Organizational Culture Changes Result in Improvement in Patient-Centered Outcomes: Implementation of an Integrated Recovery Pathway for Surgical Patients

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BACKGROUND: The goals of quality improvement are to partner with patients and loved ones to end preventable harm, continuously improve patient outcomes and experience, and eliminate waste, yet few programs have successfully worked on of all these in concert.

STUDY DESIGN: We evaluated implementation of a pathway designed to improve patient outcomes, value, and experience in colorectal surgery. The pathway expanded on pre-existing comprehensive unit-based safety program infrastructure and used trust-based accountability models at each level, from senior leaders (chief financial officer and senior vice president for patient safety and quality) to frontline staff. It included preoperative education, mechanical bowel preparation with oral antibiotics, chlorhexidine bathing, multimodal analgesia with thoracic epidurals or transversus abdominus plane blocks, a restricted intravenous fluids protocol, early mobilization, and resumption of oral intake. Eleven months of pre- and post-pathway outcomes, including length of stay (LOS), National Surgical Quality Improvement Program surgical site infection (SSI), venous thromboembolism, and urinary tract infection rates, patient experience, and variable direct costs were compared.

RESULTS: Three hundred ten patients underwent surgery in the baseline period, the mean LOS was 7 days, and the mean SSI rate was 18.8%. There were 330 patients who underwent surgery on the pathway, the LOS was 5 days, and the rate of SSI was 7.3%. Patient experience improved and variable direct costs decreased.

CONCLUSIONS: Our trust-based accountability model, which included both senior hospital leadership and frontline providers, provided an enabling structure to rapidly implement an integrated recovery pathway and quickly improve outcomes, value, and experience of patients undergoing colorectal surgery. The study findings have significant implications for spreading surgical quality improvement work. (J Am Coll Surg 2015;221:669–677. © 2015 by the American College of Surgeons)

Since the Institute of Medicine's report "To Err Is Human" in 2001, intense efforts have been directed to reducing adverse events in hospitalized patients.[1] The Centers for Medicare and Medicaid Services (CMS), along with others, initiated programs focused on eliminating preventable harm, yet results have been mixed, with significant improvement realized in some areas and little in others, including perioperative care.[2] Millions of people suffer the adverse effects of medical errors, including health care-associated infections, medication errors, errors during transitions from one health care setting to another, and loss of dignity and respect.

Although most patients suffer multiple harms, hospitals are addressing preventing 1 harm at a time. Improvement programs should aspire to eliminate all preventable harm

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Abbreviations and Acronyms

CUSP = Comprehensive Unit-Based Safety Program
HCAHPS = Hospital Consumer Assessment of Healthcare Providers and Systems
IRP = integrated recovery pathway
LOS = length of stay
SSI = surgical site infection
TRiP = translating research into practice
UTI = urinary tract infection
VTE = venous thromboembolism

(eg, fall prevention, venous thromboembolism [VTE] prophylaxis, surgical site infection [SSI]), increase value, and optimize patient experience concurrently using an interdependent, holistic, and integrated platform.[3] This systems approach is analogous to systems engineering, in which the care team works as a cohesive team, applies the most updated and valid science and evidence to patient care, uses robust process improvement methods, and engages patients and their families to ensure they participate in care. To be successful, hospital leadership must create multidisciplinary teams effective at developing systems solutions. Successful implementation of this infrastructure will result in a change in long-term organizational culture that will foster ongoing process improvement.[4] We previously used this approach and achieved significant and sustained reductions in one type of harm: health care-associated infections.[5] In this article, we describe the stepwise development and implementation of a comprehensive program to prevent harm, improve value, and optimize the patient experience in colorectal surgery patients.

METHODS

The program was developed and implemented at Johns Hopkins Hospital, a 1,059-bed tertiary care, academic medical center. The intervention focused on patients operated on by 5 colorectal surgeons with advanced training, who perform 500 major elective abdominal procedures annually. The Johns Hopkins University Institutional Review Board deemed this study exempt.

