A Checklist-Based Intervention to Improve Surgical Outcomes in Michigan Evaluation of the Keystone Surgery Program

Bradley N. Reames, MD, MS; Robert W. Krell, MD; Darrell A. Campbell Jr, MD; Justin B. Dimick, MD, MPH

**Importance** Previous studies of checklist-based quality improvement interventions have reported mixed results.

**Objective** To evaluate whether implementation of a checklist-based quality improvement intervention—Keystone Surgery—was associated with improved outcomes in patients in a large statewide population undergoing general surgery.

**Design, Setting, and Exposures** A retrospective longitudinal study examined surgical outcomes in 64,891 Michigan patients in 29 hospitals using Michigan Surgical Quality Collaborative clinical registry data from 2006 through 2010. Multivariable logistic regression and difference-in-differences analytic approaches were used to evaluate whether Keystone Surgery program implementation was associated with improved surgical outcomes following general surgery procedures, apart from existing temporal trends toward improved outcomes during the study period.

**Main Outcomes and Measures** Risk-adjusted rates of superficial surgical site infection, wound complication, any complication, and 30-day mortality.

**Results** Implementation of Keystone Surgery in 14 participating centers was not associated with improvements in surgical outcomes during the study period. Adjusted rates of superficial surgical site infection (3.2% vs 3.2%, \( P = .91 \)), wound complication (5.9% vs 6.5%, \( P = .30 \)), any complication (12.4% vs 13.2%, \( P = .26 \)), and 30-day mortality (2.1% vs 1.9%, \( P = .32 \)) at participating hospitals were similar before and after implementation. Difference-in-differences analysis accounting for trends in 15 nonparticipating centers and sensitivity analysis excluding patients receiving surgery in the first 6 or 12 months after program implementation yielded similar results.

**Conclusions and Relevance** Implementation of a checklist-based quality improvement intervention did not affect rates of adverse surgical outcomes among patients undergoing general surgery in participating Michigan hospitals. Additional research is needed to understand why this program was not successful prior to further dissemination and implementation of this model to other populations.
There is widespread enthusiasm for the use of checklists to improve hospital outcomes. Perhaps one of the most widely known and successful examples is the Keystone ICU (Intensive Care Unit) Patient Safety Program. This intervention used a checklist emphasizing evidence-based processes of care and a program to improve safety culture to dramatically decrease rates of catheter-related bloodstream infection and ventilator-associated pneumonia in Michigan. The program has since been implemented nationally and similar programs have expanded to other patient populations. One such expansion was Keystone Surgery, a Michigan program designed to reduce rates of surgical site infection and other adverse surgical outcomes.

The effectiveness of checklist-based interventions to improve surgical outcomes is still unclear, however. Recent work by Urbach and colleagues failed to report an association between implementation of surgical safety checklists and improved outcomes in a large population. Previous evaluations of programs directed toward surgical site infection specifically have been limited to small cohorts and single institutions, and no studies have used a concurrent control group to assess effectiveness. Although previous studies have demonstrated that the Surgical Care Improvement Program (SCIP) process measures used in Keystone Surgery are not associated with improved outcomes, none have evaluated these processes when coupled with a program to improve safety culture. Given the substantial resources necessary to implement interventions like Keystone Surgery, evidence evaluating effectiveness is essential prior to broader dissemination.

In this study, we capitalize on a unique natural experiment to evaluate the effect of Keystone Surgery on general surgery outcomes in a large statewide population. We used 5 years of clinical registry data to examine outcomes before and after implementation of the Keystone Surgery program. To account for secular trends in the state, we compared this cohort with a control group of patients undergoing surgery during the same period at Michigan hospitals that did not implement the program.

Methods

Data Sources and Study Population

This study was completed using clinical registry data from the Michigan Surgical Quality Collaborative (MSQC), a regional consortium of 52 hospitals funded by Blue Cross and Blue Shield of Michigan and The Blue Care Network. Details of data collection have been previously published. Clinical nurse reviewers collect data on patient characteristics, intraoperative processes, and 30-day outcomes for patients undergoing general and specialty surgery throughout the state, using a standard 8-day case sampling strategy. Annual nurse reviewer and data audits ensure data accuracy. For this study, we identified all patients undergoing general surgery procedures at MSQC hospitals from 2006 through 2010 using relevant Current Procedural Terminology codes. We chose inpatient procedures that account for the vast majority of postoperative infections, including abdominal exploration and lysis of adhesions, cholecystectomy, appendectomy, colorectal resection, ventral hernia repair, bariatric surgery, pancreatic resection, esophagectomy, gastrectomy, fundoplication, peptic ulcer surgery, liver resection, biliary reconstruction, pelvic exenteration, small-bowel operations, and splenectomy.

