FORUM

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Summer 2020

VA | U.S. Department of Veterans Affairs
Veterans Health Administration
Health Services Research & Development Service

Commentary

VHA's Vision for a High Reliability Organization

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The Veterans Health Administration (VHA) is undergoing a transformational modernization at a scale and scope not experienced since General Omar Bradley's leadership of the Veterans Administration in the 1940s. At the center of this modernization is a culture change that will be realized throughout VHA – our transformation into a high reliability organization (HRO).

An HRO is an organization that experiences fewer than anticipated accidents or events of harm despite operating in highly complex, high-risk environments where even small errors can lead to tragic results. HROs establish trust amongst leaders and staff by creating a Just Culture that balances individual accountability with systems thinking. HRO leaders empower all staff to lead continuous process improvements within their own workspace. Creating an environment where employees feel safe to report harm or near misses requires our leaders to focus on the why, not the who, when errors occur. Leaders must fairly distinguish between conduct deserving of discipline versus the much more common unintentional human error or drift from protocol that can lead to harm despite the best efforts and intentions of staff.

The work to become an HRO not only unleashes the incredible talent and commitment within our system to do great things, but it also supports our efforts to strengthen the trust of Veterans and the American people in VA.

VHA has been a leader in the patient safety movement for more than 20 years. We are committed to continuing to build on the great strides we have made with improving safety and quality of care. In February 2019, VHA launched an enterprise-wide HRO transformation effort and made a long-term commitment to pursuing a goal of Zero Harm. As Veterans Integrated Service Networks (VISNs) and VA Medical Centers (VAMCs) advance toward HRO maturity, leaders are applying an organization-wide commitment to Zero Harm by developing a strong safety culture featuring empowered, collaborative frontline teams supported by engaged leadership within a climate of trust and continuous improvement.

VHA's HRO Journey to Date

Our renewed focus on becoming an HRO over the last year builds on efforts led by VHA's National Center of Patient Safety (NCPS) starting in the 1990s. This transformation is being led by the VHA HRO Steering Committee (whose members include select VISN and Medical Center Directors, Chiefs of Staff, Nurses, Patient Safety Experts, and Quality Managers), as well as an HRO Leadership Coalition comprised of all VISN Directors and national leaders within VHA. We are building on our organization's existing safety and high reliability practices and developing an enterprise-wide strategy that was launched with 18 VAMCs in early 2019. This phased approach, with 18 "lead sites" in the first year, is expanding to include all VHA facilities. The foundational work

of becoming an HRO includes developing leadership commitment to the goal of Zero Harm, establishing a positive safety culture, and engaging and supporting all employees in a continuous process improvement culture.

VHA's 2020 HRO activities are focused on the following six areas.

1. **HRO Baseline Training** for all frontline staff, supervisors, and executive leaders to develop behaviors that foster a Just Culture, error prevention, and continuous improvement.

2. **Clinical Team Training (CTT)** on how to integrate team-based error prevention and management practices to improve patient safety and job satisfaction by facilitating clear and timely communication through collaborative teamwork in the clinical workplace.

3. Implementation of daily **continuous process improvement (CPI)** management systems and tracking of improvement efforts including expanded training in Lean methodologies.

4. **Site-specific assessments and planning** will help each facility continue to strengthen their safety culture and practices.

5. **HRO leadership coaching** provides facility leaders with opportunities to work with a coach to target site-specific HRO practices to help reach the next level in their journey to high reliability.

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DIRECTOR'S LETTER

Strategies for improving organizational performance are continually evolving, sometimes abetted by a rotating cast of high-priced management consultants and changing fashions in business schools. Previously, the business press was filled with stories on "Toyota Lean" management approaches, a model built on Japanese system engineering principles to reduce waste and error. Many healthcare organizations, including VA, adopted these principals effectively to improve their supply chains, standardize clinical processes, and improve use of data to reduce errors and improve quality. At the same time, it is clear that managing healthcare and reducing medical errors is very different from running the assembly line that produces high-quality, defect-free automobiles. Healthcare is a classic example of what is known as a "complex adaptive system." In Plsek and Greenhalgh's 2001 BMJ series, the authors describe a "complex adaptive system is a collection of individual agents with freedom to act in ways that are not always totally predictable, and whose actions are interconnected so that one agent's actions change the context for other agents." Thus, rather than being amenable to rigid processes and reductionist thinking, healthcare needs to "accept unpredictability, respect (and utilize) autonomy and creativity, and respond flexibly to emerging patterns."

How then, in the face of the complex nature of healthcare delivery, can an organization approach the problem of reducing errors and improving quality? The concept of a high reliability organization was coined by Weick and Sutcliffe to describe the principals of an organization that will perform well in the face of such complexity. High reliability is manifested by managing complex, hazardous situations with a high level of safety (e.g., landing a fighter jet on an aircraft carrier in bad weather). The possibility of error is rife in healthcare settings, including misdiagnosing illnesses, prescribing errors, and hospital acquired infections. These problems are further exacerbated by unexpected situations such as the recent COVID outbreak, disruptions to usual processes, and a surge of severely ill patients. Other papers in this issue outline the core characteristics of an HRO, but at its heart it is a culture change that asks all involved staff to understand their role and empowers them to apply their unique expertise to prevent error.

VA launched its enterprise-wide HRO transformation effort in February 2019. The commitment to HRO principals does not mean that creating efficient and reliable processes and relying on evidence-based practices is any less important. The concepts of system engineering and complexity science are both important to creating a better healthcare delivery system. Researchers from the Ann Arbor VA are working with the Office of Organizational Excellence to develop measures by which to gauge the transformation of VA into an HRO. The value of research will be to help VA understand how to assess how much progress we have made – what tools and training help support this change, and how we sustain and strengthen the new culture of safety.

David Atkins, MD, MPH, Director, HSR&D

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6. **Experiential learning** where site leaders and teams collaborate and interact with other VAMCs within and across VISNs on HRO practices, challenges, and innovations.

HRO Research Questions

In keeping with VHA's goal of becoming a learning organization and our commitment to continuous process improvement, VHA's Health Services Research and Development Service (HSR&D) is evaluating the impact of VHA's HRO implementation at the 18 lead sites. New insights will be gleaned from this evaluation to improve ongoing system-wide implementation of HRO activities.

