
Effective Surgical Safety Checklist Implementation

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- BACKGROUND:** Research suggests that surgical safety checklists can reduce mortality and other postoperative complications. The real world impact of surgical safety checklists on patient outcomes, however, depends on the effectiveness of hospitals' implementation processes.
- STUDY DESIGN:** We studied implementation processes in 5 Washington State hospitals by conducting semistructured interviews with implementation leaders and surgeons from September to December 2009. Interviews were transcribed, analyzed, and compared with findings from previous implementation research to identify factors that distinguish effective implementation.
- RESULTS:** Qualitative analysis suggested that effectiveness hinges on the ability of implementation leaders to persuasively explain why and adaptively show how to use the checklist. Coordinated efforts to explain why the checklist is being implemented and extensive education regarding its use resulted in buy-in among surgical staff and thorough checklist use. When implementation leaders did not explain why or show how the checklist should be used, staff neither understood the rationale behind implementation nor were they adequately prepared to use the checklist, leading to frustration, disinterest, and eventual abandonment despite a hospital-wide mandate.
- CONCLUSIONS:** The impact of surgical safety checklists on patient outcomes is likely to vary with the effectiveness of each hospital's implementation process. Further research is needed to confirm these findings and reveal additional factors supportive of checklist implementation. (J Am Coll Surg 2011;212:873–879. © 2011 by the American College of Surgeons)
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In 2009, investigators documented a significant reduction in mortality and other postoperative complications with use of the WHO surgical safety checklist.¹ Since then, the checklist has been adopted by more than 3,900 hospitals in 122 countries, representing more than 90% of the world's population.² Twenty-five countries are moving to adopt the checklist at a national level.

Such expansive uptake begs the question, "can adopting hospitals achieve results similar to those seen in the WHO pilot study?" Limited but encouraging real world data have begun to suggest that they can. In Washington State, for example, the checklist has been endorsed by Governor Christine Gregoire and championed by the Surgical Care and Outcomes Assessment Program. Preliminary data from elective colorectal operations in 22 hospitals showed

significant improvement in a proxy measure for surgical site infection around the time of checklist implementation (Flum D, personal communication, October 27, 2010). Likewise, Neily and colleagues³ reported decreased surgical mortality among 74 medical centers that participated in a Veterans Health Administration Medical Team Training Program featuring perioperative checklists. More recently de Vries and collaborators⁴ from the Netherlands' Surgical Patient Safety System documented a significant reduction in in-hospital mortality (from 1.5% to 0.8%) and in overall complications (from 27.3 to 16.7 per 100) after implementation of a comprehensive surgical checklist.

To impact outcomes, the checklist must be effectively implemented by hospitals that adopt it. Implementation is a series of "planned efforts to mainstream an innovation within an organization"⁵ that serves as "the critical gateway between an organizational decision to adopt an intervention and the routine use of that intervention".⁶ Effective implementation processes vary in their details depending on the innovation and context,⁷ but existing theories suggest important commonalities.

Edmondson and colleagues⁸ made an important contribution to our understanding of surgical implementation processes in 2001. Her group performed a qualitative field study of 16 hospitals implementing minimally invasive

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technology for cardiac surgery. Effective implementers took a deliberate approach to enrollment, inviting the most qualified and enthusiastic team members to participate. Preparation included full team dry runs and ample discussion. Trials emphasized multidisciplinary communication.

Similar strategies have been effective outside the operating room. A 2004 meta-analysis of implementation by Greenhalgh and associates⁵ produced a unified conceptual model from among 495 studies in medical sociology; communications; evidence-based medicine; and organizational process, context, and culture. In addition to recapitulating Edmondson's findings, the analysis suggested that effective implementation processes incorporate hands-on leadership, frontline decision making, dedicated resources, local modification, and feedback.

With Greenhalgh and Edmondson in mind, we recently studied factors that distinguished highly effective checklist implementation processes among a small but diverse group of hospitals.

METHODS

Five Washington State hospitals consented to semistructured interviews with their implementation leader (nurse, anesthesiologist, or surgeon) and a surgeon who had used the checklist but was not a member of the implementation team. Sixty- to 90-minute interviews with implementation leaders conducted from September to October 2009 explored factors suggested by prior studies (including leadership, resources, enrollment, decision making, training, modification, piloting, communication, coaching, and feedback) and observations from the WHO pilot. Thirty- to 45-minute interviews with surgeons conducted from October to December 2009 covered many of the issues discussed with implementation leaders as well as the individual surgeon's experience using the checklist in his or her operating room.