Keystone Surgery

The Keystone Surgery program was a prospective cohort intervention implemented within specialty-specific surgical teams at participating Michigan Health & Hospital Association hospitals with a goal of improving surgical care throughout the state. Hospitals volunteered to participate and did not receive financial support. Implementation occurred during a 2-year period using a stepped-wedge design. Most Michigan Health & Hospital Association hospitals (n = 76) enrolled during April 2008, while a second group (n = 25) enrolled in April 2009. Within each hospital, a surgeon, anesthesiologist, and operating room nurse were designated as operative team leaders. Throughout the program, monthly coaching calls and semiannual collaborative meetings were used to support the implementation process.

Similar to the Keystone ICU program, the Keystone Surgery program used 2 principal components (Table 1): a novel model to translate evidence into practice and the Comprehensive Unit-based Safety Program to improve safety culture. The evidence-based practice component used a checklist tool that focused on compliance with 6 Centers for Medicare & Medicaid Services SCIP processes: appropriate prophylactic antibiotic use, appropriate antibiotic timing, appropriate antibiotic discontinuation, appropriate hair removal, maintenance of perioperative normothermia, and glucose control. At the start of implementation, operative teams were provided with supporting materials and references to educate staff. Throughout the program, teams were
encouraged to implement the tool during briefings and de-
briefings surrounding every procedure and to monitor com-
pliance, adapt the tool based on local needs, and work to-
gether to resolve issues that surfaced during the process.29,30

The Comprehensive Unit-based Safety Program is an it-
ervative 5-step process previously validated to improve team-
work and safety culture (Table 1).5–24 Through these steps, the
program attempts to educate participants on the principles of
safety science, identify defects, increase communication be-
tween frontline health care professionals and senior leader-
ship, encourage learning from identified defects, and imple-
ment tools to assist the quality improvement process. At
initiation and annually thereafter, a validated assessment of
culture was performed to support and guide the program.31

Within the 34 MSQC study hospitals, 10 hospitals imple-
mented the program before May 1, 2008, 2 hospitals imple-
mented the program on June 1, 2009, 1 on December 1, 2009,
and 1 on January 1, 2010. Fifteen hospitals did not imple-
ment the program, and 5 hospitals that implemented Keystone Sur-
gery before joining MSQC were excluded. For this analysis, hos-
ptals were divided into 2 groups: hospitals that imple-
mented the Keystone Surgery program (Keystone hospitals)
and those that did not (non-Keystone hospitals). Patients un-
dergoing a procedure at Keystone hospitals before the speci-
fied date of implementation were considered pre-
implementation, while patients undergoing a procedure after
that date were considered post-implementation. Because most
Keystone hospitals implemented the program on or before May
1, 2008, patients undergoing procedures at non-Keystone hos-
pitals were considered post-implementation if they under-
surgery after May 1, 2008.

Outcome Variables
The primary outcomes of this analysis included superficial sur-
0gical site infection, any wound complication (superficial, deep,
or organ-space surgical site infection or wound disruption), any
complication, and death within 30 days of operation. Addi-
tional complications recorded in the MSQC registry include
acute kidney injury, intraoperative or postoperative trans-
fusion, cardiac arrest requiring resuscitation, coma lasting more
than 24 hours, superficial or deep venous thromboembo-
lism, myocardial infarction, prolonged ventilation lasting more
than 48 hours, peripheral nerve injury, pneumonia, pulmo-
nary embolism, renal insufficiency, stroke, sepsis, septic shock,
unplanned intubation, and urinary tract infection.

