Cardiac Enhanced Recovery After Surgery: A Guide to Team Building and Successful Implementation

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Enhanced Recovery After Surgery (ERAS) is a bundled approach to perioperative care based upon the philosophy that patients do better when emotional and physiologic stresses are minimized during surgery. The goal of ERAS is to return patients to normal functional status as quickly as possible. Initially designed for patients having colorectal surgery, ERAS programs have now been developed for nearly every surgical subspecialty. Multiple studies examining the effect of ERAS have demonstrated decreased postoperative complications, length of stay, costs, and increased patient and staff satisfaction. Interest in the application of ERAS to cardiac surgery has grown significantly over the last few years. Several core principles transcend all ERAS cardiac programs. Implementation of cardiac ERAS is more than simply the installation of a protocol. ERAS involves a methodical shift in culture, meeting the challenges of initiating and sustaining meaningful organizational change, and pivoting to a patient-centered system of care to optimize speed and completeness of recovery. Herein we detail the crucial team building, education, planning, and processes needed to develop and sustain a successful ERAS cardiac program.

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Appendix B: Example of a Cardiac ERAS Process Dashboard

Process	2019 MTD	2019 YTD	2018 MTD	2018 YTD
Preop Albumin Level				
Preop A1c				
CHO Loading				
NPO <4 Hours				
5M Walk Test				
Delirium Screen				
Pre-Hab Attendance				
SSI Bundle % Adherence				
IntraOp Glucose <180				
Anti-Fibrinolytics				
Sternal Closure Method				
IntraOP MME total				
Postop MME total				
Ambulation TID (POD 1)				
PO Intake POD 0				
Urinary Biomarkers				
D/C MME				
CT Clearance				

CHO, carbohydrate; MME, morphine milligram equivalents; TID, three times daily; PO, by mouth; CT, cardiothoracic

Example performance/compliance dashboard that can reveal the impact of an ERAS program

Central Message

Implementing an Enhanced Recovery After Surgery program for cardiac surgery involves challenges due to the urgency of the procedures as well as the complexity of the perioperative course. In an effort to achieve standard care, reduce the surgical stress response, and improve patient outcomes, ERAS for cardiac surgery is gaining increased attention. However, the need for an organized, methodical implementation process is essential for a successful program.

INTRODUCTION

Enhanced Recovery After Surgery (ERAS) is a bundled approach to perioperative care based upon the philosophy that patients do better when emotional and physiologic stresses are minimized during surgery. The goal of ERAS is to return patients to normal functional status as quickly as possible. Initially designed for patients having colorectal surgery, ERAS programs have now been developed for nearly every surgical subspecialty. Multiple studies examining the effect of ERAS have demonstrated decreased postoperative complications, length of stay, costs, and increased patient and staff satisfaction.[1–6] Interest in the application of ERAS to cardiac surgery has grown significantly over the last few years. Several core principles transcend all ERAS cardiac programs. Implementation of cardiac ERAS is more than simply the installation

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of a protocol. ERAS involves a methodical shift in culture, meeting the challenges of initiating and sustaining meaningful organizational change, and pivoting to a patient-centered system of care to optimize speed and completeness of recovery. Herein we detail the crucial team building, education, planning, and processes needed to develop and sustain a successful ERAS cardiac program.

COMMUNICATING THE CASE FOR CHANGE

Implementing ERAS involves complex change management aimed at fundamental clinical behavior and organizational culture. Gap analysis is a necessary first step in breaking down the silos that often exist in healthcare. This step should include a thorough and objective analysis of program data to identify opportunities for improvement as well as acknowledge areas currently performing at a high standard. Crucial programmatic parameters to evaluate include unnecessary variance in delivery of care, gaps in existing protocols, the approach to patient education, team member knowledge, and local infrastructure. This analysis proves vital when the core team seeks to garner leadership engagement and team building for change prior to implementation. Effectively communicating the need for change is essential when recruiting key stakeholders and leaders who share a common vision.[7] Identifying a few respected clinical leaders to communicate the message to the right people on the frontline can be crucial to starting an ERAS program. Keeping these leaders engaged as champions will move the program through developmental and implementation phases while engendering enthusiasm and feedback from frontline providers.[8] Creation of an ERAS program can be facilitated through the deployment of several specific steps (Appendix A1–4).

