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High Reliability

Applying the High Reliability Health Care Maturity Model to Assess Hospital Performance: A VA Case Study

Jennifer L. Sullivan, PhD; Peter E. Rivard, PhD; Marlena H. Shin, JD, MPH; Amy K. Rosen, PhD

Despite all the recent attention, patient safety appears to have improved relatively slowly in the past few years.[1,2] Other high-hazard industries, such as aviation and nuclear power, have achieved greater improvements in safety than health care because they were specifically focused on improving reliability in one microsystem.[3–5] Hospitals deliver care in multiple microsystems, yet care cuts across these microsystems in ways that make achieving high reliability more difficult. Some successful organizations in these industries, characterized as high reliability organizations (HROs), "rarely fail even though they encounter numerous unexpected events."[6(p. 18)] It has been argued that reliability science, a framework for safety improvement applied in health care and other industries, has the potential to reduce the rate of patient harm to near zero.[7,8]

The characteristics of an HRO, such as a relentless focus on threats to safety and reluctance to simplify interpretations, can be developed by organizations seeking to achieve zero patient harm.[9] However, the absence of a tool for categorizing and differentiating hospitals according to their HRO–related characteristics has hindered progress toward implementing and sustaining evidence-based HRO practices. To reduce the risk of harm and improve outcomes, hospitals would benefit both from a more sophisticated understanding of the organizational characteristics that support HRO practices and from knowledge about the steps necessary to achieve HRO status.

In 2013 The Joint Commission introduced a model to support HRO development in health care. The High Reliability Health Care Maturity (HRHCM) model is composed of three major domains for promoting high reliability—Leadership, Safety Culture, and Robust Process Improvement®.[10] The domains, and their associated 14 components, constitute a framework for assessing an organization's maturity. Stage of maturity is determined by the nature and extent of practices used by the hospital to move it toward the goal of high reliability.

The HRHCM model has a substantial degree of face validity,[11] which is based on the developers' experiences in the field, the model's grounding in a literature review, the developers' discussions with other experts in high reliability science, and the

Article-at-a-Glance

Background: The lack of a tool for categorizing and differentiating hospitals according to their high reliability organization (HRO)–related characteristics has hindered progress toward implementing and sustaining evidence-based HRO practices. Hospitals would benefit both from an understanding of the organizational characteristics that support HRO practices and from knowledge about the steps necessary to achieve HRO status to reduce the risk of harm and improve outcomes. The High Reliability Health Care Maturity (HRHCM) model, a model for health care organizations' achievement of high reliability with zero patient harm, incorporates three major domains critical for promoting HROs—Leadership, Safety Culture, and Robust Process Improvement®. A study was conducted to examine the content validity of the HRHCM model and evaluate whether it can differentiate hospitals' maturity levels for each of the model's components.

Methods: Staff perceptions of patient safety at six US Department of Veterans Affairs (VA) hospitals were examined to determine whether all 14 HRHCM components were present and to characterize each hospital's level of organizational maturity.

Results: Twelve of the 14 components from the HRHCM model were detected; two additional characteristics emerged that are present in the HRO literature but not represented in the model—teamwork culture and system-focused tools for learning and improvement. Each hospital's level of organizational maturity could be characterized for 9 of the 14 components.

Discussion: The findings suggest the HRHCM model has good content validity and that there is differentiation between hospitals on model components. Additional research is needed to understand how these components can be used to build the infrastructure necessary for reaching high reliability.

development and pilot testing of a model checklist at seven hospitals.[10] The work done to date could be described as that of obtaining a clear picture of how complex health care organizations establish and maintain extremely high levels of safety. We believe that an assessment of content validity, which entails testing whether a fresh set of empirical data yields the phenomena posited in the model,[11] is the appropriate next step. Accordingly, we conducted a study in the US Department of Veterans Affairs (VA) to examine if the HRHCM model can be used to characterize hospitals' levels of high reliability.

Our first aim was to examine the content validity of the HRHCM model by (a) assessing the extent to which the HRHCM components were present and (b) identifying instances in which other high reliability organizational characteristics based on the literature were not included in the HRHCM model. Our second aim was to evaluate the extent to which it is possible to differentiate hospitals' maturity levels for each model component. We assessed the HRHCM model using qualitative data collected from six VA hospitals. The VA represents a useful setting in which to assess the model because it is a large integrated health care system with oversight at local, regional, and national levels. The VA has a strong commitment to improving quality and safety of care,[12] resulting in the diffusion of improvement tools and practices, along with additional accountability for measurable improvement.

Methods

Sample

This study involved secondary analysis of qualitative data from 6 VA hospitals, which were selected from a larger sample of 28 hospitals used in a previous study conducted in 2009 and 2010[13] to validate the Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators (PSIs).[14] These 6 hospitals were purposively selected for diversity on both geographic location and patient safety performance, as measured by the AHRQ PSI composite measure for VA fiscal year 2007.[13] The larger sample was also limited to hospitals with the highest ICU complexity levels (that is, a proxy for patient acuity).

We used purposive sampling to select a diverse and representative cross-section of study participants, including individuals whose primary focus was patient safety (for example, patient safety managers), senior leadership (the executive leadership and service chiefs), and staff with a special interest in patient safety (infection control nurses). The study was approved by the Institutional Review Boards at the lead study site (VA Boston Healthcare System)—the home site for the research team—and the six participating hospitals from which the data were obtained.

Data Collection

In the previous study,[13] we conducted semistructured interviews, with an average of 24 interviews per hospital. The informants were representatives from senior leadership, middle managers, and frontline clinical staff in medical and surgical units. The interview guide (Appendix 1, available in online article), derived from the literature, covered a comprehensive set of specific domains of organizational structures and processes that influence patient safety in health care organizations.[15–17]

Conceptual Framework

The ultimate goal of the HRHCM model is to help organizations characterize their current state of maturity on the HRO components within the three major domains. Organizations can then focus reliability-building efforts on specific components. Table 1 (pages 391–392) presents the components and describes the maturity stage items within each domain of the HRHCM model. Appendix 2 (available in online article) displays a mapping of HRHCM model components to the semistructured interview questions.