Statistical Analysis
We performed 2 distinct analyses to evaluate the effect of Key-
stone Surgery on surgical outcomes: a pre-post analysis and a
difference-in-differences analysis. For the pre-post analysis,
we assessed patients undergoing surgery at hospitals that
implemented Keystone Surgery. We used multivariable logistic
regression to evaluate the relationship between our pri-
mary outcomes and program implementation. Each model in-
cluded a variable indicating whether patients at Keystone
hospitals had surgery before program implementation (pre-
implementation) or after (post-implementation). To further
evaluate the effect of the program on outcomes following spe-
cific procedures, we stratified analyses by the 4 most com-
mon operations: cholecystectomy, colorectal resection, ap-
pendectomy, and ventral hernia repair.

We then used a difference-in-differences analysis to ac-
count for coincident temporal trends toward improved out-
comes among all study hospitals. This econometric tech-
nique, frequently used to evaluate the effect of policy
changes,32–34 uses a control group to isolate changes in out-
comes associated with an intervention apart from changes ob-
erved in the control group. Our control group included MSQC
hospitals that did not participate in Keystone Surgery, as they
were exposed to all factors driving improved outcomes dur-
ing the period except the intervention. In addition to the post-
implementation variable, this model included a dichoto-
mous variable indicating whether the hospital implemented
Keystone Surgery, as well as the interaction of this variable and
the post-implementation variable. The odds ratio (OR) from
this interaction term (ie, the difference-in-differences estima-	or) can be interpreted as the independent effect of Keystone
Surgery implementation on surgical outcomes.35,36

In all models, we adjusted for patient characteristics, co-
omorbidities, and details of the procedure. Patient character-
istics included age, sex, race/ethnicity, and their interactions.
Comorbidities included American Society of Anesthesiolo-
gists class, diabetes mellitus, smoking status, dyspnea, do-
not-resuscitate status, functional status, chronic obstructive
pulmonary disease, pneumonia, congestive heart failure, he-
modialysis, hemiplegia, transient ischemic attack, dissemi-
nated cancer, prior myocardial infarction, angina, hyperten-
sion requiring medication, peripheral vascular disease, prior
operations, and impaired sensorium. Procedure details in-
cluded emergency status, operative approach, and proce-
dure type. To account for within-hospital outcome correla-
tion (clustering), we generated robust standard errors.

We performed sensitivity analyses to account for variabil-
ity in program compliance during the initial phase of imple-
mentation. For the Keystone ICU Patient Safety program, in-
vestigators estimated that implementation would take less than
6 months.6 Therefore, we performed 2 pre-post analyses af-
[0x2]fter excluding patients who underwent surgery during the first
6 or 12 months following program implementation.

Risk-adjusted outcome rates were determined by calcu-
lating marginal effects for each model. C statistics for the mod-
els ranged from 0.74 (surgical site infection) to 0.95 (30-day
mortality). For all statistical tests, P values are 2-tailed, with α
= .05. All analyses were performed using STATA, version 12.1
(StataCorp LP). This study was not regulated by the Univer-
sity of Michigan Institutional Review Board.

Results
Our study cohort consisted of 64,891 patients in 29 hospitals.
Fourteen hospitals implemented Keystone Surgery during the
study period. In these hospitals, 14,005 patients underwent sur-
gery before program implementation and 14,801 patients un-
derwent surgery after program implementation. A total of
36,085 patients underwent surgery at non-Keystone hospi-

Table 2. Characteristics of Patients Undergoing Surgery at Keystone and Non-Keystone Hospitals During 2006-2010

