



# Enhanced Recovery After Surgery: A Paradigm Shift in Perioperative Care

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## Introduction

Surgery involves a deliberate injury to the body. It is most often performed with the aim to remove a disease such as a cancer or inflammatory process (Crohn's) or to repair tissue that has become broken or damaged (hernia repair) or surgery following an accident. Surgery is one of the most utilized treatments worldwide, with an estimated 300 million major operations performed yearly [1]. Surgery can in some cases be regarded as a dangerous treatment—25% of all patients undergoing surgery will have a complication, and a significant number will die as a result.

Over the years, surgery has become increasingly complex with incorporation of highly developed techniques involving computing and advanced visualization support, which has resulted in improvements in surgical precision. Today, high-resolution screens used to enlarge and improve vision at the site of the operation are available and are commonly used for most operations that only a few decades ago were done under direct vision or at best magnifying glasses. Minimally invasive techniques and robotics have made precision surgery a daily practice in many hospitals around the world. In parallel, anesthesia has developed with advanced detailed monitoring devices controlling all vital signs, allowing for better control of pain, depth of anesthesia, relaxation, control of vital organ function, and fluid balance. New drugs allow for return to lucidity almost instantly after anesthesia, and better pain management without side effects supports very rapid return to mobilization and function. These medical and technical advances have allowed for a dramatic change in status of the surgical patient in the postoperative period, allowing for better recovery. This, alongside therapeutic improvements for cancer patients and medicine in general, has

allowed for fewer complications after surgery and better overall survival in both the short and long term.

With the development of improved techniques and practice in the operating room, the needs of the postoperative patient have changed, and this has impacted nursing. At the same time, nursing has developed into a science that is evolving and complementing the more classical medical sciences in surgery and anesthesia. Nurses take on new roles and missions and advance many of the elements in the care of the patients. The same is true for nutrition care, where dietitians are becoming more and more involved in the care of the surgical patient. The realization that the stress responses activated by injury and surgery (e.g., the metabolic response) play a key role for the development of complications and delaying recovery after surgery has highlighted the need for management of such responses in the surgical patient [2]. Nutrition plays a key part in this process. While it was not long ago that patients were ordered nil per os (NPO) and strict bed rest for days after surgery, today the roles of nutrition and physical activity have come into focus. With the concept of pre-habilitation, the combination of physical training, protein-supplemented nutrition, and mental preparation has shown to impact preoperative physical capacity in a way that facilitates recovery after surgery. With this concept, the important role of the physiotherapist has been raised.

Modern technology and development of society have also influenced surgery in a different way. The growing availability of information and exchange of information has helped build the knowledge of surgery and anesthesia practice and availability around the globe. This has increased the pressure for more high-quality surgery in most countries around the world. While at different levels in different countries and regions, the pressure on surgery and healthcare in general is growing. There is a huge unmet need for surgery globally, but this is very unevenly distributed. In all societies the cost of healthcare is rising, in part because of an increasingly older population, but also because of new inventions, medications, and improvements that allow better care and

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increased chance for cure. Many of these changes, however, come with a higher cost. Thus, there is a continuous struggle to deliver more and better care, but at a lower price (or at least not a higher price).

Despite the short summaries described above of some of the more prominent developments in recent years in the care of the surgical patient, overall there is still a very slow movement toward the use of new proven methods that are better than many old traditions still in use. In a world where communication has become very cheap, modern Web-based information is spread at an unprecedented speed, and where many professions change very rapidly, surgery and anesthesia and perhaps medicine in general are slow to adopt new treatments and ways to address the care of the surgical patient. The same doctors, nurses, and allied healthcare staff who change the operating systems on their phones within minutes or, if slow, in days will not change their practice in surgery for 15 or more years. Fast-track surgery was first published as a concept in 1994 by Engelman and colleagues [3], and shortly thereafter remarkable results in recovery time were published by Kehlet and colleagues in 1995 and 1999 [4, 5]. The Enhanced Recovery After Surgery (ERAS) project was initiated in the year 2000 [6], and since then there has been an exponential development in this field with more than 600 publications registered in PubMed in 2018 alone for ERAS (Fig. 1.1). So, the knowledge has been around for a long time, yet the use of these principles is far from daily practice around the world. ERAS practice is still limited to key opinion leaders and early adopters. This becomes evident when data on length of stay from different countries are reviewed. These national data usually reveal average postoperative stays that are longer compared to what is reported when employing ERAS principles—often by 2–3 days or more. While a good ERAS program for colorectal surgery will result in recovery times that allow the patient to be perfectly fit to leave the hospital in 2–4 days, national averages for the same operations are often 6–10 days (in extreme cases 12–14 days). So, the million-dollar question

