Major article

Reducing health care-associated infections (HAIs): Lessons learned from a national collaborative of regional HAI programs

Catherine Amber Welsh PhD a,b,*, Mindy E. Flanagan PhD a, Shawn C. Hoke BA c, Bradley N. Doebbeling MD, MSc a,c,d,e, Loreen Herwaldt MD f, for the Agency for Healthcare Research and Quality Hospital-Acquired Infections Collaborative

a Indiana University Center for Health Services and Outcomes Research, Indianapolis, IN
b School of Engineering Technology, Indiana University-Purdue University Indianapolis, Indianapolis, IN
c Regenstrief Institute, Indianapolis, IN
d VA Health Services Research and Development Center of Excellence, Indianapolis VA Medical Center, Indianapolis, IN
e Department of Medicine, Indiana University School of Medicine, Indianapolis, IN
f Department of Internal Medicine, University of Iowa, Iowa City, IA

Key Words:
Health care-associated infection
Quality improvement
Patient safety

Background: Health care-associated infections (HAIs) are a leading cause of death in United States health care settings, with an overall estimated annual incidence of 1.7 million. As antimicrobial resistance has increased, so too have efforts to reduce HAI rates. The objective of this study was to identify commonly cited lessons learned across a wide variety of HAI projects and hospital settings.

Methods: Thirty-three hospitals participated in 5 different regional collaboratives supported by the Agency for Healthcare Research and Quality (AHRQ). Data on hospitals’ successes, challenges, and lessons learned were collected via key informant interviews and structured, standardized case report forms.

Results: Seven commonly cited themes were identified: foster change by first understanding resistance; commit to regular strategic communication and join a collaborative; start small and tailor implementation to local needs and cultures; engage frontline staff by involving them in the project and enlisting champions; educate and reeducate; convince administration to provide leadership, funds, and dedicated staff and assign accountability; and provide timely, relevant feedback and celebrate successes.

Conclusion: Despite the diversity of hospital settings, cultures, personnel, and HAI reduction projects, we found that hospitals encounter similar challenges and facilitators across projects. We offer a model of 7 process elements shown to be important to successful implementation.

Copyright © 2012 by the Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.
Bundles, especially when implemented by interdisciplinary teams, have been very effective. For example, Pronovost et al demonstrated that hospitals in Michigan were able to lower their rates of CLABSI to nearly zero when they adopted a bundle of evidence-based practices related to placement and use of central lines. Educational interventions elsewhere have been associated with reductions in bloodstream infection (BSI) rates by approximately two-thirds. Many best practices are not implemented routinely, however.

In 2007, the Agency for Healthcare Research and Quality (AHRQ) created the AHRQ HAI Initiative, which funded 5 regional collaboratives. The AHRQ selected Regenstrief Institute and Indiana University to serve as the HAI Assessment Center to facilitate communication and to support the collection, analysis, and dissemination of information and knowledge from this initiative. This article summarizes the successes, challenges, and lessons learned common to these 5 collaboratives.

METHODS

Participants

The 5 regional collaboratives (known as “Partners”) consisted of 33 hospitals with a range of hospital types and geographic locations (see Table 1). Table 2 provides brief descriptions of the HAI-reduction projects implemented and evaluated in this study.

Data collection

This research was approved by each Partner’s institutional review board and the Agency for Healthcare Research and Quality’s Office of Management & Budget (OMB). Indiana University’s Institutional Review Board approved the data collection procedures, analysis strategies, and research procedures.

Each Partner was asked to complete a standardized case report. The case report form was developed based on the study goals of identifying successes, challenges, and key lessons learned in implementing HAI reduction efforts. The form included a series of tables requesting information about the characteristics of the participating hospitals, the degree to which frontline staff and physicians were involved in HAI reduction efforts, descriptions of the specific HAI reduction efforts implemented (ie, activities and timelines), characteristics of the teams implementing these interventions (ie, personnel involved), assessments of the projects (eg, methods, outcomes), challenges encountered during projects, solutions for the challenges encountered, and lessons learned. Some Partners included brief narratives about their hospital’s specific experiences in implementing infection prevention measures.

