

# The effects of crew resource management on teamwork and safety climate at Veterans Health Administration facilities

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Communication failure is a significant source of adverse events in health care and a leading root cause of sentinel events reported to the Joint Commission. The Veterans Health Administration National Center for Patient Safety established Clinical Team Training (CTT) as a comprehensive program to enhance patient safety and to improve communication and teamwork among health care professionals. CTT is based on techniques used in aviation's Crew Resource Management (CRM) training. The aviation industry has reached a significant safety record in large part related to the culture change generated by CRM and sustained by its recurrent implementation. This article focuses on the improvement of communication, teamwork, and patient safety by utilizing a standardized, CRM-based, interprofessional, immersive training in diverse clinical areas. The Teamwork and Safety Climate Questionnaire was used to evaluate safety climate before and after CTT. The scores for all of the 27 questions on the questionnaire showed an increase from baseline to 12 months, and 11 of those increases were statistically significant. A recurrent training is recommended to maintain the positive outcomes. CTT enhances patient safety and reduces risk of patient harm by improving teamwork and facilitating clear, concise, specific and timely communication among health care professionals.

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Communication failure has been established as a leading source of adverse events in health care and is an insidious contributor to medical mishaps.<sup>1,2</sup> Gawande and colleagues reported that communication breakdowns were contributing factors in 43% of the 146 surgical incidents analyzed.<sup>3</sup> In their related study, communication breakdowns between surgical residents and attending physicians in the pre- and postoperative settings were cited as common contributors to patient injury; this places the focus on communication transactions as opportunities for patient safety improvements.<sup>4</sup> Communication is also a commonly identified root cause of sentinel events based on voluntary reporting to the Joint Commission.<sup>5</sup> Communication issues include different

forms (eg, oral, written, and electronic) transmitted among staff, physicians, administrators, patient, and family.<sup>5</sup> The Veterans Health Administration National Center for Patient Safety Root Cause Analysis (RCA) database suggests that communication failures were a contributing factor in nearly 77% of all RCAs between 2010 and 2013.<sup>6</sup> Thus, the challenges resulting from communication failures in health care need to be addressed in order to promote patient safety, avoid failures, prevent errors, and reduce patient harm.

## CREW RESOURCE MANAGEMENT IN AVIATION AND HEALTH CARE

Crew Resource Management (CRM) was implemented by the aviation industry when it was established that a majority of airline accidents were related to failures in interpersonal communication, decision making, and leadership—human factors that ultimately affect teamwork.<sup>7–9</sup> CRM initially focused on the pilots in the cockpit, but the training evolved to include the whole crew as a team.<sup>9</sup> The aviation industry has reached and sustained an exemplary safety record despite its high-risk activities, in large part due to the culture change generated by CRM.<sup>10,11</sup> In health care, the quantification of preventable harms remains a topic of debate since the Institute of Medicine's (IOM) landmark report *To Err Is Human*.<sup>12</sup> For example, the number of hospitalized patients who suffer a preventable harm that contributes to their death is currently estimated to be between 210,000 and 400,000.<sup>13</sup> Whatever the number, deaths and serious harm related to preventable medical events remain a significant challenge in health care.<sup>14</sup> Acknowledging the critical role that human factors (such as teamwork and communication) play in preventing adverse events is an important step in patient safety, and as part of the initial call to action, the IOM recommended the need to establish CRM-based team training programs employed in aviation.

The Veterans Health Administration (VHA) National Center for Patient Safety (NCPS) was an early responder to this call to action and was already on track to improving patient safety prior to the publication of the IOM report. The VHA-NCPS developed team training programs based on the principles of CRM: the Medical Team Training (for surgical suites and intensive care units), which started in 2003,<sup>1,15–20</sup> and the Nursing Crew Resource Management (for frontline nursing care), which began in 2010.<sup>21–25</sup> The two programs merged as an interprofessional team training program in 2013, and the phrase “Clinical Team Training” was adopted.

## CLINICAL TEAM TRAINING AT THE VETERANS HEALTH ADMINISTRATION NATIONAL CENTER FOR PATIENT SAFETY

Clinical Team Training (CTT) is a program established to improve patient safety at Veterans Health Administration (VHA/VA) facilities. CTT applies aviation's CRM

methods to the clinical environment by teaching targeted team safety behaviors aimed at managing human error and mitigating threats to safe care. Specifically, the applied CRM concepts facilitate clear, concise, specific, and timely communication, to include graded assertiveness techniques, teamwork and team engagement strategies, and methods to enhance team situational awareness. The use of CRM principles to improve teamwork is now well documented in the health care literature. CRM and its related tools (such as checklists and briefings) result in positive outcomes in diverse health care settings in a variety of ways. Examples of CRM benefits in health care include: improved teamwork and communication<sup>6,16–18,22,25–35</sup>; lower surgical mortality rates<sup>17</sup>; fewer medication errors<sup>23</sup>; improved perception of patient safety culture<sup>20,36–38</sup>; and fewer adverse events than expected in medication events with harm, central line-associated bloodstream infections, hospital-acquired decubitus ulcers, hospital-acquired surgical site infections, and ventilator-associated pneumonias.<sup>39</sup>

The CTT curriculum includes three modules, as shown in **Table 1**. Topics include high-reliability organizations, CRM, culture of safety, just culture fundamentals, leader behaviors, effective followership, briefings/debriefings, checklists, situational awareness, high-fidelity simulation, and other relevant concepts.<sup>1,6,15–26,40,41</sup>

## CLINICAL TEAM TRAINING—A CRITICAL STEP IN BUILDING A CULTURE OF SAFETY

Culture of safety (COS) was defined by Riley et al. as “an integrated pattern of individual and organizational behavior, based upon shared beliefs and values, that continuously seeks to minimize patient harm that may result from the processes of care delivery.”<sup>42</sup> CTT teaches all health care personnel to enhance teamwork, to optimize communication, and to transform their environment into a workplace practicing COS concepts within the domain of a just and fair culture. The key features of the COS are:

1. Shared beliefs and values about the health care delivery system;
2. An organizational commitment to detecting and analyzing patient injuries and close calls;
3. Open communication regarding patient injury results, both within and outside the organizations; and
4. The establishment of a just culture.<sup>42</sup>

COS translation into patient safety is dependent on individuals working and training together in interprofessional teams and assuming personal responsibility for safe practices.<sup>42</sup> Sculli and Hemphill wrote that an organization with a just and fair culture learns and improves by reflecting on its own strengths and

**Table 1: An Outline of the Veterans Health Administration Clinical Team Training Curriculum**

Module	Contents	Description
I	<ul style="list-style-type: none"> <li>• High-Reliability Organization (HRO)</li> <li>• Crew Resource Management (CRM)</li> <li>• Culture of Safety</li> <li>• Error Paradigms</li> <li>• Fault Tolerance</li> <li>• Just and Fair Culture</li> </ul>	Principles of HRO that contribute to a culture of safety are explored. Introduction of CRM concepts applicable to health care processes—high reliability with low frequency of adverse events. Discussion of a systems approach in addressing human errors and fault tolerance in light of a just and fair culture.
II	<ul style="list-style-type: none"> <li>• Leader Behaviors</li> <li>• Leadership Strategies</li> <li>• Briefings</li> <li>• Debriefings</li> <li>• Followership</li> <li>• Assertive Communication With Respect</li> </ul>	Leader behaviors that encourage teamwork and honest communication among team members are discussed. Exploration of leadership strategies. The use of briefing for team building and situational awareness is explained. Debriefing of low-frequency high-risk events included for learning/improving processes and team performance. The effective followership algorithm for respectful assertiveness in the workplace is described.
III	<ul style="list-style-type: none"> <li>• Situational Awareness and Countermeasures</li> <li>• Fatigue Management</li> <li>• Reducing Distractions</li> <li>• Change Blindness</li> <li>• Avoiding Premature Closure</li> <li>• Managing Automation</li> <li>• Checklists</li> <li>• Clinical Simulation</li> </ul>	Situational awareness is introduced as a foundation for individual and team mindfulness and cooperation. Countermeasures to address multiple risk factors for low or inadequate situational awareness are introduced. Development and implementation of checklists are discussed. Simulation utilizing unit-specific clinical scenarios using either high-fidelity manikin or standardized patient, incorporating audience participation.

weaknesses in a transparent manner.<sup>43,44</sup> Consequently, in such a nonpunitive environment, employees feel safe and protected when voicing concerns about patient safety and discussing their own and others' actions regarding an actual or potential adverse event.<sup>43,44</sup> The CTT program was developed to promote the COS. The participants embark on a one-year journey starting with training and implementing a patient safety project.