is: Why is this so? There are several explanations for this, and in the following, the main ones will be highlighted.

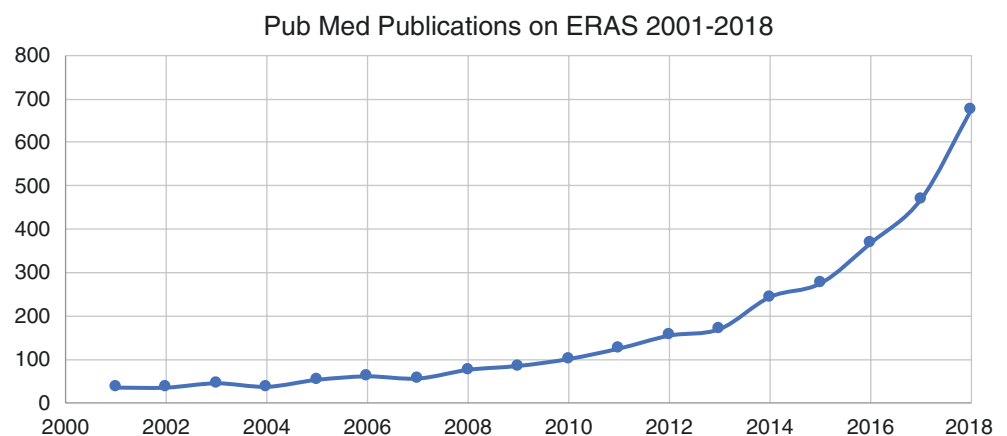
## Effect of Specialization

Performing good surgery, as always, remains a team-based activity between surgery and anesthesia in the operating room. As specialization is growing in surgery and anesthesia, there is a risk that they grow further and further apart. As specialties become more advanced, the harder it is for one to get the insights of the other. Yet, when improvements are made, they cannot work in isolation but must fit the overall care pathway; this creates an even greater need to work more closely together to make sure the improvements harmonize. This is obvious when reading most of the research published in the two specialties. A paper in anesthesia will describe the anesthesia in minute details and report on outcomes after the patient “was operated on.” Many surgical papers will give the details of the operations while the patient “had anesthesia” and report on the same outcomes. None of them knows or feels the other may impact the outcomes and fails to take the other into account. Since both surgery (which operation, the technique, blood loss, etc.) and anesthesia (which type and depth of fluid management, temperature control, etc.) all have direct impact on the same recovery measures and outcomes that both are looking for, there is need for communication and continuous collaboration to develop both fields effectively. This is true for research but even more so for daily practice. To improve this situation, the ERAS® Society has published guidelines for publications on ERAS [7]. This is how ERAS and the new ways of working play its vital role.

## Resources for Care

A second limiting factor lies with the available resources in parts of the world. The Lancet Commission on Global Surgery reported that there is a lack of availability of surgery

**Fig. 1.1** Development of PubMed registered publications on Enhanced Recovery After Surgery



in vast parts of the world. The variation in access to care is enormous, not only between different countries [8] but in many cases also within countries [9]. There is a lack of knowledge about surgery since even the most basic data is not available in most countries [10]. Only a relatively small minority of countries can deliver accurate data on mortality after surgery. Despite these shortcomings, much of the ERAS principles can be applied in every unit regardless of resources. Communication, teamwork around practice, harmonization of care pathways, and some basic audit can be achieved everywhere.