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Patients Undergoing General Surgery at Keystone Hospitals</th>
<th>Patients Undergoing General Surgery at Non-Keystone Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-implementation</td>
<td>Post-implementation</td>
</tr>
<tr>
<td>Patients, No.</td>
<td>14,005</td>
<td>14,801</td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td>52.1 (17.6)</td>
<td>53.7 (17.6)</td>
</tr>
<tr>
<td>Female sex, No. (%)</td>
<td>8731 (62.3)</td>
<td>8968 (60.6)</td>
</tr>
<tr>
<td>African American race, No. (%)</td>
<td>2164 (15.5)</td>
<td>1905 (12.9)</td>
</tr>
<tr>
<td>Laparoscopic approach, No. (%)</td>
<td>7397 (52.8)</td>
<td>7821 (52.8)</td>
</tr>
<tr>
<td>Emergency, No. (%)</td>
<td>2684 (19.2)</td>
<td>3149 (21.3)</td>
</tr>
<tr>
<td>≥3 Comorbidities, No. (%)</td>
<td>1752 (12.5)</td>
<td>1974 (13.3)</td>
</tr>
<tr>
<td>ASA class, median</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Procedure type, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholecystectomy</td>
<td>3786 (27.0)</td>
<td>3003 (20.3)</td>
</tr>
<tr>
<td>Colorectal resections</td>
<td>2604 (18.6)</td>
<td>3119 (21.1)</td>
</tr>
<tr>
<td>Appendectomy</td>
<td>1924 (13.7)</td>
<td>2241 (15.1)</td>
</tr>
<tr>
<td>Bariatric surgery</td>
<td>2055 (14.7)</td>
<td>2057 (13.9)</td>
</tr>
<tr>
<td>Ventral hernia repair</td>
<td>1609 (11.5)</td>
<td>2026 (13.7)</td>
</tr>
<tr>
<td>Other general surgery</td>
<td>2027 (14.5)</td>
<td>2355 (15.9)</td>
</tr>
<tr>
<td>Comorbidities, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>6111 (43.6)</td>
<td>6904 (46.6)</td>
</tr>
<tr>
<td>Smoker</td>
<td>3333 (22.4)</td>
<td>3351 (22.6)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>2030 (14.5)</td>
<td>2402 (16.2)</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>1801 (12.9)</td>
<td>2033 (13.7)</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>1158 (8.3)</td>
<td>1328 (9.0)</td>
</tr>
<tr>
<td>Dependent functional status</td>
<td>718 (5.1)</td>
<td>869 (5.9)</td>
</tr>
<tr>
<td>TIA or cerebrovascular accident</td>
<td>718 (5.1)</td>
<td>834 (5.6)</td>
</tr>
<tr>
<td>COPD</td>
<td>626 (4.5)</td>
<td>766 (5.2)</td>
</tr>
<tr>
<td>Prior operations</td>
<td>329 (2.4)</td>
<td>297 (2.0)</td>
</tr>
<tr>
<td>Cancer</td>
<td>300 (2.1)</td>
<td>286 (1.9)</td>
</tr>
<tr>
<td>Peripheral vascular disease</td>
<td>191 (1.4)</td>
<td>231 (1.6)</td>
</tr>
<tr>
<td>Renal failure or dialysis</td>
<td>216 (1.5)</td>
<td>247 (1.7)</td>
</tr>
<tr>
<td>CHF</td>
<td>162 (1.2)</td>
<td>113 (0.8)</td>
</tr>
</tbody>
</table>

Abbreviations: ASA, American Society of Anesthesiologists; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; TIA, transient ischemic attack.

In this study, we performed a controlled evaluation of a checklist-based quality improvement intervention—Keystone Surgery—that focused on reducing surgical site infections. We were unable to find a significant association between program implementation and adjusted rates of superficial surgical site infection, wound complication, any complication, and 30-day mortality in patients undergoing general surgery in participating hospitals. No association was present between adjusted odds of adverse outcomes and Keystone Surgery implementation: 30-day mortality (OR, 0.88; 95% CI, 0.68-1.14), superficial surgical site infection (OR, 1.02; 95% CI, 0.76-1.36), wound complication (OR, 1.12; 95% CI, 0.90-1.40), or any complication (OR, 1.09; 95% CI, 0.94-1.27). Difference-in-differences models accounting for competing time trends during the study period did not change these results (Table 4). Sensitivity analysis excluding patients undergoing surgery within 6 or 12 months of the start of Keystone Surgery implementation also yielded similar results.

Table 2. Characteristics of Patients Undergoing Surgery at Keystone and Non-Keystone Hospitals During 2006-2010
hospitals. This finding was robust across multiple analyses, including a difference-in-differences analysis, stratified analyses of the most common operations, and sensitivity analyses excluding patients undergoing surgery in the first 6 or 12 months after program implementation.

Previous studies evaluating checklist-based interventions have reported mixed results.\textsuperscript{11-13,15} For example, Hedrick et al\textsuperscript{11} reported a decrease in surgical site infection rates at a single institution from 25.6% to 15.9% over 2 years following implementation of a checklist-based intervention in patients undergoing colorectal surgery, while Forbes and colleagues\textsuperscript{12} reported a nonsignificant decrease in rates following a similar intervention and Anthony et al\textsuperscript{13} reported an increase in rates following a single-center randomized trial. While a recent meta-analysis examining the effects of the World Health Organization surgical safety checklist reported a significant association with improved outcomes,\textsuperscript{16} the individual studies reviewed were heterogeneous and reported widely mixed results. Furthermore, no studies examined in the meta-analysis used a control group to isolate the effect of the checklist from coincident secular trends toward improved outcomes.