As the VA facility works toward a COS within the sphere of a just and fair culture, CTT obtains the personnel's input on teamwork and safety climate in every work unit involved in the training. The CTT participants are surveyed with the Teamwork and Safety Climate Questionnaire (TSCQ), which is based on a shorter version of the University of Texas Safety Attitudes Questionnaire (SAQ) by Sexton et al.<sup>45,46</sup> The SAQ survey

was chosen given its six-factor model covering teamwork, safety climate, perceptions of management, job satisfaction, working conditions, and stress recognition. This survey has been associated with clinical-related outcomes, and it has good construct validity and internal consistency.<sup>45–49</sup> Baseline TSCQ results provide the CTT facilitators with an understanding of the work units' current environment and where to focus efforts on projects for improvement in their microenvironments.<sup>49,50</sup> This article presents the largest study of teamwork and safety climate in the greatest diversity of clinical areas at the VA from an enterprise-wide implementation of CTT. It focuses on the improvement of interprofessional teamwork, communication, and safety in the workplace.

## Clinical Team Training and the development of a culture of safety

A goal of CTT is to develop features of high-reliability organizations (HROs). With that in mind, it is also understood that an antecedent to high reliability is a safety culture.<sup>51</sup> HROs have high-risk, complex activities but “persistently have less than their fair share of accidents.”<sup>52</sup> Weick and Sutcliffe presented the five hallmarks of HROs that make up what they called collective mindfulness.<sup>52–54</sup> These features are:

1. Principles of anticipation—to sustain high levels of safety in the workplace
  - Preoccupation with failure
  - Reluctance to simplify
  - Sensitivity to operations
2. Principles of containment—to manage unexpected events
  - Commitment to resilience
  - Deference to expertise

All workers in HROs practice collective mindfulness, embrace the complexities of their activities, and do not simplify the interconnections among people, processes, and policies; they are sensitive to the details of daily operational activities. They take notice of vulnerabilities and report unsafe conditions and small problems before these escalate into larger problems that can cause failures, adverse events, and consequences for the people served by their organizations and for the personnel involved.<sup>55,56</sup> This is made possible by the HRO principles of anticipation. And if inevitable errors or unexpected events occur, HRO systems are well prepared to manage unexpected situations and resilient enough to continue functioning while sustaining high levels of safety in their operations. Clinical leaders understand, value, and defer to the talents that all individuals bring to the table as they find solutions to problems that arise. The HRO principles of containment are utilized for this purpose.

The primary aim of CTT is to develop high-functioning or high-reliability teams, and it operates on the premise that this goal is highly dependent on the evolution

of a safety culture. While specific communication and decision-making tools are presented in later modules, the curriculum initially lays out a foundation by highlighting attributes that are central to a safety culture. Key elements of CTT's three modules support the development of a safety culture. It has been argued that even the best safety tools will not be effective without a culture that embraces the reasons for their use.<sup>57</sup> Thus, initial CTT modules focus on the idea that human error is ubiquitous and inevitable. The focus shifts from error elimination to error management as clinicians operate within a complex health care delivery system. Through the practice of well-defined safety behaviors, human errors can be avoided and detected and harm mitigated. For example, a standardized briefing accomplished by a leader will alert team members of potential threats, clarify roles, emphasize the use of acknowledgments, and provide an invitation to promptly and openly share safety concerns. The briefing may also emphasize team monitoring and cross checking, where team members monitor one another to ensure that observed behaviors are consistent with expected standard operating procedures. The actions outlined in a briefing can impede and/or trap the movement of a potential error through the system.

In a safety culture, the idea that human error is inevitable also sheds light on long-held and often incorrect paradigms about human behavior. The culture of safety also guides how organizations should handle individuals who commit mistakes, slips, and procedural variances, often resulting from production pressure in the day-to-day work environment. Human error is not a choice; on the contrary, it often occurs when individuals are working earnestly and in the best interest of the patient. Therefore, a propensity to exact discipline as a reflex response to human error has a chilling effect on the system, and it is inherently unfair; employees feel that they are held to a standard of perfection, in spite of system flaws. Rather than share information about safety concerns, they will conceal it and do their best to protect themselves at all costs. A safety culture, rather, espouses just culture fundamentals, where frontline staff are encouraged to speak up and report safety concerns without fear of punitive reprisal so the system can be augmented. In keeping with the idea of reporting, developing a safety culture requires that staff are exposed to and understand basic human factors principles, the limits of human performance, and the complexity of the health care delivery system. With this knowledge, frontline staff will readily survey and identify both actual and potential defects in the system.

In later modules, CTT focuses on the three main themes: participatory leadership, effective followership, and the maintenance of situational awareness in dynamic settings. Participatory leadership highlights behaviors that leaders in the operational setting can apply to ensure that team members are engaged and not delaying or, worse yet, withholding information that may improve a clinical decision. For example, leaders can ensure that they are approachable and interpersonally warm, openly invite

participation as part of a briefing, create an expectation to use closed-loop communication, and conduct debriefings either routinely or after a critical event.<sup>40,41</sup>

Effective followership applies assertive advocacy behaviors to subordinate team members who are not the final decision maker in a clinical situation. Followers must be actively engaged as clinical care is provided. They must be willing to speak up to team leaders, even take action, to preserve operational safety. The desire to speak up and the ability to do so are not synonymous. Therefore, CTT emphasizes the Effective Followership Algorithm (EFA), which provides a standardized method of escalation. The EFA ensures that conflicts regarding the appropriateness of clinical decisions are resolved before risky or irreversible actions are carried out.<sup>6</sup>

In dynamic settings, situational awareness or the ability to perceive and correctly process information is greatly challenged. Human cognitive resources are tenuous in the best of circumstances, and when the production pressures of fast-paced environments are added to the mix, situational awareness and the quality of clinical decisions are placed at great risk. CTT first explores the limits of human cognition, and then identifies specific threats to the development of situational awareness such as mental load, task load, time pressure, distractions, and fatigue.<sup>40,41</sup> Teams learn threat countermeasure behaviors that are designed to either preserve situational awareness or recognize when situational awareness may not be optimal. These countermeasures include team monitoring, red flag recognition, and practicing the “1-2-3” rule (teams inserting a pause in the action to step back, analyze, and use resources). These concepts are covered in CTT, recommended for use in the frontline staff’s daily work activities, and practiced during high- and low-fidelity simulations.

## Features of Clinical Team Training

From the beginning phases through the leadership briefing after the learning sessions, CTT encourages—even demands—top leadership engagement. There are multiple ways that leader engagement is required: letter of commitment, presence at leadership calls and learning sessions, and reporting of progress along the way. CTT also emphasizes operational leadership in the clinical work space in real time. Leaders encourage team members to speak up and create a participatory environment with the CTT techniques (eg, briefing/debriefing projects). While other programs may touch on followership, CTT has dedicated focus and implementation of the Effective Followership Algorithm.<sup>6</sup>

Recurrent training at 12 months with simulation (specific to the service/unit and their project) is an integral part of CTT. There is a combination of the simulation requirement and *in-situ* mode of delivery for the CRM-based tools and techniques in CTT projects (**Appendix A**). The requirement for recurrent repeat

training 12 months later sets a tone for the theme that training should repeat on a perpetual basis. The CTT project implementation involves regular coaching and consultation calls with the interprofessional and multidisciplinary NCPS faculty and the participating frontline staff of each VA facility. While other trainings encourage projects, the CTT project implementation is a structured requirement of the program.

VA facilities and services/units are embedded in the NCPS learning organization. This provides a supportive environment for the growth and sustainability of teamwork and innovative culture in local VA sites posttraining. The NCPS faculty team travels to facilities, trains VA staff, and works with them over the next 12 months of CTT project implementation—yet there is no financial burden other than the frontline staff taking time away to attend training sessions. In other words, the VA is using internal resources.