As VHA continues HRO implementation across the system, we are also reviewing the literature on HRO frameworks, metrics, and evidence of effects within and outside VHA. Despite widespread adoption of HRO practices and principles across numerous U.S. healthcare systems in recent years, there is still much we simply do not know. HSR&D's May 2019 "Evidence Brief: Implementation of HRO Principles" provides a comprehensive overview of the current state of HRO science, including key gaps in our knowledge on HRO implementation. As the authors of this Evidence Brief note, the major gaps are:

1. whether we can establish a causal relationship between HRO activities and improved safety and process improvements;

2. assuming we can establish a causal relationship, which components of HRO implementation are causing observed effects and how should we most appropriately measure those effects;

3. whether certain HRO frameworks lead to better results; and

4. what contextual factors affect a successful HRO implementation.

Opportunities for researchers to help answer each of these pressing questions are increasing with the many HRO activities currently occurring and rapidly spreading to more facilities across VHA.

Creating a Just Culture

While each of the aforementioned research topics are critical to improving VHA's approach to implementing HRO practices, perhaps no inquiry is more important than determining how to appropriately assess progress in creating a Just Culture. To become and remain an HRO, we must develop environments where all staff feel safe to speak up about potential safety issues and identify areas that need improvement. Though we must appropriately monitor progress on our journey to Zero Harm, we must also ensure that these performance metrics don't unintentionally create a disincentive to report real or potential errors, or undermine the broader strategic goals associated with becoming an HRO.

Response to Commentary
Three HRO Evaluation Priorities

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Drs. Stone and Lieberman outlined the journey we are on within VHA to become a High Reliability Organization (HRO). This high priority initiative takes on even more urgency in the face of unexpected, enormous disruptions like the COVID-19 pandemic. Many facilities, including the lead 18 sites and others, have already been on the journey to HRO maturity. This journey is a marathon, not a sprint; this depth of cultural transformation will take time and long-term commitment by everyone throughout the system.

Learning is at the heart of an HRO in its laser focus on Zero Harm to patients. The HRO rests on three key pillars as shown in Figure 1. The journey starts with leaders at all levels who visibly demonstrate commitment to HRO through their actions. This commitment leads to a robust safety culture that embraces Just Culture, creating psychological safety to encourage error reporting and learning from mistakes.[1] Teams are strengthened as they engage in Continuous Process Improvement to optimize patient care processes. Mature HROs promote teamwork and increase a sense of purpose and meaning in work for all employees.

We have been fortunate in building partnerships with key leaders throughout the VHA to do the groundwork necessary to evaluate progress toward HRO in a way that helps the system learn. We convened a panel to develop a research agenda to address HRO evaluation priorities at the HSR&D Annual Meeting in October 2019 in collaboration with Dr. Gerard Cox (Deputy Under Secretary for Health for Organizational Excellence), Dr. William Gunnar (Executive Director, National Center for Patient Safety), Dr. B. Vince Watts (Director, Systems Redesign and Improvement Program Office), and Christopher Mannozzi (Supervisory Analyst, RAPID-Performance Measurement Office). Participants and partners identified three key priorities: 1) measurement and prediction; 2) effective approaches to implement HRO; and 3) pragmatic yet robust study designs. HSR&D and QUERI have quickly contributed funds to support foundational work to help advance knowledge across these domains.

Measurement and Prediction

Pragmatic, simple measures are needed to monitor progress, understand relationships between key organizational attributes and HRO maturity, and to develop and affirm a causal pathway from HRO implementation to safety outcomes. Leaders throughout VHA need metrics to help guide their efforts toward HRO maturity; metrics must balance the need to demonstrate clinical impact while, at the same time, ensuring that robust safety culture is a key mediator to positive impacts. Our team is working to identify indicators of HRO based on longitudinal changes in items within the All-Employee Survey (AES) as the first 18 sites continue their HRO journey. There is also a need to validate the safety culture measures added to the AES in 2019 and assess their relationship with event reporting. A guiding hypothesis is that error reporting will increase as organizations mature and that the ratio of potential errors versus safety events will increase; this indicates transparency, a key characteristic of the safety culture.

Effective Approaches to Implement HRO

Effective implementation strategies are needed to help organizations mature as HROs. As mentioned above, HSR&D funded a Rapid Review Evidence Brief that identified major knowledge gaps in how to effectively implement HRO. Our team is partnering with Systems Redesign and Improvement (SR&I) in an evaluation of newly updated Lean belt training curriculum and QUERI's Learn. Engage. Act. Process. (LEAP) QI training program. We are using evolutionary learning methods to compare and learn from delivering these two training approaches. Our goal is to engage frontline clinical teams in continuous process improvement, a key HRO pillar. Much more is needed to design effective strategies to address all three HRO pillars. Other specific topics identified by the HSR&D partnered panel members included learning from other organizations outside VHA, designing incentives that encourage team-based development and training, and identifying strategies to leverage necessary process changes to align with HRO in response to the Cerner Electronic Health Record Migration.

Figure 1. Pillars of HRO

THREE PILLARS OF HRO

Leadership Commitment
Safety and reliability is reflected in leadership's vision, decisions and actions.

Safety Culture
Throughout our organization, safety values and practices are used to prevent harm and learn from mistakes.

Continuous Process Improvement
Across the organization, teams use effective tools for continuous learning and improvement.

Change Management

"The result is an organization that celebrates transparency and contributions from every individual regardless of their position."[1]

1. Adapted from Chassin, Mark R. and Loeb, Jerod M. "High-Reliability Health Care: Getting There from Here," The Milbank Quarterly 2013; 91(3):459-90.

Learning from Lean Enterprise Transformation in VA

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Lean thinking emphasizes standardization while reducing waste and improving processes. Various tools that together came to be known as "Lean" were first pioneered in the automotive industry and eventually spread to healthcare.[1,2] Lean offers not only quality improvement methodologies but also a management system for organizations to implement change and sustain results. A Lean transformation, however, is more than just eliminating waste. It requires changing culture and embedding Lean principles into "a way of life" for the organization.