Each of the 5 partners received the case report form in April 2009. Project Coordinators or Principal Investigators for each collaborative completed the case report based on semi-structured interviews with the investigators and/or coordinators at participating hospitals. In addition to these key informant interviews, 2 Partners conducted focus groups with personnel at participating hospitals. After receiving completed case reports, the assessment team conducted 1-hour phone interviews with Partner Project Coordinators to clarify and verify methodology and case report content.

Data analysis

Two independent, doctorally trained social scientists used qualitative data analysis techniques to assess data from Partners’ case reports to identify successes, key challenges, and lessons learned. The reviewers developed an initial list of labels that they discussed and developed into codes. They condensed these codes into a final list of categories, with each category including groups of similar concepts. The reviewers resolved areas of disagreement by discussion until consensus was reached. The final coding categories were reviewed and refined by all of the study’s authors.

RESULTS

The reviewers identified 7 themes in Partners’ comments about their efforts to implement HAI reduction programs. Table 3 provides a list of these themes, representative comments, and the number of Partners mentioning each theme. The 7 themes are as follows:

1. Fostering change. Resistance to change was reported as the greatest challenge Partners faced. Unit staff provided the following reasons for their resistance: competing priorities, skepticism due to previous projects that failed, absence of convincing evidence, and too little time. Although most Partners spoke about resistance from physicians, one Partner found resistance from nursing to be a greater challenge than resistance from physicians. Another Partner reported challenges with unit management such that one particular unit manager did not want to confront noncompliant personnel. Partners found that the key to overcoming resistance was to identify a mechanism of persuading staff members to become involved, such as having leaders model desired behaviors, opinion leaders give presentations, staff members tell personal stories, administration tie bonuses to performance on key measures, managers continually remind staff to model desired behaviors, and frontline staff participate in decision making. Partners noted that if they could engage their most vocal resisters (or slow adopters) and convince them to become involved in the project, then the resisters often became their most active supporters.

2. Communication and collaboratives. Several Partners felt that it was important to have standardized processes, messages, and metrics to ensure that all staff members got the same information, measured the processes and outcomes in the same manner, and reported results in the same way regardless of their department, job classification, or shift worked. For example, one hospital spent 9 months creating bedside tools to help ensure that evidence supporting the intervention was used in a consistent manner before implementing the intervention. Partners reported that they used numerous venues to educate staff and communicate their project’s goals. These venues included lunch-and-learns, daily work rounds, Grand Rounds, newsletters, routine educational sessions such as new staff orientations, online educational programs, discipline-specific presentations, strategically placed posters, e-mails, letters in employees’ mailboxes, and announcements from leadership. Partners also stated that being part of a larger collaborative, such as a statewide effort or the national AHRQ project, helped them avoid endless debate and provided both momentum and a vehicle for learning.

<table>
<thead>
<tr>
<th>Table 1: Hospital characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital type</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Rural</td>
</tr>
<tr>
<td>Tertiary care</td>
</tr>
<tr>
<td>Community</td>
</tr>
<tr>
<td>Government</td>
</tr>
<tr>
<td>Teaching</td>
</tr>
</tbody>
</table>

*IP, infection preventionists. The total exceeds 33 given that some hospitals are included in more than one hospital type.*
One Partner stated specifically that being a part of the statewide collaborative provided staff members with a sense of pride and accomplishment that helped them sustain the program.

3. Local, focused implementation. Although hospital leaders often defined the projects’ objectives, Partners found success when frontline staff and managers defined how the objectives would be accomplished in their units. Partners found that staff had to adapt the intervention to their own units (ie, unit staff had to define the “how” of implementation) given the variations in patient acuity, patient care procedures, technology, and unit cultures. The Partners found that it was important to focus on a few high-priority projects at a time and to start small (eg, in 1 or 2 units) so they could test ideas, build tools, and create protocols before spreading the initiative to other units.

4. Frontline staff engagement. Partners reported that involving frontline staff helped ensure that projects would be successful because frontline staff are the experts about their units—they understand best what must change. Partners involved frontline staff by having scheduled multidisciplinary meetings, holding quick daily huddles, and conducting brief in-person interviews to identify issues and gather ideas. Partners noted that it was a mistake to exclude frontline staff from the decision making process and to simply tell them what to do, because these staff had essential insights into how care could be improved.