## METHODS

### Study design

A cross-sectional study design for performance improvement was carried out with a survey to explore the teamwork and safety climate at three points of the 12-month duration of the CTT program. The repeated cross-sectional studies provided a pseudo-longitudinal study that may indicate associations existing between CTT and the results of the survey. During this 12-month period, the participants undergo initial CTT/CRM training followed by the implementation of a unit-based improvement project in patient safety. Some examples of projects are shown in **Table 2**.<sup>1,6,15–26,40,41,58</sup>

### Survey instrument

The 27-item Teamwork and Safety Climate Questionnaire (TSCQ) uses a 5-point Likert scale: 5 = agree strongly, 4 = agree slightly, 3 = neutral, 2 = disagree slightly, and 1 = disagree strongly.<sup>59</sup> The TSCQ was derived from the Safety Attitudes Questionnaire (SAQ) by Sexton et al.<sup>45,46</sup> The TSCQ is a shorter version representing three of the SAQ 6-factor models and cover teamwork, safety climate, and perceptions of management (see **Table 3**). Questions 1 through 10 and 12 through 14 assess teamwork climate, Questions 11 and 15 through 23 evaluate the safety climate, and Questions 24 through 27 examine perceptions of management in the respondents’ clinical areas and the institution’s leadership (see **Table 4**). The questionnaire was given during the training before the initial CTT session and in the recurrent session that occurred 12 months later. The questionnaire was also sent to the personnel in the clinical areas that participated in the initial session at 6 months after the initial training. In addition to the survey questions in the TSCQ, participants were asked to identify their job position and the clinical area in which they spend the majority of their time.



**Table 2: Crew Resource Management (CRM-Based) Projects**

Examples of Projects	When	Where
Briefing	Start of every shift, procedure or any event	Medical/Surgical hospital units Outpatient clinics
Huddle	Midshift Any time during the shift	Medical/Surgical hospital units Outpatient clinics Any unit where unforeseen events alter the daily workflow and tasks
Debriefing	Postprocedure Post-critical event	Outpatient surgical units Specialty clinics Skilled Nursing Facilities (SNFs) or VHA Community Living Centers (CLCs)
Situational Awareness	At any point when something does not seem right In real time when an unexpected event or crisis is occurring	Medical/Surgical hospital units Outpatient clinics Urgent care clinics
<ul style="list-style-type: none"> <li>• <i>Applying the 1-2-3 Rule</i></li> <li>• <i>Active Team Monitoring and Cross Checking</i></li> <li>• <i>Task Load Division</i></li> <li>• <i>Recognition of “Red Flags”</i></li> </ul>		
Checklist Development and Implementation	<i>Read and Verify</i> Clinical tasks such as intravenous (IV) or Foley catheter insertion Preprocedure <i>Read and Do</i> Advanced Cardiac Life Support (ACLS) Algorithm during Code Blue event	SNFs or VHA CLCs Medical/Surgical hospital units Outpatient clinics
<ul style="list-style-type: none"> <li>• <i>Read and Verify</i></li> <li>• <i>Read and Do</i></li> </ul>		
Standardized Handoff	Care transitions	Postanesthesia care unit (PACU) to operating room (OR) or OR to PACU Any unit for shift changes or transfers
Sterile Cockpit	During critical tasks Medication pass Time-out Critical parts of an operation (eg, cardiopulmonary bypass)	Any clinical area
<ul style="list-style-type: none"> <li>• <i>Reducing Distractions</i></li> </ul>		
The Daily Plan <sup>®58</sup>	During inpatient admission	Medical/Surgical hospital units
<ul style="list-style-type: none"> <li>• <i>Communication Tool</i></li> <li>• <i>Empower Patient Engagement</i></li> <li>• <i>Encourage Family Involvement</i></li> </ul>		

**Table 3: Teamwork and Safety Climate Questionnaire (TSCQ)**

**VA NCPS Clinical Team Training Teamwork and Safety Climate Questionnaire**

*This questionnaire is anonymous. Do not include your name.*

Facility: \_\_\_\_\_ Date: \_\_\_\_\_

Training area: \_\_\_\_\_

Survey number: \_\_\_\_\_

In what clinical area do you spend the majority of your time (circle one)? PLACE AREAS HERE

What is your job position (circle only one)?

- |                        |                          |                       |                            |              |                     |
|------------------------|--------------------------|-----------------------|----------------------------|--------------|---------------------|
| 1. Attending Physician | 4. Physician Assistant   | 7. Pharmacist         | 10. Occupational Therapist | 13. Fellow   | 16. Other (Specify) |
| 2. Nurse               | 5. Nurse Practitioner    | 8. Social Worker      | 11. Technician             | 14. Resident |                     |
| 3. Nurse Anesthetist   | 6. Respiratory Therapist | 9. Physical Therapist | 12. Nurse Aide             | 15. Student  |                     |

**Please circle a response to the right of each item as it refers to your clinical area.**

	<b>1 = Dis- agree Strongly</b>	<b>2 = Dis- agree Slightly</b>	<b>3 = Neutral</b>	<b>4 = Agree Slightly</b>	<b>5 = Agree Strongly</b>
1. Nurse input is well received in this clinical area.	1	2	3	4	5
2. In this clinical area, it is difficult to speak up if I perceive a problem with patient care.	1	2	3	4	5
3. Decision making in this clinical area utilizes input from relevant personnel.	1	2	3	4	5
4. The physicians and nurses here work together as a well-coordinated team.	1	2	3	4	5
5. Disagreements in this clinical area are resolved appropriately (ie, not <i>who</i> is right, but <i>what</i> is best for the patient).	1	2	3	4	5
6. I am frequently unable to express disagreement with the attendings/staff physicians here.	1	2	3	4	5
7. It is easy for personnel here to ask questions when there is something that they do not understand.	1	2	3	4	5
8. I have the support I need from others to care for patients.	1	2	3	4	5
9. I know the first and last names of all the personnel I worked with during my last shift.	1	2	3	4	5
10. Important issues are well communicated at shift changes.	1	2	3	4	5
11. Briefing personnel before the start of a shift (ie, to plan for possible contingencies) is important for patient safety.	1	2	3	4	5
12. Briefings are common in this clinical area.	1	2	3	4	5
13. I am satisfied with the quality of collaboration that I experience with staff physicians in this clinical area.	1	2	3	4	5

*Continued*

**Table 3: Continued**

Please circle a response to the right of each item as it refers to your clinical area.	1 = Dis- agree Strongly	2 = Dis- agree Slightly	3 = Neutral	4 = Agree Slightly	5 = Agree Strongly
14. I am satisfied with the quality of collaboration that I experience with nurses in this clinical area.	1	2	3	4	5
15. The levels of staffing in this clinical area are sufficient to handle the number of patients.	1	2	3	4	5
16. I would feel safe being treated here as a patient.	1	2	3	4	5
17. I am encouraged by my colleagues to report any patient safety concerns I may have.	1	2	3	4	5
18. Personnel frequently disregard rules or guidelines (eg, hand-washing, treatment protocols/clinical pathways, sterile field, etc) that are established for this clinical area.	1	2	3	4	5
19. The culture in this clinical area makes it easy to learn from the errors of others.	1	2	3	4	5
20. I receive appropriate feedback about my performance.	1	2	3	4	5
21. Medical errors are handled appropriately here.	1	2	3	4	5
22. I know the proper channels to direct questions regarding patient safety in this clinical area.	1	2	3	4	5
23. In this clinical area, it is difficult to discuss errors.	1	2	3	4	5
24. Hospital management does not knowingly compromise the safety of patients.	1	2	3	4	5
25. This institution is doing more for patient safety now than it did one year ago.	1	2	3	4	5
26. Leadership is driving us to be a safety-centered institution.	1	2	3	4	5
27. My suggestions about safety would be acted upon if I expressed them to management.	1	2	3	4	5
<b>Have you ever completed this survey before?</b>	Yes		No		Don't Know

### Setting

There were 33 VA facilities that participated in the initial CTT trainings and 17 VA facilities completed the 12-month recurrent trainings during the study period. A variety of clinical areas were represented, including inpatient and outpatient settings, medical and surgical wards, day surgery clinics, operating rooms, surgical recovery rooms, postanesthesia care units (PACUs), intensive care units (ICUs), nursing homes (CLCs), leadership offices, and administrative and operational units.