Organizational structure

Comprehensive unit-based safety program

The Comprehensive Unit-Based Safety Program (CUSP) was initially designed for the ICU and has been translated to different clinical areas.[6] Every clinical area that implements CUSP assembles a multidisciplinary team and follows 5 iterative steps: training in the science of safety, identifying patient safety hazards, partnering with senior executives, learning from defects, and implementing tools to improve teamwork and communication. After the success in the ICUs at Johns Hopkins Hospital, development of CUSP teams on inpatient units and preoperative/recovery room areas was a key element of the institutional strategic plan to improve surgical care, teamwork, and safety culture.[7] All teams included providers from relevant disciplines such as nurses, physicians, hospital infection control practitioners, technicians, advanced practice providers, resident physicians, and clerks.

Colorectal comprehensive unit-based safety program

In 2010, we piloted CUSP in the operating room with the goal of preventing harm and improving teamwork and safety culture, with a specific focus on addressing higher than expected rates of SSI in patients undergoing colorectal surgery.[8] The CUSP team included surgeons, anesthesiology providers, nurses, surgical technicians with local leadership (surgeon, anesthesia provider and nurse). The colorectal CUSP team integrated with the existing other CUSP infrastructure (inpatient units, preoperative and recovery rooms, and ICUs) to address issues that crossed work areas.

To further reduce preventable harm, optimize patient outcomes and experience, and reduce waste, the CUSP team used the model for translating research into practice (TRiP) as well as specific tools (staff safety assessment, learning from defects, and optimized briefings and debriefings for each procedure) combined with patient engagement strategies to develop, implement, and optimize a bundle of SSI-related interventions over 2½ years. These included focused infection-related preoperative education; mechanical bowel preparation with oral antibiotics; preoperative bathing with chlorhexidine washcloths; use of forced-air warming devices in the preoperative area; and standardized skin preparation with ChloraPrep (CareFusion). The efforts of the CUSP group resulted in a significant and sustained reduction of the SSI rate, from 27% to 18% over 3 years, yet SSI rates remained higher than those in comparable hospitals and the hospital leadership's goal of 10%.[8] In addition to persistently high SSI rates, VTE and UTI rates continued to be higher than expected, LOS for colorectal procedures exceeded those at comparable institutions, and patient satisfaction was low (Tables 1 and 2 and Fig. 1 A, B, and C).

Conceptual framework

To address all elements of preventable harm in colorectal surgery patients, we leveraged the existing CUSP infrastructure and developed a trust-based accountability model at each level, from senior leaders (chief financial

Table 1. Integrated Recovery Pathway Reduced Mean Length of Stay and Variable Direct Costs

Variable	Integrated recovery pathway	Baseline	Net savings
n	330	310	
Mean length of stay, d	5.3	7.2	(−) 1.9 d (26.4%)*
Variable direct cost, $	9,036	10,933	(−) 1,897 (17.3%)†

*$p < 0.001$.
†$p = 0.013$.

officer and senior vice president for patient safety and quality) to frontline staff (Fig. 2).[9] Our trust-based accountability model was designed to include important stakeholders, and it defined the actions needed for each stakeholder. For example, senior leaders clearly communicated why the improvement effort was important, what the goals were, ensured that sufficient resources were allocated to achieve the goal, and monitored results based on predetermined timeline. In addition, senior leadership committed central resources (data analytics, project management, and robust process improvement tools) through the Armstrong Institute for Patient Safety and Quality as well as departmental resources (portion of a nurse, additional staff member for the acute pain service, discretionary funds for patient education materials, nonclinical time for the surgeon and anesthesiologist leads) and met with the CUSP team frequently to help break down barriers and ensure success.

Two major barriers to success before development of the accountability model were consistent teams of providers in the operating room and cohorting of postoperative patients in a single inpatient hospital unit. Before this effort, anesthesiology providers (physician anesthesiologists and/or certified registered nurse anesthetists [CRNAs]) were randomly assigned to colorectal surgery procedures, limiting the ability of the CUSP team to standardize practice and implement and evaluate interventions, as well as hindering the development of trusting relationships between anesthesia and surgical providers. With senior leadership support, we pilot tested a new model of operating room staffing with a group of 10 CRNAs consistently assigned to the colorectal procedures in partnership with a small group of engaged physician anesthesiology faculty. In addition, postsurgical patients were preferentially boarded on a single inpatient hospital unit.

