

Strategies for Cost Optimization in Minimally Invasive Gynecologic Surgery

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ABSTRACT

Background: Cost and quality are important, complex, and intertwined surgical outcomes. Evidence suggests that major cost drivers include operating room time, length of stay, re-admission, surgical complications, and quality of pre-operative and operative care in general. Our practices shape both costs and quality of gynecologic surgery. Various factors are explored in this review article to present and identify ways to implement cost-effective change that also improve quality of patient care.

Database: We searched MEDLINE and PubMed databases for relevant articles.

Discussion: Clinical preferences and decisions, surgeon experience, trainee education, and defensive medicine can influence cost. In addition, an incongruent physician-administration relationship may impact decisions across the healthcare system. The accelerating adoption of minimally invasive surgery, particularly the robotic approach, presents both an opportunity and a challenge. An example of practices that improve outcomes, patient satisfaction, and cut cost is pre-operative optimization, enhanced recovery after surgery, and the growing adoption of outpatient hysterectomy. The identification of cost-drivers and finding strategies to improve them would simultaneously improve quality and patient outcomes while

reducing costs in minimally invasive gynecologic surgery.

Key Words: Cost, ERAS, Healthcare, Minimally invasive surgery, Litigation, Quality.

INTRODUCTION

The United States has the highest healthcare spending per capita, ranging from 50% to 200% more than comparable developed countries.¹ The value of healthcare defined with simple mathematics is quality divided by its cost (Value = Quality/Cost).² Therefore, a healthcare system with an average quality and higher cost can have a substantially lower value. In many situations, higher costs correlate with inefficient resource utilization without an increase in the quality of care. Alternatively, being conscientious of cost does not necessarily mean compromising patient care.³ Quality and cost are the products of healthcare processes, practices, and decisions. It is likely that many physicians understand the importance of cost and intentionally improving quality but may also be less equipped to navigate this in clinical practice. The aim of this review is to elucidate minimally invasive gynecologic surgery (MIGS) relevant cost drivers and cost-containment strategies to ultimately improve clinical practice (**Figure 1**).

DYNAMICS OF MINIMALLY INVASIVE GYNECOLOGIC SURGERY COSTS

Facility and Professional Fees

Services provided in standalone offices receive one bill that includes both the provider (professional) fee, services, and supplies needed. On the other hand, services provided by hospitals such as in outpatient offices on the hospital premises, can get two separate bills for both professional and facility (hospital) services. Thus, the same outpatient procedure can have different billing processes and different charges, depending on whether it is performed in a standalone office (sometimes called unregulated space) or a hospital-based office (sometimes called

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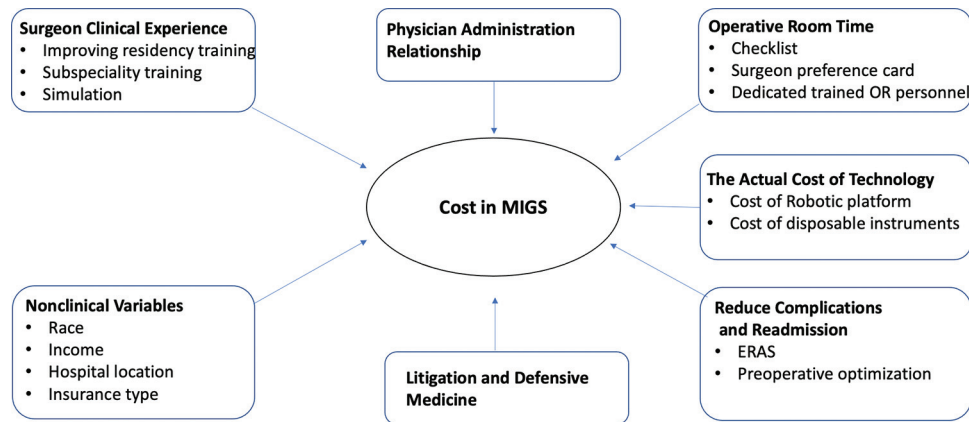