Following local hospital association recommendations, hospitals were selected to represent a range of structural characteristics and implementation experiences, from quick and complete to protracted and incomplete (Table 1). We defined "quick" implementation processes as those lasting less than 2 months from pilot to hospital-wide rollout. "Protracted" processes lasted more than 6 months. The

study benefitted from the fact that participating hospitals all began their implementation process within a 2-month window from December 2008 to January 2009. We defined "complete" implementation processes as those that achieved thorough and consistent use of the checklist in all operating rooms. "Incomplete" processes achieved partial or inconsistent checklist use. Of note, all 5 implementation leaders reported complete implementation in their institution. We subsequently compared their assertions with those of a local surgeon to make a more realistic assessment. Only hospitals in which the two agreed are listed as "complete" in Table 1.

Interviews were transcribed and analyzed question by question to identify factors distinguishing hospitals. These were then refined in an iterative process and compared with findings from previous implementation research.^{8,9}

RESULTS

Implementation leaders and surgeons revealed significant variation in implementation processes, with corresponding differences in surgical staff members' response. The 2 most effective processes (those that led to quick and complete implementation) will be described in a vignette below. A less effective process will also be described because it illustrates essential differences. Each vignette is composed of quotes from implementation leaders and surgeons that capture aspects of the hospital's implementation process from the makeup of the implementation team to strategies for enrollment and/or motivation, approach to training, piloting, hospital-wide checklist rollout, presence or absence of coaching and/or feedback, and the current state of checklist use.

The remaining 2 processes were critically flawed and did not contribute significantly to our understanding of effective checklist implementation. In one case, fear of insurmountable resistance and poor interdisciplinary communication led the implementation leader to expand the Joint Commission time-out rather than implementing a surgical safety checklist. In the other case, according to the implementation leader, the hospital was unable to move beyond pilot testing or provide a surgeon to interview.

Table 1. Structural Characteristics and Implementation Experience of Participating Hospitals

Site	Size (No. of operating rooms)	Location	Professional discipline of leader	Implementation experience
1	Medium (10–20)	Suburban	Multidisciplinary team	Quick, complete
2	Small (<10)	Rural	Surgeon	Quick, complete
3	Large (>20)	Urban	Surgeon	Quick, incomplete
4	Large (>20)	Urban	Multidisciplinary team	Protracted, incomplete
5	Small (<10)	Suburban	Anesthesiologist	Protracted, incomplete

Site 1. Highly effective implementation: a team effort

"It was a team effort . . . everybody worked together. The chief of surgery was a strong member who helped drive the process."

Implementation at this hospital was led by a multidisciplinary team including a surgeon and 2 surgical nurse managers who met biweekly ". . . to prep everything, to strategize and then put it into action." In addition, the team met spontaneously ". . . 2 to 3 times per week, whenever we saw each other in the hallway or in the OR [operating room] . . . The CMO [chief medical officer] checked in with the OR daily. If one of us needed help, we could get help right away."

The team "had a lot of conversations around why" to build enthusiasm and achieve buy-in. They promoted the checklist as an innovative intervention aligned with the hospital's established commitment to patient safety. Surgeons were eager to join the implementation leader ". . . on the cutting edge." However, they "wouldn't have listened if we brought in a 'quality person.' They responded because it was people that they knew and trusted." The rest of the staff ". . . helped pull [resistant staff members] in with their acceptance [of the checklist]." Nurse managers also believed that ". . . there were informal MD to MD discussions about using the checklist to become leaders in the OR . . . like the checklist was a vehicle for reclaiming leadership."

Once the checklist had been introduced, the implementation team provided extensive training. Sessions were tailored to each discipline to expose surgical staff ". . . over and over in a nonthreatening way that encouraged their participation. The idea was for them to walk in the room and be able to use the checklist." In a surgeon's words, "when you have a nurse standing next to you with a huge poster and all you have to do is read it, it's easy."

When the checklist was piloted in a small number of general surgery operating rooms, members of the implementation team offered real time coaching and feedback. In addition, "a private general surgeon who usually resists new measures . . . [had clearly] been practicing and was able to run the checklist flawlessly. He became a 'poster child,' and his efforts were publicized in newsletters."

The original plan was to pilot the checklist in the general surgery service and then roll it out to other surgical services. However, ". . . other services picked it up right away and didn't want to wait for an official rollout. We didn't hold them back." Over the next 6 weeks, the Checklist spread hospital-wide spontaneously. Implementation team mem-

bers continued to provide real-time coaching and feedback throughout that period.