Partners also reported that strong physician and nurse champions were very important to infection prevention initiatives. The types of champions differed across projects and hospitals; some hospitals had unit champions, whereas others had project or executive champions. The common lesson was that at least one person had to actively communicate with staff about the project and motivate other staff to participate. Champions helped bring attention to the project, highlighted the value of the change for colleagues, and motivated others to participate. Partners did not identify specific characteristics of a good champion, but they noted that champions who were liked and well respected facilitated successful intervention.

5. Organizational learning. Few would argue against the need to educate staff members at the beginning of improvement projects. However, Partners discovered that continuous education and reeducation were necessary because staff members forget important information, trained staff members leave, and new, untrained employees join the team. In addition, Partners found that they needed to continuously share new research results with their staff members so that they understood the evidence supporting the recommended practices and the science behind infection prevention. Some Partners provided their staff with summaries of important research results that supported the best practices and explained how microbial pathogens spread so that their staff could provide excellent routine care and could make educated decisions in novel situations.

Partners most commonly conducted large-group educational sessions or provided educational programs online. They reported challenges with using either modality. For example, staff members forgot log-in information, had problems accessing the course, had limited access to computers, or thought the training was not important. Partners also noted that the number of educators was limited, especially for programs led by Infection Prevention personnel, and that it was difficult to find times when most staff members could attend educational sessions. In some cases, Partners also used one-on-one conversations to correct misinformation, to address an individual staff member’s concerns or issues, and to garner support for improvement projects. To address these issues, Partners sent multiple reminders, provided education in multiple venues using multiple methods (eg, online, group, post) at multiple times (eg, sessions offered during the day, evening, and night shifts), and offered presentations tailored for the audience (ie, both clinical and nonclinical staff).

6. Support, resources, and accountability. Partners viewed strong administrative support as a critical factor to ensuring a project’s success. Administrators who supported projects publicly communicated to managers and frontline staff that such projects were important. One hospital had promoted hand hygiene for 15 years, but adherence did not improve significantly until the hospital’s President gave hospital-wide presentations via television and podcasts. Other Partners found that having hospital leaders, such as Chief Executive Officers, Chief Medical Officers, and Chief Nursing Officers, ask staff about projects and needed resources during executive rounds on units helped ensure successful implementation of infection prevention interventions.

---

Table 2

<table>
<thead>
<tr>
<th>Project title</th>
<th>Brief description</th>
<th>Involved parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambassador program</td>
<td>Increase staff understanding of infection prevention protocols and increase adherence</td>
<td>IPs and Ambassadors</td>
</tr>
<tr>
<td>Bundle implementation</td>
<td>CLABSI, MRSA, CDI, VAP (chlorhexidine bathing and oral care), SSIs/sepsis</td>
<td>ICU clinical staff, ancillary staff</td>
</tr>
<tr>
<td>Color-coded armbands</td>
<td>Decrease incidents related to falls, allergic reactions, and restricted extremities</td>
<td>Nursing and admissions</td>
</tr>
<tr>
<td>Education/training</td>
<td>VAP, CLABSI, chest tube insertion, CAUTI, SSI, Just Culture, infection prevention, HAI certification</td>
<td>Clinical staff, residents, all hospital personnel, new hires</td>
</tr>
<tr>
<td>Environmental cleaning</td>
<td>Evaluating terminal cleaning by placing fluorescent dye on high-touch areas and assessing whether or not the dye was removed via terminal cleans after 2 or 3 patients have been discharged from a room</td>
<td>Infection Prevention &amp; Control and Environmental Services</td>
</tr>
<tr>
<td>Influenza vaccination</td>
<td>Infection Prevention and Control personnel educate employees about the value of influenza vaccinations as a way to increase vaccination rates</td>
<td>All staff</td>
</tr>
<tr>
<td>Increasing adherence</td>
<td>Increase adherence to the hand hygiene and contact isolation protocols</td>
<td>All staff</td>
</tr>
<tr>
<td>Nurse Champion program</td>
<td>Facilitate implementation of VAP and CLABSI bundles in ICUs</td>
<td>ICU nurses</td>
</tr>
<tr>
<td>Product testing</td>
<td>Pilot test a CHG coated dressing material; pilot test silver-coated Foley catheter</td>
<td>Critical Care Unit staff, MICU staff</td>
</tr>
<tr>
<td>Statewide collaboratives</td>
<td>Participate in a collaborative dedicated to facilitating engagement, communication, data sharing, implementation of best practices, and public reporting of data</td>
<td>Administrators, Infection Prevention and Control personnel, and Quality Improvement staff, from hospitals statewide</td>
</tr>
<tr>
<td>Surveys</td>
<td>Use the 3 AHRQ data forms to assess attitudes perceptions and practices related to infection prevention</td>
<td>Clinical staff, Infection Prevention and Control personnel, Patient Safety personnel</td>
</tr>
</tbody>
</table>

