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Authors

Stone, Alexander
Grant, Michael
Wu, Christopher
et al.

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Enhanced Recovery after Surgery for Colorectal Surgery: A Review of the Economic Implications

Alexander B. Stone, MD[1,2] Michael C. Grant, MD[2] Christopher L. Wu, MD[2] Elizabeth C. Wick, MD[3]

[1] Department of Anesthesiology, Brigham and Womens Hospital, Boston, Massachusetts
[2] Department of Anesthesiology/Critical Care Medicine, The Johns Hopkins Medical Institutions, Baltimore, Maryland
[3] Department of Surgery, The University of California San Francisco Medical Center, San Francisco, California

Address for correspondence Elizabeth C. Wick, MD, Department of Surgery, The University of California San Francisco Medical Center, 513 Parnassus Avenue, Room S549, San Francisco, CA 94143 (e-mail: Elizabeth.wick@ucsf.edu).

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Abstract

Enhanced Recovery After Surgery (ERAS) programs are transdisciplinary, evidence-based perioperative protocols that aim to standardize best practices and increase the value of delivered healthcare. Quality improvement programs such as ERAS for colorectal surgery have been linked to a reduction in rates of hospital-acquired infections (HAIs) including surgical site infection as well as a reduction in overall length of stay. Importantly, to achieve these results, hospitals must commit to fostering transdisciplinary collaboration across surgery, anesthesiology, and nursing, as well as alignment between frontline providers and hospital executives. This requires upfront investment as well as ongoing resource allocation to sustain the program but given the magnitude of the potential impact of a successful ERAS program on multiple domains of quality and safety, the investment will easily reap ongoing rewards. The purpose of this manuscript is to outline implementation and sustainability costs of an ERAS program as well as discuss the potential cost savings related to the program to further inform hospitals considering adoption of this approach to care.

Keywords

- ERAS implementation cost
- cost savings
- ERAS hospital charges

Enhanced Recovery After Surgery (ERAS) programs are transdisciplinary, evidence-based perioperative protocols that aim to standardize best practices and increase the value of delivered healthcare. Quality improvement programs such as ERAS for colorectal surgery have been linked to a reduction in rates of hospital-acquired infections (HAIs) including surgical site infection (SSI) as well as a reduction in overall length of stay (LOS).[1–3] The success of these programs has led to their early adoption in Canada and parts of Europe. However, despite these encouraging results, adoption of ERAS for colorectal surgery has been far slower in the United States.[4]

As the United States redirects its focus toward increasing value to the patient in the healthcare setting, it has become imperative to evaluate the potential costs—the denominator of the value equation—of proposed quality improvement interventions.[5] ERAS programs are complex quality improvement initiatives that rely upon the simultaneous adoption of several process measures across multiple care environments.[6] While a single ERAS intervention executed in isolation may yield incremental results, the net amalgamation of marginal gains leads to measureable improvements in outcomes.[7] In illustration of this point, prior data suggest that higher compliance with ERAS process measures leads to improved outcomes.[8] Certainly, implementation, surveillance, and maintenance of a concerted ERAS program is a potentially arduous endeavor and before hospitals allocate the necessary resources to ensure program success, it is essential to understand their potential economic impact. To that end, the purpose of this review is to synthesize the available evidence for both the economic demands and potential gains of ERAS for colorectal surgery.

Implementation Costs

The implementation costs of ERAS programs have not been widely reported in the literature. Our group has previously

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published a detailed description of the program costs of implementing an ERAS program at a large academic center in the United States.[9] In brief, the majority of ERAS implementation costs were secondary to personnel costs (salary for a full-time project coordinator, addition of an acute pain nurse, and protected time for leaders in surgery and anesthesiology). Personnel costs were twice the sum of the all of the other budgeted expenses (educational materials, equipment, and training costs). A report from New Zealand reported that approximately half of the budget for ERAS was allocated to hiring a temporary ERAS nursing coordinator.[10]

Reports of implementation costs may not be generalizable. The baseline resources that an institution has will likely affect the costs of implementing a surgical pathway and these factors are difficult to quantify. For example, a major recommendation of the ERAS society guidelines is for ERAS programs to provide auditing of clinical outcomes and to make this information available to providers.[11] This is most likely less costly at an academic center, complete with a centralized electronic medical record and on campus data management researchers. No studies have explicitly reported costs of implementing a data management strategy for ERAS, which may due to the fact that all reports of the costs of ERAS implementation costs come from academic centers.[9,10,12]

Program Maintenance Costs

There are two studies that report ERAS maintenance costs. Estimates for yearly program maintenance range from around 80,000 dollars for a program in Canada to 350,000 dollars for a program in the United States.[9,12] Both of these programs employed at least one full-time ERAS coordinator that made up the majority of the yearly budget. The wide range in yearly maintenance costs may be attributable to differences in the salaries in each market and that in the Canadian study; surgeon and anesthesiologist champions did not receive salary support for their role in the ERAS program. The wide difference highlights the point that maintenance costs at an institution may not be widely generalizable.