The project leaders were accountable to all frontline providers, patients, and senior leadership, and they regularly met with and adjusted processes based on feedback. Ongoing senior leadership support was contingent on reports on progress toward prevention of harm and improvements in the patient experience at regular intervals using the accountability model.

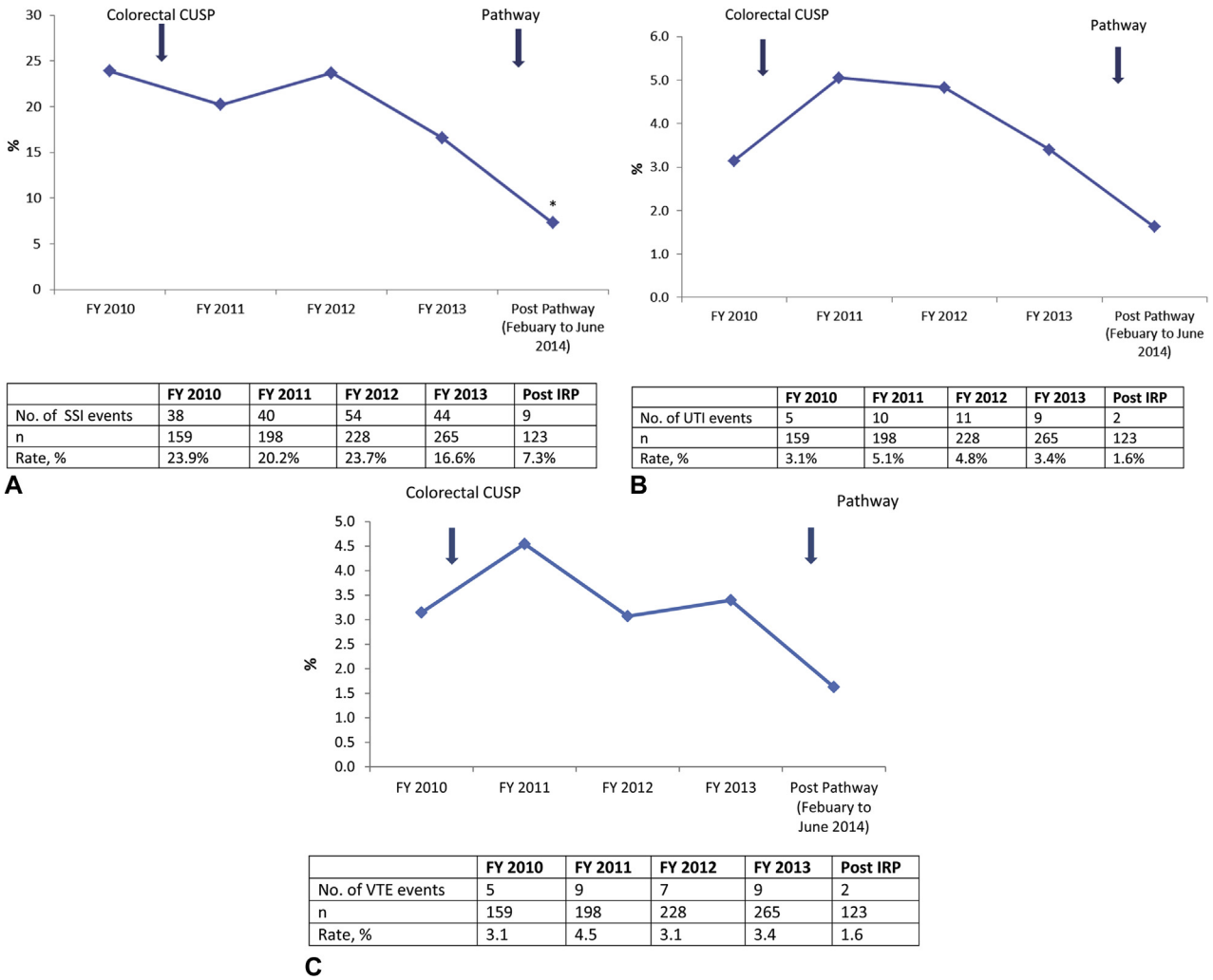
Pathway development

Using the model of translating research into practice (TRiP), a multidisciplinary team of surgeons, anesthesiology providers, and nurses reviewed national guidelines and level 1 evidence supporting enhanced recovery,[10-12] prevention of SSI,[13] VTE,[14] UTI,[15] and patient- and family-centered care.[16] The team developed a pathway that integrated processes to address these elements of preventable harm and unified all phases of the colorectal surgery patients' care from their preoperative evaluation in the office, through hospitalization, and to the postdischarge follow-up visit. A major focus of the pathway was to engage patients and family through education and shared responsibility for recovery. Details of the pathway are in Table 3. Using the principles of the 4Es (engage, educate, execute, and evaluate) within the TRiP model, local unit-based education and discussions were conducted before pathway implementation using the existing CUSP infrastructure (preoperative/recovery room, operating room, inpatient units). To promote engagement, all process measures were discussed by frontline providers and changed based on feedback. Processes were integrated into the electronic medical record and checklists were developed where appropriate, with the goal of ensuring that all patients received the practices, and compliance data were reviewed with providers.[17] As part of this model, both pathway process and outcomes measures were communicated to senior leadership

Table 2. Integrated Recovery Pathway Impact on Surgical Site Infection and Length of Stay in Colorectal Surgery Exceeded Secular, Contemporaneous Trends in General Surgery Patients

Outcomes	Colorectal procedures		Pancreas procedures		Difference in difference (p value)
	2013, pre-IRP	2014, IRP	2013	2014	
Surgical site infection, %	20.7	7.3	19.1	17.7	−12.0 (0.016)