The domain Leadership refers to senior leaders' commitment to, and actions toward, embracing the culture and practices of high reliability within the organization.[18–20] The domain Safety Culture is a key ingredient of high reliability because it drives and supports timely identification and reduction of hazards.[3,21,22] Finally, the domain Robust Process Improvement is central to HROs because it entails a systematic approach to continuous safety improvement, including measurement of safety events; identification of causes of those events using cutting-edge tools; problem resolution; and implementation of programs that ensure sustainability.[23–25] For each of the components within these domains, the four stages of maturity—"beginning," "developing," "advancing," and "approaching"—are characterized by the nature and extent of practices used by the hospital to reach high reliability. For example, a "beginning" stage of maturity is characterized by an organization that does not assess trust or intimidating behavior, emphasizes blame, does not recognize or evaluate close calls, has limited efforts to assess system defenses and remedy weaknesses, and does not measure safety culture.[10] At the other end of the continuum, an "approaching" stage is one in which a hospital has high levels of (measured) trust in all clinical areas, has staff who act on personal responsibility to maintain safety culture, routinely reports close calls and unsafe conditions, proactively assesses system defenses, and reports safety culture measures as strategic measures to the board.[10]

Table 1. A Description of the Components and Maturity Stage Descriptive Items Within Each Organizational Component in the High Reliability Health Care Maturity Model

Organizational Domain	Component	Maturity Stage Descriptive Items			
		"Beginning" Stage	"Developing" Stage	"Advancing" Stage	"Approaching" Stage
Leadership	Board	• Focus is on compliance with regulation.	• Board hears only about quality committee reports.	• Board develops and improves quality plan and hears about adverse events.	• Commitment to zero harm through entire organization has been made.
	CEO/ Management	• Management's quality focus is nearly exclusively on regulatory compliance.	• Management acknowledges need for plan to improve quality and delegates the development and implementation of a plan to subordinate.	• Management leads the development and implementation of a proactive quality agenda.	• Management aims for zero patient harm for all processes; some demonstrate zero or near-zero rates of harm.
	Physician	• Physicians rarely lead quality improvement activities; overall participation by MDs in these activities is low.	• Physicians champion some quality improvement activities; physicians participate in these activities in some areas but not widely.	• Physicians often lead quality improvement activities; physicians participate in these activities in most areas, but some important gaps remain.	• Physicians routinely lead clinical quality improvement efforts and accept the leadership of other appropriate clinicians; physicians' participation in these activities is uniform throughout the organization.
	Quality Strategy	• Quality is not identified as a central strategic imperative.	• Quality is one of many competing strategic priorities.	• Quality is one of the organization's top three or four strategic priorities.	• Quality is the hospitals' most important strategic goal.
	Measurable Goals and Outcomes (i.e., quality measures)	• Quality measures are not prominently displayed or reported internally or publicly; the only measures used are those required by outside entities and are not part of reward systems.	• Few quality measures are reported internally; few or none are reported publicly and are not part of reward systems.	• Routine internal reporting of quality measures begins. With first few measures reported publicly and the first quality metrics introduced into staff reward systems.	• Key quality measures are routinely displayed internally and reported publicly; reward systems for staff prominently reflect the accomplishment of quality goals.
	Information Technology (IT)	• IT provides little or no support for quality improvement (QI).	• IT supports some QI activities, but the principles of safe adoption are not often followed.	• IT solutions support many quality initiatives; the organization commits to principles and the practice of safe adoption.	• Safely adopted IT solutions are integral to sustaining improved quality.
Safety Culture	Trust	• Trust or intimidating behavior is not assessed.	• Codes of behavior are adopted in some clinical departments.	• Leaders establish a trusting environment for all staff by modeling behaviors and championing efforts to end intimidating behavior.	• High levels of trust in all clinical areas exist; self-policing of codes of behavior are in place.
	Accountability	• Emphasis is on blame; discipline is not equitable.	• Importance of equitable disciplinary procedures is recognized and adopted in some departments.	• Managers prioritize establishing a safety culture; equitable, clear disciplinary procedures are implemented.	• All staff act on their personal accountability for maintaining a culture of safety.

(continued on page 392)

Table 1. A Description of the Components and Maturity Stage Descriptive Items Within Each Organizational Component in the High Reliability Health Care Maturity Model (continued)

Organizational Domain	Component	Maturity Stage Descriptive Items			
		"Beginning" Stage	"Developing" Stage	"Advancing" Stage	"Approaching" Stage
Safety Culture (continued)	Identifying Unsafe Conditions	• Root cause analysis (RCA) is limited to adverse events; close calls are not evaluated.	• Pilot reporting programs begin; a few early interventions are present.	• Staff begin to recognize and report unsafe conditions before patients are harmed.	• Close calls and unsafe conditions are routinely reported, which results in reduced harm to the patient.
	Strengthening Systems	• Limited efforts exist to assess system defenses against quality failures and remedy weaknesses.	• RCAs begin to identify the same weaknesses in system defenses across departments, but no systematic efforts are in place to strengthen them.	• System weaknesses are catalogued and prioritized for improvement.	• Systems are proactively assessed and weaknesses regularly repaired.
	Assessment	• No measures of safety culture exist.	• Some measures of safety culture exist but are not widespread nor used to improve safety culture.	• Safety culture measures are adopted and utilized across the organization; efforts to improve safety culture are beginning.	• Safety culture measures are reported to management; improvement initiatives are under way to have a fully functioning safety culture.
Robust Process Improvement®	Methods	• No formal approach to quality management has been adopted.	• Exploration of modern process improvement tools begins.	• Commitment to adopt all Robust Process Improvement® (RPI®) tools has been made.	• Adoption of RPI tools is implemented.
	Training	• Limited training (e.g, compliance or quality staff) is available.	• Training in performance improvement tools outside the quality department is recognized as critical.	• Training of select staff in RPI is under way, and a plan is in place to broaden training.	• Mandatory training in RPI for all staff as appropriate for their jobs
	Spread	• No commitment to widespread adoption of improvement methods exists.	• Pilot projects using some new tools are conducted in a few areas.	• RPI is used to improve business processes, clinical quality and safety; a positive return on investment is achieved.	• Consistent use of RPI tools for all improvement work; patients are engaged in redesigning care processes, and RPI proficiency is required for career advancement.

Data Analysis

To evaluate the content validity and the extent to which it is possible to differentiate hospitals' maturity levels for each model component, we used the component descriptions provided in the HRHCM model. Specifically, we reexamined our data at the HRHCM component level to identify (1) evidence that corresponded with the HRHCM model's specifications, (2) components for which there was no evidence, and (3) HRO–relevant themes in our data that were not included in the model's specifications.

Figure 1 (page 394) displays the data analysis work flow. In the previous study,[13] analysis of verbatim interview transcripts generated one case summary per site, which contained quotes from informants on the domains of interest. The summary included verbatim quotes if two or more informants responded similarly about a specific domain. Similarly, quotes representing differing opinions were included in the summary if at least two informants reported an alternate viewpoint. Each detailed case summary was approximately 20 pages long, with 10 to 15 verbatim quotes per domain. Although we could not include every quote in the summary, we included evidence that captured the range of perspectives at the site from respondents in different job categories. NVivo qualitative coding software (QSR International [Americas] Inc., Burlington,

Massachusetts) was used for all data analysis.[13]

To address our study aims, we conducted secondary analyses of the data in each of the site-level case summaries. The first author [J.L.S.] recoded the six case summaries using a priori codes derived from the HRHCM model components.[10] In particular, we assessed the components within each domain (Leadership, Safety Culture, and Robust Process Improvement) at each hospital. If the case summary did not contain evidence pertaining to a particular component within an HRHCM model component, we then rereviewed verbatim transcripts for evidence that may not have been coded in the previous study.[13] For example, we reread the transcripts to search for evidence of participation in high reliability interventions or other specific Robust Process Improvement practices that had not been coded originally. Case summaries were also coded for emergent themes that were instances of relevant concepts from the HRO literature but were absent from the HRHCM model.