Our study goes beyond this current literature in several important ways. First, we evaluated a diverse statewide population of patients undergoing surgery in many hospitals representing diverse sizes, teaching statuses, and affiliations. Second, our analysis included a control group of hospitals not participating in the program to isolate the effect of the intervention from secular trends toward improved outcomes during the study period. When compared with previous work, these findings highlight the importance of accurate risk adjustment and control cohorts when evaluating effectiveness.

![Figure](image-url)
and are corroborated by similar evaluations of other programs. Benning and colleagues, for example, found that, although care improved in UK hospitals during the Health Foundation’s Safer Patients Initiative, there was no additional effect beyond that seen in control hospitals.

This study has multiple limitations. First, use of data from the MSQC limits the study cohort to a subset of Michigan hospitals participating in a statewide organization collaborating for quality improvement. Although use of this clinical registry allowed rigorous adjustment of patient characteristics, it precluded evaluation of the Keystone Surgery program in other Michigan Health & Hospital Association hospitals not participating in the collaborative. Nevertheless, MSQC hospitals provide the vast majority of surgical care delivered in Michigan. Furthermore, no systematic prospective quality improvement initiatives targeting superficial surgical site infections beyond outcomes measurement and feedback were implemented during the study period. Second, because we lack detail regarding program compliance at individual hospitals, we cannot explain why the program did not improve outcomes in these hospitals. Finally, hospitals participating in Keystone Surgery volunteered to participate, which may have introduced selection bias. However, these latter limitations do not reduce the internal validity of this study, as this analysis was not designed to evaluate the details of implementation but instead to examine program effectiveness as it was implemented.

Ultimately, a more comprehensive evaluation will be necessary to understand why Keystone Surgery failed to affect surgical outcomes. There are 2 possible reasons the program did not have its intended effect. First, Keystone Surgery may have failed because it encouraged adherence to processes that are not strongly associated with outcomes,17,18,39 However, this study adds to the current literature on SCIP measures by showing that the addition of a previously validated process to improve teamwork and safety culture (Comprehensive Unit-based Safety Program) to SCIP measure processes did not enhance their effectiveness.

A second possible explanation is a failure of the implementation process. Successful implementation of clinical interventions depends not only on high-quality evidence but also a receptive environment and facilitation.40 The Keystone ICU program, for example, was implemented in ICUs, used small teams of nurses and advanced health care professionals, and focused on a single procedure. In contrast, the Keystone Surgery program was implemented in the operating room on a heterogeneous group of complex procedures and engaged diverse teams that underwent frequent personnel changes. It would not be surprising if this increased complexity created an environment less conducive to successful implementation. Moreover, surgical site infections are diverse and complex complications, and it is less likely that a single bundle of interventions can be successfully applied across organizations. Another notable difference between the Keystone Surgery and Keystone ICU programs was that, for Keystone Surgery, many participating sites lacked infrastructure for data collection and outcome feedback to frontline teams—a key attribute of successful improvement efforts.41

### Table 4. Adjusted Odds of Adverse Outcomes Before and After Keystone Surgery Implementation

<table>
<thead>
<tr>
<th>Adverse Outcome</th>
<th>Pre-Post Analysis (Keystone Hospitals)</th>
<th>Difference-in-Differences Analysis (Entire Study Cohort)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted Odds Ratio (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Superficial SSI</td>
<td>1.02 (0.76-1.36)</td>
<td>1.06 (0.77-1.46)</td>
</tr>
<tr>
<td>Any wound complication</td>
<td>1.12 (0.90-1.40)</td>
<td>1.19 (0.95-1.50)</td>
</tr>
<tr>
<td>Any complication</td>
<td>1.09 (0.94-1.27)</td>
<td>1.10 (0.89-1.36)</td>
</tr>
<tr>
<td>30-d Mortality</td>
<td>0.88 (0.68-1.14)</td>
<td>0.84 (0.58-1.21)</td>
</tr>
</tbody>
</table>

Abbreviation: SSI, surgical site infection.

