completion to guidelines availability resulted. This time lapse between education and implementation of the new guidelines impacted the strength of the results. The project team recommends that future initiatives ensure guidelines' approval be obtained before implementing online education.

### **Conclusions**

This process improvement initiative implemented standardized preoperative anesthesia interview guidelines and used online educational modules,

developed by anesthesia providers to provide formal anesthesia education to RNs conducting preoperative interviews, both of which improved the overall perioperative efficiency at this institution. Improvements in the completion of PAIRs, a decrease in unnecessary laboratory testing, and reductions in preventable surgical cancellations were all observed. Overall, these improvements enhanced perioperative efficiency and reduced unnecessary costs for both patients and the hospital system.

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