In 2014, in an effort to improve quality, safety, and the Veteran's experience, the Veterans Health Administration (VA) embarked on a pilot project, the VA Lean Enterprise Transformation (LET) program. As VA embarks on becoming an enterprise-wide High Reliability Organization (HRO), we hope lessons from the LET pilot evaluation may elucidate effective strategies to implement facilitators and reduce barriers. The LET program was designed by the Veterans Engineering Resource Center (VERC) to implement and spread Lean management tools and strategies in ten VA medical centers (VAMCs). The overarching goal of LET was organization-wide transformation, not simply implementation of individual process improvements or a set of improvements in a narrow setting. The LET program consisted of a centralized deployment strategy that included sensei (coaching) services along with programmatic and implementation support and guidance. Each site was provided two senseis. An "executive sensei" assisted the medical center's senior executives in developing their knowledge and skills in Lean, and creating a strategy for implementing Lean. An additional sensei, together with a team of systems redesign experts local to each VAMC, helped conduct training in Lean tools and techniques for middle managers and frontline staff and provided analytic support and

coaching to assist in implementing process improvements. In May 2015, the VERC, in collaboration with the VA Quality Enhancement Research Initiative (QUERI), initiated a Partnered Evaluation Center (PEC) to conduct a formative evaluation of the LET program. The objective of this evaluation was to understand which strategies interact to ensure successful, sustained transformation efforts and investigate how LET implementation strategies could be improved.

Over the course of the four-year partnered, mixed-methods evaluation, we conducted three rounds of site visits, one in-person site visit and two follow-up telephone visits, at 6-month intervals.[3] Between October 2015 and December 2017, we conducted 227 semi-structured interviews (including focus groups) representing 268 distinct key stakeholders. Interview participants included medical center directors and other executive leadership, systems redesign and process improvement directors, value stream process owners, middle managers, frontline staff, and Lean senseis. From these interviews, we learned that successful Lean implementation required several mechanisms of change, including culture change, changes in processes, leadership behavior, capability development, alignment of improvement efforts, resources, and incentives with strategic goals, and collaboration (integration).[4] The multiple factors that contributed to successful transformation are depicted in Figure 1. As the figure illustrates, success requires change at various levels in the medical center. At an individual level, change can be leveraged through staff engagement, Veteran engagement, and capability development. The service line or value stream level of a medical center is where improvement initiatives typically have the most impact. Efforts to change culture, impetus for improvement, and staffing are considered organization-level. Other factors,

Key Points

- Lean tools offer not only quality improvement methods, but also a management system for organizations to implement change and sustain results over time.

- The Veterans Engineering Resource Center (VERC) designed the VA Lean Enterprise Transformation (LET) to spread Lean management strategies across ten VAMCs.

- In 2015, VERC partnered with QUERI to undertake a four-year evaluation of the LET program.

like leadership, alignment, and communication cut across all levels of the medical center. In this article we highlight some of our key findings and comment on the relationship between the most salient factors associated with transformation and how they may vary at different levels of a medical center.

Senior leadership has the most influential role in transforming culture. Using both words and actions, senior leaders must convey expectations and establish priority. Moreover, communication must be consistent and repeated, as supported by organizational change literature, and communication must be applied to all levels of management from the executive team to frontline supervisors. Where executive leaders did not convey the priority of Lean, we found that sites floundered. One successful strategy used by leaders was Gemba walks, or visiting the place where work is done. When thoughtfully planned, executed, and followed-up these walks provide managers an important opportunity to show support and reinforce the importance of Lean principles and activities directly to frontline staff, while seeing first-hand what is occurring at the frontline.

Figure 1. VA Lean Multi-Level Intervention
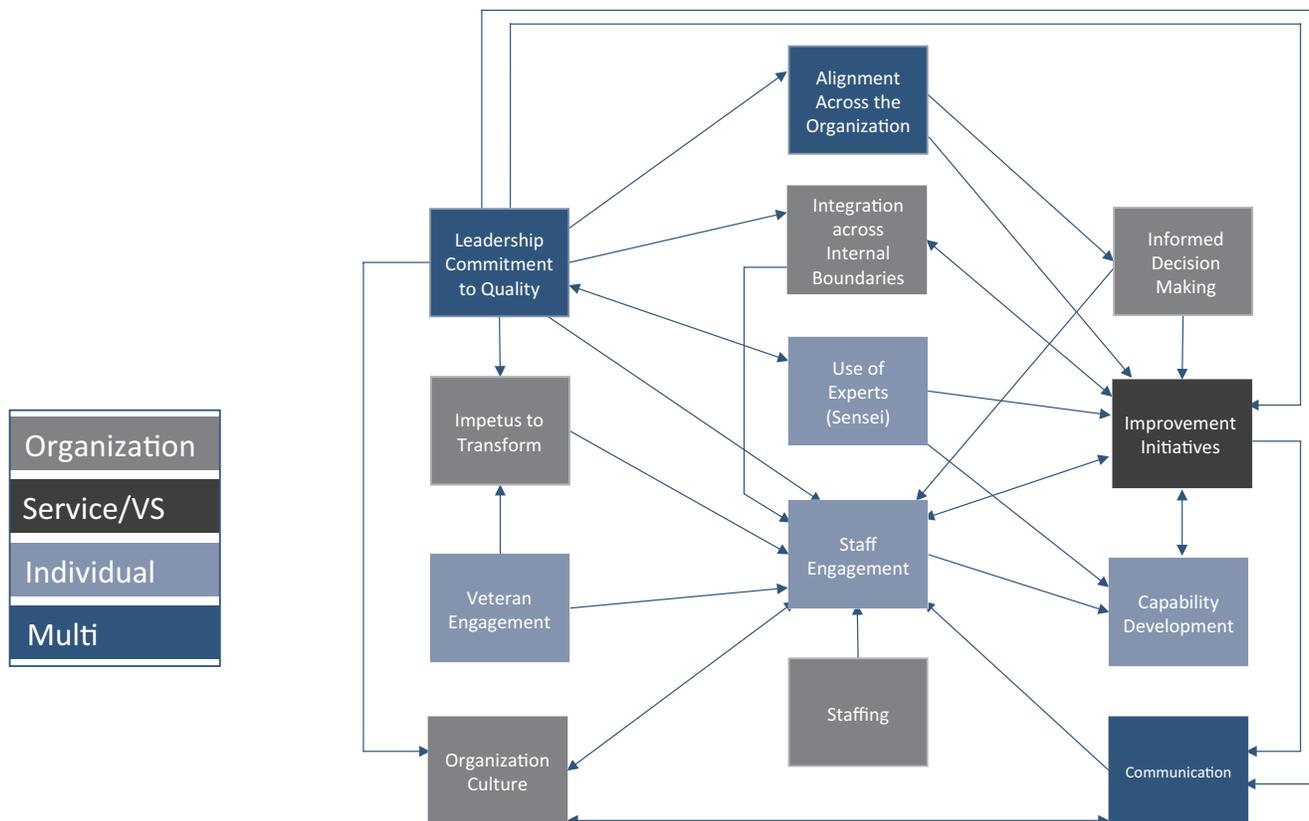
Senior leaders are also responsible for aligning organizational strategy, resource allocation, goals, and personnel evaluations (corresponding to "Alignment" in Figure 1). While this is straightforward to describe, surprisingly we found it lacking in many of the sites in our study. We found many centers lacked "True North" goals. "True North" is a key concept in Lean process improvement that connotes the compass needle for Lean transformation. It might be viewed as a mission statement, a reflection of the purpose of the organization, and the foundation of a strategic plan. Ideally, True North goals are tied to measurable goals and benchmarks. At less successful sites, True North goals were absent or vaguely stated. True North was most effective when paired with metrics that were specific and tightly aligned with improvement activities.