Regardless of the underlying cause, the lack of effectiveness observed following Keystone Surgery implementation requires health care professionals to reevaluate how such interventions are designed. Lessons learned from use of the Comprehensive Unit-based Safety Program in Keystone Surgery were subsequently incorporated into the development of a similar program—Surgical Comprehensive Unit-based Safety Program—that was successfully implemented at a single institution in July 2011.42 First, instead of using SCIP process measures, researchers used input from health care professionals to identify local defects with the greatest potential to prevent surgical site infections. Second, during the program, process measures were objectively audited (eg, postoperative temperature was measured to ensure patients were normothermic) rather than given credit for process compliance per se (eg, the current SCIP temperature control measure gives credit for use of a warming blanket regardless of a patient’s temperature). Focused efforts to address and mitigate local defects were associated with reductions in surgical site infection rates following colorectal surgery from 27.3% to 18.2% during a 2-year period.

### Conclusions

In this study, we evaluated a checklist-based quality improvement intervention focused on a statewide population of surgical patients. We found that the Keystone Surgery program was not associated with improvements in adjusted rates of adverse outcomes regardless of the cohort evaluated or the methods used. It is unclear whether this outcome was due to a failure of evidence or implementation. Although reasons are likely multifactorial, the experience gained through completion of Keystone Surgery resulted in valuable lessons for implementation of future programs. Going forward, evaluations of similar programs should incorporate both quantitative and qualitative methods to better understand how implementation influences outcomes.43 Given the resources necessary to widely implement programs like Keystone Surgery, it is essential that researchers assess clinical effectiveness before broad dissemination. This study illustrates that success of a program in one clinical context may not translate to others. Instead, each program must be evaluated individually to determine its true clinical effectiveness.

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Checklist-Based Intervention to Improve Outcomes

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Study concept and design: Reames, Dimick.
Acquisition, analysis, or interpretation of data: Reames, Krell, Campbell.
Drafting of the manuscript: Reames, Krell, Dimick.
Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Reames, Krell.
Administrative, technical, or material support: Campbell.

Study supervision: Dimick.

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Exclusions: None.

Institution: University of Michigan.

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REFERENCES
The Challenge of Quality Improvement in Surgical Care

David R. Urbach, MD, MSc

The story of surgical quality improvement has become a saga of high hopes followed by dashed expectations. Eminently sensible quality and safety interventions—promoted by opinion leaders, endorsed by health quality organizations, and supported by impressive results in promising early studies—too frequently fail to perform as expected when they are introduced into routine care. Reames and colleagues appear to have added one more disappointment to this boulevard of broken dreams. Keystone Surgery—a checklist-based quality improvement program modeled after the successful Keystone ICU (intensive care unit) program, consisting of a tool to enhance compliance with the Surgical Care Improvement Program process of care measures and a Comprehensive Unit-based Safety Program intended to improve teamwork and a culture of safety—did not improve the rates of adverse surgical outcomes as hoped when it was implemented in Michigan hospitals.

Why do quality improvement programs fail in practice when they appear so promising in the research setting? Here, Reames and colleagues offer 2 possible explanations: (1) that adherence to the Surgical Care Improvement Program process measures is not strongly associated with improved outcomes, or (2) that the Surgical Care Improvement Program measures are effective, but implementation of the Keystone Surgery program was not effective in increasing compliance. Information on whether implementation of the program affected the use of process-of-care measures could help distinguish between these 2 possibilities.

Further improvements in the quality of surgical care in typical practice settings will happen only if we know how to ensure that efficacious processes are actually used during routine care. To make matters more complex, Reames and colleagues remind us that programs that work in one clinical setting, such as intensive care units, do not work in other settings, such as operating rooms.

ARTICLE INFORMATION

Author Affiliations: Department of Surgery, University Health Network, Institute for Clinical Evaluative Sciences, Toronto, Ontario, Canada; Department of Surgery and Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ontario, Canada.

Corresponding Author: David R. Urbach, MD, MSc, University Health Network, 200 Elizabeth St, Room 10-214, Toronto, ON M5G 2C4, Canada (david.urbach@uhn.ca).


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REFERENCES