After coding was complete, the first author [J.L.S.] compiled a cross-site matrix[26] comparing hospitals on each component within each of the three domains. To determine data sufficiency for each component within a hospital, the analyst assessed the level of agreement among informants within the organization (for example, if two or more informants described a phenomenon that analysts rated as present). Information from both informants had to agree to rate the maturity level. We obtained three or more quotes for each component within each hospital. If informants' information was contradictory, we rated a maturity level on the basis of the perspective of the majority. We were able to identify a majority viewpoint for all components when there was sufficient evidence.

Table 2. Job Categories and Number of Informants Interviewed at Study Hospitals

	Hospital						
	A	B	C	D	E	F	Total
Executives: hospital director, associate director, chief of staff, and chief/associate nurse executive	2	3	5	5	4	5	24
Middle Managers: medical, surgical, pharmacy, and anesthesiology service chiefs; risk manager; patient safety manager; and quality/performance improvement manager	7	5	7	6	5	3	33
Surgical Service Front Line: staff surgeon, OR nurse manager, PACU nurse manager, SICU nurse manager, assistant/chief surgical nurse, surgical floor nurse manager, OR staff nurse, SICU staff nurse, surgical floor nurse, PACU staff nurse, and surgical chief resident	3	10	1	7	9	2	32
Medical Service Front Line: skin care specialist/wound care nurse, medical intensive/critical care unit nurse manager, floor/ward nurse manager, staff physician, chief medical resident, medical ICU nurse, medical unit floor nurse, and respiratory therapist	3	7	5	4	6	2	27
Other: VA surgical quality improvement program nurse/physician, coder, staff pharmacist, and infection control nurse	2	5	4	5	4	2	22
Total	17	30	22	27	28	14	138

OR, operating room; PACU, postanesthesia care unit; SICU, surgical ICU; VA, US Department of Veterans Affairs.

Results

Respondents

We interviewed a total of 138 employees at the six hospitals in our sample. Table 2 (above, right) displays respondents' job categories and the number of respondents interviewed at each study hospital.

Interview Questions and Model Components

The comparison of the interview questions and the HRHCM model components (Appendix 2) revealed that the interview guide provided more opportunities for informants to discuss some components than others. The components with most opportunities for discussion were Identifying Unsafe Conditions and Strengthening Systems within the Safety Culture domain. There were very few opportunities to discuss certain components, including Physician and Information Technology (IT) components within the Leadership domain, Assessment within the Safety Culture domain, and Spread within the Robust Process Improvement domain.

Aim 1a. Presence of High Reliability Health Care Maturity Model Components

In terms of Aim 1, we found evidence of the presence of 12 (86%) of the 14 components among all three domains (Table 3, page 395). However, for 10 of these 12 components, we were unable to find examples of the full set of descriptive items provided by the HRHCM model within that component. For example, within the Trust component, we found evidence of fear of reprisal and trusting practices but did not find examples concerning adoption of codes of behavior or leaders' championing of efforts to remove threatening behavior. The 2 (14%) remaining components for which we were unable to find any evidence

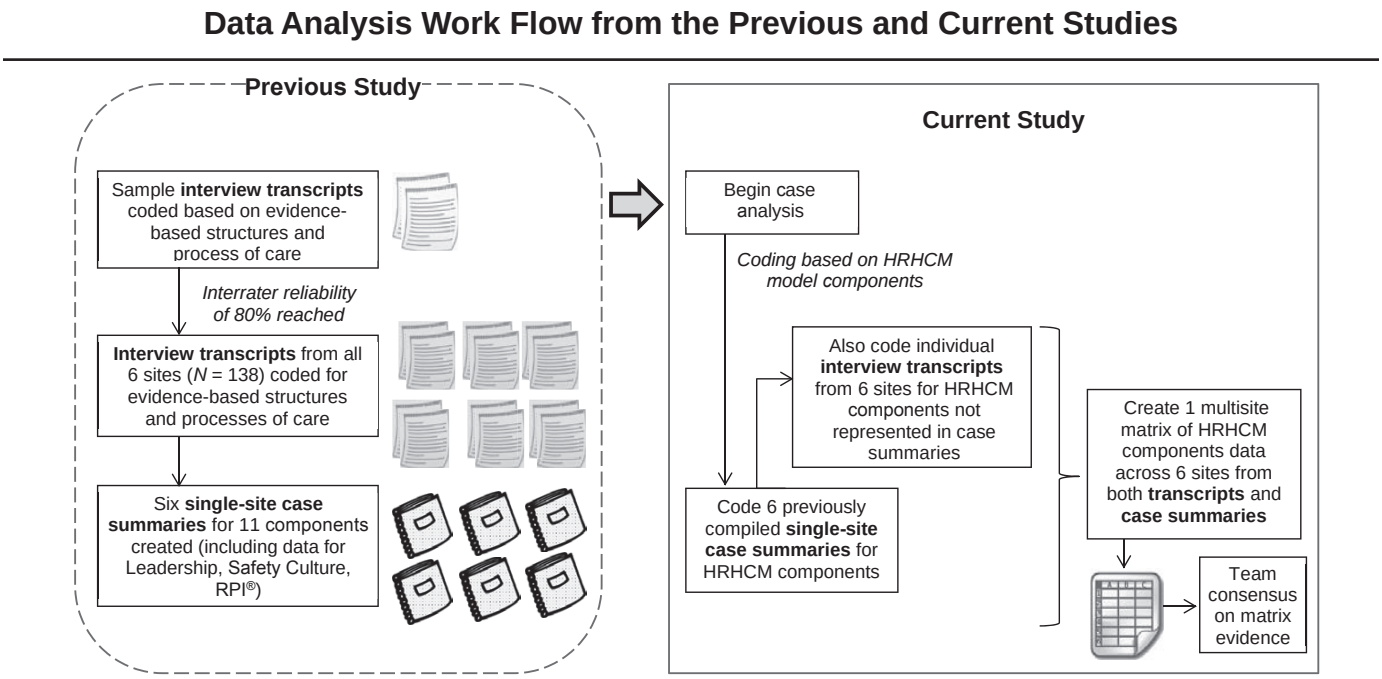

Figure 1. *The data analysis work flow from the previous (Shin MH, et al. Examining the validity of AHRQ's Patient Safety Indicators (PSIs): Is variation in PSI composite score related to hospital organizational factors?* Med Care Res Rev. *MCRR. 2014;71(6):599–618) and current studies are shown. HRHCM, High Reliability Health Care Maturity. RPI®, Robust Process Improvement®.*

were Board Leadership (Leadership domain) and Assessment (Safety Culture domain).