TEAM BUILDING

The first step in forming a cardiac ERAS program is alignment of the correct team. A successful team must have shared trust amongst the members and believe in the common goal.[7] There are many types of caregivers that contribute to a successful ERAS effort, and the specific disciplines involved can vary based on local talent, interest, and overall resources. Choosing team members who are enthusiastic, influential, open-minded, pragmatic, and display strong communication skills will facilitate the creation, implementation, and sustainability of an ERAS program.

One constant is the importance of patient involvement and advocacy. Patients can be incorporated as standing members of the team or, more commonly, frequently polled throughout the implementation process to solicit input and feedback. Access to patients can be via digital platforms connecting the team to current patients, volunteers, or via formal patient feedback committees (ie, focus groups) often associated with individual service lines or hospitals.

The professional components of the team should be multidisciplinary. The creation of a large multidisciplinary group involving all cardiac surgery stakeholders is useful for establishing consensus and broad buy-in. Additionally, the creation of a smaller steering committee or core team of ERAS champions is an effective structure for setting goals and maintaining progress. The core team can develop specific care elements and protocols which can then be reviewed and amended by the larger integrated care group.

Suggestions for the core group of ERAS champions may include: registered nurse manager of the cardiac surgical intensive care unit, registered nurse manager of telemetry and/or stepdown, cardiac anesthesiologist, cardiac surgeon, intensivist, cardiac surgery advanced practice provider, physical therapist, clinical pharmacist, director of surgical services, biostatistician or data manager, and information technology specialist. The core team should be limited in number, but large enough to provide a broad swath of perspectives. The exact number or type of people on the team will vary according to local talent and service-line infrastructure. Often the motivation and engagement of the team member is as important as the individual's specific discipline. The core team should be small enough to meet frequently and communicate easily. There are many additional individuals who will contribute to a successful ERAS program, including service line leader, perfusionist, occupational therapist, respiratory therapist, rehab and/or prehab, dietician, clinical educator, social worker, and case manager. The decision to incorporate these individuals should be tailored to the specific needs of the local cardiac surgical service line.

Fostering physician engagement is 1 of the keys to success for any ERAS program. By encouraging peer comparison and outcomes transparency, physicians can measure and manage performance. Celebrating small early successes will promote further efforts to standardize best practice throughout the service line. Physicians need to be engaged leaders with the autonomy to set their own strategy to realize goals. With true ownership and the ability to see the positive impact of ERAS on their patients and the organization, engaged physicians bring energy and enthusiasm to the program.[9]

If resources are available, the designation of a nurse champion or ERAS coordinator can be particularly impactful. Although this resource may not be feasible at the beginning of implementation, early programmatic gains may support the creation of such a position later in program development. At least 1 passionate nurse and physician champion are essential to help disseminate the ERAS culture and tackle barriers.

In addition to all the stakeholders, formal endorsement of the ERAS program from the hospital administration is crucial to underscoring the importance of the effort and gaining widespread collaboration. Hospital administrators may have motivations and concerns that, though indirectly aligned with the principals of ERAS, may seem initially incompatible with your program (ie, hesitant to spend the up-front costs). By accounting for this different perspective, program features that are more likely to generate acceptance and support should be emphasized. Health system administration is a key partner in a

successful and sustainable ERAS program, assisting in procurement of additional resources, mitigating bureaucratic hurdles, and establishing organizational support for additional program development and iterations.[6,8]

TEAM MEMBER EDUCATION

As ERAS represents a new philosophy of care, education within the entire cardiac surgery program is essential. An excellent way to begin this journey is for the core team to attend a regional or national ERAS meeting. Meetings can educate and inspire providers and help crystallize the vision for a local ERAS team. The core team or an ERAS coordinator can then begin the critical task of educating the service line and institution regarding the ERAS philosophy of care. Consider utilizing nurse managers, assistant nurse managers, or nurse champions in a "train the trainer" approach to help disseminate education. Nurses climbing the clinical ladder are often eager to participate in program development and peer education. Engaging front-line providers is helpful in providing peer-to-peer support once the program is underway.

High level education can take place early to help communicate the need for change. However, more comprehensive information, including pathway specifics, should be closer to actual program deployment to ensure retention of the information. Nursing and medical grand rounds, departmental meetings, and smaller group meetings can all be helpful in spreading the concept. In the event of a local "naysayer," or individual practitioner resistant to change, tailored educational materials may be beneficial with individual meetings to discuss concerns and receive feedback. Comprehensive education for nurses and allied health professionals should be done in person, which facilitates gathering feedback and communicating how essential the frontline staff are to the success of an ERAS program. In addition to covering the principles of ERAS and specific local program bundles, always explain the *why* behind ERAS.