## The Role of Individual Doctors

The influence of the individual doctor on care is also a major factor. Reports on how anesthesiologists manage key aspects of care during anesthesia, such as fluids, reveal huge variations. While some may order 2 ml/kg/h for an uncomplicated abdominal procedure, others will give up to 40 ml/kg/h [11]. Since keeping fluid balance is key for outcomes, this alone shows how just one decision can impact the entire outcome [12, 13]. For surgeons, reports on outcomes also show huge variations, but these data are harder to interpret since the outcome may also be influenced by the entire care delivered in different units and different doctors in that unit—not just the operating surgeon alone. In addition, it is very hard for any one doctor to keep track of all the aspects of care by following the literature and the novel developments within their field. Most clinicians are busy managing their daily practice with little time to read literature. Many developments are driven by industry, and many of the technical advances tend to catch much of the attention. Softer changes or improvements have less chance of reaching larger audiences. This is where expert guidelines and consensus statements can play an important role in helping busy clinicians by reviewing and assembling updated knowledge from the literature.

## The Basics of ERAS®

ERAS® is a new way of working. There are a few cornerstones in ERAS® (Table 1.1). The care plan is standardized and covers the entire patient journey from the first meeting with the surgeon to the follow-up visit a month after surgery.

**Table 1.1** The cornerstones of ERAS®

Evidence-based perioperative care
Multidisciplinary and multi-professional approach
Teamwork
Continuous interactive audit and reporting
Data-driven change
Readiness to make the next change

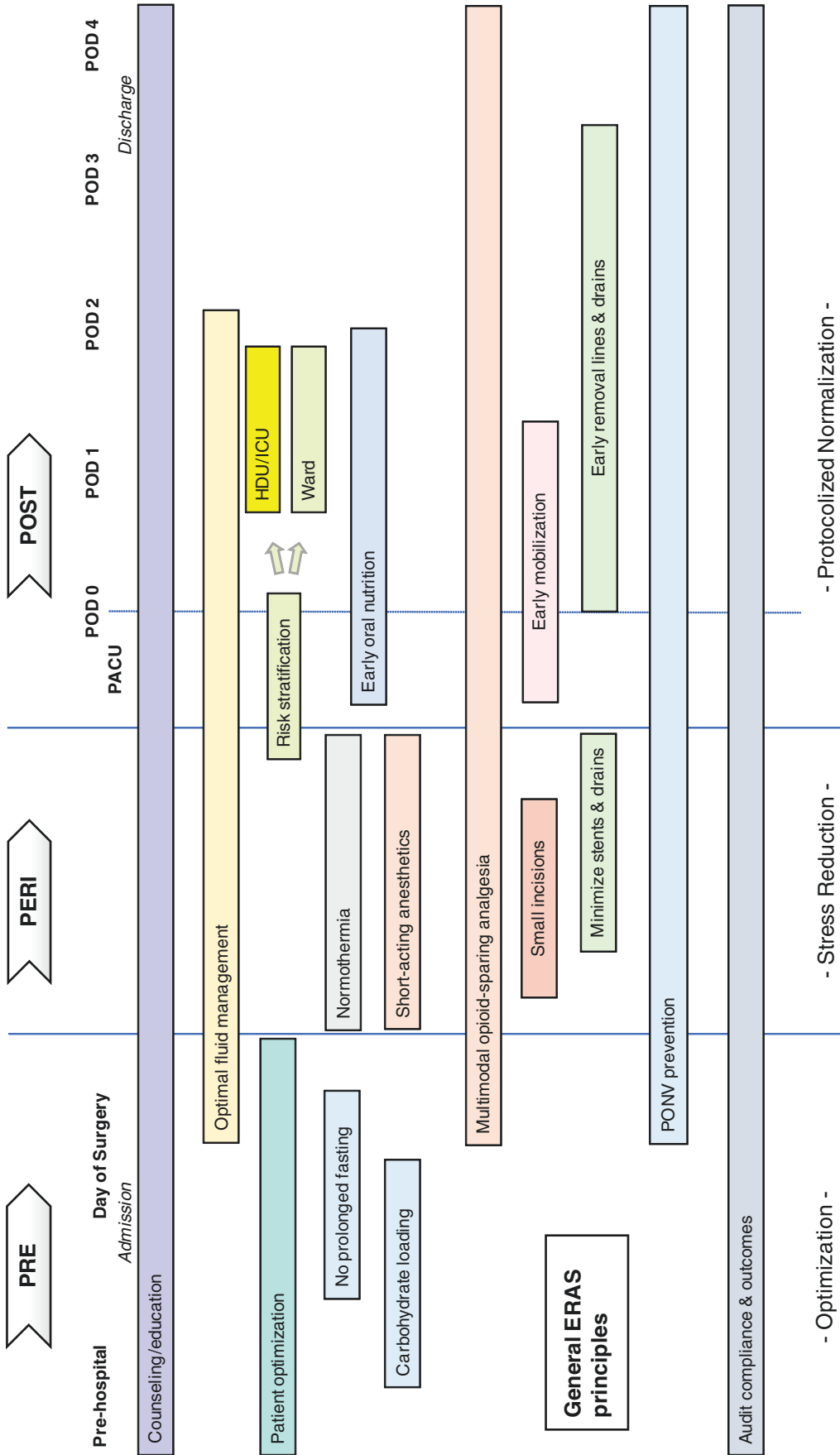
Every care element in the care protocol is evidence based. The evidence base is presented in guidelines developed and reviewed by experts in the field. There is a local ERAS team formed involving all disciplines and professions involved in the patient's care. This team develops and institutes the ERAS principles at the home unit based on the guidelines. Obviously, the ERAS team needs to have the full support of the hospital administration and heads of departments and the support from their colleagues to lead this new way of working. Continuous control of the care process is introduced through enrollment of every consecutive patient into an information technology (IT)-based interactive audit (based on the ERAS® Guidelines) performed by the team on a regular basis. And at the core, ERAS ensures patient involvement in their own care and recovery. Lastly, but not least, ERAS is not a fixed protocol—it is a new way of working. It is about building a readiness to make changes. Surgery and anesthesia care are constantly developing, and that requires continuous updating to run the most modern and best care protocols.