Aim 1b. Absence of High Reliability Organization Characteristics in the High Reliability Health Care Maturity Model

We were also interested in identifying instances in our data in which HRO characteristics that were present in the literature were not included in the HRHCM model—teamwork culture and system-focused tools for learning and improvement. Sample quotes to illustrate these characteristics are provided in Table 4 (page 396). In terms of teamwork culture, we found that communication patterns across disciplines were generally positive in our sample; however, at three hospitals, there were reports of negative physician-nurse interactions that might have negatively affected levels of trust. In terms of system-focused tools for learning and improvement, while all six hospitals used traditional tools such as root cause analysis, three hospitals employed Healthcare Failure Mode and Effects Analysis (HFMEA™). We also identified use of structured problem-solving techniques, such as gathering data through chart review; checklists; and run or control charts to identify trends in data at all six hospitals.

Aim 2. Differentiation of Hospitals' Maturity Levels for Model Components

In terms of the extent to which it is possible to differentiate hospitals' maturity levels for each model component. Appendix 3 (available in online article) presents selected quotes supporting the maturity level descriptive items for each component. We characterized the level of organizational maturity at each hospital for 9 of 14 of the components within the model. There was no evidence for the Assessment or Board components at any of the six hospitals; these components were not covered in the interview guide. Of the 12 components for which there was at least some evidence, 3 could not be identified at all six hospitals. For example, for the domain Leadership, four of the six hospitals showed no evidence regarding the component Physician. The remaining two hospitals highlighted the value of including physician champions to improve quality and were rated at the "developing" maturity level. Five hospitals showed no evidence regarding the components Training and Spread in the Robust Process Improvement domain. The remaining hospital was characterized at the "developing" stage of maturity because Lean Six Sigma methods had been implemented in a few areas, staff outside the quality department were being trained to use these methods, and senior leaders were involved in setting

Table 3. Evidence of the High Reliability Health Care Maturity Model Components and Descriptive Items

Model Domains	Components with Corresponding Evidence in Descriptive Items	Components Without Corresponding Evidence in Descriptive Items
Leadership		
• Board		• No evidence—VA does not report to a governing board.
• CEO/Management	• Shared commitment about quality	
• Physician	• Physician champions	• Unclear if physicians accept leadership of other clinicians and participate in quality improvement throughout organization.
• Quality Strategy	• Quality as a strategic goal • Patient safety as a priority	
• Measurable Goals and Outcomes	• Leaders expect PS events measured. • Data are benchmarked. • Results reviewed by formal committees. • Performance expected to improve. • Direct involvement in process improvement	• Incentives, although VA has an incentive system for facilities meeting measures.
• Information Technology	• Electronic medical record • Bar code management administration	
Safety Culture		
• Trust	• Fear of reprisal (negative evidence) • Trusting practices	• Adoption of codes of behavior • Leaders champion efforts to remove threatening behavior.
• Accountability	• Accountability and discipline • Personal accountability for performance	• Transparent disciplinary procedures • Equitable disciplinary actions
• Identifying Unsafe Conditions	• Incident reports used • Reports disseminated to multiple entities	• Close-call recognition or reporting, which leads to early problem resolution
• Strengthening Systems	• Patient safety manager follows through on reports to improve care. • Staff participate in improvement efforts. • Education to improve processes is occurring.	• How reports are compiled across events to assess safety systems • Proactively assessing strength & resilience of systems in place
• Assessment		• No evidence*
Robust Process Improvement® (RPI®)		
• Methods	• Lean Six Sigma adopted by one hospital.	
• Training	• A few staff members at one hospital trained on Lean Six Sigma.	• Whether employees are trained at appropriate levels to their jobs
• Spread	• Senior leaders were involved in setting priorities for using Lean Six Sigma.	• Whether RPI is part of performance evaluations • Whether RPI has been adopted hospitalwide

PS, patient safety; VA, US Department of Veteran Affairs.

* Although we had no evidence of the Assessment component, the VA measures patient safety culture every four to five years (McCarthy D, Chase D. Advancing Patient Safety in the U.S. Department of Veterans Affairs authors. Commonwealth Fund pub. 1477, vol. 9. Mar 2011. Accessed Aug 1, 2016. http://www.commonwealthfund.org/~/media/Files/Publications/Case%20Study/2011/Mar/1477_McCarthy_VA_case_study_FINAL_March_v2.pdf).

priorities for using Lean Six Sigma to spread these practices.

Although we were able to fully or partially characterize hospitals' maturity levels for many of the components, for six of the nine components for which we could rate all the hospitals, we found little cross-hospital differences in maturity. For example, for the Strengthening Systems component, we categorized all hospitals as "advancing" because evidence was consistent with an advancing maturity level (that is, "system weaknesses were catalogued and prioritized"). Strengthening of systems occurred through staff involvement in patient safety event investigation, results were communicated to frontline staff involved in the issues, and education was considered an important part of the improvement process. As another example, within the Leadership domain, for the CEO/Management component, we

categorized all hospitals as "developing." Although middle managers and senior leaders (particularly hospital directors) communicated clearly to staff about the importance of patient safety within their hospitals, we found little evidence of staff involvement in developing the quality agenda.

We observed variation across hospitals for two components for which we had complete data on all six hospitals. For example, for the component Trust, we classified four of the six hospitals as "developing." In some clinical areas in these hospitals, leaders were trying to eliminate intimidating behaviors that could suppress reporting; however, staff also mentioned that fear of reprisal remained—illustrating a "shame and blame" safety culture.[27] In comparison, the other two hospitals displayed a hospitalwide focus on creating a culture in which staff felt comfortable reporting safety incidents, and the culture appeared to be more trusting and less retaliatory. Given their focus on "establishing a trusting environment for all staff," we characterized these hospitals as "advancing."

Discussion

In terms of our first aim, this study demonstrated that each of the three HRHCM model domains was represented in all six hospitals, suggesting that the HRHCM model has good content validity. Given the literature, we expected that the components within the three HRHCM model components would be present in some form. The lack of evidence for the components within Robust Process Improvement was not surprising because, at the time of the study, the VA was at an early stage of introducing its systems redesign program, which contained components of Robust Process Improvement. However, these components might not have been in place at the participating sites. While virtually all components of the HRHCM model were partially or fully present in our data, two additional characteristics emerged from our data that were not explicitly present in the model: teamwork culture and system-focused tools for learning and improvement. We believe that these characteristics are consistent with the literature and essential for improving and sustaining reliability within an organization. A culture of high reliability requires strong teamwork among members. For example, good cross-functional communication, both in real time and improvement activities (that is, through cross-functional teams and good cross-hierarchy communication) is an essential component of an HRO.[28] We believe that teamwork culture should be added to the HRCM model (Safety Culture domain). Similarly, we believe that systems-focused tools for learning and improvement should also be added (Robust Process Improvement domain). Such tools serve as building blocks for Robust Process Improvement capability and sometimes even overlap with Robust Process Improvement methods.[29–39] The HRHCM model uses Robust Process Improvement as a gold standard, but it does not include other tools that could serve as a foundation for process improvement. For example, including evidence of system-focused tools (for example, use of chart review or Health Failurecare Mode and Effects Analysis) in the