Figure 1. Cost drivers in minimally invasive gynecologic surgery.

regulated space).⁴ With an increase in the number of offices owned by hospitals, patients may end up paying more due to the added facility fee but without utilizing the facility itself.⁴ Out-of-pocket ancillary co-insurance payment contributes to about 20%–30% of the facility fee.⁴ Increasing the awareness of these “hidden” costs is the first step to reducing unnecessary costs in facility-related fees. This concept is derived from policies promoted by the American College of Physicians but may be applied to our surgical specialty.⁴

The Trend Toward Minimally Invasive Hysterectomy

There is an increased trend of the laparoscopic hysterectomy approach from the total abdominal hysterectomy.^{5,6} The American College of Obstetricians and Gynecologists (ACOG) emphasizes that vaginal hysterectomy is the preferred method of minimally invasive hysterectomy approaches due to its cost-effectiveness without compromising patient outcomes.⁷ ACOG recommendations were derived from studies during the 1990s and early 2000s, which is less representative of more recent considerations when choosing the type of minimally invasive hysterectomy. With the introduction of robotic surgery, the abdominal route of hysterectomy has declined.⁶

Analysis of data from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample (HCUP-NIS) database between January 1, 2003 and December 31, 2010 showed that laparoscopic hysterectomies increased from 11% to 29%, which may be an underestimation when considering outpatient laparoscopic hysterectomies.⁵ In addition, one analysis reported that the total abdominal hysterectomy was the most common route of hysterectomy

until the year 2010. The trend of total abdominal hysterectomy to total laparoscopic hysterectomies may also differ depending on the current procedural terminology codes used as well as the practice setting. More recently, the National Surgical Quality Improvement Program (NSQIP) database showed a substantial increase in total laparoscopic hysterectomy from 12% to 68% and a decrease in total vaginal hysterectomy (TVH) from 51% to 13% out of all minimally invasive hysterectomies between January 1, 2008 and December 31, 2018.⁶

The change in route of hysterectomy is not a uniform change when considering social disparities in gynecologic surgery. A cross-sectional study of 725,050 patients undergoing hysterectomy found that robotic hysterectomy was significantly less available to rural hospitals, Black women, and publicly insured or uninsured women.^{8,9} Moreover, access to minimally invasive hysterectomy is influenced by physician expertise and equipment availability.⁸ Lack of resources with the decreasing numbers of TVH may further predispose patients to the abdominal approach, which is less favorable both in the aspect of patient outcomes as well as cost when compared to minimally invasive techniques.⁸

Rising MIGS Costs

Hysterectomy is the most common gynecological surgery, with about 600,000 performed every year.¹⁰ The increasing use of robotics in benign gynecology, ranked high compared to other specialties, reached a total of about 252,000 cases in 2017.¹¹ With the increased numbers of minimally invasive hysterectomies, physicians must be aware of inadvertent increases in cost. Robotic surgery has become an attractive edge over conventional

laparoscopy due to better visualization with 3-dimensional technology, improved surgeon ergonomics, elimination of the fulcrum effect, and articulating endowrist instruments that increase the degree of movement and dexterity.^{10,12} Whether these technical advantages improve the quality of care is debatable. Several studies did not show a significant difference in safety, efficacy, or improved patient outcomes in robotic hysterectomy compared with conventional laparoscopy.^{13–15}