Synthesis of the Literature on Reduction in Hospital Charges

ERAS for colorectal surgery was arguably the first program of its kind and as a result has been extensively studied within the context of numerous reimbursement models. A majority of articles that report on the economic impact of ERAS programs conclude that ERAS is, in fact, cost saving.[2,9,12–15] A recent meta-analysis of randomized controlled trials concluded that ERAS reduced the total cost for the hospital stay among all included studies (MD = − $639.064; 95% CI: −933.850 to −344.278), an effect that was also shown in the colorectal subgroup (MD = − $1003.790; 95% CI: −$1872.567 to −$135.012; $p = 0.024$) as well.[2] While this latter analysis included the results of only three studies involving colorectal surgery, another recent systematic review of observational studies and randomized controlled trials for colorectal ERAS programs found that 8 of 10 included studies reported significantly reduced hospital costs.[13] These data have led groups to conclude that ERAS has the potential to not only improve quality but significantly reduce costs. This increased value to both the patient and hospital makes it a dominant intervention.

Although encouraging, some of these results must be interpreted in the context of certain limitations. First, the quality of the studies that have reported upon the economic impact of ERAS is generally poor. In the most recent systematic review of the economic impact of ERAS for colorectal surgery, the mean Consensus Health Economic Criteria list (CHEC-list) score was 7.8 out of a maximum of 19, which corresponds to at best a moderate ranking.[16] Second, the studies that report upon economic data for ERAS for colorectal surgery programs report a wide variety of types of economic data. While most studies reported direct hospital costs for each admission, the numbers reported ranged widely (anywhere from $2,000 to $20,000 per procedure),[13] which is most likely a reflection of the variations in reimbursement patterns in different countries as well as differences in specific components of direct hospital costs. While some groups report a breakdown by where costs were accrued,[17,18] other groups report a single total for the total hospital costs.[19–21] At least two published studies attempted to report the indirect costs, which include costs incurred after hospital discharge.[12,22] A group from Canada used surveys to quantify the number of follow-up visits as well as lost caregiver and family productivity.[12] These approaches more than likely extrapolate cost rather than properly quantify it. Another study reported 30-day overall direct hospital costs in an attempt to take into account the potential added charges associated with readmissions to the hospital.[15] While certainly a noble undertaking, this highlights the reality that it remains unclear whether one ought to focus more on index hospitalization or the entirety of the perioperative procedural event. Perhaps most problematic, the implementation costs of the ERAS programs are not consistently reported. To our knowledge, there are three studies which outline the costs of developing and implementing their respective ERAS programs.[9,12,18] Creating a sustainable ERAS program involves a considerable initial investment of both capital and personnel as well as a sustained yearly budget to properly maintain it. The range of these implementation and maintenance costs span from approximately $108,770 to $500,000 per year.[9,12] Expressed differently, this corresponded to $200 to 2,000 dollars per patient.[9,12] Finally, it remains a little unclear who should incur the potential cost savings. An excellent example of this point involved one study that, upon incorporating implementation costs into their evaluation, showed a net benefit to society at large but were unable to show a true cost savings for the institution.[12] Simply stated, each of the various approaches to articulating the economic impact of ERAS for colorectal surgery has approached their evaluation through a different lens, which has prevented experts from coming to consensus on its financial implications.

How ERAS Programs Reduce Hospital Charges

While most studies agree that ERAS programs can reduce cost, there remains debate regarding the chief mechanisms by which these programs accomplish this task. There are likely two primary drivers for ERAS cost savings: (1) decrease in hospital LOS and (2) reduction in rates of perioperative complication.

Hospital Length of Stay

Virtually all ERAS programs for colorectal surgery report a decrease in the index hospitalization LOS.[1,2] Perhaps the most obvious mechanism by which ERAS programs reduce costs is through reducing the amount of resources allocated to patients by discharging them earlier. Some calculations indicate that an individual hospital saves approximately $2,000 per day LOS reduction.[15] These estimates are derived by simply dividing the reduction in hospital costs by the reduction in LOS. Some argue that ERAS programs merely shift the burden of costs from the hospital to the consumer and caretakers either in the home, rehabilitation center, or within the community.[23] Unfortunately, this assertion has not been well studied and the few studies that report indirect costs show that ERAS programs actually reduce healthcare costs to the community.[12] In addition, certain studies have shown that readmission rates are not appreciably impacted by ERAS programs and therefore economic models may need to be expanded to incorporate the entire postoperative phase associated with a single colorectal surgical encounter rather than be limited to the index hospitalization alone. It is possible that the gains associated with reduction in LOS are not as substantive when accounting for subsequent readmission LOS data.