Table 4. Components Not Included in the High Reliability Health Care Maturity Model

Components	Selected Quotes
Teamwork Culture	• "There is an understanding we're all in this together." [Executive Leader] • "We have mutual respect for each other to allow us to meet the goal of excellence in patient care." [Executive Leader] • "Communication between staff physicians and nurses is horrible. In the medicine service, physicians don't talk to the nurses." (Middle Manager) • "A lot of our physicians don't appreciate that problems are multidisciplinary. They don't appreciate the problems that nurses have with certain situations. That is where a lot of the conflicts can come up. That is probably one of our major issues with communication." [Middle Manager]
System-Focused Tools for Learning and Improvement	• "An adverse event would become a root cause analysis; they set up a committee; the committee looks at it; they come up with recommendations; they report it to the director's office; then they come up with recommendations; and all of the recommendations are tracked until they are completed." [Nurse] • "We had an RCA a couple of months ago that we had to implement in the surgical suite. There were some distractions occurring so we had to implement some new signs. We were all part of it because we had to fix something that wasn't just affecting physicians, also the patients, and the flow. "[Middle Manager] • "I was a team leader on an HFMEA™ to standardize reporting of patient safety events." [Pharmacist] • "There is an HFMEA that we are doing now about an issue with coordinating services after patient discharge for the hospital. We realized it would longer than 45 days to figure this one out because it's complicated and it did." [Middle Manager] • "We review 10 charts a month from different areas in the hospital." [Frontline Staff] • "We did the chart reviews to see the events leading up to the codes." [Middle Manager] • "We have several checklists that we are obligated to make sure are filled out." [Frontline Staff]

RCA, root cause analysis; HFMEA™, Healthcare Failure Mode and Effects Analysis™.

model might help an organization understand its capacity for implementing Robust Process Improvement. Incorporating system-focused tools for learning and improvement might have been particularly useful for the hospitals in our study that were at the "beginning" maturity level on the methods component.

As stated, we did not find corresponding evidence in the data for two components in the HRHCM model–Board and Assessment. The finding regarding Board leadership would reflect the fact that the VA's organizational structure does not include a governing board. Safety culture assessment is critical because organizations need to understand where they stand in regard to trust, accountability, identification of unsafe conditions, and strengthening of systems before implementing changes in these areas. In the VA, patient safety culture has been assessed about every four years since 2000,[12] yet we could not find evidence regarding these assessments in our data, probably because it was not an explicit focus of the larger study. Yet we were still able to characterize the maturity levels for the associated domains, such as Leadership and Safety Culture. Data in Board and Assessment could provide organizations with additional information to assist them in reaching high reliability beyond what we describe in this article; however, examples in every component within a domain might not be needed to effectively apply the model.

Our findings regarding the HRHCM model's content validity find support in a recent article in which Griffith reported that 11 of the 14 HRHCM model components were congruent with the Baldrige National Quality Program (now known as the Baldrige Performance Excellence Program) health care criteria were congruent with components.[40] Additional work is necessary, however, to understand how the HRHCM domains and their specific components can be helpful in building the infrastructure necessary for achieving high reliability.

In terms of our second aim, we were able to characterize hospitals' maturity levels for the majority, but not all, of the components within each domain. Within some hospitals, we observed variation in maturity levels across the domains' components. We did not find cross-hospital variation on all components, which could be due to either a lack of diversity within our sample of VA hospitals or limitations in our data collection.

The HRHCM model was useful in that it enabled us to examine the variation in component maturity levels within domains at each individual hospital. For example, within the Leadership domain, a hospital could have an "approaching" stage of maturity for the IT component, an "advancing" stage of maturity for the Quality Strategy and Measurable Goals and Outcomes components, and a "developing" stage for the CEO/Management and Physician components. Although it is not the intent of the HRHCM model to summarize component maturity levels into one rating for the entire domain, and there is no empirical evidence suggesting that correlations between the components are sufficiently high to justify combining them, a higher-level component summary might be useful for leaders or process owners faced with reviewing a great deal of other hospital performance data.

We observed components to varying degrees in practice. For example, within the Safety Culture domain, we found cross-hospital variation in maturity for two of the four components—Trust and Accountability—that we were able to rate for all six hospitals. This cross-hospital variation may be particularly relevant if hospitals are compared or "benchmarked," which is not the intent of the HRHCM model. A health care system's examination of data from multiple hospitals could facilitate system-wide changes to improve maturity levels. For example, a finding that hospitals' systems are generally at the "beginning level" for the Robust Process Improvement domain could motivate leaders to provide additional resources to address the issue.

A major strength of our study is that it is the first to apply the HRHCM model to a health care system using rich, qualitative data; we found good model fit within the VA health care system. Our data were collected with a broader a priori conceptual "net" than HRO; that is, they represent a full range of organizational structures and processes associated with patient safety. This reduces bias in the data and potentially increases the robustness of our findings. We also found characteristics not represented in the model, which may be important to consider when improving reliability processes and may represent opportunities for refinement of the HRHCM model.

Our study also has its limitations. We had data from only six hospitals; a larger sample of hospitals may have provided more examples of the components. Given the secondary analysis of these data, the interview guide did not include explicit questions regarding each HRHCM model component (for example, Board, Assessment, and Spread). Therefore, we cannot conclude that a lack of evidence means that the component did not actually exist at the hospital. In addition, we began our data analysis process using case summaries containing a selection of quotes on domains related to patient safety but not incorporating HRHCM components. Although all verbatim transcripts were reviewed as a second step, use of those case summaries could have resulted in our finding less evidence of the model components in the data. Thus, our findings do not necessarily indicate complete accuracy or comprehensiveness about the specific components in the model. Future prospective research on the

HRHCM model should create questions specifically designed for each component. In addition, our data were collected before the model was developed. This may partially explain why we had so little evidence on the Robust Process Improvement domain; The Joint Commission adopted Robust Process Improvement as its internal process improvement methodology in 2008, a year before we started collecting our data.[7,10,22] Finally, although we treated the hospital as the unit of analysis, in correspondence with the model, future research might assess a hospital's services or microsystems, as each might have its own set of issues, with varying impact on high reliability. J

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Appendix 3. Quotes Illustrating the Organizational Stages of Maturity of the High Reliability Health Care Maturity Model by Major Domain in a Sample of Six US Department of Veterans Affairs Hospitals

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Please tell us your current position here, how long you've worked at this facility, and other positions you've held here.

Questions

DOMAINS:
Monitoring Quality of Care
Quality Improvement

1. What are some of the most common adverse events that you see in your day-to-day work? Please refer to the list provided.
    a. What is being done now to reduce the incidence of this event?
        i. Are there guidelines or procedures designed to reduce the incidence of this?
    b. What do you think would be helpful in further reducing the incidence of this?
    c. Is there anything not on the list we provided you that you believe is a concern?