Higher cost is evident in robotic surgery compared to laparoscopic surgery, according to a cost model analysis which included hysterectomies for benign conditions, sacrocolpopexy, and myomectomy.¹¹ According to some studies, the cost of robotic surgery is estimated to be \$2000 to \$3000 higher than laparoscopy.^{10,16} Initial studies supporting the nonsuperiority of robotics over laparoscopy involved high-volume surgeons who were well-trained in laparoscopic surgeries.¹⁷ Evaluating the cost effectiveness of robotic surgery is challenging because there are multiple components such as the initial purchase, ongoing maintenance, cost of instruments, and investing in training for operating room personnel.¹⁸ According to a randomized control study in Sweden, the robotic approach was shown to be more cost effective when compared to laparoscopic surgery when performed by experienced and high volume surgeons.¹⁸ There are several important limitations in this study. The results are not generalizable based on the analysis which only included high-volume surgeons and considered the cost of the robotic equipment as a pre-existing investment without the original cost and regular maintenance expenses. One major challenge present in cost analyses is the various confounders and heterogeneity among studies available. Defining what is included in cost analyses is difficult to standardize.¹⁰ Other factors are indirectly related such as time needed off work and other nonhealthcare related costs.¹⁰

The Impact of Surgical and Simulation Training

Residency programs and credentialing organizations in the U.S. have emphasized the importance of proficiency in minimally invasive gynecologic surgery. Some programs have reported a reduction in gynecologic surgery volume for trainees.¹⁹ Improving residency and fellowship training is a key element in providing high quality and cost-effective healthcare as well as training competent and capable physicians. The analysis of two surveys evaluating the preparedness of OB/GYN residents for fellowship revealed that incoming fellows are perceived by their

program directors to be unprepared for subspecialty training.^{20,21} Out of 1,187 respondents, 79.4% felt they can complete a vaginal hysterectomy compared with 92.5% who reported the ability to complete a laparoscopic hysterectomy. The confidence of trainees regarding complex procedures greatly improved when training involved a MIGS fellowship rotation.²² Whether the four-year OB/GYN residency provides enough surgical volume has come into question. There is a well-established positive relationship between surgical volume and patient outcomes.²³ Fellowship-trained MIGS specialists perform more complex hysterectomies with shorter operative times with no significant differences in complications and are more cost-effective as a result.²⁴ However, there is a lack of data comparing this to high-volume surgeons who have not completed subspecialty training.

Whether the surgeon chooses a TVH can depend on the surgeon's comfort and skill level.¹⁰ The Accreditation Council for Graduate Medical Education requires a minimum of 15 TVH out of a total of 70 minimally invasive hysterectomies.²⁵ The small proportion of required TVH cases compared with the total minimally invasive hysterectomies created the potential for potentially choosing laparoscopic routes over vaginal hysterectomy in future practice.

Simulation training is valuable and should be incorporated in residency training. Although studies are limited, there is evidence demonstrating increased surgical proficiency correlates with better surgical outcomes. For example, surgical simulation reduces operative time and blood loss as well as length of postoperative hospital stay. Whether these benefits in outcomes improve costs is an important area to explore in future studies.^{26,27}

The Impact of Litigation and Defensive Medicine

The impact of litigation costs, malpractice insurance and defensive medicine significantly contribute to the cost of healthcare in the United States. The U.S. Department of Health and Human Services reported the cost of malpractice insurance was estimated to be about 6.3 billion in 2002. Defensive medicine contributed an additional 60–108 billion dollars.²⁸ According to an ACOG survey in 2015, fear of litigation influenced 50% of practicing OB/GYN physicians to change their practice.²⁹

In another study, 85% of OB/GYN physicians were involved in one or more lawsuits during their career.³⁰ Surgical complications made up 42% of all claims and 27% of all gynecological claims were related to

hysterectomy.³¹ In an attempt to minimize litigation, 20% of physicians reduced their gynecologic surgical procedures, while 8% stopped performing major gynecologic procedures at all.²⁹ Lawsuits that follow surgical complications include inadvertent injury, lack of informed consent, and delay in diagnosing postoperative complications.^{30,32} An estimated amount paid by OB/GYN's were \$300,000 and \$400,000, with 6% of "payouts" reaching above 1 million dollars.³⁰

Adequate training, obtaining informed consent and being vigilant is paramount to the learning process for surgical care; however, there is room for growth in litigation training.²⁵ Half of graduating residents receive no formal training in risk management when it comes to medical liability, yet more than 20% of residents are already involved in a lawsuit by graduation.²⁵ According to a nationwide survey of residency program directors in 2005, the average number of medicolegal didactic sessions for residents is only four per year.²⁵ This did not improve after 15 years according to another survey in 2020. Reported results showed that 67% of graduated residents believed they did not have adequate exposure to medicolegal topics and 19% were unsure.³³ Educating trainees on navigating the medical legal system will better prepare physicians when faced with litigation.