## Evidence-Based Protocols

ERAS® care is based on information that is available in the medical literature. The aim is to find information that can help improve the outcomes for patients undergoing surgery. The focus is on reducing complications and ultimately mortality and supporting the return of normal function and well-being of the patient while also taking cost into account. Academic expert scholars in the field review and grade the knowledge in the medical literature in a systematic way and build an evidence-based guidance for perioperative care. This usually consists of somewhere between 15 and 25 different care items depending on the operation ([www.erassociety.org](http://www.erassociety.org) for updated and free available guidelines on many major surgeries).

Evidence based means that the evidence has been assembled and graded to inform the reader how good the best evidence available is. It does not guarantee that the evidence is of high quality by default and gives no promise that the care item recommended has the highest evidence. All it states is that the level—unavailable, fair, good, or strong—has been assessed and is presented. This grading is coupled with a second assessment, this time on the potential risks of harm by the treatment. Together these two factors are weighed by the experts to give a graded recommendation for each item.

The protocol aims to find all care elements and actions that impact the recovery and outcomes of the patient's care. It starts from the first meeting with the patient and covers the entire journey, ending with a follow-up and audit no sooner than a month after surgery (Fig. 1.2). Every single element—be it screening for anemia or malnutrition and subsequent actions depending on the findings, to the choices of surgical



**Fig. 1.2** General ERAS principles. PACU postanesthesia care unit, HDU high-dependency unit

approach or anesthesia, to care elements such as early feeding—is included as long as they have support in the literature for improving outcomes (see Fig. 1.2).