### Participants in Clinical Team Training

The vast majority of CTT participants were employees of VA facilities across the United States, representing

a myriad of professions and disciplines: medicine, surgery, nursing, anesthesia, mental health, social work, psychology, pharmacy, rehabilitation services (physical, occupational, and respiratory therapy), biomedical engineering, logistics administration, operations, and ancillary support. The job positions and levels or ranks of CTT participants demonstrated the interprofessional and interdisciplinary nature of the training: physicians, nurse anesthetists, nurses, nurse aides, physician assistants, nurse practitioners, pharmacists, psychologists, social workers, rehabilitation specialists (physical therapists, occupational therapists, speech therapists, respiratory therapists), audiologists, hospital administrators, leadership, ancillary support and operational staff members, and others. The participants represented all levels of each profession and discipline (eg, students, trainees, attendings, residents, fellows, supervisors, managers, executive leadership).



**Table 4: The Factors and Corresponding Items in the Safety Attitudes Questionnaire (SAQ) in the Short Version of the Teamwork and Safety Climate Questionnaire (TSCQ) in Our Study**

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#### **Teamwork Climate**

1. Nurse input is well received in this clinical area.
2. In this clinical area, it is difficult to speak up if I perceive a problem with patient care.
3. Decision making in this clinical area utilizes input from relevant personnel.
4. The physicians and nurses here work together as a well-coordinated team.
5. Disagreements in this clinical area are resolved appropriately (ie, not *who* is right, but *what* is best for the patient).
6. I am frequently unable to express disagreement with the attending/staff physicians here.
7. It is easy for personnel here to ask questions when there is something that they do not understand.
8. I have the support I need from others to care for patients.
9. I know the first and last names of all the personnel I worked with during my last shift.
10. Important issues are well communicated at shift changes.
12. Briefings are common in this clinical area.
13. I am satisfied with the quality of collaboration that I experience with staff physicians in this clinical area.
14. I am satisfied with the quality of collaboration that I experience with nurses in this clinical area.

#### **Safety Climate**

11. Briefing personnel before the start of a shift (ie, to plan for possible contingencies) is important for patient safety.
15. The levels of staffing in this clinical area are sufficient to handle the number of patients.
16. I would feel safe being treated here as a patient.
17. I am encouraged by my colleagues to report any patient safety concerns I may have.
18. Personnel frequently disregard rules or guidelines (eg, hand-washing, treatment protocols/clinical pathways, sterile field, etc) that are established for this clinical area.
19. The culture in this clinical area makes it easy to learn from the errors of others.
20. I receive appropriate feedback about my performance.
21. Medical errors are handled appropriately here.
22. I know the proper channels to direct questions regarding patient safety in this clinical area.
23. In this clinical area, it is difficult to discuss errors.

#### **Perceptions of Management**

24. Hospital management does not knowingly compromise the safety of patients.
  25. This institution is doing more for patient safety now than it did one year ago.
  26. Leadership is driving us to be a safety-centered institution.
  27. My suggestions about safety would be acted upon if I expressed them to management.
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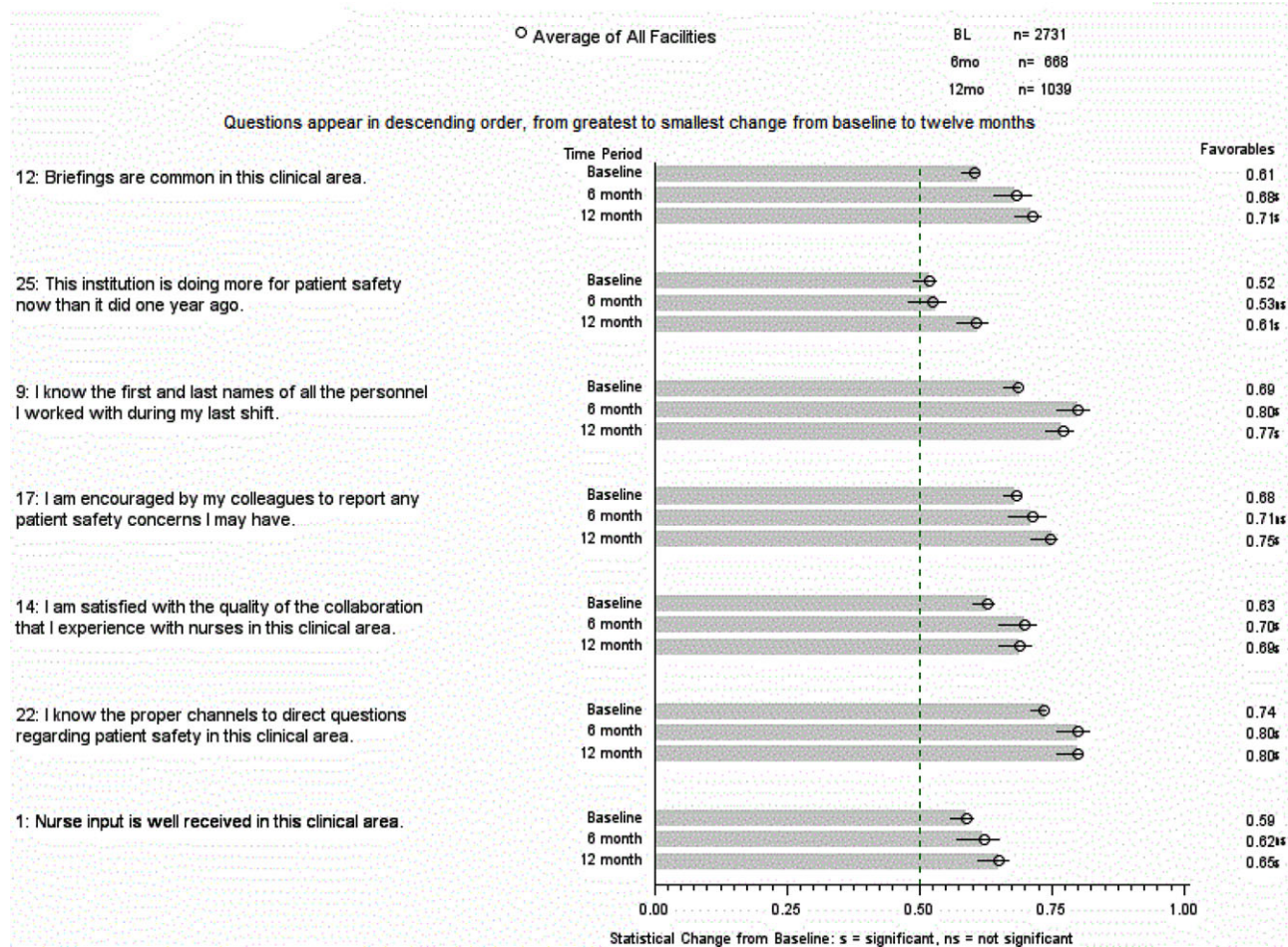
### **Data collection**

Data were collected from March 1, 2013, through August 31, 2015. During this time, 33 VA facilities participated and provided results in the initial CTT, 20 VA facilities submitted TSCQ data at 6 months after the initial CTT, and 17 VA facilities provided TSCQ data for the 12-month recurrent training. Responses from all time points were anonymous and confidential. Of note, fewer

sites were reported as having provided TSCQ data at 6 and 12 months because many sites were still within the time frame for the CTT period; that is, it had not been 6 or 12 months since the initial CTT session.

NCPS faculty were responsible for administering the surveys immediately prior to the initial and 12-month sessions, and returning the completed surveys to NCPS. The 6-month surveys were distributed via e-mail and/or

**Figure 1:**  
**95% Probable Intervals: Favorable Response Rate of Each Question**



hard copy by the CTT coordinator at each participating VA facility. Completed surveys were then forwarded to NCPS for analysis.

### Data analysis

The *positive response rate* for each question was calculated using the number of positive/favorable responses as the numerator, and total number of responses to that question as the denominator. Bayesian methods were applied to determine if there were significant changes in *positive response rates* from baseline to 6 or 12 months follow-up (**Appendix B**).