In VA, turnover in senior leadership was a challenge that interfered with senior leaders' ability to change culture and achieve transformation. In addition to losing momentum, when new leaders joined a medical center, their priorities often differed from those of prior leaders. When this occurred repeatedly, staff developed the expectation that whatever initiatives new leaders promote will be short-lived ("this too shall pass"). Consequently, staff were less enthusiastic about new initiatives and often waited to see if shifts in priority were enduring.

The most effective leaders recognize that engaging staff is necessary and critical to culture change. The complicated relationships involving staff engagement are shown in Figure 1. Staff need to be encouraged to engage in Lean. One way to achieve this is leaders directly asking managers and staff for their involvement. A second way is to clearly portray a gap in medical center performance or an aspiration for a higher level of performance that rings true to staff. In Figure 1, this is portrayed as "Impetus to Transform." Typically medical center staff are highly motivated to improve patient care, improve patient safety, and eliminate errors; although important to the medical center, less motivating are appeals to reduce waste and cut costs. To have an effective impetus to transform, the presenting problem or aspiration has to be linked to Lean to convince staff that Lean can address the issue. This impetus to transform is usually conveyed by leadership. Articulating a motivating impetus to transform is a critical factor given staff hesitancy to become engaged based on prior experience of programs that have ended after a few months, and the challenge of multiple conflicting priorities that originate at medical center, VISN, and national levels. These compete for leadership and staff time, effort, and attention. Moreover, they have different and conflicting terminology that creates confusion. As culture transforms, not only does the expectation for staff to identify problems and identify possible solutions increase, but so does the expectation for staff engagement. One way to increase staff engagement is to involve Veterans in Lean improvement activities. Interviewees in sites with Veteran engagement expressed that they were motivated to engage in Lean improvement work for the Veteran. Staffing

Towards Diagnostic Safety in High Reliability Organizations: Translating Priorities Into Action

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Diagnostic errors cause substantial patient harm and lead to increased costs and unnecessary utilization, yet many organizations have found it challenging to improve diagnostic safety.[1] This is in part because methods to detect and measure diagnostic errors are still in an early phase of development. Diagnosis often entails a series of events across multiple dates, locations, and providers, and may evolve over the course of a patient's care even in the best case scenario. As such, diagnostic errors (i.e., diagnoses that are missed, delayed, or wrong) can be challenging to define and even more challenging to measure reliably.

Vulnerabilities in the diagnostic process may be related to numerous factors including providers, patients, and/or other components of complex, technology-enabled health systems. Amid this complexity, where to focus measurement and improvement efforts is not always obvious. Individual clinicians' thinking and behavior influence diagnostic performance, but these factors are difficult to change, especially on a broad scale. While clinician- and patient-focused interventions are still early in their development, focusing on vulnerable systems and processes may have greater potential for impact on diagnostic safety in the near term. In this article, we describe an example of discovery translated to system-level policy and practice impacts, and discuss strategies to stimulate improvements in diagnostic safety in high-reliability organizations.

Case Study: Missed Test Results as a Target for Improvement

Missed or delayed response to diagnostic test results has been identified as a frequent obstacle to timely diagnosis and a target for diagnostic safety measurement. In two of our team's previous studies, almost 8 percent of abnormal imaging and 7 percent of laboratory test notifications in the electronic health records (EHRs) lacked timely follow-up at four weeks, sometimes even when providers had acknowledged receipt of these results.

Although not all missed test results cause harm to the patient, they can increase the risk of adverse clinical outcomes for serious and/ or time-sensitive diagnoses, such as cancer. In our studies of patients with newly diagnosed lung and colorectal cancers, we found evidence of missed opportunities in diagnosis, often related to test result follow-up, in 25 percent and 31 percent of cases, respectively. Informed by these and other studies demonstrating the frequency and potential harm of missed test results, the Veterans Health Administration (VHA) implemented a new policy, VHA Directive 1088, to encourage more reliable and timely communication of test results. The Directive requires Veterans Affairs (VA) providers to communicate normal test results to patients within 14 days after the result becomes available, or within seven days when results require follow-up action.

In 2013, VHA contracted with the External Peer Review Program to pilot test the adoption of new performance indicators on timely communication of test results. This process involved random chart abstraction and data collection to assess compliance with Directive 1088, quantified as the percentage of test results (normal, actionable, and all) in compliance, and the percentage of all test results communicated within 30 days of the report for each facility. These measures were initially pilot-tested through intensive manual record reviews and then nationally implemented. All VA facilities now have access to their data and are benchmarked.