Are some elements in an ERAS protocol more important than others? When reviewing the patient's journey and the elements that have an impact on outcomes, it quickly becomes evident that all specialties and professions involved in the care of the patient have elements on the list. Some units might think that a certain element is standard of care and argue that only a few of the list of elements in an ERAS® guideline are true elements that need to be in an ERAS protocol. While this is probably true for that unit, the neighboring hospital will most likely not have the exact same view about what is standard of care. For them another set of the elements may apply. When moving between countries and regions, this becomes even more obvious. In fact, there is solid data to show that the variation in care delivery comes down to the individual doctor delivering the care [11]. This variation in care delivery is probably the leading cause of the differences in outcomes between hospitals, countries, and regions.

What has been shown repeatedly is that with increasing use of the care elements recommended by the ERAS® Society Guidelines, outcomes improve substantially. With an increase in compliance from 50% to above 70% with the colorectal protocols, several reports from different units show a reduction in complications by 25–30% and length of stay by several days (30–40%) [14–16]. Depending on the unit and their specific practice, different care elements were found to be the most important. This informs us that it is hard to single out one or two elements from the entire protocol as always being the most important, since the main factor determining this is related to what the local practice is when introducing all elements of the protocol.

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## The ERAS Team

The ERAS team is the core of having ERAS in place in a hospital unit. Because it is a completely new and different way to run care, it has to have the full support of the management/administration, heads of departments, and other decision makers.

All professions and specialties need to be represented on the team to ensure successful implementation of the ERAS protocol. The team should secure that there is at least one member covering every unit engaged in the care of the patient. This includes a surgeon, an anesthesiologist and pain and recovery specialist, nurses, physiotherapists, and dietitians. These specialties form the core ERAS Team for each surgical department and always in collaboration with anesthesia and post-op care. The team collects key data on every patient and meets on a regular basis (weekly or biweekly).

The team makes medical decisions to align their local practices with the guidelines to form a local protocol. Nurses, physician assistants, dietitians, and physiotherapists add their insights and knowledge to help form the practicalities of the local program. This team forms the core of the entire transformation the unit is doing to continuously improve care and to sustain changes and improvements made. The task of the team is to lead ERAS processes and changes in the care of the patients. They do so by getting control of practice and outcomes using audit as a core tool.

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## Audit

In some countries it is mandatory, or at least expected, to report to national or regional quality registries for many surgeries. These registries are very common in northern Europe and in North America. They typically report back to each participating unit on an annual basis. The report typically shows the results for every participating hospital or unit while benchmarking against all others. These results include mortality, complications, practice, patient demographics, and other basic information. Many of them are also used for research with the inclusion of all patients, thus reflecting current practice. Quality registries represent a very important step in the development of national quality improvement projects and have been shown to help improve practice outcomes. The weakness of quality registries is that the data reports what happened at least 1 year ago. In many cases, they are focused on the specialty interest and may miss out on reporting factors that may also influence the outcomes reported (see above surgery and anesthesia). Analysis is done retrospectively, and it remains uncertain if the data entered was done in a prospective or retrospective fashion. Nevertheless, these registries have played a major role in the development of surgery and anesthesia and continue to do so.

From the start, the ERAS® Society aimed to further develop audit by introducing the ERAS® Interactive Audit System (EIAS) [17]. The idea was to develop a system that could be used in a more direct way on a regular weekly basis by allowing almost immediate feedback on outcomes. It also aimed to secure that all processes involved in outcomes are captured and integrated into the analysis. This allows for the clinical ERAS team to understand why they may have certain outcomes and direct actions to change practice where it is failing to improve outcomes. The system is built on the ERAS® Society Guidelines, but it also includes definitions of outcomes based on a number of international societies' definitions and grades severity of the complications using the Clavien classification to tell what level of care was instituted [18]. The system is built to be swift and allow the team to instantly access all their data in an interactive semi-live way.

Since the data collected comprises all elements needed for a quality registry, it serves as an introduction in countries that do not have it. In addition, it also comprises all the elements that are recommended to include in studies of ERAS [19], and as such the system is also built to be used for research.