### RESULTS

A total of 2731 participants provided baseline TSCQ data. At 6 months after the initial CTT program, 668 individuals provided TSCQ responses, and 1039 CTT participants provided TSCQ data at the 12-month recurrent training. The participant survey respondent rates during the initial and recurrent CTT sessions in each

facility were >95%. The average participant survey respondent rate at 6 months after the initial CTT training was 24%.

**Figures 1 through 4** show the results. Questions appear in descending order, from greatest to smallest change from baseline to 12 months.

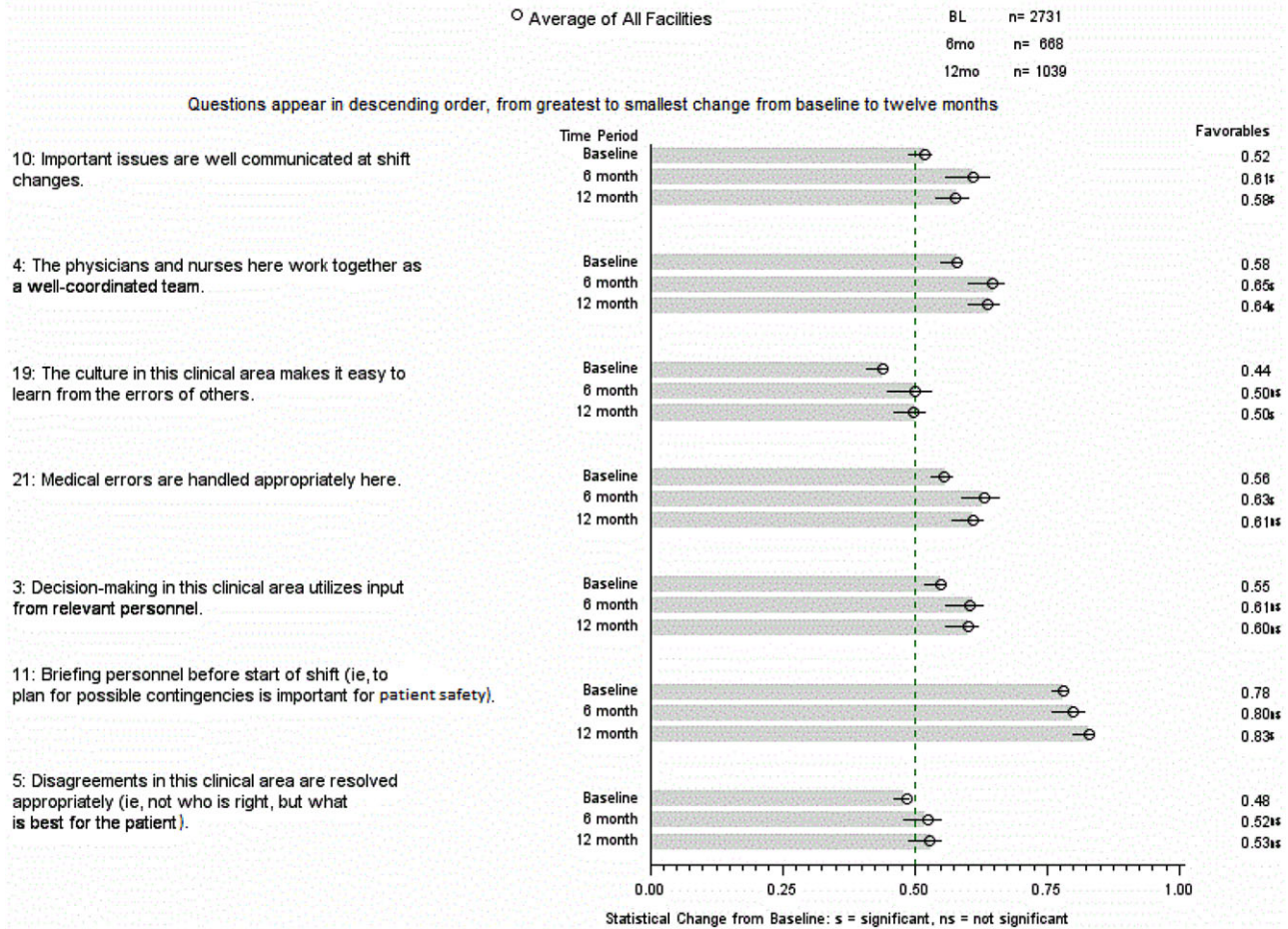
### Figure 1 details

There was a statistically significant increase in the positive response rate from baseline to both 6 and 12 months post-CTT for Question 12. Briefings were incorporated in the clinical areas. The positive response rate for Question 25 increased from baseline to 6 months post-CTT, and the increase from baseline to 12 months post-CTT was statistically significant. The CTT participants responded that the institution is doing more for patient safety one year after the training. Question 9 relates to whether team members knew who they were working with during their last shift. After the CTT program, more of the participants indicated that they know the first and last names of people



Figure 2:

95% Probable Intervals: Favorable Response Rate of Each Question



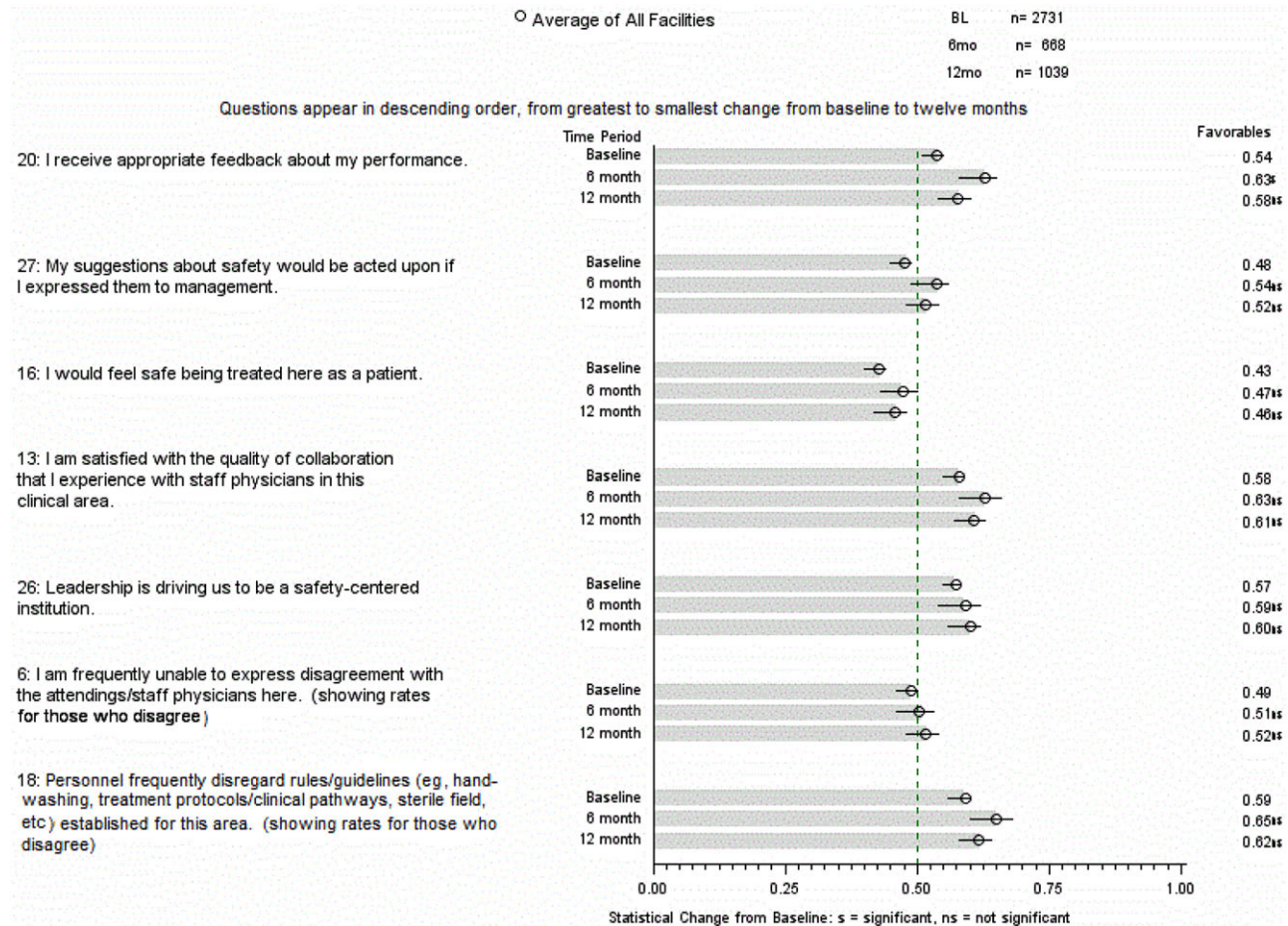
that they work with. Question 17 addresses perceptions about encouragement from colleagues to report patient safety concerns and the increase from baseline to 12 months was statistically significant. Satisfaction for the quality of collaboration experienced with nurses in the participating clinical areas is assessed in Question 14. The positive response rate showed a statistically significant increase from baseline to 6 months and 12 months post-CTT. Question 22 indicates staff knowing channels to direct patient safety questions. The positive response rate for this question shows a statistically significant increase from baseline to both 6 months and 12 months post-CTT. Question 1 is related to acceptance of nurse input in clinical areas. The change in positive response rate showed statistically significant improvement from baseline to 12 months.