Similar processes can be used in settings outside VA. For instance, Kaiser Permanente is one of several healthcare organizations that are now launching large-scale initiatives to improve follow-up on abnormal test results. Outside VA, several health systems have introduced other initiatives to measure and improve diagnostic performance. Stakeholders such as the Agency for Healthcare Research and Quality

Key Points

- Diagnostic errors are multifactorial and cannot be addressed through a single strategy.

- A case study of missed lab test results offers lessons learned for improvement.

- Organizations can use principles of patient safety measurement and monitoring to learn from missed opportunities for safer diagnosis.

(AHRQ), the National Quality Forum, and the Centers for Medicare and Medicaid Services have committed to developing methods to operationalize and monitor diagnostic safety.

Diagnostic Safety in Action: Common Principles, Many Paths Forward

Diagnostic errors are multifactorial and cannot be addressed through a single strategy, nor are there standardized metrics for diagnostic error. However, organizations can apply general principles of patient safety measurement and monitoring to learn from missed opportunities for safer diagnosis. For instance, the Health Foundation's framework for patient safety measurement, depicted in Figure 1 and modified to focus on diagnostic safety, offers guidance for safety monitoring regardless of the specific focus of improvement efforts or metrics used.[2] Implications of the framework for diagnostic safety initiatives in high reliability organizations include the following.

1. **Learning from past diagnostic harms:** Organizations should enable discovery of diagnostic safety risks, errors, and harms through reporting as well as other methods (e.g., electronic triggers).

2. **Reliability in diagnostic processes:** Policies and procedures should emphasize consistent

Figure 1. Characteristics of Diagnostic Safety Measurement and Monitoring in High Reliability Organizations

Adapted from Vincent C, Burnett S, and Carthey J, *BMJ Quality and Safety* 2014; 23:670-77.

and timely diagnostic processes (e.g., timely follow-up of abnormal test results).

3. **Sensitivity to operations:** Diagnostic safety programs should be designed with awareness of the organization's capacity for information gathering and monitoring.

4. **Anticipation and preparation:** Measurement and monitoring should be proactive, and prospective and "real time" methods should be implemented as feasible.

5. **Integration and learning:** Organizations should cultivate a "learning system," reviewing and revisiting how information is acted upon to improve diagnostic safety and how changes are sustained.

Actionable information on diagnostic process breakdowns may come from voluntary clinician reports, reviews of adverse events, patient complaints, or other sources. Data mining strategies, such as

the use of electronic triggers applied to EHRs, may yield other unique insights into system vulnerabilities. In order to enable organizations to begin measuring diagnostic error and reduce preventable diagnostic harms, we recently co-authored an issue brief released by AHRQ as a "call to action" for achieving high reliability related to diagnostic performance.[3] This resource provides pragmatic recommendations for organizations to use readily available data sources to begin to target high-risk diagnoses and diagnostic processes.

At present, most healthcare organizations have few structures or processes in place to detect, mitigate, or prevent diagnostic errors. However, as our experience demonstrates, learning from errors is possible, and the outcome of this process can impact system-wide policy. A spirit of discovery and learning for the sake of improvement will inevitably bring forth much needed opportunities to enhance the reliability and safety of diagnostic processes and prevent patient harm.

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How will we know we're making progress in creating a Just Culture? Reviewing patient safety culture survey results from the All Employee Survey (AES) or assessing Root Cause Analysis (RCA) reporting trends may provide some insights, but are those measures sufficient? VA researchers can and hopefully will help us answer this critical question so that we may continue to improve the culture and empower VHA staff to better care for the Veterans we are privileged to serve.

In our ongoing response to the COVID-19 pandemic, adoption of HRO principles and practices is more important than ever. Some

VAMCs are using Safety Forums to improve communication about COVID-19, while others use daily briefings and short newsletters to highlight how specific HRO principles and behaviors can be applied in our response. Most importantly, the adoption of Just Culture allows any employee to speak up if they have concerns or see a safety risk – such as insufficient use of personal protective equipment, or when a patient requires COVID-19 testing. VHA is demonstrating throughout COVID-19 that we do indeed have high-performing teams across our enterprise who have trust and respect for each other – hallmarks of an HRO.

Over the past decade, VHA has tackled systemic issues facing our healthcare system and we have made incremental progress. We have done so while largely continuing to achieve the quality and outcomes that VA healthcare is known for. As VHA moves forward with its journey to high reliability, we will work to reinforce HRO principles and Just Culture, from VHA Central Office to frontline clinicians and administrative staff. We look forward to partnering with and learning from the VA research community in our collective goal of restoring trust with our workforce and with Veterans, contributing to the creation of a learning organization, and supporting the modernization of VHA systems.

Improving Safety Measurement in Outpatient Surgery: A Case Study Applying a Trigger Dashboard to Detect Adverse Events

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As VA transforms into a high reliability organization, accurate measurement of safety events will be critical.[1] This is particularly true for the 28 ambulatory surgery centers (ASCs) that perform thousands of VA outpatient surgeries annually, yet are not subject to the rigorous quality measurement efforts in hospitals. The VA Surgical Quality Improvement Program (VASQIP) was designed to measure quality in VA surgical care and prioritizes high-risk procedures for nurse review. Trained VASQIP nurses review cases to identify adverse events (AEs) and these data are used to drive quality improvement efforts. Implementation and continuous use of VASQIP has lowered surgical morbidity and mortality throughout VA and is hailed as a significant contribution to patient safety.