Education regarding the need to reduce the surgical stress response and eliminate variability in care to reduce errors and improve patient outcomes are important concepts to reinforce. This is a critical step in creating an ERAS culture. Focusing on the benefit to the patient will help orient team members and garner institutional support. Approach skeptics individually to address questions and concerns. A crucial concept is to understand that ERAS is a philosophy of care, not just a specific protocol. ERAS team member education is an iterative process. A successful education plan includes ongoing structure to accommodate yearly competencies and new hire education. This can be done through the creation of standardized educational materials which disseminate ERAS protocols to the local stakeholders. Educational materials for staff will reinforce ERAS principles as well as local program specifics. Every team member who will impact patient care should receive education. This includes, but may not be limited to nurses, nursing assistants, dietitians, pharmacists, physical therapists, respiratory therapists, perfusionists, advanced practice providers, intensivists, hospitalists, cardiac rehab staff, surgery schedulers, clinic staff, and others. A combination of discussion, presentations, and unit signage can aid initial training and should be available for ongoing reference and updates. Also helpful is the creation of ERAS reference handouts or an intranet online page which includes protocols, checklists, supportive literature, and champion contact information. The use of social media in healthcare is an emerging area which may be well suited for ERAS program socialization and implementation.

ASSESS CURRENT STATUS

In order to develop the ideal ERAS program, the current care model needs to be analyzed in detail. This analysis should occur along 2 main avenues. The first is an analysis of the processes of care. The questions that must be answered include: What is the current state? How well-defined are the processes? How much variability exists and where? Is there a unifying philosophy of care? How cohesive is the team's message along the continuum of care? The second avenue of analysis is an honest assessment of current outcomes, and identification of the greatest opportunities for improvement. For programs in the United States, the Society of Thoracic Surgeons Adult Cardiac Surgery Database provides the best foundation for measuring outcomes. Identification of key metrics where a local program currently underperforms is necessary to direct specific processes to incorporate into program design.

PLANNING

The next important step is to decide which specific ERAS measures and/or processes will comprise the cardiac ERAS program. Though care bundles are traditionally organized into 3 phases of care: preoperative, intraoperative, and postoperative, it may be helpful to consider the surgical journey as "home-to-home." The ERAS team must meet to determine: (1) outcomes on which to focus (ie, informed by review of the current status), (2) targets and/or metrics related to those outcomes, and (3) processes and/or clinical interventions evidenced to meet those metrics. National and international expertise can be leveraged through ERAS meetings and by reviewing the literature. An excellent place to start are the ERAS Cardiac Society's published expert recommendations.[10] The local team should set goals based on established ERAS evidence. Although there are over 25 well-recognized cardiac surgery care bundles, a new program is usually more successful if a modest subset of measures (ie, between 5 and 10), are chosen for initial deployment. The specific bundles chosen will depend on local expertise, resources, and attitudes. Initial care bundles should leverage existing program strengths and be locally achievable.

While a degree of variation is appropriate, certain care measures are considered core to an ERAS program. These include optimal patient education, shortened preoperative *nil per os* times, multimodal opioid-sparing analgesia, and early mobilization. While, other aspects, including prehabilitation, which includes formally optimizing patients from a psychological, nutritional, and physical standpoint, are increasingly well recognized aspects of ERAS, constructing a viable prehabilitation

program may require extensive planning and resources and thus may be best tackled later in ERAS program iteration. Care should be taken to keep pathways relatively straightforward and avoid "over-bundling" interventions. More controversial and complicated care bundles are often better deployed later, when a program is more mature, has built good-will through demonstrated benefits of the initial ERAS efforts, or additional supportive evidence has emerged in the literature.[11] Early ERAS success can be facilitated by choosing a subset of initial care bundles that rank low on the scale for risk, controversy, and cost. In addition, early focus should be on care bundles that are the simplest to integrate into clinical practice, are easy to measure with current record systems, and felt most likely to achieve early positive outcomes.[12,13]

Next the team should decide on which data endpoints best measure the compliance and outcomes related to ERAS interventions. National guidelines suggesting specific data elements that should be tracked for every cardiac ERAS program are currently being developed. Locally tracking the effect of ERAS compliance on outcomes is important. Auditing outcomes such as Society of Thoracic Surgeons (STS) postoperative complications, length of stay, patient satisfaction, staff satisfaction, 300-day readmissions, and direct variable costs will directly track and demonstrate improvements following successful ERAS implementation and compliance. A continuous monthly dashboard of performance and/or compliance with essential elements and outcomes related data endpoints is essential to understand the impact of a new ERAS program.