Figure 2 details

Perceptions about clearly communicating important issues at shift change are examined in Question 10. The positive response rate showed a statistically significant increase from

baseline to both 6 and 12 months post-CTT. Question 4 examines the working relationship and well-coordinated teamwork of physicians and nurses in CTT participating areas. The positive response rate showed a statistically significant increase from baseline to 6 months and 12 months post-CTT. Question 19 addresses participants' perception of whether the culture in their clinical areas makes it easy to learn from others' errors. The positive response rate showed the same increase from baseline to 6 months and 12 months post-CTT. Question 21 evaluates whether medical errors are handled appropriately in CTT participating areas. Question 3 assesses the utilization of relevant personnel in decision making within CTT participating clinical areas. For both preceding questions, the positive response rate showed an increase from baseline to 6 months and 12 months post-CTT. Question 11 relates to briefing personnel before the start of shifts. The change in positive response rate from baseline to 6 months post-CTT was not statistically significant, but the change from baseline to 12 months was statistically significant. The positive response rate for Question 5, which queries whether disagreements are resolved appropriately

**Figure 3:**  
**95% Probable Intervals: Favorable Response Rate of Each Question**



showed an increase, albeit non-statistically significant, from baseline to 6 months and 12 months post-CTT.

### Figure 3 details

The recognition of having received appropriate feedback about staff performance is covered in Question 20. The positive response rate had a statistically significant increase from baseline to 6 months post-CTT and a nonsignificant increase from baseline to 12 months. Question 27 examines the participants' perception of the management's response, if presented with suggestions about safety. The positive response rate increased from baseline to 6 months and 12 months post-CTT. Question 16 is another "safety climate" query and evaluates whether the staff would feel safe "being treated here." The positive response rate increased from baseline to 6 months and 12 months post-CTT. The quality of collaboration with staff physicians in participating clinical areas is queried in Question 13. The positive response rate increased from baseline to 6 months and 12 months post-CTT. The respondents' perception of whether leadership in their facility is driving their clinical

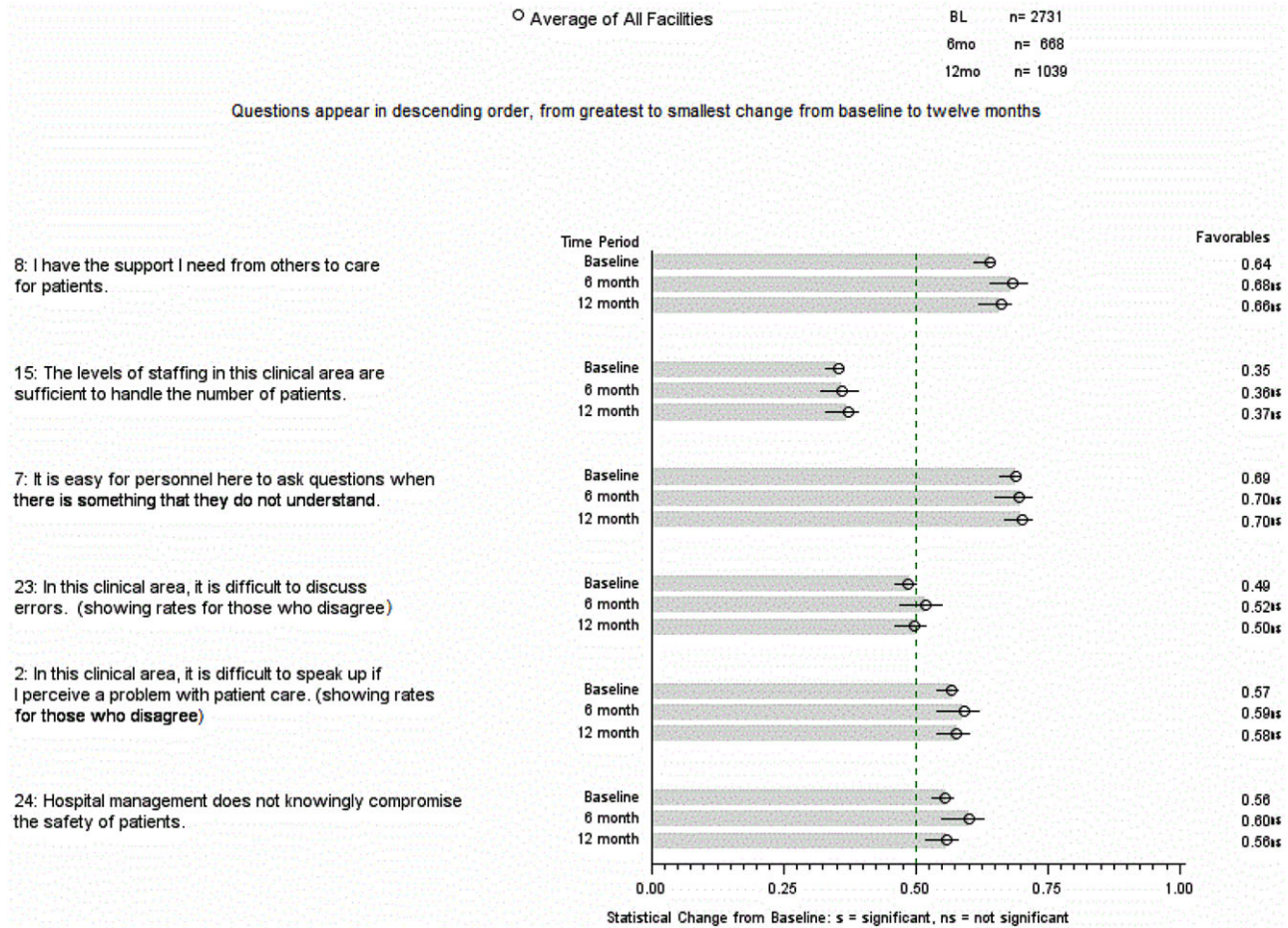
areas toward a safety-centered institution is reflected in Question 26. The positive response rate showed an increase from baseline to 6 months and continued increase at 12 months post-CTT. Question 6 relates to expressing disagreements with attending/staff physicians in the participating clinical areas. For this question, the positive response rate is based on the preferred answers "disagree slightly" or "disagree strongly." The positive response rate showed a small, non-statistically significant increase from baseline to 6 months and 12 months post-CTT. Question 18 examines whether personnel frequently disregard rules or guidelines in clinical areas; the positive response rate is based on the preferred answers "disagree slightly" or "disagree strongly." The results show a nonsignificant but improved change in positive response rate from baseline to 6 months and 12 months post-CTT.

### Figure 4 details

Question 8 evaluates whether the staff think they have the support that they need from others to care for patients. The positive response rate increased from baseline to 6 months



**Figure 4:**  
**95% Probable Intervals: Favorable Response Rate of Each Question**



and 12 months post-CTT. Question 15 is related to whether staffing is sufficient to handle the number of patients. Even though the scores are low, the positive response rate did increase from baseline to 6 months and 12 months post-CTT.