Although VASQIP is applicable from complex to ambulatory care settings, fewer cases are VASQIP-eligible in lower complexity settings. In addition, some service lines could perform 10 to 20 percent of total surgical volume without performing VASQIP-eligible cases. Half of surgical site infections identified in a study of VA outpatient surgeries occurred in VASQIP-ineligible procedures.[2] To address this gap in surgical AE detection, Dr. Hillary Mull was awarded a VA Health Services Research & Development Career Development Award to develop and validate an AE surveillance tool for outpatient surgery.[3] The tool assigns predicted probabilities of an AE to outpatient surgeries, using patient, procedure, and facility characteristics as well as triggers, electronic algorithms based on medical record data, to flag cases with patterns of healthcare utilization consistent with an AE. The surveillance tool identified an overall outpatient surgical AE rate of 9 percent.[3]

Implementation Process

In Spring 2019, we commenced a staff-initiated implementation of the AE surveillance model for outpatient surgery in one ASC (Figure 1). Phase 1 of this effort involved taking three months of cases at the pilot site from the prior fiscal quarter and comparing the AEs detected through the usual VASQIP review process with the predicted probabilities of an AE generated by the surveillance model. We determined that the predicted probabilities of an AE aligned well with the cases that had a true AE, but that many cases with a high probability of an AE were not assigned VASQIP review. These encouraging findings led us to develop a local, internal mechanism to identify outpatient surgeries with a possible AE.

Phase 2 of the project involved working with Knowledge Management & Analytics (KM&A) at the VISN level to develop a program that would flag outpatient surgeries for VASQIP nurse review. Dr. Mull provided the SAS code used to run the triggers and apply coefficients from the logistic regression model used to assign predicted probabilities; however, the KM&A team used SQL coding, and applying the logistic regression model was deemed infeasible. Instead, we decided to program the triggers in a user-friendly format that the VASQIP nurse could assess and determine whether further review might identify an AE. The Trigger Dashboard built by KM&A could classify the outpatient surgeries so cases could be separated by service lines to allow tracking of patients as a quality initiative.

The following triggers from Dr. Mull's surveillance tool were retained: a postoperative emergency department (ED)/ urgent care visit, a postoperative hospital admission, and more than three visits to

Key Points

- The VA Surgical Quality Improvement Program (VASQIP) measures quality in VA surgical care and prioritizes procedures for nurse review.

- The newly developed Trigger Dashboard has been a useful adjunct to VASQIP review, allowing adverse events (AEs) not previously identifiable to be collectively monitored.

- Detecting safety events and identifying specialties with high AE rates supports earlier intervention.

surgical clinics postoperatively. With input from the VASQIP nurse, we modified the AE surveillance algorithm. The triggers were programmed to cover a 30-day range instead of 15 days and the list of Current Procedure Terminology (CPT) procedures qualifying as outpatient surgeries was expanded. Next, the "2 or more visits to the urology clinic" trigger was dropped because the ASC did not perform many urology surgeries, and the telephone triage trigger – which was tested but ultimately rejected in Dr. Mull's earlier work – was added to the Trigger Dashboard. Lastly, we added columns to the dashboard indicating whether the patient died within 30 days of the procedure, the number of post-operative days between surgery and ED visit or telephone call, and the length of stay for the admission. The Phase 2 AE Trigger Dashboard required 13 hours of effort from the KM&A team – three hours to write the code and 10 hours to make user-driven modifications and an acceptable interface.

Following a use period of three months, we revised the trigger dashboard again to improve the detection of AEs and remove trigger flags with limited utility. We also added a new trigger that was not used in the AE surveillance system Dr. Mull created – a flag for whether the patient had any emergency care covered on a fee-for-service basis in the community. We removed the telephone triage trigger and added back the urology clinic trigger. While it requires more time than reviewing only the VASQIP-targeted cases, the Trigger Dashboard helped to identify five outpatient surgeries with an AE compared to zero AEs detected in the VASQIP-eligible procedures. These AEs include surgical site infections, urinary tract infections, and urinary retention, all of which represent potentially preventable surgical complications.
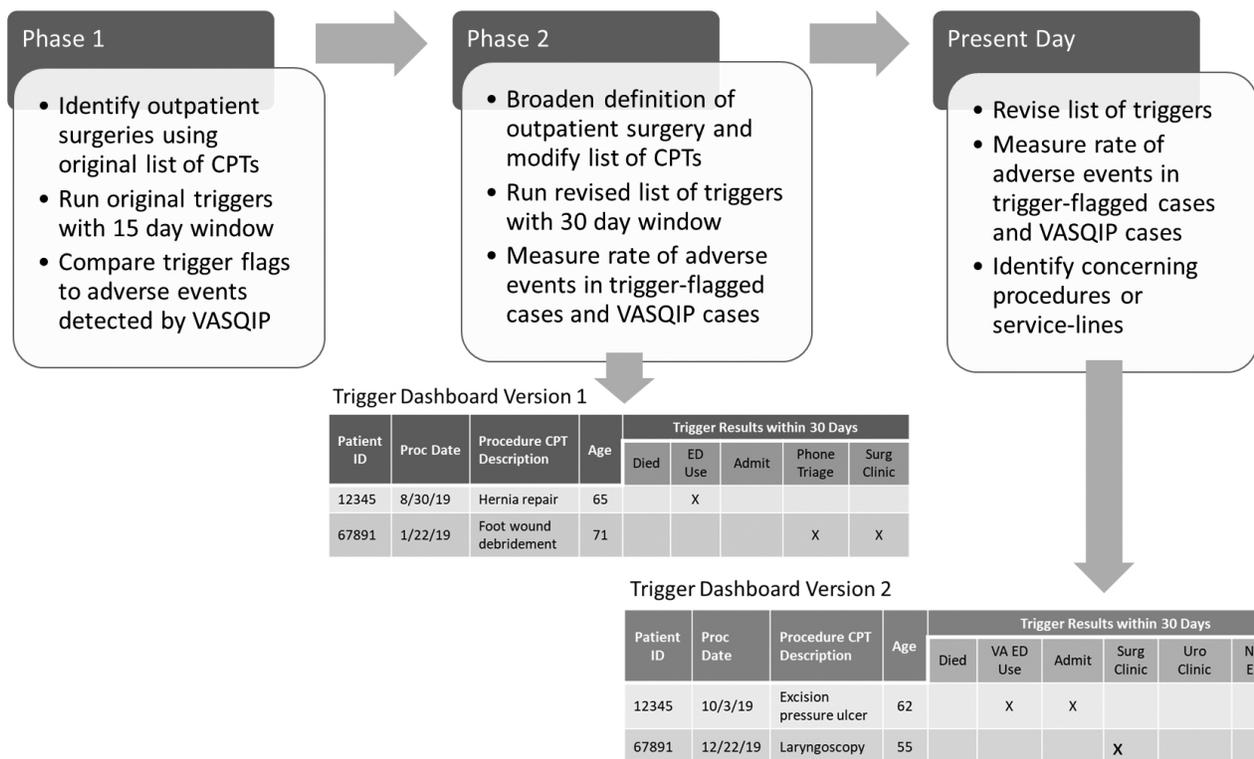
Impacts