A successful ERAS program requires clear identification of the ERAS patient from the moment the patient is scheduled for surgery. One common and straightforward approach is to designate all patients undergoing a certain type of surgery to be on the ERAS pathway. Some programs instead designate a subset of patients to be ERAS eligible and this requires a tool to clearly identify these patients to all team members. Utilizing the institution's electronic medical record can be effective to identify ERAS patients and facilitate future data collection. One method is to engage the information technology team to create a check box in the electronic medical record at the time of case posting. Something as simple as an ERAS yes and/or no check box will create a permanent identifier. This identifier must be linked to the patient's ERAS encounter only to avoid all future admissions being labeled as ERAS. Other possible tools include a colored ERAS armband or a labeled sign on the patient's room door. Regardless of the method, the means of identifying the ERAS patient should be included in the team member education.

Although variable, groups can expect planning for a new ERAS program to require between 9–12 months. Unanticipated hurdles can emerge, such as discovery of new stakeholders or unexpected areas of friction within your institution's current status-quo. Attempting to expedite or circumvent critical steps of the implementation will threaten the success of the program. The core team should plan on meeting frequently, typically at a set day and/or time on at least a monthly basis. Critical aspects of planning include setting a timeline for education and deployment, and a plan for tracking and reviewing data to audit the success of the program. Barriers to successful implementation exist at every institution and the team should compile a list of anticipated barriers.

One common barrier to ERAS is existing variation in care with strong personal physician preferences. This can be challenging to address. Some programs have engaged with key physician leaders in their respective disciplines to create and champion key elements. Basing the protocols on the best available evidence helps maintain dispassionate objectivity, focusing the discussion on the patient and away from provider historical preferences. Resist the urge to "piggy-back" new dogma in the name of enhanced recovery.

Financial barriers are also common. One strategy is to avoid high-investment care bundles during initial program deployment. This allows an opportunity to demonstrate to hospital leadership the clinical advantages and potential cost savings from ERAS prior to requesting significant financial resources.[1,8] Another important aspect of the planning phase is to explicitly state the goals of the program such as the specific impact on the processes and outcomes that will be tracked. The goals can be a combination of process goals (ie, fifty percent decrease in opioid use) and outcome goals (ie, decreased complications, length of stay, and improved patient satisfaction). Goal setting is program specific and depends heavily on baseline performance. Setting realistic expectations is helpful when discussing the importance of ERAS with hospital administrators and clinical leaders.

The best planned program will still encounter obstacles in the early phases of deployment. Teams that create formal order sets and specific protocols can often anticipate challenges before they interrupt the new workflow for ERAS. When difficulties with program logistics are encountered, the best response is to listen attentively to the staff, query patients, and be flexible when searching for solutions. It is important to rigorously adhere to core ERAS principles but realize that local conditions may alter the path to achieving ERAS goals. Throughout the process, a list of program barriers can be compiled, which can include logistics as well as individuals. The team should meet regularly to discuss solutions. In addition, the core ERAS team should be highly visible on the units during early deployment to convey commitment and reinforce the value of ERAS.[1]

PATIENT EDUCATION

Making a patient a partner in their own care is 1 of the pillars of a successful ERAS program.[14] Engagement and education for patients regarding their surgical journey should begin with the surgeon. The patient needs to understand the surgeon's support of the ERAS principles and this is the first step in shared decision making. Additional in-depth education should be provided to the patient prior to surgery. This will help allay anxiety for the patient and the family, as well as set reasonable expectations. Clear goals regarding preparation for surgery including alcohol and smoking cessation, diet, moderate

activity, pain expectations, and planning a postoperative support system can provide physiologic and psychologic advantages. Materials for patients can be presented in multiple formats including written, video, and web-based platforms. Several commercial interactive, digital platforms have emerged which can be employed to educate and engage patients throughout their journey.[10,14,15]

AUDIT

One of the most essential, and challenging elements of an ERAS program is monitoring compliance with new care bundles as well as measuring progress with stated outcome goals. Many of our current systems are insufficient to provide timely feedback and may not even measure certain ERAS core metrics. Local information technology resources can be leveraged in collaboration with the clinical expertise of the ERAS team to develop dashboards for regular review. Examples of dashboards are provided (Appendix B, Appendix C). Consider integrating patient reported outcomes into the dashboard. Existing data manager infrastructure used for other cardiovascular registries and databases may also be leveraged to monitoring program compliance.