CDI, Clostridium difficile infection; ICU, intensive care unit; IP, infection preventionist; MICU, medical intensive care unit; MRSA, methicillin-resistant Staphylococcus aureus.
Table 3
Commonly cited themes, representative quotations, and the number of partners that addressed each theme

<table>
<thead>
<tr>
<th>Theme</th>
<th>Comments</th>
<th>Number of partners mentioning theme (n = 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fostering change</td>
<td>“There was a good deal of initial resistance. Frontline staff only became engaged after initial success” (with another infection reduction project). “Changing practice was the biggest challenge... it took 6 months to see the results of practice change.” “Cultural and political barriers... can hinder initiatives if frontline staff are not directly involved in the process and part of the decision making.” “The Patient Safety Officer has had to lead the physicians to support this effort. Things had to be carefully orchestrated in terms of having all the materials prepared in advance, an exact plan of action, and strong support with the first steps.” “[The unit] manager didn’t want to address issues with nondedicated staff members.”</td>
<td>5</td>
</tr>
<tr>
<td>2. Communication and collaboratives</td>
<td>“Hospitals must have standardized procedures and metrics to ensure that everyone gets the same information and knows the same rules. Communication, monitoring, and reporting mechanisms need to be uniform across shifts, departments, and people.” “Use multiple venues to raise awareness and reinforce evidence-based practice such as Lunch and Learns, rounding, newsletters, Grand Rounds, routine education of new staff, reeducation of existing staff, and presentations to different disciplines by members of the same discipline.” “Posters were strategically placed throughout the unit, notices and reminders were sent [about the project, about performance metrics, etc.]” “Being part of a larger collaborative allows us to continue to learn and share experiences, challenges, and successes.” “Having a state-wide effort spurred hospitals to embrace HAIs reduction/elimination initiatives. No one hospital wanted to perform more poorly than the other.”</td>
<td>4</td>
</tr>
<tr>
<td>3. Local, focused implementation</td>
<td>“Start small. Build on successes. Celebrate successes in a big way.” “Focusing on a few high-priority patient safety efforts was critical. This helped prevent diluting the program.” “Staff can be told the steps but they need to figure out how to accomplish the outcomes [themselves].” “Doing what works locally has been a critical success factor.” “[Unit-based] hand hygiene coaches supporting each unit/area to find something that works in their setting have helped to improve compliance.”</td>
<td>4</td>
</tr>
<tr>
<td>4. Frontline staff engagement</td>
<td>“Key success factors include involving frontline staff... in improvement processes.” “Clinical bedside physicians are actively involved as well.” “Empowerment of staff in a team approach (physicians, bedside nurses, unit managers, etc.) is key to success of a project and ensuring ongoing adherence to improvement measures.” “Infection prevention is a shared responsibility and collaborative effort. Unit-based champions are crucial to the effort.” “Another vital success factor was having an engaging and popular physician champion (hospital epidemiologist).”</td>
<td>4</td>
</tr>
<tr>
<td>5. Organizational learning</td>
<td>“Constant education, reeducation, and reinforcement are critical. One-shot educational sessions do not work.” “Providing the evidence to the staff and educating them on the bundle were key success factors.” “Hospitals offered many training sessions to accommodate employees’ varying schedules.” “Have different in-person and online trainings for clinical and nonclinical staff.”</td>
<td>5</td>
</tr>
<tr>
<td>6. Support, resources, and accountability</td>
<td>“Initiatives with the most administrative support are the most successful since they are discussed the most and because frontline workers are given time to participate in task forces, which allow ‘grassroots’ promotion of the initiative.” “Executive support was critical and helped inform staff that they aren’t doing more work, but rather are focusing their efforts on the right work.” “Know that the initiative will take dedicated staff and lots of time.” “Communicate expectations, emphasize accountability and reinforce accountability by reporting unit-based results to staff and up through administration all the way to the board of trustees.” “Until the directors on the units were told they needed to take ownership of the initiative and that they were responsible for improving outcomes, the initiatives did not get implemented or monitored.”</td>
<td>5</td>
</tr>
<tr>
<td>7. Feedback and reinforcement</td>
<td>“Provide regular feedback, including performance data to staff.” “Give staff feedback on the results of the training interventions.” “Celebrate success. [You know you’re at] the tipping point when staff stop each other as they observe others not washing their hands.” “It [hand hygiene compliance] has also become a part of the annual bonus program for staff known as the Performance Incentive Plan.”</td>
<td>5</td>
</tr>
</tbody>
</table>