The ERAS team can use the audit tool to give feedback to every unit involved in the care pathway. This information should typically include the overall outcomes for the patients but also the processes behind the outcomes and the compliance to the guidelines. This helps the team to understand everyone's role in the bigger picture. Many complications occur not only because of just one missed or failed treatment. Instead most complications often arise from several poorly or mis-performed treatments in the care pathway. This demands the actions of several units to maximize the impact to reduce the occurrence of a given complication. This is why the audit needs to cover all care choices that impact outcomes and that it is being measured for every patient in near real time. This allows for better targeted actions and immediate follow up for all involved to see how well they are doing and an effective way of studying the impact of changes made.

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## Reporting

A very important factor in raising the quality of care in complex organizations is to involve as many people as possible. To have the entire staff engaged and working in the same direction will allow for substantial improvements in just about any hospital.

While it may seem trivial, reporting on outcomes and processes to the entire staff in a department of surgery or anesthesia on a regular basis is often a completely new feature. While many units struggle to meet economic needs and secure hospital beds when in shortage—this and other similar problems are the focus—the actual outcomes of the care are less often reported. This is an overlooked way of managing the exact same problems and actually of much higher intrinsic value for the staff performing the care. Many units implementing ERAS have shown that it reduces cost substantially by improving the outcomes of care [20–23].

Still, the experiences from implementation of ERAS in different parts of the world show the same picture: In the teams of doctors and nurses trained for ERAS, just about nobody knows the outcomes of the care delivered in their own unit, and when asked to estimate the results, most are overly optimistic. It is common that the members of the ERAS team starting their training underestimate the complication rates and the length of stay by about 30% or more. When asked about how well they are performing ERAS, the compliance to the guidelines is also substantially lower than what is found when consecutive patients are assembled and

audited. Most units start with a compliance rate of 40–45%. The truth of where the problems and the poorly performed care elements lie demands a strict and continuous audit. What is not measured remains unknown.

This example is even more true for the rest of the staff who are delivering the care on a daily basis. To get the engagement of the staff, data is extremely helpful to make things change for the better. Professionals in healthcare have often chosen this line of work to help their fellow men and women. If there are ways that leadership can support this ambition, it is nearly always most welcomed. Therefore, one of the most important tasks is to report to everyone on a regular basis and to help them see how they can improve the recovery and care of their patients. The ERAS team also should report to management, as this is a way of showing value to them for the investment they have made by giving the team part of their valuable time to run and lead ERAS. Anyone who has experienced the transformation of the patient from a traditional care pathway to ERAS will immediately recognize the difference. This is the best pay-back for all involved, not least the staff on the floor.

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## Readiness to Change

The ERAS team is developed to lead continuous change. Surgery and anesthesia change all the time. And one change in a certain part of an ERAS protocol may result in many more changes to follow. One example is the change from open to minimally invasive surgery. This not only changed anesthesia drastically but also pain management, mobilization, and a range of other care items along the initial ERAS care pathway. It is important to understand that ERAS is not a protocol that is static. On the contrary, ERAS is a way of constantly updating best practice with new knowledge and care plans. Surgical units and departments being prone to change and staying informed of the latest improvements via updated guidelines and that use clever IT systems to audit their practice will improve their chances of always staying and using the best available care.

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## The Next Steps in ERAS

There have been substantial improvements in surgery and anesthesia over the years, and many of them have involved monitoring or technical improvements. ERAS is bringing these improvements together by adding the softer aspects to the table: communication and teamwork. But it also brings in an element of something missing for a long time: basic information needed to run the improvements in care—useful audit for everyday purposes. This has been missing until now.

Because of the economic pressure and an unsustainable rise in cost of healthcare, new ways of sustaining cost or decreasing it and yet developing care have to be found. To date few innovations in surgery can match the cost savings from ERAS. Repeated reports have shown savings of thousands of dollars from implementing ERAS even when taking all investments in personnel and IT and other support into account. This is likely to be an important factor for the continuous growth and spread of ERAS around the world.

Another opportunity that is being developed is the collaboration in large and growing groups of ERAS hospitals to work together in clinical research. By using the platform of the common IT system, a worldwide platform is spreading and allowing for immediate collaborations on various projects. Already a large number of studies have been produced using this system, and more are underway.

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