Data on the impact of defensive medicine in gynecologic surgery costs is limited in the literature. Defensive medicine is also challenging to define due to its subjectiveness but has been investigated through general physician surveys and surveying practices in high litigation areas.³⁴ In their findings, obstetricians and gynecologists reported avoiding certain high-risk procedures, opted for referral to subspecialty care as well as avoiding performing gynecologic surgery. The article also addresses the potential for increased quality of care through subspecialty referrals while unnecessary diagnostic imaging may contribute to increased healthcare costs.

Gap Between Surgeons and Administrators

Healthcare is evolving and administrators possess a major role in managing healthcare delivery.³⁵ The number of administrators increased by 3200% as opposed to the 150% increase in physicians between 1975 and 2010.³⁵ As a result, new policies and regulations ultimately contribute to physician emotional exhaustion and burnout.³⁵ Generally, there are differences in the way these two entities operate and navigate the healthcare system. There are disputes over goals of care or a "blame game" between the two groups.³⁶ Physicians criticize the core values of

the administrative team as being mostly profit-oriented, while administration blames the physician for misusing resources.³⁶

PROPOSED COST CONTAINMENT STRATEGIES

Reducing Operative Time, Length of Stay, Complications, and Readmissions

Operative time, length of hospital stays, re-admission, and surgical complications are some contributors to overall surgical cost. With regard to operative time, it is important to consider the length of time added to the procedure during the initial patient preparation of the case, specifically with robotic procedures.³⁷ Several studies showed that a well-trained, dedicated team can reduce the time needed for docking, undocking, and robot troubleshooting issues, which consequently reduces the operating room (OR) time and overall cost.^{10,32} Reusable sealing devices showed comparable efficacy, operating time, and safety when compared to more costly disposable devices.³⁸ Another useful strategy to decrease operative time and reduce cost is through using a surgeon preference card and a pre-operative checklist. One study found that the involvement of surgeons in reviewing preference cards may reduce waste and provide ongoing cost savings by having required instruments available in the OR while removing unnecessary reusable supplies.³⁹

The length of stay is an impactful cost-driver. Same-day discharge has been implemented in more recent years with minimally invasive hysterectomy as a safe means to avoid unnecessary hospital admissions that increase cost and decrease patient satisfaction.⁴⁰ Some factors can be modified to increase the same day discharges which eliminate the cost of the hospital stay and decrease the overall hospital costs.⁴¹ Looking specifically at robotic hysterectomy, Borahay et al. found that outpatient hysterectomy can be significantly cost-effective for the institution investing in the robotic surgery platform.⁴⁰ On a larger scale, a systematic review and meta-analysis of eight studies found that outpatient hysterectomy had a low overall re-admission and complication rate. Further research is needed due to effects of selection bias recognized in these studies.⁴²

Postoperative complications occur in 6%–7% of surgeries and can increase the cost by a median of \$11,626 per event.¹⁰ Societal factors such as lost wages, employer cost, and the need for a caretaker at home are challenging to

measure, but also raise the costs of surgery.¹¹ Pre-operative optimization (i.e., smoking cessation, glycemic control, pain control, medications, and nutrition) will result in significant cost reduction by decreasing complications and improving outcomes.⁴³ Implementation of the “Enhanced Recovery After Surgery” has a significant impact on cost reduction.⁴⁴ This evidence-based, multimodal approach considers pre-operative factors and optimizes intraoperative and postoperative care resulting in decreased length of stay, less blood loss, decreased need for analgesia, faster recovery of bowel function, and higher patient satisfaction.^{44,45}