In addition to providing critical motivation and direction, administrators facilitated projects by providing funds for necessary supplies, equipment, project personnel, and overtime pay for project personnel. For example, one Executive Leadership Team provided funds to pay consulting physicians for time that they spent working with project committees. Other hospital projects learned through failures that projects with few or no dedicated staff performed less well than projects with dedicated staff. Another hospital’s Infection Prevention Manager discovered that a person dedicated to maintaining adherence and collating the data was essential to maintaining high levels of compliance.

Partners learned that administrators could also help implement HAI prevention strategies by assigning accountability. Methods for ensuring accountability included assigning responsibility for particular processes or outcomes to specific persons, posting scorecards on units, reporting performance data to executive bodies, and tying the leaders’ annual bonuses to performance. One Partner found that initiatives were not implemented or monitored until the administration told Unit Directors that they were accountable for improving outcomes in their units.

7. Feedback and reinforcement. Partners reported that providing compliance data regularly was “vital to any improvement activity.” To increase compliance, some Partners provided feedback daily, whereas others reported it weekly, monthly, or quarterly. Some Partners created unit scorecards, whereas
successes publicly recognize specific rewards included unit pizza parties, gift cards, awards banquets to cultures, which often takes 18 months or longer. Examples of rewards included unit pizza parties, gift cards, awards banquets to publicly recognize specific persons or groups, and annual bonus programs.

**DISCUSSION**

The 33 hospitals participating in this study varied substantially with respect to size, populations served, organizational structure, culture, and HAI reduction projects implemented. Yet these hospitals encountered common challenges when working to change practice, suggesting that some elements of human behavior are consistent across diverse health care settings. For example, all Partners agreed that both top-down support and bottom-up involvement were essential if HAI reduction efforts are to succeed. Hospital administrations must provide financial and political support, and frontline staff members must provide ideas and expertise.

In addition, Partners indicated that HAI reduction efforts are resource-intensive. Thus, hospital administration must provide the resources—personnel (eg, to collect, analyze, and report data), supplies and equipment (eg, isolation carts, gowns, disposable stethoscopes), time (eg, to assess current processes, identify gaps, develop solutions and plans, and implement changes), and money (eg, for salaries, overtime pay, and supplies)—necessary to make the interventions successful. As a practical matter, Partners noted that administrators and direct supervisors must include participation in infection prevention activities in their employees’ job responsibilities and provide “release time” during which frontline staff are freed from their usual duties to work on HAI reduction projects.

We identified 7 major lessons in the information that Partners shared about their experiences when implementing interventions to reduce HAIs: (1) foster change by first understanding resistance; (2) commit to regular strategic communication and join a collaborative; (3) start small and tailor implementation to local needs and cultures; (4) engage staff by involving them in the project and enlisting champions; (5) educate and reeducate; (6) convince administration to provide leadership, funds, dedicated staff and assign accountability; and (7) provide timely, relevant feedback and celebrate successes. Four of the lessons were mentioned by all 5 Partners as vital to success. These were foster change, educate and re-educate; gain administrative support, resources, and accountability; and provide timely feedback and reinforcement. The remaining 3 lessons were mentioned as vital for success by 4 out of 5 Partners. These lessons are consistent with findings from other studies. Damburg et al reviewed 104 projects and found that successful implementation required committed top managers, financial resources, a tailored design, and dedicated, involved, persistent staff. The 7 lessons are also consistent with the Team STEPPS model, which states that good teamwork depends on good leadership, good communication, mutual support (ie, collaboration), and accurate monitoring (ie, relevant feedback).