Teams should strive to provide a venue for soliciting feedback from frontline staff and patients. Regular outcome updates to the healthcare team, administration, patients, and the community can help acknowledge the team's success and identify areas for future focus. This also reinforces the *why* behind ERAS implementation. Continuing to engage the team requires effective and credible communication.[7] Additionally, outcome data can be used to leverage needed resources such as an ERAS Coordinator, additional nursing staff, or capital equipment. Frequent outcomes and process data analysis should be performed by a capable individual.

Efforts to obtain accurate feedback on program performance are crucial to permit continuous process improvement. Currently, multiple groups are working on more useful data tracking for clinical providers in ERAS programs. One important goal is to provide a standard tool for all cardiac ERAS programs to measure and compare results. This will allow effective research and sharing of best practice.[16]

CONCLUSION

Developing and implementing an ERAS program can seem daunting. Not only does the broad perioperative arena present an almost overwhelming list of possible targets and interventions, but its success depends on nonclinical skills such as team building, changing local culture, and navigating the inner politics of each organization. We have provided a conceptual framework to systematically approach the design and implementation of a new ERAS program at an institution. In addition to the ERAS Cardiac Society's published guidelines, the published results from existing cardiac enhanced recovery programs can guide the development of a local program.[1,2,4,6,10] Regardless of the starting-point, the end product is a protocol consisting of standardized essential ERAS cardiac elements which are consistently applied, tracked, benchmarked, and correlated with standard and patient-centered outcomes across international institutions. The goal is to establish an ERAS network from the ground-up, built through multidisciplinary collaboration of evidence-based best practice, and nested in a local culture of patient-centered care. Only then can we definitively demonstrate the potential for ERAS protocols to result in better patient outcomes Appendix A1.

APPENDIX A1. ERAS PROGRAM DEPLOYMENT STEPS: IMPLEMENTATION CHECKLIST

ENHANCED RECOVERY AFTER SURGERY IMPLEMENTATION CHECKLIST	
A. Creating a case for change:	
1. Gap analysis of a service line a. Follow patient through the surgical journey b. Process/value stream mapping c. Teamwork: determine communication gaps between providers in all phases of care	☐
2. Create vision of future pathways a. How will the interdisciplinary teamwork in delivering pathways? b. Look at the evidence and decide which elements to incorporate c. Obtain patient feedback on their experience of surgical case d. Identify clinical stakeholders necessary to make the change e. Recognize what is going well and what needs to change	☐
3. Collect baseline data of service line: a. Process measures i. Existing protocols b. Outcome measures i. Existing dashboards / STS outcomes	
B. Communicate the case for change:	
1. Done by executive sponsor and clinical lead (champion) 2. Communicate all information collected during Step #1 3. Communicate to all internal clinical areas 4. Communication to be consistent 5. Address any and all questions/pushback 6. Clinical Change: All clinical change is vetted through the ERAS Committee with opportunity for input and approval from key stakeholders	☐
C. Building the ERAS team: Include name and contact information	
1. Surgeon Champion(s)	☐
2. Anesthesiologist Champion(s)	☐
3. Nurse Champion(s) / ERAS Coordinator	☐
4. Hospital Administration	☐
5. CRNA(s):	☐
6. Service Line Navigator:	☐
7. Pharmacist:	☐
8. Allied Staff: Physical Therapist, Occupational Therapist, Respiratory Therapist, CAN, Exercise Tech, Nutritionist	☐

(*continued*)

9. Administrative support staff:	☐
10. Case Manager	☐
11. Quality Improvement:	☐
12. Dimensions:	☐
13. Capital Equipment Committee member:	☐
14. Other:	☐
D. Clarify ERAS Committee Roles, Responsibilities, and Goals:	
1. Goals Established:	☐
2. ERAS Committee Meeting Schedule Established: **who owns the meeting invite and agenda development?	☐
3. Committee Chair(s):	☐
4. Protocol Development Team established: **set deadline for protocol completion	☐
5. Patient Education Materials Team established: **set deadline for patient education materials	☐
6. Nursing Education Team established:	☐
7. Order Set Development Team established:	☐
8. ERAS Data Collection Team established:	☐
9. Capital Needs Assessment: Complete and submit **EARLY,** should be minimal	☐
E. Education Planning: Plan to begin when protocol near finalization	
1. All care settings (mandatory: in-person education sessions) *include APP, Residents, RN, CNA, PT, OT, RT, Exercise Tech, Rehab, Pharmacist, Case Manager • Office • Preop Clinic • Preop holding • PACU • OR • ICU • Floor	☐