Optimizing Surgical Training

It is well-established that experienced surgeons with higher case volumes have better patient outcomes and are more cost-effective than their counterparts.^{10,24} Different approaches have been proposed to improve residency training and refine surgical skills. Adequate surgical training that prepares physicians effectively in all minimally invasive approaches will eventually reduce the surgeon preference that affects the choice of surgical route. Simulation training has a positive impact on OB/GYN resident surgical performance and reduces operation time.^{46,47} However, a standardized simulation training curriculum with competency parameters designed to prepare trainees for the operating room has yet to be established.⁴⁷ The first national summit on women’s health proposed different models aiming to redefine the OB/GYN graduate medical education.⁴⁸ The concept of tracking is implemented in the Cleveland Clinic residency program, where 30 weeks of focused training are dedicated to the subspecialty of interest.⁴⁸ Advantages of tracking include graduates exceeding the minimum case numbers and having a greater sense of competency. However, a drawback is that the clinical areas without an assigned resident may be more demanding on inpatient providers, midwives, and advanced practitioners.⁴⁸ There are benefits to increased surgical volume with fellowship training or with increased volume in residency. There are multiple studies in the literature supporting the benefits of higher surgical volume and patient outcomes as well as cost.²³

Improving the Physicians-Administrators Communication

The first step toward solving the incongruent relationship between physicians and administrators is implementing ways to empathize with each other. Formal training in business education has not always been integrated into

medical education. Combined MBA/MD programs are now offered in more than 50% of medical schools.³⁵ It would be invaluable to receive additional education in hospital operations, policy, and finance during all levels of training.³⁶ This background knowledge may provide physicians with the means to fully understand the roles of administrators. For administrators, clinical shadowing of physicians is a proposed method for further understanding direct clinical roles in addition to the system-wide management of medicine.³⁵ Cultivating a new culture where there is a common purpose between physicians and healthcare leadership would improve patient outcomes and care.⁴⁹

Hospital quality scores are 25% higher in physician-led hospitals than in manager-led hospitals according to one study when looking at structure, processes, and outcomes.⁵⁰ The key is not to emphasize that only physicians can lead physicians, but rather an open understanding and insight can create more synchronicity in the roles of administrators and physicians.

Nonclinical Training is Essential

Clinical training is the primary focus during residency and fellowship, while learning to manage a practice is secondary. Understanding billing processes, costs, and litigation would translate to providing conscientious as well as cost-effective health services. Simple education tools can produce a profound impact. A study investigating a cost-awareness intervention for gynecologists involving posters in the operating room led to a significant decrease in the use of disposable surgical items per procedure.⁵¹ A simple understanding of limiting waste and strategies that are easy to implement may introduce more cost-effective methods.

CONCLUSION

Cost in minimally invasive gynecology is a complex, multilayered process and many physicians have limited knowledge of its various constituents. Improving the quality of care should include reducing unnecessary costs; however, the relationship of cost and quality is also inadequately studied. Advances in technology specifically in gynecologic surgery instruments and robotic surgery are ongoing. The shorter learning curve in robotic surgery will influence trainees and shift practices among attending physicians as opposed to other minimally invasive approaches. Simulation training, remodeling resident gynecologic training, and increasing the number of

minimally invasive fellowships are strategies of interest. The optimal treatment should be available to all patients, regardless of hospital location, race, income, insurance, or lack thereof. Surgeons should choose the safest, most economical, and minimally invasive route, to allow for both the shortest possible hospital stay and reduce readmission rates. In addition, bridging the role of physicians and administrators creates a more unified healthcare system. It is of paramount importance that physicians continue to be diligent in reducing costs at their institutions without compromising patient quality. We believe that despite the studies needed to further understand this area of medicine, some of our strategies mentioned create attainable goals.

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