Today the checklist proceeds as follows: "there is a written checklist that is actually laminated and held on the wall with Velcro. The nurse takes it down and holds the consent next to it, then looks at me [the surgeon] and I initiate the checklist . . . Essentially everyone stops and we go through each point. It's not like we get each member to say, 'I agree.' But I look around and make sure that there is consensus. As the surgeon, I see myself as the one orchestrating the event. So I make sure that I'm getting a look of consent from everyone. If they [look like they] have a question, I'll ask to make sure they're comfortable."

Checklist use is mandated in all operating rooms and before all surgical procedures. One surgeon ". . . cannot honestly think of any circumstance where it does not warrant 30 seconds to stop and think about what you're going to do before you do it and make sure everyone is ready. Especially in emergency situations." In addition, surgeons adopted morning briefings as a ". . . natural adjunct to going through the checklist when you get into the room . . . Say we have a 7:30 start and I'm doing 8 cases. I know I'm working in the same room and have pretty much the same staff all day. So it may be worth taking 5 minutes to sit down, go through the day and give everyone an expectation of how it should flow . . . Like, 'I've got a hand fracture . . . do we have the modular hand kit?' Or, 'I've got this unique rotator cuff and I'm planning on doing it in this position, which is not what I usually do.' I think it would be safer."

Site 2. Moderately effective implementation: the empowering leader

"I was trying to involve the entire OR crew . . . to empower them with the safety of the patient. I was going for a flattening of the hierarchy to allow everybody to speak up."

The CMO, a surgeon, took responsibility for checklist implementation at this hospital. "I am hospital leadership . . . People understand that my position is unique. I have been in this position for 7 years and am very fortunate to get buy-in from all of my colleagues . . . [They] see me on the frontline with them."

As at site 1, this implementation leader spent considerable time discussing and demonstrating the checklist. "We ask so much of clinicians. You don't want to pile things on without good reason. I didn't want this to seem like my pet project. There had to be reasoning and rationale behind it. The approach was to say that we were going to make cultural change in the OR. That we weren't implementing a list—we were effecting cultural change."

In addition, surgical staff at this hospital were motivated by a sentinel event that “opened people’s eyes” to the need for ongoing patient safety efforts. “We had a wrong site incision . . . Those kind of experiences showed staff that there are regulatory requirements that actually help us improve patient care . . . That culture of quality improvement lives on.”

The checklist was piloted by the implementation leader and several other general surgeons known to be interested in quality improvement. Rather than a widely publicized event, the pilot was a 1-week “. . . trial run to make sure nothing was missing or dysfunctional.” Before hospital-wide rollout, the implementation leader enlisted checklist enthusiasts from nursing, anesthesia, and surgical subspecialties (including orthopedics and otorhinolaryngology). The goal was to build enthusiasm and “. . . to take a quick ‘timeout’ and change it into something that was cultural. I was trying to involve the entire OR crew and empower them with the safety of the patient. I was going for a flattening of the hierarchy, to allow everybody to speak up when something was going on in the OR.”

Surgical staff responded to the implementation leader’s approach to enrollment and took an interest in ensuring that checklist processes were completed correctly. For example, nurses prompted surgeons to complete the checklist before the first incision. Previously “. . . we felt that only the surgeon could initiate it or else it wasn’t a success. [But at that point] the surgeon is really focused on the case in front of him or her. If the nurse prompted the surgeon to start the checklist, it would get done every time.” Scrub technicians were also asked to keep scalpels out of reach (on the back table, as opposed to the Mayo stand) until the checklist was complete.

Although the implementation leader performed multiple demonstrations, a surgeon suggested that the process would have benefitted from “. . . a little more formal education of surgeons . . . There wasn’t a meeting, not that I remember.” When the implementation leader offered to conduct real time coaching and feedback, surgical staff declined. He also opted not to conduct follow-up observation to prevent “a big brother feeling . . . [This is] something we do, not something we police.”

Checklist use was mandated in all operating rooms and before all surgical procedures. However, compliance varied from surgeon to surgeon. “Who enforces this stuff when the surgeon isn’t behaving? . . . That is where we have had problems when we have ‘bad players.’ It is a difficult position for nurses and even anesthesiologists to be in.” There was no mechanism for monitoring checklist use or ensuring that the checklist is used as intended (eg, read from a poster rather than being recalled from memory). “There really

isn’t someone following along to ensure that every item is covered.”

Site 3. Less effective implementation: the *laissez faire* leader

“This is a no brainer. I don’t understand why there would be pushback.”