Question 7 relates to the comfort level of personnel to ask questions if there is something that they do not understand. The results show a nonsignificant statistical change in the positive response rate from baseline to 6 months and 12 months post-CTT. Question 23 inquires whether it is difficult to discuss errors in the CTT participants' clinical areas. This is another question where the positive response rate is based on the preferred answers "disagree slightly" or "disagree strongly." The positive response rate increased from baseline to 6 months and 12 months post-CTT. Question 2 relates to difficulty in speaking up if a staff member perceives a problem with patient care. For this question, the positive response rate is also based on the preferred answers "disagree slightly" or "disagree strongly." The positive response rate increased from baseline to 6 months and 12 months post-CTT. Question 24 relates to the perception that hospital management does not knowingly

compromise the safety of patients. The positive response rate increased from baseline to 6 months post-CTT, but returned to the baseline rate at 12 months post-CTT.

## DISCUSSION

### Clinical Team Training and TSCQ results

The comparison of TSCQ results at baseline (during the initial CTT session) and at 12 months (during the recurrent CTT learning session) showed statistically significant results in different aspects of the survey. For this work, we correlated the TSCQ questions to the topics covered in the CTT curriculum and developed categories, which included communication, teamwork, patient safety/patient care, culture/work environment, leadership, followership, behaviors of a leader or follower, leadership management/direction, organizational/staffing, and perception.

In all but one case, survey scores improved from baseline to 12 months, with scores for 10 of the 27 questions showing

**Table 5: Clinical Team Training (CTT) and Its Greatest Impact on Culture of Safety**

**CTT—Greatest Impact on Safety Culture**

- Briefings before the start of a shift or case have become a standard communication method in many clinical areas
- Important issues affecting patient safety are well communicated at shift changes
- Personnel report knowing the first and last names of coworkers
- Colleagues encourage one another to report patient safety concerns
- Staff better understand the proper channels to direct questions regarding patient safety
- Physicians and nurses work together as well-coordinated teams
- Satisfaction with the quality of collaboration with nursing staff was improved
- Nurse input is well received in clinical areas

a statistically significant improvement at 12 months after the CTT program implementation. **Table 5** shows the greatest impact of CTT on safety culture in the workplace.

Briefing as a mechanism of communication before the start of shifts in clinical areas became part of the team's standardized communication. The improvement in participants' perception or belief that their specific facilities were doing more for patient safety than they had a year ago implies that the CTT participants knew, observed, and/or understood that their leadership supported the team training to improve communication and enhance patient safety in their clinical units. More of the participants indicated that they knew the first and last names of people whom they worked with, which can improve the "esprit de corps" in clinical areas. Moreover, the increase in the participants' perception of encouragement from colleagues to report patient safety concerns implies that CTT participants understand the importance of supporting one another as they "speak up" to improve patient safety.

The improvement in satisfaction with the quality of collaboration experienced with nurses in the participating clinical areas reflects upon the positive behaviors of leaders and followers. An improved relationship between the leadership/followership dynamics in clinical areas encouraged team members to collaborate and work better together. The staff had a better understanding of the processes in place for speaking openly and directing patient safety-related questions. Input from nurses was perceived to be more well received at 12 months post-CTT. This implies increasing mutual respect of the leader/follower dynamics in participating clinical areas, which indicates that clinical providers, other health care professionals, and ancillary staff respect the nurses' opinions in the workplace.

The improved positive response rates in the perception of communicating important issues at shift changes, and briefing personnel before the start of shifts suggest a greater understanding of clear, concise, specific, and timely communication and its important role in patient safety. The improvement in positive response rates related to the following items have a collective consequence: (1) better working relationship between physicians and nurses, (2) the inclusion of relevant personnel when making decisions, (3) resolving disagreements appropriately, (4) the culture making it easy to learn from others' errors, and (5) the appropriate handling of medical errors. This reflects a recognition of everyone's significance in the team and an appreciation of all staff members' contributions. This also developed a greater focus on providing safe and high-quality patient care as a team rather than fostering individualism and laying blame on others in the workplace.

The TSCQ results convey that providing more feedback about performance may be a welcome process for the staff in clinical areas that participated in CTT. The recognition of work well done, provision of constructive suggestions when/where appropriate, and recommendations for professional growth can be incorporated in gentle conversations with respectful assertiveness between leaders, followers, team decision makers, and team members. There was an increase in the positive response rate regarding participants' perception of the management's response, if presented with suggestions regarding patient safety. This is an indication that management provided an environment where the staff is comfortable speaking up about ways to improve patient safety post-CTT. For example, management might have actively solicited suggestions from staff and acted upon them, or staff members might have observed others offering suggestions that were subsequently acted upon.



The participants' responses regarding the quality of collaborative work with physicians, and with their ability to express disagreements with attending/staff physicians, suggest that physicians play a strong role in fostering healthy teamwork. However, the lower positive response rate for the latter suggests that there may be barriers to expressing disagreements with physicians. This indicates that there is room for improvement in the communication and behaviors of team leaders and followers alike in this dynamic. The increase in perception of whether leadership in their facility is driving their clinical areas toward a safety-centered institution may be related to the knowledge that CTT was brought to the participating VA facilities with full support from the top leadership. The training involves extensive preparation (eg, scheduling adjustments, requiring staff to attend the program, allocating resources for the CTT program such as staff, time, effort, and organizational support).

The questionnaire responses indicate that most participants did not think personnel frequently disregard rules or guidelines that are established for their clinical areas. However, although the positive response rate improved from baseline to 12 months, it appears as if many participants would not feel safe being treated as a patient in their units. A follow-up query on this item may be necessary for clarity, for learning opportunities, and for quality improvement. It is not clear whether the participants' response is referring to a facility or a specific clinical area, although the survey did ask for the latter.

A significant improvement in teamwork post-CTT is evident based on the TSCQ results. The participants responded that they have the support needed from others to care for patients, and they find it easy to ask questions when they do not understand something. This reflects good teamwork and shows the spirit of collaboration present in the workplace post-CTT. Although teamwork related questions focus on specific clinical areas of the respondents, it would be interesting to explore whether the respondents were focusing solely within their units or were also thinking of facility-wide support. The positive response rates to inquiries, whether it is difficult to discuss errors in the CTT participants' clinical areas and to speak up if a staff member perceives a problem with patient care, are moving in the right direction, but there is more work to be done.

Many of the participants hold the perception that hospital management does not knowingly compromise the safety of patients, but the survey score for this query indicates that there is room for improvement. This finding is a helpful gauge for our colleagues in leadership positions within VA facilities. A strong support from hospital leadership and/or management is critical to the creation of a safety culture.

The question with the lowest positive response rate is about sufficient levels of staffing. A majority of respondents think staffing is insufficient to handle the

number of patients in their clinical areas. Insufficient staffing levels are a common thread in all of the participating VA facilities, and the reasons for this are multifactorial in nature. Patients are getting more complex as patients live longer with increasing comorbidities; thus, this begs the question, "Is the workload increasing but with the same staffing levels?" Mental health conditions, including delirium and mental illnesses superimposed on multiple medical problems, would create more complex medical and nursing care needs. Thus, if the level of staffing is not compatible with the complexities in the medical and nursing care of patients, this common challenge related to staffing will perpetuate. The TSCQ results strongly indicate that actual staffing levels and the perception thereof will need further evaluation.