DOMAINS:
Monitoring Quality of Care
Systems Issues and Human Factors
Leadership

2. What are the systems in place to identify an event as an adverse event?
    a. How are adverse events reported? (For frontline staff: How would you report an adverse event?)
    b. When they are reported, what is typically done to address them?
    c. To whom is this information typically disseminated?
    d. What does leadership do to facilitate increasing staff awareness and facilitate staff reporting of adverse events?

DOMAINS:
Monitoring Quality of Care
Quality Improvement

3. In your facility, what are some of the initiatives related to improving patient safety that you know about? (*Probe on facility and service-specific initiatives as opposed to VA-wide initiative. Probe on initiatives one-by-one. If interviewee comes up with **3 or more**, please ask:* In the interest of time, let's concentrate on the two or three initiatives you would want other facilities to know about?)
    a. On what does it focus?
    b. What facilitated its implementation?

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Appendix 1. PSI Study, Field Consultations: Full Interview Guide (continued)

c. What were the implementation obstacles?
d. How effective do you think it is?
e. *If the interviewee only came up with one initiative:* What others are you aware of?

DOMAINS:
Monitoring Quality of Care
Quality Improvement

4. How do you identify areas in patient safety that need improvement?

DOMAINS:
Interface with Other Services
Leadership

5. Could you give me an example of how leadership facilitates patient safety–related teamwork or cross-disciplinary activities?
    a. Typically, how does leadership facilitate this on a regular basis?

DOMAINS:
Technology and Equipment
Technical Competence of Staff

I'd like to ask a few questions about technology and equipment . . .

6. I am curious to hear about what problems, if any, you or others have had with the technology and/or equipment on the service. Specifically,
    a. What problems have you had with the **accessibility** or **availability**, **quality** or **functioning** of technology and equipment?
    b. What problems, if any, have you or other staff had being properly trained to use the technology and/or equipment?
    c. What technology and/or equipment, if any, do not exist at your hospital that would help improve patient safety?

DOMAIN:
Staffing

7. Staffing plays an important part in care. We're interested in your perceptions of staffing levels and staffing mix.
    a. In general, what percent of the time do you feel there is adequate **physician** staffing (for pharmacists only: pharmacist staffing) on all shifts for your service?
        i. What is being done to address the concerns?
    b. In general, what percent of the time do you feel there is adequate **RN** staffing on all shifts for your service?
        i. What is being done to address the concerns?

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Appendix 1. PSI Study, Field Consultations: Full Interview Guide (continued)

DOMAIN:
Coordination of Work and Communication

8. Let's talk about the procedure for communication during admissions, discharges, and transfers on your unit.
    a. How is information about patient condition, including risk factors, commonly reported at transitions between units?
    b. Do you have any thoughts on how communication during transitions between units might be improved?
    c. How often do you find a discrepancy between what you were told at the transition and what you found upon assessing the patient yourself?

DOMAINS:
Organization, Structure, and Culture
Coordination of Work and Communication
Interface within Service

Let's talk about communication between nurses and physicians regarding patient care.

9. In general, how would you describe the communication between staff physicians and nurses in this service/in your hospital?
    a. How comfortable do you think nurses feel about raising concerns to physicians?
        i. What differences are there between raising concerns with attendings and raising them with residents?
    b. How often do physicians and nurses round together?
        i. What differences are there in these rounding patterns between attendings and residents?
    c. Where do you see room for improvement?

DOMAIN:
Organization, Structure, and Culture

10. Suppose that a nurse felt that a physician's response or lack of response was putting a patient at risk for harm. What actions would the nurse most likely take?
    a. What have you seen to indicate whether nurses here are comfortable doing what you've described?
    b. What, if any, of this is covered by written policy?

DOMAIN:
Coordination of Work and Communication

11. How are important issues about patient condition communicated at shift changes?
    a. Is there a formal system in place for nurse-to-nurse (for pharmacists only: pharmacist-to-pharmacist) communication?

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Appendix 1. PSI Study, Field Consultations: Full Interview Guide (continued)

b. Is there a formal system in place for physician-to-physician communication?

DOMAINS:
Organization, Structure, and Culture
Coordination of Work and Communication
Interface within Service

12. Now I'm going to ask you about communication across different hierarchical levels regarding asking questions, revealing concerns related to patient safety, or simply communicating information.
    a. To what degree are residents encouraged to communicate with attending physicians about these issues? How about between a junior resident (e.g., intern) and attending?

DOMAIN:
Interface with Other Services

13. In what ways do the different services that support patient care interact with one another? For example, medicine, surgery, nursing, and pharmacy.
    a. How are joint planning decisions handled? For example, tumor boards or joint Emergency Department and surgery trauma meetings.
    b. How are resources shared?

DOMAIN:
Summary Evaluation of Service Overall

14. If there were one thing that could be done to further improve the overall patient safety of your service/of your hospital, what would that be?

QUESTIONS FOR CODERS ONLY:

DOMAINS:
Coding
i. We're interested in knowing about all the things that you consider when you assign codes for principal and secondary diagnoses and procedures. Could you walk us through the process that you go through to come up with these codes?

Probes (if answer is vague):

a. Are there certain people you check in with along the way? This may include physicians, other clinicians, and coders.
b. What are the information sources that you use in assigning codes (e.g., coding manuals, other sources)?
c. What sections of the medical record do you typically look in when assigning ICD-9-CM codes to inpatient encounters? Is there one section, such as the discharge summary, that you find is more helpful than others in explaining what occurred to the patient clinically?

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Appendix 1. PSI Study, Field Consultations: Full Interview Guide (continued)

d. What do you do if you have questions or doubts about how to code things?

ii. Alternate question: If the above question yields a substantial answer, do not ask Qii. Move on to ask questions iii and iv.

If the above question i does not yield a substantial answer, then ask the following question:

a. If you had to train someone who is new to coding, what would that person need to keep track of and do to be able to code diagnoses/procedures on her or his own?

iii. How would you code in the following situation: A physician indicates a "rule out" diagnosis in the medical record, and the radiological or lab test confirms that diagnosis, but the physician fails to confirm it in a progress note or discharge summary?

iv. How would you code in the following situation: A "rule out" diagnosis has been ruled out in a laboratory or radiological test report, but it is not actually ruled out by a physician in a note or discharge summary?

(**Probe example**: when needed: Chest x-ray after a central line insertion suggests a small (~10%) pneumothorax, but the physician never confirms a pneumothorax in a progress note or discharge summary.)