Urinary tract infection, %	4.1	1.6	1.5	0.3	−1.3 (0.45)
Venous thromboembolism, %	3.5	1.6	6.1	4.2	−0.0 (0.99)
Length of stay, d, mean	7.2	5.3	11.1	10.0	−0.97 (<0.001)

IRP, integrated recovery pathway.



	FY 2010	FY 2011	FY 2012	FY 2013	Post IRP
No. of SSI events	38	40	54	44	9
n	159	198	228	265	123
Rate, %	23.9%	20.2%	23.7%	16.6%	7.3%

	FY 2010	FY 2011	FY 2012	FY 2013	Post IRP
No. of UTI events	5	10	11	9	2
n	159	198	228	265	123
Rate, %	3.1%	5.1%	4.8%	3.4%	1.6%

	FY 2010	FY 2011	FY 2012	FY 2013	Post IRP
No. of VTE events	5	9	7	9	2
n	159	198	228	265	123
Rate, %	3.1	4.5	3.1	3.4	1.6

Figure 1. Implementation of integrated recovery pathway resulted in significant reduction in perioperative morbidity. (A) Thirty-day postoperative surgical site infection (SSI) rate for colorectal surgery patients before implementation of the colorectal operating room Comprehensive Unit-Based Safety Program (CUSP), after CUSP, and after integrated recovery pathway. (B) Thirty-day postoperative urinary tract infection (UTI) rate for colorectal surgery patients before and after implementation of integrated recovery pathway. (C) Thirty-day postoperative venous thromboembolism (VTE) rate for colorectal surgery patients before and after implementation of integrated recovery pathway. * $p < 0.05$ FY13 vs post-integrated recovery pathway.

and frontline providers monthly through development of a dashboard. Key elements of the dashboard were length of stay, SSI, and patient satisfaction. Both University Health Consortium (UHC) and NSQIP benchmarks for LOS for comparable hospitals were used as goals. Hospital leadership develops the annual SSI goals by taking into account past years' performance at the hospital and national trends. The SSI goal was 12% for FY 2014. This was distributed by email to all providers and discussed in the CUSP meetings and in weekly unit staff meetings. A pathway bulletin board was made for the patients and staff on the inpatient unit, where patients were cohorted. After an in-person kickoff meeting with frontline providers (surgeons, anesthesiology providers, resident physicians, nurses, schedulers, and technologists), the program was initiated on February 1, 2014. Before kickoff, 4 months were devoted to pathway development.