There are several other limitations to this mechanism of cost savings. First, the cost of a single hospital day is not consistent throughout a hospitalization. Studies have shown that the costs occurred at the start of a hospitalization are significantly higher than those later on and reduction of the last day of a hospital stay may not have nearly the same impact on the overall expense.[24] The majority of the costs associated with surgical wards—particularly those at the end of a surgical hospitalization period—are derived from nursing and personnel costs. While it may be possible to immediately occupy open beds at high-volume centers that operate at full surgical capacity, it may not be possible to apply this same framework to lower volume centers. While in theory staff wages are variable costs, they function as fixed costs in the short term. As a result, it is not feasible to adjust the amount of nursing and staff coverage to match the reduction in LOS over the short timeframe associated with these studies. As a result, no clear picture is provided to adequately account for several variables associated with reductions in LOS.

Reduction in Perioperative Complications

Another mechanism by which ERAS programs reduce costs is through the reduction of perioperative complications. Colorectal surgery patients are, by both the nature of their surgical indication (i.e., cancer, bowel obstruction, inflammatory bowel disease) and patient comorbidity (i.e., elderly, poor nutritional status, deconditioning), at high risk for surgical complications. Although less well studied than hospital LOS, numerous groups have shown ERAS programs reduce both surgical complications and a recent meta-analysis concluded that ERAS was associated with a reduction in HAIs, including surgical site, pulmonary, and urinary tract infections. Surgical complications and HAIs are expensive, with conservative estimates of approximately $10,000 per event depending on the severity of the complication.[25] It would be appropriate to expect that prevention of such resource-intensive events would lead to reduction in hospital expenses as well.

Unfortunately, not all studies that report a reduction in hospital direct costs are able to demonstrate a statistically significant reduction in rates of surgical complication.[13] This may be a reflection of the fact that most ERAS studies are small (<100 patients) and are likely underpowered to detect differences in surgical complications.[2] In addition, linking overall hospital expenses to individual surgical complications is problematic given their varied level of severity and impact upon hospital resources and personnel. Additionally, financial models associated with such an expensive event as surgical complications may serve to magnify the overall impact of a nonstatistically significant change in complication rate shown in the smaller studies. In summary, much larger prospective trials are necessary to better articulate the potential impact of reduction in surgical complication upon the overall ERAS economic model.

Impact of Economic Evaluations on ERAS Adoption

A compelling economic argument can increase the efficacy of ERAS program implementation. To ensure success and program durability, ERAS programs require a significant initial investment of resources—be it capital, leadership, and time—ranging from frontline providers and ancillary staff up to the level of hospital executives. Multiple U.S.-based ERAS groups have stated that "gaining buy-in" from hospital leadership is an essential element for ERAS program adoption.[26–28] Promotion of an ERAS economic model remains a challenge due to the differences in payer structure and institutional practices, which make it infeasible to apply an economic analysis from one hospital to another. Development of a small pilot ERAS project, extraction and analysis of local data on the economic effect, and extrapolation to an entire surgical cohort are more likely to facilitate hospital executive support and resources for larger ERAS programs.[27–29]

Certainly, changes in the political climate, state-based reimbursement practices, hospital and system-level payer mixes, and insurer contracts may serve to make ERAS for colorectal surgery programs more or less appealing. However, ERAS programs have the potential to provide more

consistent healthcare, reduction in LOS and complication rates, and improve the value of the patient care experience. In an era where the healthcare sector is shifting from fee-for-service to pay-for-performance, care that extracts the greatest value will be further targeted. Payers are increasingly experimenting with bundled payment strategies that reimburse episodes of care. Hospital systems with established ERAS programs stand to benefit most in this arena.[30] In addition, payers are levying penalties and withholding reimbursement from hospitals when patients suffer complications that are deemed otherwise preventable. This only reasserts the opportunity a concerted ERAS program may provide.

Conclusion

Based on the available data, ERAS programs have been shown to improve outcomes while leading to healthcare cost savings. Although we are only in the early stages of formally evaluating the economic impact of ERAS initiatives, even conservative models have repeatedly supported the implementation and maintenance of ERAS programs for benefit not only to the patient but to the hospital bottom line. Further high-quality economic studies are necessary and these comprehensive evaluations likely facilitate more widespread adoption of ERAS programs in the United States.

Conflict of Interest
None declared.

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