DOMAINS

- Organization, Structure, and Culture
- Monitoring Quality of Care
- Systems Issues and Human Factors
- Technology and Equipment
- Technical Competence of Staff
- Coordination of Work and Communication
- Interface within Service
- Interface with Other Services
- Leadership
- Staffing
- Quality Improvement
- Coding
- Summary Evaluation of Service Overall

Appendix 2. Mapping of High Reliability Health Care Maturity Model (HRHCM) Components to Semistructured Interview Guide Questions

Semistructured Interview Question	HRHCM component													
	Leadership						Safety Culture					Robust Process Improvement		
	Board	CEO	MD	QS	MG	IT	Trust	Acct	Ident	Strength	Assess	Method	Train	Spread
What are some of the most common adverse events that you see in your day-to-day work? • What is being done now to reduce the incidence of this event? • Are there guidelines or procedures designed to reduce the incidence of this? • What do you think would be helpful in further reducing the incidence of this? • Is there anything you believe is a concern?								x	x	x		x	x	
What are the systems in place to identify an event as an *adverse event?* • How are adverse events reported? (For frontline staff: How would you report an adverse event?) • When they are reported, what is typically done to address them? • To whom is this information typically disseminated? • What does leadership do to facilitate increasing staff awareness and facilitate staff reporting of adverse events?		x			x		x		x	x				
In your facility, what are some of the initiatives related to improving patient safety that you know about? (*Probe on facility and service-specific initiatives as opposed to VA-wide initiative. Probe on initiatives one-by-one. If interviewee comes up with **3 or more**, please ask:* In the interest of time, let's concentrate on the two or three initiatives you would want other facilities to know about?) • On what does it focus? • What facilitated its implementation? • What were the implementation obstacles? • How effective do you think it is? • *If the interviewee only came up with one initiative?* • What others are you aware of?		x	x	x	x	x	x		x	x				

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Appendix 2. Mapping of High Reliability Health Care Maturity Model (HRHCM) Components to Semistructured Interview Guide Questions (continued)

Semistructured Interview Question	HRHCM component														
	Leadership						Safety Culture					Robust Process Improvement			
	Board	CEO	MD	QS	MG	IT	Trust	Acct	Ident	Strength	Assess	Method	Train	Spread
How do you identify areas in patient safety that need improvement?		x	x	x	x		x		x			x		
Could you give me an example of how leadership facilitates patient safety–related teamwork or cross-disciplinary activities? • Typically, how does leadership facilitate this on a regular basis?														
I'd like to ask a few questions about technology and equipment. I am curious to hear about what problems, if any, you or others have had with the technology and/or equipment on the service. Specifically, • What problems have you had with the ***accessibility*** or ***availability***, ***quality*** or ***functioning*** of technology and equipment? • What problems, if any, have you or other staff had being properly trained to use the technology and/or equipment? • What technology and/or equipment, if any, do not exist at your hospital that would help improve patient safety?						x				x				
Staffing plays an important part in care. We're interested in your perceptions of staffing levels and staffing mix. • In general, what percent of the time do you feel there is adequate **physician** staffing (for pharmacists only: pharmacist staffing) on all shifts for your service? • What is being done to address the concerns? • In general, what percent of the time do you feel there is adequate **RN** staffing on all shifts for your service? • What is being done to address the concerns?		x		x					x	x				

(continued on page AP8)

Appendix 2. Mapping of High Reliability Health Care Maturity Model (HRHCM) Components to Semistructured Interview Guide Questions (continued)

Semistructured Interview Question	HRHCM component													
	Leadership						Safety Culture					Robust Process Improvement		
	Board	CEO	MD	QS	MG	IT	Trust	Acct	Ident	Strength	Assess	Method	Train	Spread
Let's talk about the procedure for communication during admissions, discharges, and transfers on your unit. • How is information about patient condition, including risk factors, commonly reported at transitions between units? • Do you have any thoughts on how communication during transitions between units might be improved? • How often do you find a discrepancy between what you were told at the transition and what you found upon assessing the patient yourself?							x	x	x					
Let's talk about communication between nurses and physicians regarding patient care. In general, how would you describe the communication between staff physicians and nurses in this service/in your hospital? • How comfortable do you think nurses feel about raising concerns to physicians? • What differences are there between raising concerns with attendings and raising them with residents? • How often do physicians and nurses round together? • What differences are there in these rounding patterns between attendings and residents? • Where do you see room for improvement?							x	x	x	x				
Suppose that a nurse felt that a physician's response or lack of response was putting a patient at risk for harm. What actions would the nurse most likely take? • What have you seen to indicate whether nurses here are comfortable doing what you've described? • What, if any, of this is covered by written policy?							x	x	x	x				

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Appendix 2. Mapping of High Reliability Health Care Maturity Model (HRHCM) Components to Semistructured Interview Guide Questions (continued)

Semistructured Interview Question	HRHCM component															
	Leadership						Safety Culture						Robust Process Improvement			
	Board	CEO	MD	QS	MG	IT	Trust	Acct	Ident	Strength	Assess	Method	Train	Spread
How are important issues about patient condition communicated at shift changes? • Is there a formal system in place for nurse-to-nurse (for pharmacists only: pharmacist-to-pharmacist) communication? • Is there a formal system in place for physician-to-physician communication?							x		x	x				
Now I'm going to ask you about communication across different hierarchical levels regarding asking questions, revealing concerns related to patient safety, or simply communicating information. • To what degree are residents encouraged to communicate with attending physicians about these issues? How about between a junior resident (e.g., intern) and attending?							x		x	x				
In what ways do the different services that support patient care interact with one another? For example, medicine, surgery, nursing, and pharmacy. • How are joint planning decisions handled? For example, tumor boards or joint Emergency Department and surgery trauma meetings. • How are resources shared?		x		x	x		x	x	x	x				
If there were one thing that could be done to further improve the overall patient safety of your service/of your hospital, what would that be?		x	x	x	x	x	x	x	x	x	x	x	x	x
Total opportunities for HRHCM component to be discussed	0	6	3	5	5	3	10	6	12	11	1	3	2	1

CEO, CEO/management; MD, Physician; QS, Quality Strategy; MG, Measurable Goals and Outcomes; IT, Information Technology; Acct, Accountability; Ident, Identifying unsafe conditions; Strength, Strengthening Systems; Assess, Assessment; Method, Methods; Train, Training.

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Appendix 3. Quotes Illustrating the Organizational Stages of Maturity of the High Reliability Health Care Maturity Model by Major Domain in a Sample of Six US Department of Veterans Affairs Hospitals