The Medical Director of Surgery, a surgeon, took primary responsibility for checklist implementation at this hospital. Although he partnered loosely with a fellow surgeon and anesthesiologist, “It was more of, ‘hey guys, this is what I want to do and I need your support.’ . . . They saw things the same way that I did. I didn’t have to spend time getting them to buy in.” The group had collaborated on patient safety projects in the past and was reportedly seen as “the ‘Darth Vaders’ who have gone over to the dark side . . . When we come back and say ‘we want to try this,’ there is rolling of the eyes.”

The implementation leader deemed dedicated education or training before implementation unnecessary. “We already had a scripted timeout posted to the wall . . . We didn’t need 3 months of in-service to get this going. I talked to all of the staff. I spent an hour with nurses and scrub techs going over everything with them and agreed to be the advocate and punching bag for this project.”

Nurses worried that they would be responsible for “forcing surgeons” to use the checklist. The implementation leader acknowledged this possibility saying, “either the nurses are too big of wimps to pull this off or the surgeons are too big of jerks to pull this off . . . Getting it done was more important than trying to make it perfect . . . if I continued to fine tune this thing it would never reach everybody’s satisfaction and would never get implemented.”

The checklist was piloted by the implementation leader and his surgical partners. “I felt that I could influence that group most . . . A lot of the other guys tend to live their lives differently with regard to cranking things out, but I could get [my partners] to think the same way that I was thinking off of the bat.”

After the pilot period, all of the hospital’s surgeons received a letter announcing that the checklist would be mandated hospital wide. A copy of the checklist was then placed in every operating room. “[During the trial] we had these gigantic posters that could hang on the wall . . . They were bulky and to check it off was kind of dumb. So we changed that format by the time we rolled out the checklist . . . We shrunk the posters down to 8 × 11 and laminated them. They are mental cues. The nurse can hold it up in front of the surgeon to look at and read or read it off for us.”

At no point was real time coaching or feedback offered, and no plan for ongoing monitoring was established. However, patient care is said to be “. . . astronomically improved. The problem is that I don’t have data to back that up . . . All I know is that we are doing better.”

Views regarding the frequency of checklist use conflicted. The implementation leader believed that the checklist was being used “. . . not to perfection, but it is used in every case.” A fellow surgeon believed “. . . that a minority of the surgeons are using the checklist.” When asked in what percent of cases he uses the checklist he said, “almost none. Typically I don’t even see it in the room, even though it is supposed to be there. The majority of my colleagues use it the same amount of time as me.”

With regard to the quality of checklist use, the surgeon added, “different people do it in different ways. Sometimes the nurse or anesthesiologist instigates the checklist . . . The sequence isn’t always the same, but we always hit everything . . . In some rooms [the checklist] is physically present and in other rooms it is done verbally [ie, from memory] . . . Many, like me, have it memorized and blast on through it. At the end I say, ‘did I forget anything?’ and somebody says something like, ‘blood loss.’” Individual variation was acceptable to the implementation leader. “I don’t have a problem with modification unless the whole thing is junked, but nobody is really doing that.”

DISCUSSION

Effective implementation processes vary in their details depending on the innovation and context. As a result, de novo examination of each innovation and context is suggested.⁶ With regards to surgical safety checklist implementation, the work of Edmondson and colleagues⁸ and Greenhalgh and associates⁵ led us to believe that dedicated resources, frontline decision making, and local modification would distinguish highly effective processes. This was not supported by the interviews we conducted. However, active leadership, deliberate enrollment, extensive discussion and training, piloting, multidisciplinary communication, real time coaching, and ongoing feedback (all of which were also highlighted by Edmondson and colleagues and Greenhalgh and associates) did distinguish highly effective checklist implementation processes. These factors play key roles in explaining why and showing how the checklist should be used.

Explaining why means providing a clear rationale for checklist implementation; communicating the benefits demonstrated in the pilot study; portraying the checklist as aligned with institutional values; and highlighting anticipated improvements in patient safety, efficiency, and teamwork. Explaining why builds understanding, enthusiasm,

and buy-in. *Showing how* means demonstrating proper technique for checklist use. It includes describing best practices, such as multidisciplinary participation and reading as opposed to relying on memory, and directly addressing staff concerns. Showing how also requires short- and long-term observation and coaching to ensure sustained compliance. Explaining why is a natural predecessor for showing how. Whether staff are inherently receptive or resistant, explaining why increases the likelihood that staff will participate in the implementation process and that subsequent efforts to show how the checklist should be used will be successful. Explaining why may therefore be seen as a prerequisite for showing how as well as a necessary component of highly effective implementation processes.

