The Impact of Interventional Radiology Mock Code Blue Drills on Team Vitality

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ABSTRACT

Keywords:
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This performance-improvement project was undertaken with two goals, to improve the care of a patient in a code blue or emergent situation and to promote a healthy interventional radiology work environment, for teams that perform minimally invasive image-guided diagnosis and treatment procedures. The mock code blue project included three tests of change based on Peplau's grounded theory of interpersonal relations that promote nurses to apply principles of human relations to problems.

The study setting was a typical American inpatient hospital interventional radiology department. The Healthcare Team Vitality Instrument (HTVI) ten-question survey was administered as a repeated measurement before and after tests of change to assess dimensions related to front-line perception of a work environment. Team vitality addresses four key factors: (1) support factors, (2) staff engagement and empowerment, (3) team communication, and (4) patient care transitions. Kotter's eight steps for implementing change were used to create an effective plan. The three tests of change spanned 4 months, from June 2017 to October 2017. The test of change 1, initial mock code blue simulation, took approximately 6 weeks to complete. The test of change 2, creation of resources on the unit, and the test of change 3, refined mock code blue simulation, both took approximately 4 weeks. Eighteen participants completed the HTVI survey, nine registered nurses and nine radiology technologists. Exploratory factor analysis of the HTVI was conducted on a 5-point Likert scale. The pretest of change 1 HVTI average mean score was 3.36. The posttest of change 1 mean score rose to 4.56. Pretest of change 2 scores had an overall lower pretest of change 1 mean score of 3.15, yet this rose to 4.6 in the posttest of change 2. The test of change 3 overall pretest of change HVTI average mean score was 4.45, reaching the highest posttest of change 3 score of 4.74, indicating the sustainability and ability to continue to improve team vitality. Scores on the ability to communicate complete information during handoffs changed from the lowest (M = 2.25) to one of the highest posttest of change mean scores of 4.63. In conclusion, the mean scores for all three tests of change indicate that team vitality improved and continued to improve through the project. Presenting the updated analytics to the interventional radiology staff throughout the project is believed to support the overall success and sustainability while implementing code blue emergent training.

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A productive healthy work environment consists of professionalism, team vitality, and openness to exploring ways to improve patient care. A healthy work environment cannot be achieved

unless the team members are able to communicate effectively and are encouraged to participate in collaborative team-building activities that make a difference with team communication and patient care. This performance-improvement project was undertaken with dual goals: (1) to improve the care of the patient during a code blue or emergent situation and (2) to promote a healthy work environment. The study setting is a Magnet®-designated academic medical center in the Southeastern United States, in a typical

inpatient and outpatient interventional radiology (IR) department where complex image-guided procedures are undertaken. Forty percent of patients come from the inpatient setting, and 60% are outpatients. The team of interventional radiologists, nurses, and technologists perform minimally invasive image-guided diagnosis and treatment procedures including angiograms, moderate sedation, implantable medication port placement, vascular angiograms, renal and iliac stenting, vertebroplasty, computed tomography (CT)-guided biopsies, and other preoperative and postoperative procedures.

Patients who undergo an IR procedure are at risk for a code blue or emergent situation, such as cardiac arrest or any situation where immediate lifesaving interventions are required to prevent serious consequences to the patient. The patients receive moderate sedation for most of their procedures. When these situations occur, the IR team must be well acquainted with processes, equipment, and knowledge required to achieve the safest and optimal patient outcome and must work well as a team. A code blue that occurs in the IR setting is unlike a code blue or an emergent event experienced by nurses on a med-surg unit, critical care unit, or emergency department. Code blue or rapid response teams respond to code blue situations throughout the health-care setting, but in the IR setting, the assumption is that the interventional radiologist and nursing staff immediately handle events related to moderate sedation, medication reactions, airway management concerns, cardiac intraprocedure arrhythmias, or hemorrhagic situations. For this reason, all registered nurses are required to be advanced cardiac life support (ACLS) trained. Whatever the cause of a code blue situation, the entire IR team must be prepared to identify those at risk and know what their roles and responsibilities are in a code situation. Educating the team and mock code blue drills can help alleviate the stress of the emergent situation, build confidence, and emphasize the IR team's roles and responsibilities during a real situation (Murdock, 2013). Optimal patient outcomes in a code blue situation depend on collaborative efforts of a well-trained vastly competent team (O'Donoghue, DeSanto-Madeya, Fealy, Saba, Smith & McHugh, 2015). Conversely, inadequate or poor communication, role ambiguity, and confusion can lead to poor patient outcomes. Tenets of team collaboration, credibility, communication, and accountability are embedded in the constituents of a healthy work environment and are associated with improved patient outcomes (Apker, Propp, & Ford, 2009).

The purpose of this performance-improvement project was to present the outcomes on nursing team vitality (interdisciplinary functioning and collaboration and an improved work environment) after implementing code blue emergent situation training in IR. The departmental need for the project was established when the author (MS) and newly designated nursing director of the IR department listened to the nurses and radiology technologists describe gaps in communication and team perceptions of code blue roles and responsibilities. The staff expressed hindrances in code blue events related to inconsistent and ineffective communication, insufficient role clarity and task performance, and inefficiencies related to knowledge of infrequently used code blue equipment. The staff expressed anxiety and a knowledge deficit related to code blue readiness. They supported the need for developing a greater awareness of their role and responsibilities in an emergent situation and ways to communicate more effectively with team members.

Mock code blue drills have been part of the nurse competencies in general hospital settings for many years. However, drills were never fully integrated or conducted in the IR department project setting. Mock code blue and emergent situation annual competency drill lends itself to simulation scenario methodology, where the team members can be educated on specific roles and

responsibilities such as moderate sedation and ACLS. The goal of the mock code blue situation drill should be to provide education and communication skills to improve performance.