Leadership	Level of Maturity (No. of Hospitals)	Selected Quotes
Board	Unable to rate (6 hospitals)	No evidence—VA does not have a governing board.
CEO/ Management	Developing (6 hospitals)	• "[Leadership] are all on board. They talk about patient safety wherever they go in meetings. They get what patient safety is all about. It is not just a program to report. It is about quality of care and they understand it." [Middle Manager] • "The Medical Center Director always asks do you have what you need to take care of the patient? He always asks do you have this surgery, did you get that and that's the topic of discussion in our conferences, do you have this do you need this, what else do you need, what's going on? Tell me why this happened. He asks the right questions." [Frontline Staff]
Physician	Developing (2 hospitals) Unable to rate (4 hospitals)	• "One of our infectious disease doctors led an effort to improve the process of appropriate use of Foley catheters. These are the kinds of things that physicians championed on their own; a couple of ways to have better quality by doing safer things for patients." [Middle Manager]
Quality Strategy	Advancing (6 hospitals)	• "We're in a safety era and I constantly emphasize the importance of patient safety to staff." [Executive] • "We have key priority areas that we make our decisions off of and we communicate that, we ask employees to hold us accountable to that. Our number one priority is quality safe patient care." [Executive] • "Patient safety is one of those areas that's critical on our monthly leadership meeting. It's like one of the legs of a chair." [Executive] • "There's so many demands of our staff right now, coming from every which way, that I spend a lot of my day putting out fires, instead of sitting down and saying, 'Gee, what's our next adventure in patient safety?' We just don't have that luxury." [Executive]
Measurable Goals and Outcomes	Advancing (6 hospitals)	• "We have an organizational structure that I think communicates pretty well up and down the organization. I think we do a pretty good job of communicating issues and changes in policies and new procedures through our operating committees and oversight council structure." [Executive] • "The biggest way that we've figured out to reduce errors is through leadership making it very clear to the staff on the wards that this is a big issue and this is something that has leadership's attention. It is discussed at morning report every day and then we follow up on each issue. We have significantly reduced the number of events that we've had." [Frontline Staff] • "The director is very involved in all meetings whether you are in there. He wants to know numbers and what's happening." [Frontline Staff] • "The Chief of Staff and Nurse Executive should be visible on the unit. So at least once a month they make rounds to talk to the staff and see some of the things that they need. It is important that they see the Nurse Exec and the Chief of Staff together so staff understand they have a cooperative relationship." [Executive]

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Appendix 3. Quotes Illustrating the Organizational Stages of Maturity of the High Reliability Health Care Maturity Model by Major Domain in a Sample of Six US Department of Veterans Affairs Hospitals (continued)

Leadership	Level of Maturity (No. of Hospitals)	Selected Quotes
IT	Approaching (6 hospitals)	• "I think the EMR itself was a major step forward and the accountability that goes on there and the availability of the record for multiple people using it at the same time. The accountability where you cannot tear up something that you goofed up on and try again and the time frames and so forth, it's a whole lot easier for me to go in and check on anything that looks a little bit off because it is all there. The transparency of it is really helpful." [Frontline Staff] • "The EMR certainly helps us create a safer environment because of being able to document and trending as it's been well documented in books and news stories and news prints." [Executive] • "BCMA . . . is a wonderful thing. The system counts the medicine, labels the medicine, and then queues it up by patient because most of our patients get many, many medicines. It is bar-code driven and you can scan the label and it shows you what the pill should look like, it tells you who filled it, it tells you when it was filled. It is an amazing system." [Middle Manager] • "The role of BCMA catches the vast majority of errors and works very well. We don't currently utilize BCMA in the emergency room, even though one of our members of our quad has met with us and we understand that we will be starting up BCMA in that area in the next 30 days." [Middle Manager]
Safety Culture	**Level of Maturity (No. of Hospitals)**	**Selected Quotes**
Trust	Developing (4 hospitals)	• "The number one challenge in our hospital as it relates to patient safety is driving out fear and employees believing they won't be punished for reporting a negative event. It's gotten better but it's still a real challenge. . . . there is a sense of fear." [Executive] • "I think the atmosphere right now is that they'd better not catch anything going wrong." [Executive]
	Advancing (2 hospitals)	• "We want to create a culture of safety and one that is not punitive and only improve[s] systems; that is why we have seen an increase in our reporting here. We are finally getting the staff to understand that it is not about punishing people." [Executive] • "I do feel like that we have done a good job of not being punitive with reporting but thanking people and in fact rewarding them when they give us the information even though we sometimes need to focus on remedial actions. . . . we've got a pretty good broad-based understanding that the purpose of it is to improve the quality of care." [Middle Manager]
Accountability	Beginning (2 hospitals)	• "That is the one thing in this institution . . . the environment that's been created is punitive and somewhat hostile." [Middle Manager] • "It seems like we are throwing rocks here. It can take some enforcement. In a lot of cases I don't think there is any enforcement for physicians." [Frontline Staff]
	Developing (4 hospitals)	• "We try to see all sides of it. How we can get the information out to the appropriate people and deal with it on two levels. So it may be dealt with on a systemwide issue but we also need to be looking administratively on incident reports to determine whether we have a problem individually or a problem systemwide." [Executive] • "Personal accountability . . . it is that at the individual level, not taking the nonchalant road to patient care. You can dictate what you want them to do but they get busy and they go off and do their own thing and not necessarily thinking about patient safety." [Frontline Staff]

(continued on page AP12)

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Appendix 3. Quotes Illustrating the Organizational Stages of Maturity of the High Reliability Health Care Maturity Model by Major Domain in a Sample of Six US Department of Veterans Affairs Hospitals (continued)

Safety Culture	Level of Maturity (No. of Hospitals)	Selected Quotes
Identifying Unsafe Conditions	Developing (6 hospitals)	• "I can say we have a great reporting system where people have gotten that heightened awareness that if they are uncomfortable with a situation or something that's going on they need to tell someone." [Middle Manager] • "I'm keeping patient safety in the forefront at our monthly leadership meeting which includes all of the service line executives. Patient safety is one of those that's critical. It's like the legs of a chair. I have briefings with all of the departments on a recurring basis over the year." [Executive] • "Staff go to our patient safety nurse and talk about a situation and bring it to the attention of our leadership and then they recommend action." [Frontline Staff]
Strengthening Systems	Advancing (6 hospitals)	• "We are constantly looking for trends and things that we might be outliers in and if it looks like something that needs to be reviewed, we make sure we review it through either a root cause analysis or a peer review or whatever is necessary to make sure we know what is going on." [Executive] • "There is a standard mechanism for disseminating patient events to the leadership. It is reported to the Clinical Executive Board, the Hospital Safety Committee, and Performance Improvement and Quality Committee. It gets reported 3 or 4 times." [Middle Manager]
Assessment	Unable to rate (6 hospitals)	No evidence
Robust Process Improvement	**Level of Maturity (No. of Hospitals)**	**Selected Quotes**
Methods	Beginning (4 hospitals)	• "We did over 20 RCAs that were completed." [Middle Manager] • "We can do an issue brief, peer review, an RCA, or it can go to an aggregate." [Executive]
	Developing (1 hospital)	• "We have a six sigma program" [Middle Manager] • "We have a hospitalwide 5S project to look at a national problem" [Executive]
Training	Unable to rate (5 hospitals)	No evidence
	Developing (1 hospital)	• "We have made a big investment in Six Sigma. We're on the verge of having 4 black belts and 14 green belts." [Executive]
Spread	Unable to rate (5 hospitals)	No evidence
	Developing (1 hospital)	• "Process improvement tasks are assigned by the executive team. At the institutional level, it is part of what's going on. It is probably the thing that is going to have the biggest impact on quality." [Executive] • "The Lean Six Sigma process is important if it can be run down to the front lines. We have talked about having yellow belts, white belts help a staff person who has an idea or take on an idea of his own." [Executive]

RCA, root cause analysis; 5S, sort, simplify, sweep, standardize, sustain; VA, US Department of Veterans Affairs; EMR, electronic medical record; BCMA, bar code medication administration.