The present version of the Trigger Dashboard has been a useful adjunct to VASQIP review. Tracking of events with the triggers has allowed events not previously identifiable to be collectively monitored. The tool also allows different triggers to be prioritized by population or specific event concerns. For example, all podiatry patients could be tracked for ED visits or clinic-based joint injections for hospital admissions. In many ASCs, podiatry surgeries make up a significant proportion of cases and the patients are often high risk with multiple comorbidities. This tracking would be labor intensive and cumbersome if performed without the dashboard. Perhaps the most useful contribution of the dashboard is the inclusion of podiatry procedures as this specialty is largely excluded from VASQIP. Detecting safety events and identifying specialties with high AE rates supports earlier intervention.

The Trigger Dashboard is facilitating ongoing quality measurement of surgical care in an ASC. This close collaboration between research, clinical care, and KM&A is a case study in how VA translates research into practice and furthers our goal to become an enterprise-wide high reliability organization.

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Figure 1. Description of Implementation Process at One VA ASC*

Phase 1
- Identify outpatient surgeries using original list of CPTs
- Run original triggers with 15 day window
- Compare trigger flags to adverse events detected by VASQIP

Phase 2
- Broaden definition of outpatient surgery and modify list of CPTs
- Run revised list of triggers with 30 day window
- Measure rate of adverse events in trigger-flagged cases and VASQIP cases

Present Day
- Revise list of triggers
- Measure rate of adverse events in trigger-flagged cases and VASQIP cases
- Identify concerning procedures or service-lines

Trigger Dashboard Version 1

Patient ID	Proc Date	Procedure CPT Description	Age	Trigger Results within 30 Days				
				Died	ED Use	Admit	Phone Triage	Surg Clinic
12345	8/30/19	Hernia repair	65		X			
67891	1/22/19	Foot wound debridement	71				X	X

Trigger Dashboard Version 2

Patient ID	Proc Date	Procedure CPT Description	Age	Trigger Results within 30 Days					
				Died	VA ED Use	Admit	Surg Clinic	Uro Clinic	Non-VA ED Use
12345	10/3/19	Excision pressure ulcer	62		X	X			
67891	12/22/19	Laryngoscopy	55				X		X

*Note: The phase 2 and present Trigger Dashboard screen shots are for example purposes only and do not contain actual patient data.

Research Highlight

Implementing HRO: The VHA Safe Patient Handling and Mobility Program

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The Veterans Health Administration (VHA) is nationally recognized for leadership in implementing a highly successful, evidence-based Safe Patient Handling and Mobility (SPHM) program. Beginning in 2009, the program was implemented in partnership with local, VISN, and Central Offices. In 2009, 2010, and 2011, VHA funded the national SPHM program with a budget of $208 million. The original evaluation team developed a three-year longitudinal study, and obtained data from VA administrative databases on nursing back injuries and surveys of 141 VA facility champions (collected at baseline and six-month intervals, from October 2008 to June 2011). The data analysis employed multiple regression to test the effect of SPH program elements while controlling for organizational factors. VHA led the nation in SPHM implementation and this is substantiated by 1) peer-reviewed articles that document reduced musculoskeletal injury rates among nurses after adoption of mechanical means to mobilize patients instead of using manual methods;[1] 2) collaborations and products produced with national partners, including the American Nurses Association and the National Institute for Occupational Safety and Health; 3) citations of VA work by the Joint Commission and others; and 4) national media attention.

Program Evaluation
The results showed that three organizational risk factors – bed days of care, facility complexity level, and baseline injury incidence rate – were significantly associated with injury incidence rate. Five SPHM components significantly predicted a decrease in injury

incidence rates: deployment of ceiling lifts and other new technologies, peer leader effectiveness, competency in equipment use, facility coordinator link with safety committee, and peer leader training.[1]

The VHA SPHM Program continues to enhance staff safety across multiple patient settings (e.g. inpatient acute care, rehabilitation, long term care). SPHM equipment is available for each patient physical activity, such as walking, transferring in and out of beds, stretchers, or chairs, and showering. SPHM technology includes powered mechanical lifts, accessories, and slings, which can be customized for any mobility task. The most recent available data from FY 2009 to FY 2017 demonstrated a 45 percent reduction in all VA nursing staff back injuries.[2] Other associated advantages include: avoiding lost work time due to injury, fewer compensation claims, and reduced costs necessitated by staff replacement resulting from injury and absence. Most recently, the VHA SPHM coordinators have created videos using the equipment to prone ventilated patients with COVID-19. These have been disseminated throughout VHA and non-VHA hospitals.

HRO Implementation Strategies
The VHA SPHM program is an example of high reliability organization (HRO) program implementation. The program components represent the day-to-day implementation strategies of an HRO.[3] The development of leadership and training for this program is exemplified by unit peer leaders and facility coordinators who continually educate, check competencies with equipment, and problem-

Key Points
- In 2009, VHA launched the Safe Patient Handling and Mobility (SPHM) program, a successful, evidence-based initiative implemented in partnership with local, VISN, and Central Offices.

- A three-year longitudinal evaluation of SPHM identified factors that both increased and decreased injury incidence rates.

- The VHA SPHM program is an example of high reliability organization (HRO) program implementation.

solve patient lifting and mobility challenges with all hospital staff involved with patient care. The culture of safety is exemplified by "no-lift" policies, "after action" or "near miss" staff safety huddles, continuous ergonomic unit assessments, and marketing. Data on staff injuries is monitored and informs coordinators which units may need further education or equipment. Patient falls and injuries that are impacted by equipment use are also monitored by unit peer leaders. Finally, implementing effective interventions is demonstrated by daily use of SPHM equipment.