Site 1 provided an example of a highly effective implementation process. With ready support from senior leadership, the multidisciplinary implementation team invested significant time and effort in explaining why the checklist was being implemented and showing how it should be used. The team provided extensive discipline-specific education (via multimedia presentations, meaningful discussions, and demonstrations) and real time coaching. They diffused resistance and achieved increasingly thorough and consistent checklist use. The implementation team planned to sustain its success through ongoing observation with an emphasis on reading the checklist rather than relying on memory. In both aviation (in which checklists were first developed) and the OR, reliance on memory is a well-established source of variation.¹⁰ Allowing such variation may compromise the benefits promised by the WHO pilot study.

Site 2 exemplified a moderately effective implementation process. The implementation leader invested heavily in explaining why but failed to show how the checklist should be implemented, preferring to empower rather than guide. Initial enthusiasm and buy-in waned as surgical staff went without instruction regarding best practices, real time coaching, and long-term observation. Although showing how may require attention to individual or disciplinary sensitivities, it is an essential component of effective implementation processes.

Site 3 modeled a less effective implementation process. The implementation leader at this hospital neither explained why nor showed how the checklist should be used, opting for a *laissez faire* style of leadership. As a result, staff did not understand the rationale behind implementation and were not adequately prepared to use the checklist. Frustration quickly led to disinterest and abandonment despite a hospital-wide mandate.

Although further study is required, the interviews performed in Washington State suggest that explaining why is

Table 2. Explaining Why and Showing How to Implement a Surgical Safety Checklist

	Implementation leaders	Surgical staff
Explaining why	Describe magnitude of changes seen in WHO pilot study Highlight values that align institution with checklist Build on past success with patient safety projects Model multidisciplinary participation	Understand rationale for checklist implementation (WHO results, institutional values) Appreciate ongoing patient safety efforts Recognize own role in patient safety Value multidisciplinary collaboration
Showing how	Welcome and respond to staff input Demonstrate best practices through tailored education and pilot testing (multidisciplinary participation including team introductions, checklist complete before incision, avoid reliance on memory) Provide real time coaching and feedback Anticipate long-term need for training, observation, encouragement, and quality control	Understand that their opinions and experiences are valued Master and commit to best practices Benefit from real time coaching Welcome long-term support

a necessary part of the implementation process but that only those sites in which implementation leaders also show how will achieve quick and complete checklist use. Table 2 lists examples of issues raised, information provided, and activities employed to explain why and show how by the leaders that achieved highly effective checklist implementation. Each item is paired loosely with the desired effect on surgical staff. Of note, “surgical staff” includes all surgical technicians, nurses, anesthesiologists, and surgeons who will ultimately be required to use the checklist.

This study had notable limitations. It was conducted via telephone with a sample of Washington State hospitals selected by a local hospital association. Although their implementation processes began within 2 months of one another, the organizations proved to have been at very different stages of readiness. Budget constraints did not allow for site visits or the inclusion of a larger sample. We acknowledge that our results may not be representative or complete. However, this study was designed to illustrate variation in implementation processes (which were abundant even among the 5 hospitals sampled) and to generate, rather than test, hypotheses.

In summary, despite significantly reducing mortality and other postoperative complications in the WHO Pilot Study¹ and the Netherlands’ Surgical Patient Safety System,⁴ the real world impact of surgical safety checklists on patient outcomes is likely to vary with the effectiveness of each hospital’s implementation process. Deploying a checklist without building an appreciation for how and why it works ignores the critical sociocultural dimension of how safer care is achieved.¹¹ Our qualitative exploration of implementation processes at 5 hospitals suggests that implementation effectiveness hinges on the ability of implementation leaders to persuasively explain why and adaptively show how to use the checklist. In our most effective example, a multidisciplinary team exemplified the multidisciplinary teamwork that the checklist seeks to pro-

mote.¹² Coordinated efforts to explain why the checklist was being implemented and extensive education regarding its use resulted in buy-in among surgical staff, and ultimately, thorough and sustained implementation. Further research is needed to confirm these findings and reveal additional factors supportive of checklist implementation.

Author Contributions

Study conception and design: Singer, Edmondson, Berry, Gawande
Acquisition of data: Conley, Singer, Edmondson
Analysis and interpretation of data: Conley, Singer, Edmondson, Berry, Gawande
Drafting of manuscript: Conley, Singer
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