Clearly, these lessons are highly interrelated and should be integrated to achieve maximum effect. For example, staff members could foster change (lesson 1) by engaging frontline staff (lesson 4), and they could increase accountability (lesson 6) by providing unit specific feedback (lesson 7). Thus, we posit that the 7 themes are interrelated components important for any change effort, because they function as a behavioral change “bundle” (see Fig. 1 for a model of key elements of behavior change in health care). As such, the elements in this model do not need to be implemented in a specific order—change efforts can start with any of the 7 elements—but health care facilities that address each element in the bundle may help ensure that their efforts are successful.

Given the Institute of Medicine’s 500,000 Lives and 5 Million Lives campaigns and the Joint Commission’s Patient Safety Goals, many hospitals are implementing programs to reduce HAIs. This study provides hospitals seeking to implement such programs with information that can help staff focus their time and resources on elements that may facilitate success. The structured, standardized case study form was also a strength of this study, because it guided Partners as they gathered information, thereby facilitating the qualitative analysis and identification of common lessons. On the other hand, Partners might have reported their observations in a way that would reflect positively on their projects. Thus, the reader should consider these results as possibilities for consideration rather than absolute requirements.

The Partners felt that it was important to include frontline workers in efforts to reduce HAIs, in part because they can help reduce resistance to change. Thus, future research might study different populations of frontline workers to identify factors that motivate staff to change and the resources that they need to change. Rogers found that specific types of people can facilitate or
inhibit the adoption of innovations. He categorized people into 5 types based on their response to innovation—innovators, early adopters, early majority, late majority, and laggards—each with a unique “personality” and time span for accepting innovations. Future studies might evaluate whether health care workers in different disciplines (e.g., surgeons, internists, infectious disease physicians, intensive care unit nurses, pediatric nurses, surgical nurses) are more or less likely to be in one of Rogers’ categories, whether they have different motivations for changing their behavior, and whether they need different resources or information before they are willing to change. Moreover, hospitals might be able to hasten change and increase the likelihood of successful implementation if they had access to detailed information about HAI reduction initiatives at other facilities, including descriptions of the units in which initiatives were introduced, the rationale for choosing specific units and projects, the challenges encountered, the solutions attempted and those that were successful, and the outcomes of the interventions. Therefore, additional qualitative case studies describing such implementations would be useful.

Despite the diversity of hospital settings, cultures, personnel, and HAI reduction projects, this study found similar barriers and facilitators across projects. Such a finding is valuable given that hospitals and units often focus on their differences rather than on their similarities. We offer 7 elements shown to be important to implementation success in numerous projects across multiple settings.

References


APPENDIX: AHRQ HAI COLLABORATIVE MEMBERS

American Institutes for Research (AIR): Sigrid Gustafson, PhD (PI), Kristin Carman, Deepa Ganachari, Beth Harber, Anthony Slonim, MD
Denver Health: Sheri Eisert, PhD (PI), Walter Biffi, MD, Anthony Dal Nogare, MD, Wade Dansby, RN, BSN, CSPDT, CIC, Ivor Douglas, MD/MRCP (UK), Valerie Hart, PhD, RN, MSN, Amy Irwin, DNP, RN, Connie Price, MD, Angelique Ramirez, MD, Pranavi Seeramamoju, MD, MPH, Shirley Shores, MA, CIC, Brad Walsh, MPH
Health Research and Educational Trust (HRET): Deborah Bohr, MPH (PI), John Combes, MD, Christine George, RN, MS, Morgan Martin, MHA, Kimberly Sepulvado, RN, Sam Watson, MSA, MT, Kevin Van Dyke, MMP
University of Iowa: Marcia M. Ward, PhD (PI), Loreen A. Herrwaldt, MD
Yale New Haven Health Services Corporation: Anthony D. Harris, MD, MPH (PI), Beverly Belton, RN, BSN, CNA-BC