Outcomes

Outcomes measurement

The primary outcomes variables were length of stay, SSI, UTI and VTE rates, patient experience, and variable direct costs. Baseline data were obtained for comparison for LOS and variable direct costs (February 1, 2013 to November 30, 2013), patient experience (February 1, 2013 to September 30, 2013), SSI (July 1, 2009 to

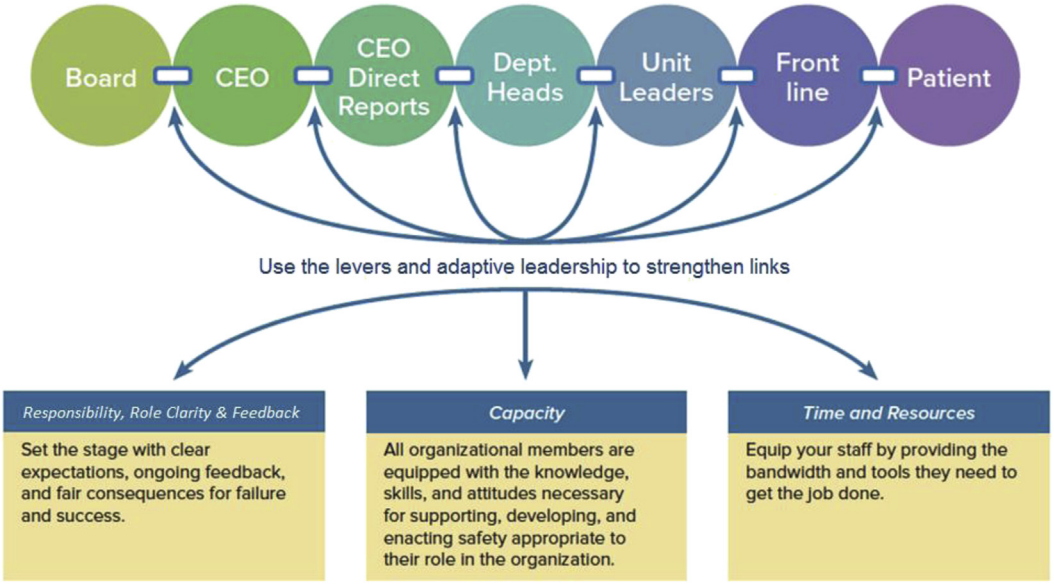


Figure 2. Organizational accountability model.

June 30, 2013), catheter-associated UTI (July 1, 2010 to June 30, 2013), and VTE (July 1, 2010 to June 30, 2013). Length of stay was defined as hospitalization time from time of operation to time of discharge. Postoperative SSI, UTI, and VTE rates were monitored by a trained nurse clinical reviewer using standardized definitions provided by the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP).[18] The Johns Hopkins Hospital participates in the targeted procedure program of ACS-NSQIP for colectomy and proctectomy. Therefore, all patients undergoing these procedures were followed for 30-day morbidity and mortality. Patients' experience with their hospitalization was assessed using the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey as defined by the Centers for Medicare and Medicaid Services (CMS). To evaluate patient experience, 50% of patients discharged from Johns Hopkins Hospital were randomly surveyed. Overall percentile scores (based on average of responses to all questions) were compared pre- and post-implementation. We also measured variable direct cost associated with each case using our health systems cost accounting system. Variable direct cost was used to evaluate the program's financial impact because it represents hospital costs that can be controlled by the provider, including drug, laboratory, operating room, radiology, room and board, and supply costs.

Length of stay and cost data were available for all patients on the pathway. This was obtained from the hospital administrative database. Subsets of patients (proctectomy and colectomy patients with CPT codes included in the targeted procedure program of ACS-NSQIP) were followed for 30-day outcomes (SSI, deep venous thrombosis, UTI) using ACS-NSQIP. Another subset of patients completed patient experience surveys. Given that this was a quality improvement initiative and not research, some variables (SSI, deep venous thrombosis, UTI, and patient experience) were not available for the entire cohort.