The results from our TSCQ survey and its association with CTT agree with evidence in the literature that CRM improves communication, teamwork, and safety climate in various health care settings. Similar findings of improvement especially in teamwork and communication, after CRM implementation, were reported recently. These results are based on the Hospital Survey on Patient Safety Culture (HSOPS) pre- and post-CRM implementation across eight departments spanning three hospitals and two campuses.<sup>60</sup>

Briefings became a tool of communication in a variety of clinical settings at multiple VA facilities after CTT, including nursing homes, community living centers (CLCs) medical/surgical floors, ICUs, operating rooms (ORs), emergency rooms, urgent care, outpatients clinics, and other clinical areas. This finding suggests that CRM tools can be utilized with successful outcomes in different settings beyond the ICU and OR where procedures are very common.<sup>61,62</sup> Our TSCQ findings support the notion of utilizing CRM to improve teamwork and communication in different health care settings. Our data support previous reports in the literature that CRM and briefings were related to positive behavioral changes in the OR,<sup>63</sup> reduced surgical morbidity and mortality postsurgery<sup>16,17</sup> and served as an important tool in enhancing teamwork and communication, reducing the perceived risk for wrong-site surgery coupled with improving perception of collaboration among OR personnel.<sup>30</sup> Moreover, our results showed improvement of interprofessional teamwork in a variety of settings CRM training. This finding concurs with the literature evidence of better collaboration among different disciplines after CRM in acute care domains,<sup>64</sup> primary care clinics,<sup>65</sup> emergency and critical care departments,<sup>66</sup> and other clinical units.<sup>67</sup> In addition, our results show similar findings to those studies looking at the effects of CRM in obstetric units, labor and delivery (L&D), after one year from the initial training. There were sustained improvements in both perceptions of teamwork and patient safety climate in a perinatal unit one year after CRM training.<sup>68</sup> The sustained improvement in interprofessional teamwork and communication was feasible and effective in another L&D study.<sup>69</sup> These

findings, along with our data from the CTT, suggest that benefits derived from CRM are sustainable. A reinoculation of CRM training is also important for the sustainability of such positive outcomes. This view is shared by Ricci and Brumsted who reported that CRM training and implementation had an impact on reducing the incidence of wrong site surgery and retained foreign bodies in their operating rooms.<sup>70</sup> They recommended that constant reinforcement and refresher training is necessary for sustained results from CRM training.

## Limitations

This study provided more evidence that CRM improves teamwork, communication, and safety climate in spite of some limitations. A selection bias may be present because we had a convenience sample. The VA facilities selected the clinical areas that had CTT, and the TSCQ scores were related to cultural characteristics of the units involved. Benchmarking was not performed, as there are differences in the clinical areas, disciplines, and safety concerns of the CTT participants. The TSCQ results show an association between CTT/CRM project implementation and the teamwork and safety climate. A direct causal relationship was not included in the analysis. It is possible that other factors may have influenced the findings. For the initial (baseline) and recurrent (12 months after) CTT programs, the NCPS CTT faculty was distributing and collecting the TSCQ during the training sessions when participants were all present; this increased the number of respondents for the TSCQ during these sessions. Although the participant survey respondent rates at baseline and at 12 months post-CTT are greater than 90%, the respondent rate of 24% at 6 months post-CTT is low. There are multiple reasons for this low respondent rate, including the fact that the TSCQ respondents were not all in one place during the 6-month survey, as was the case with the initial and 12-month surveys during the training sessions. Moreover, the TSCQ was not mandatory at 6 months post-CTT. Another factor may be related to insufficient staffing, the frontline clinical staff are often tied-up with their workload and are unable to respond to the TSCQ at 6 months post-CTT. They may also be experiencing survey fatigue. We cannot report survey nonresponse bias because we do not have a nonresponse analysis.

Another limitation is that we cannot trace each respondent because the TSCQ is anonymous and confidential. A large number of respondents did not include their clinical areas and job positions for a variety of reasons that may include loss of anonymity, potential exposure to a punitive environment, forgetting to answer the sections for these questions, and the presence of interruptions or distractions. Thus, there was no subanalysis of missing information on clinical areas and job positions which were not answered by the respondents. Moreover, the respondents at the three time points of the TSCQ may not be all the same participants but may include new staff who joined the clinical areas during the yearlong project implementation.

## Summary

Clinical Team Training is carried-out in VA facilities at the request of the local executive leadership. An intensive preparation for the program requires leadership support and extensive planning for the scheduling of work hours for clinical staff in participating areas. The scores for all of the 27 questions on the TSCQ showed an increase from baseline to 12 months, and 11 of those increases were statistically significant. These results indicate that participating in CTT improves communication, teamwork and situational awareness for patient safety. Decreases in scores from 6 to 12 months post-CTT may be attributed to the low respondent rate at 6 months encountered in this study. On the other hand, the observed “dip” may also point to the need for earlier, embedded “refresher” training to further reinforce the initial CTT lessons learned.

## DISCLOSURE

The opinions in this article are those of the authors and are not intended to represent the position of the Department of Veterans Affairs or the US government. The authors declare no grant support or conflicts of interest.

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## APPENDIX A: CLINICAL TEAM TRAINING (CTT) TOOLS

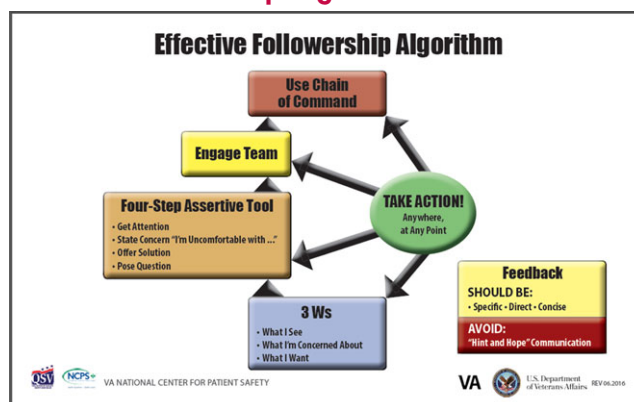
### Team Briefing Checklist

### Team Briefing Checklist

- Greet team
- Goals
  - Safety
- Rules
  - Follow Standard Policy and Procedure -- "NO SHORT CUTS"
  - Speak Up
  - Acknowledge Communications
- Roles
- Expected threats
- Any questions


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### Effective Followership Algorithm



### Team Debriefing Checklist

### Debriefing Checklist

- What went well?
- What did not go well?
- Did we have what we needed?
- Did equipment function properly?
- What can we do better next time?
- Other?


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### Situational Awareness

#### Situational Awareness

##### Red Flags


- Failed Cross Check
  - Conflicting input - Two things that should agree do not agree
- Confusion
  - "This doesn't make sense"
- Not Following Policy
  - Operating outside of established policy
- Failure to Meet Targets
  - Expectations after an intervention are not met
- Not Communicating
  - People on the team stop talking - obvious tension
  - no one saying anything

##### 1-2-3 Rule

1. Step Back

2. Analyze

3. Use Resources


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## APPENDIX B: BAYESIAN ANALYSES OF THE TSCQ DATA

Bayes' theorem (alternatively Bayes' law or Bayes' rule) describes the probability of an event, based on conditions that might be related to the event, stated mathematically as the following equation:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)},$$

where:

$A$  and  $B$  are events.

$P(A)$  and  $P(B)$  are the probabilities of  $A$  and  $B$  without regard to each other.

$P(A|B)$ , a conditional probability, is the probability of observing event  $A$  given that  $B$  is true.

$P(B|A)$  is the probability of observing event  $B$  given that  $A$  is true.

### The basis of the Bayesian approach for these analyses

Our goal was to estimate the positivism of respondents to survey questions. Positivism was defined as the disposition for responding positively to a question. For most questions, this meant that a participant responded that they either agree strongly or agree slightly. For those questions that were worded negatively (eg, Question 6: I

am frequently unable to express disagreement with the attendings/staff physicians here.), positive responses were “disagree slightly” or “disagree strongly.”

1. **Assumptions.** Data are manipulated so that each question has two outcomes (ie, positive or not positive).
2. **Prior beliefs.** To carry out the Bayesian analysis, we quantify our *prior beliefs* about the positivism of a question. This comes down to specifying a probability distribution about our beliefs regarding the positivism of questions. We use a binomial distribution/function to model our beliefs.
3. **Posterior beliefs.** With our prior belief and a binomial distribution to model this belief, we use Bayes' rule to calculate a *posterior belief* about a question's positivism. This is repeated at sequential periods starting from baseline; whence from baseline posterior results we obtain the 6-month prior beliefs, and whence from 6-month posterior results we obtain the 12-month prior beliefs.
4. **Inference.** Upon calculating each period's posterior belief, we estimate a question's positivism by choosing the maximum posteriori probability (MAP) generated from the binomial function and produce a 95% credible interval whereby the probability of positivism being within the interval is 0.95.



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