The most important implementation tool for the SPHM program is the network of coordinators, national program directors, and national SPHM advisory group members. This network has face-to-face training conferences

and monthly national and Veterans Integrated Service Network meetings. The network assures the sustainability and success of the program by gathering and disseminating information on equipment, how to integrate the program into building plans, and most importantly, how to assimilate new coordinators into the program.

Currently, the Nursing Innovations Center of Evaluation is developing a Mobility Screening and Solutions Tool to expand the SPHM program to include all clinical care providers who are responsible for safely moving and transferring patients across multiple settings. This tool will quickly assess a patient's mobility and align possible equipment to use in a specific task. The newest focus of SPHM is on patient outcomes. The VISN 8 Patient Safety Center of Inquiry (PSCI) has many ongoing SPHM projects, including studies to examine how the equipment is used in Veterans' rehabilitation, how to best utilize overhead and sling technology, how to prevent skin injury, and how to minimize patient and staff injury due to patient falls. Other projects include how SPHM equipment and practices could impact early mobility in ICUs and installing SPHM equipment in Veterans' homes. This effort would include training family caregivers on how and when to use SPHM equipment and represents an exciting opportunity to transfer what we have learned from inpatient SPHM programs to the home setting. Such a transfer would reduce negative caregiver outcomes while promoting mobility for the patient. Finally, a newly funded research study is underway to develop a measure of Veterans' experiences of assisted mobility during a hospital admission.

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Innovation Update

Engaging Veterans in Medication Reconciliation via Pharmacist-Mediated Secure Messaging

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Medication discrepancies, defined as unintentional differences found between patients' medical records and patients' reports of medications they are taking, occur frequently after hospital discharge, predisposing patients to adverse drug events, emergency department (ED) visits, and readmissions.[1,2,3] Medication reconciliation is required at every care transition, yet high discrepancy rates after hospital discharge remain and suggest the need to develop strategies to ensure accurate and reliable medication data within the electronic health record. One innovative solution is to leverage online patient portals (e.g., myHealtheVet) that allow interactive, asynchronous electronic communication for review of medications. Thus, we developed an electronic tool for medication review, known as the Secure Messaging for Medication Reconciliation Tool (SMMRT).[4]

To test the effect of SMMRT, we conducted a randomized controlled trial among 240 Veterans hospitalized in one Veterans Affairs Medical Center. Participants were randomized to receive the SMMRT intervention (n=118) or usual care (n=122). Veterans in the SMMRT group were enrolled in myHealtheVet, trained to use both secure messaging and the SMMRT tool, and contacted by a clinical pharmacist to review medications and reconcile discrepancies in the two-week period following discharge.

Thirty days after discharge, fewer medication discrepancies occurred in the SMMRT group (4.4/person) than in the UC group (6.4/person; p<0.001), a 34 percent reduction. No between-group difference occurred in rates of the combined endpoint of 30-day readmissions and ED visits (SMMRT, 30% vs. UC, 34%; p=0.51).

An intervention to promote asynchronous medication review after hospital discharge reduced medication discrepancies by 34 percent but does not appear to reduce 30-day readmissions and ED visits. For patients with adequate computer literacy, asynchronous electronic communication may improve post-discharge patient safety. Additional forms of communication (e.g., mobile apps, text messaging) should be explored as potentially innovative mechanisms to improve the safety and quality of care provided to Veterans.

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Pragmatic Yet Robust Study Designs

HRO as an intervention is highly complex in several ways: it is a complex intervention with multiple highly abstract components with unclear definitional boundaries (e.g., safety culture embraces concepts of psychological safety, just culture, and more); it relies on complex pathways comprising multiple feedback loops, mediators, and moderators; it impacts both employee experience and Veteran safety outcomes; the contexts within which HRO is being implemented are complex environments that may dynamically change over time (e.g., impact of the COVID-19 pandemic), which

in turn demands complex, adaptive, multi-component implementation strategies. In the face of these realities, panel members recognized the need and the challenge of identifying pragmatic, feasible, and yet, robust evaluation designs. For example, our team is using qualitative, quantitative, and mixed methods approaches in our formative evaluation work. The way forward will likely include robust trial designs to enable comparisons of HRO versus non-HRO organizations.

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shortages, common in VAMCs, were an oft cited challenge to achieving staff engagement.

Lean improvement activities in the form of value streams, improvement projects, and continuous daily improvement also contributed to staff engagement. In addition to the resulting improvements in processes, improvement initiatives provided an opportunity for staff training, and a positive experience that contributed to increasing expectations of the value of Lean and greater engagement. Successful improvement initiatives helped to reduce the expectation that the Lean initiative was just another fad that soon will pass. A key factor contributing to success was careful scoping of the improvement initiatives. Overscoping led to failure in several sites. Overscoping required contributions by large numbers of people over a long period of time and higher likelihood of organizational politics and lack of coordination required of multiple services or service lines. When improvement initiatives were successful, communication of this success was important for continued culture change and engagement of additional staff in subsequent improvement initiatives.

Successful sites used improvement fairs, prominent displays describing improvements, posting of metrics and their relationship to medical center improvement goals, and discussion of improvements and key metrics in workgroups as well as in service/service line and organization-wide regular meetings. One of the two highest performing sites held a daily meeting to review the status of key processes across the medical center and to prioritize action items.

It is important to note that training ("Capacity Building") is a necessary but not sufficient activity. Several sites in our study that were unsuccessful in changing their culture invested substantial effort in training but did not attend to other factors. As shown in Figure 1, the impact of developing skills is realized by putting those skills into practice, which is done through improvement initiatives. The sites that were most successful encouraged staff to put their newly-learned skills into practice by improving processes. A pitfall, however, was the lack of supportive supervisors, who needed to encourage their staff, reinforce the importance of the effort, provide time and resources, and provide on-the-job training.

Thus, middle managers played a key role in Lean implementation. In effective sites they actively promoted Lean and reinforced senior executive messaging.

Lean and high reliability principles share many commonalities, including tools and techniques, but perhaps most important, achieving high levels of employee engagement and a change in culture to reinforce the focus on improvement, "no blame," and encouragement of all staff to raise potential problems and potential improvements.

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