Statistical analysis

We used a Fisher's exact test to compare post intervention LOS, variable direct costs, SSI, VTE, and UTI rates with pre-intervention baseline data. Reported p values are 2-sided. A value of $p < 0.05$ was considered significant.

In order to confirm that differences over time in SSI and LOS were attributable to the integrated recovery pathway (IRP) and not to other secular trends, we performed a difference-in-difference analysis comparing colorectal IRP patients with pancreatectomy patients. We used the same time period for pre and post for both groups of patients and entered both colorectal and pancreas patients into a linear regression model with terms for surgery group (colorectal or pancreas), time period (pre-IRP or IRP), and their interaction. The interaction coefficient from this model represents the difference between the colorectal and pancreas groups in the pre-IRP to IRP change in complications. We used SAS software (version 9.2; SAS Institute) for all analyses.

Table 3. Integrated Recovery Pathway

Before surgery	Day of surgery	Inpatient recovery	Outpatient recovery
Preoperative counseling about surgery, anesthesia, pain management and recovery plan	Preoperative multimodal analgesia and postoperative nausea and vomiting prevention	Early ambulation protocol	Phone call from hospital nurse to review discharge instructions 2 days after hospital discharge
Facilitate smoking cessation if appropriate (SSI prevention)	Pre-operative VTE prophylaxis (before incision or 1 hour after epidural placement if applicable) (VTE prevention)	Urinary catheter removal on postoperative day 1 if no epidural; removal on day 2 if epidural or pelvic procedure (CAUTI prevention)	Referral to home health care agency for transition to home if new ostomy
Preoperative visiting with enterostomal therapist if ostomy planned for procedure	Maintenance of normothermia by preoperative and intraoperative forced air warming devices (SSI prevention)	Discontinue intravenous fluids	Return office visit in 10−14 days with surgeon and enterostomal therapist (if applicable)
Mechanical bowel preparation with oral antibiotics (SSI prevention)	Prophylactic antibiotic administration (cefotetan 2 g or clindamycin 600 mg and gentamicin 5 mg/kg) before incision and redosed per recommendations during procedure (SSI prevention)	Rapid resumption of regular oral intake	
Chlorhexidine bathing (SSI prevention)	Intraoperative anesthesia management protocol (epidural anesthesia, total intravenous anesthesia, colloid and crystalloid protocol to reduce total intravenous fluids, avoid immunosuppressive agents)	Multimodal analgesia (with or without epidural analgesia) delivered by acute pain team (physicians and nurses)	
Continue oral intake until 2 h before surgery (Anesthesia guidelines)	Avoidance of urinary catheter placement for procedures less than 2 hours (CAUTI prevention)	Risk-stratified VTE prophylaxis (VTE prevention)	
	Mobilization to a chair and resumption of oral intake	Education by enterostomal therapist about ostomy (if applicable)	

CAUTI, catheter-associated urinary tract infection; SSI, surgical site infection; VTE, venous thromboembolism.

RESULTS

We examined a total of 640 patients: 330 patients underwent elective colorectal procedures during the study period and 310 in the baseline period. Patient demographics during the baseline vs the study period were similar (median age 51.9 vs 52.6 years, and 148 of 310 [48%] vs 162 of 330 [49%] patients were male). There was an increase in the use of laparoscopy in the study period (48 of 310 patients [15%] vs 69 of 330 patients [21%], $p > 0.05$), but the distribution of colon vs rectal vs small bowel resections was similar (123 of 310 patients [39%], 89 of 310 patients [29%], 79 of 310 patients [25%] vs 130 of 330 patients [39%], 91 of 330 patients [28%], 105 of 330 patients [23%], respectively, $p > 0.05$). The Charlson Index (2.09 vs 2.08, $p > 0.05$) and case index (Medicare severity diagnosis-related groups [MS-DRG]: 2.34 vs 2.29, $p > 0.05$ and All patient refined diagnosis-related groups [APR-DRG]: 1.91 vs 1.73, $p > 0.05$) did not vary between the baseline and implementation period. The baseline (pre-intervention) mean LOS was 7 days and the median LOS was 6 days. Post-intervention, the mean LOS was 5 days and median was 4 days, significantly reduced from the baseline period, $p < 0.05$. We also realized a significant reduction in 30-day morbidity during the post-intervention period compared with the pre-intervention period (SSI 18.8% vs 7.3%, $p < 0.05$; VTE 3.5% vs 1.6% $p > 0.05$; UTI 4.1% vs 1.6% $p > 0.05$; Fig. 1 A, B, and C). Difference-in-difference