(*continued*)

2. Anesthesiologist/CRNA education	☐
F. Patient Education Materials	
1. Begin early in process and finalize after program finalization	☐
2. Considerations a. hospital process to approve patient materials b. patient input during development c. different learning styles d. ability to modify materials in future	☐
G. Questions to Consider	
1. All patients or a subset?	☐
2. Who will provide patient education and where?	☐
3. Will message always be the same?	☐
H. Create ERAS dashboard/database	
1. Determine who will collect and report the data	☐
2. Process Metrics – See attached file, Appendix A	☐
3. Outcomes Dashboard – Consolidated, see attached file, Appendix B	☐
I. Other Completion Items	
1. Protocol Checklists in ORs (in binders or on computer desktop)	☐
2. Protocols/Checklists in central location or EHR	☐
J. Implementation Day	
1. Have patient sign marketing release (possible story on hospital intranet)	☐
2. Make sure all MD orders are complete and correct	☐
3. Designated person in care areas, following patient, available for questions/help as needed	☐
4. Celebrate	☐
K. Future Planning	
1. Review outcome and process data – Key!	☐
2. Report data to ERAS Committee and disseminate to all care areas	☐
3. If low compliance, address with nursing leadership AND ask front line staff challenges	☐
4. Review PDSA	☐
5. Plan for expansion of program / further innovation	☐

APPENDIX A2. ERAS PROGRAM DEPLOYMENT STEPS: PROJECT SCHEDULE

Project Schedule		
	Original Plan	Actual Dates
1. Kickoff meeting		
2. Committee formation		
3. Nursing education		
4. Protocol completion		
5. Implementation date		
6.		
7.		
Please explain the reasons behind schedule changes, if any:		

APPENDIX A3. ERAS PROGRAM DEPLOYMENT STEPS: LESSONS LEARNED

Lessons Learned: Please describe lessons learned in each of the categories below. Think about what went well, what went wrong, what you would do differently next time, and how you would advise someone else going through this process.

Project Development Lessons Learned
1. Initial decision-making process and feasibility:
2. Design, stakeholder interaction:
3. Equipment procurement:

APPENDIX A4. ERAS PROGRAM DEPLOYMENT STEPS: CAPITAL NEEDS COST ASSESSMENT

Capital Needs Cost Assessment: Complete and Submit EARLY

Equipment Description	Hospital Unit	Manufacturer	Location of Manufacturer (City/ State/ Zip/ Country)	Quantity	Unit Cost	Total Cost
						$ -
						$ -
						$ -
						$ -
						$ -
Equipment Costs						$ -
Other						$ -
Other						$ -
Other						$ -
Total Cost						$ -

APPENDIX B. EXAMPLE OF A CARDIAC ERAS PROCESS DASHBOARD

Process	2019 MTD	2019 YTD	2018 MTD	2018 YTD
Preop albumin level				
Preop A1c				
CHO loading				
NPO <4 hours				
5M walk test				
Delirium screen				
Pre-Hab attendance				
SSI bundle % adherence				
IntraOp glucose <180				
Antifibrinolytics				
Sternal closure method				
IntraOP MME total				
Postop MME total				
Ambulation TID (POD 1)				
PO intake POD 0				
Urinary biomarkers				
D/C MME				
CT clearance				

CHO, carbohydrate; CT, cardiothoracic; MME, morphine milligram equivalents; PO, by mouth; TID, 3 times daily.

APPENDIX C. EXAMPLE OF AN OUTCOMES DASHBOARD

Outcome	Center	Benchmark	% Change
Mortality %			
Any major morbidity %			
Reoperation %			
Mediastinitis %			
Acute renal failure %			
Prolonged ventilation %			
CVA %			
Readmission %			
Length of stay (LOS)			
Postoperative LOS			
Extubation <6 hours %			
Direct variable costs ($/case)			
Patient satisfaction			
Staff satisfaction (% excellent)			

CVA, cerebral vascular accident.

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