Table 4. Hospital Consumer Assessment of Health Care Providers and Systems Scores for Colorectal and Pancreas Surgery (Baseline vs Integrated Recovery Pathway or 2013 vs 2014)

Variable	Colorectal				Pancreatectomy			
	Baseline (n = 67), top box responses (% always)	Integrated recovery pathway (n = 40), top box responses (% always)	p Value	Change, %	2013 (n = 75), top box responses (% always)	2014 (n = 78), top box responses (% always)	p Value	Change, %
HCAHPS domain								
Nurse communication	75	84	NA	+11	83	84	NA	+1
Doctor communication	83	83	NA	NA	81	86	NA	+5
Staff responsiveness	24	34	NA	+10	41	34	NA	−7
Pain management	68	77	NA	+9	74	72	NA	−2
Communication about medications	52	71	NA	+19	61	67	NA	+6
Discharge information	93	92	NA	−1	96	91	NA	+5
HCAHPS item								
Using any number from 0 to 10, where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital during your stay?	52 (35 of 67)	67 (26 of 39)	0.16	+15	72 (53 of 74)	69 (54 of 78)	0.86	+3
Would you recommend this hospital to your friends and family?	79 (52 of 66)	90 (35 of 39)	0.19	+11	89 (67 of 75)	95 (74 of 78)	0.24	+6

HCAHPS, Hospital Consumer Assessment of Healthcare Providers and Systems; NA, not applicable.

analysis comparing contemporaneous colorectal and pancreas patients at Johns Hopkins Hospital demonstrated that the significant improvements observed with the IRP in colorectal surgery exceeded any secular improvements in LOS and SSI in the hospital (Table 2).

Improvement was realized in all domains of the HCAPHS survey, but most significant gains were noted in staff responsiveness (24% vs 34% top box scores), communication about medication (52% vs 71% top box scores), and pain management (68% vs 77% top box scores). Overall, 90% of patients said they would recommend the hospital to their friends and family after the pathway implementation, as compared with 79% before (Table 4). To determine the impact of other patient experience improvement efforts occurring in the hospital during this period, the HCAHPS scores for colorectal and pancreas surgery patients were compared. In the colorectal population, scores increased between 9% and 19% for nurse communication, staff responsiveness, pain control, and medication communication. Increases in the pancreas group ranged from 1% to 6% in nurse and physician and medication communication and discharge information.

Variable direct costs decreased from $10,933 to $9,036 (−18%), $p < 0.05$, after pathway implementation. The greatest impact was seen on routine costs, which included the daily room charge (decreased from $3,920 to $3,071, $p < 0.05$), but reduction was also reflected in all categories (supplies, drugs, operating room, medications, radiology, and other).

DISCUSSION

Comprehensive prevention of harm requires creation of a culture of safety and interdisciplinary systems solution. Here we described how we leveraged an existing CUSP infrastructure that was successfully and widely applied in the prevention of health care-associated infections, and we developed a trust-based accountability model to address all elements of preventable harm in colorectal surgery patients. This initiative resulted in a rapid improvement in patient outcomes, patient experience, and cost. Program implementation resulted in a significant decrease in hospital LOS of 2 days, greater than 50% reduction in SSI, significant improvement in patient experience, and improved value, as well as a trend toward reduction in VTE and UTI. Enhanced recovery protocols in the United Kingdom have been associated with reduced length of stay, but associated prevention of harm and improvement of the patient experience have been inconsistent.[11,19-22] Similarly, successful SSI or VTE reduction efforts have not been associated with broader improvements in quality, patient experience, or costs. Our

program has significant implications for large-scale dissemination of improvement initiatives.

Improvement projects initiated by management are frequently viewed by clinicians as being done to rather than with them, and are often highly resisted and largely ineffective because they are not sensitive to local context. Instead, in this model, we leveraged the intrinsic motivations of the clinical leaders, tapping their wisdom to improve patient outcomes and experience. Importantly, the initial catalyst for this work was valid, benchmarked clinical data demonstrating worse than expected surgical outcomes (SSI) and patient experience scores.[18] This provided the vision and motivation for clinicians to form a team of diverse frontline providers who previously were not aware of each other's contributions to the patient experience. This group, in partnership with senior hospital leadership, through a model of trust, support, and accountability, were able to make, over 4 years, increasingly greater changes to improve patient outcomes and ultimately increase the value of care delivered.[23,24] Transparent reporting of process and outcomes including length of stay, patient satisfaction, and SSIs jointly to frontline providers and organizational leadership drove improvements. Through the model of trust, support, and accountability, participants at each level of the organization were asked to reflect on their role in the initiative's success and were then answerable, particularly as system level barriers and resistant clinicians were encountered. Although valid clinically relevant data were essential, data alone, without the facilitating infrastructure describe earlier, are insufficient to drive change.[25] Introducing an IRP and addressing the entire episode of care in an integrated fashion, as well as focusing on patient education and engagement, are likely to have also helped improve compliance with SSI prevention process measures already in place. For example, as part of the IRP, patient education was greatly enhanced, and this may have significantly improved patient compliance with mechanical bowel preparation with oral antibiotics.

Through this focused initiative to improve the care of colorectal surgery patients, the organization has realized that comprehensive reorganization of surgical care to improve quality, value, and patient experience is an attainable and necessary goal. Spread will be marked by engaging clinicians and supporting them with the needed skills and resources including transdisciplinary teams, executive support, robust process improvement tools, and clinical and value analytics to assess impacts of interventions and audit practices. A cornerstone to spreading work will be transparent reports on performance to both frontline teams and executive leadership as a mechanism to hold all stakeholders accountable for results.

This study has several limitations. First, the study design and bundled intervention precludes us from making causal relationship between the overall intervention and the improved outcomes or to identify the independent contribution of individual components of the bundle. Second, because existing hospital data infrastructure was used to develop a sustainable model of improvement, patient satisfaction and outcomes data are only available on a subset of patients. Furthermore, because only a subset of the patients are part of the hospital NSQIP database, limited patient demographics are available to compare the patient populations in the pre- and post-intervention periods. As a result, changes in our patient population over time may have contributed to the improved outcomes observed. Approximately 50% of procedures were prospectively abstracted through NSQIP, and approximately 20% of patient experiences were evaluated by survey. Given that patients were sampled randomly, that baseline metrics have been stable over time, and that improvements were identified across multiple outcomes metrics, including SSI rates, and LOS, value and patient experience suggest it is unlikely that the impact of the intervention was overestimated.

CONCLUSIONS

In summary, surgical care is expensive and fraught with preventable harm.[2,18] We implemented a comprehensive intervention that harnessed the intrinsic motivation of clinicians and existing resources to reduce length of stay, reduce SSIs and other preventable harms, and improve the experience of patients undergoing colorectal surgery. Previous efforts to reduce preventable harm in surgical patients have had mixed results, and undoubtedly, addressing harms independently is exceedingly slow and resource intensive.[2] Given that 50 million patients undergo surgery annually and it is estimated that approximately 1 million patients die or sustain a preventable harm associated with the procedure, broad dissemination and implementation of this model of change could lead to both major cost savings as well as improvement in the patient experience with health care in the United States.

Author Contributions

Study conception and design: Wick, Hobson, Benson, Efron, Pronovost, Wu

Acquisition of data: Wick, Galante, Hobson, Benson, Lee, Wu

Analysis and interpretation of data: Wick, Galante, Hobson, Benson, Lee, Berenholtz, Pronovost, Wu

Drafting of manuscript: Wick, Pronovost, Wu

Critical revision: Wick, Galante, Hobson, Benson, Lee, Berenholtz, Efron, Pronovost, Wu

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