Methodology

Combining a standardized mock code blue simulation educational opportunity with a tool to measure team vitality allowed the IR nurses to complete their annual review for competency and provide outcomes to support time-intensive and labor-intensive mock code blue training. The Healthcare Team Vitality Instrument (HTVI) was established to assess team vitality of health-care providers who work as a team in inpatient settings. HTVI was developed as part of the initiative, Transforming Care at the Bedside, a national program of the Robert Wood Johnson Foundation and the Institute for Healthcare Improvement. The ten-question survey is suggested to be used for as a repeated, regular measurement of tests of change to assess dimensions related to front-line perception of a work environment supportive of safe and high-quality patient care, staff empowerment and engagement, team collaboration, and effective communication (Lee, Shannon, Rutherford, & Peck, 2008; Lee & Upenieks, 2016; Upenieks, Lee, Flanagan, & Doebbeling, 2010). The survey, comprised of ten questions, addresses four key factors: (1) support factors, (2) staff engagement and empowerment, (3) team communication, and (4) patient care transitions (Figure 1).

The instrument uses a 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. Internal consistency Cronbach correlation coefficients ranged from .52 to .72 (Upenieks et al., 2010). Exploratory factor analysis, using the SPSS Statistics for Windows, Version 24.0 (IBM Corp. Armonk, NY) software, was used to identify observed patterns in the IR health-care workers' perspectives. Exploratory factor analysis presents the variance by generating mean scores on a 1 to 5 scale, following the basic assumption that for a collection of observed variables, there are a set of underlying factors that can explain the interrelationships among those variables (Costello & Osborne, 2005). The primary purpose to measure critical factors of interdisciplinary functioning and collaboration is that it is essential to basic research. This project added reliability of tracking the impact of improved work environments over time and three tests of change.

Theoretical Framework for Tests of Change

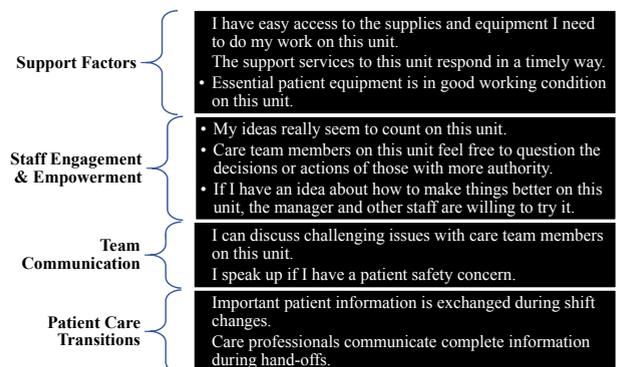The mock code blue performance-improvement project included three tests of change based on Peplau's grounded theory

Figure 1. Four key factors and questions of the HTVI survey. HTVI, Healthcare Team Vitality Instrument.

of interpersonal relations that nurses should apply principles of human relations to problems. The development of the training was a team effort, which encouraged the nurse to view himself/herself as stranger, teacher, leader, surrogate, and counselor (Peplau, 1991). The job description for IR nurses includes patient care delivery coordination and establishment of an interpersonal relationship. Applying Peplau's role of a stranger assists the nurse to understand and exhibit his/her need to serve as a resource to the patient and team. A professional approach, with simple and clear statements, is useful and provides a basis for communication to be delivered and received (Peplau, 1991). The nurse is taught to identify the scope of the problem without a persistent bombardment of questions, which may silence the team member in need of help to think through their dilemma. Applying Peplau's nurse role as a teacher assists the nurse to understand and exhibit his/her ability to provide education both to the IR team member who needs assistance and to the patient to alleviate anxiety. Learning by experience is something that health-care professional do; by taking on the teacher role, they can share their experience and support team members. Applying Peplau's nurse role as a leader in a mock code simulation situation assists the nurse to understand and exhibit his/her ability to provide goals for the IR team and the patient. Nurses should be able to observe and gather evidence on what the patient may be experiencing, therefore understanding what the appropriate needs are for the patient (Peplau, 1991). Applying Peplau's nurse role as surrogate assists the nurse to understand and exhibit his/her ability to be a symbolic mother figure for the IR team and the patient who needs assistance. The nurse's duty is to provide answers by providing reassurance, appropriate treatments, and hope. Patients who are weak often have strong wishes for dependency and often relate nurses with someone they know; therefore, nurses need to be mindful of their actions, body gestures, and manner of speaking (Peplau, 1991).

Applying Peplau's nurse role as counselor assists the nurse to understand and exhibit his/her ability to display a purposeful behavior process to provide reassurance to the IR team. The IR nurse has many resources to assist in providing counseling support and training. Using Peplau's grounded theory of interpersonal relations frames the nurses' establishment of situational relationships to effectively communicate patient safety issues.

Tests of Change

The mock code blue performance-improvement project included three tests of change spanning 4 months, from June 2017 to October 2017. Test of change is a scientific method, sometimes revered to the Plan-Do-Study-Act, in which the team plans, tries, and observes results to be able to act based on what is learned (Lee et al., 2008). HTVI data were collected before and after simulation for each test of change. Test of change 1, the initial mock code blue simulation, took approximately 6 weeks to complete, beginning with the IR nurses researching the literature and discovering that code blue emergent situation simulation drills improved health-care members' competency. The project steps are as follows:

- Developing an action plan: the staff researched a change model that will work for this project. The staff decided to use Kotter (2012) eight-step process of creating change.
- Creating simulation emergent/code blue environment in one of the IR suites.
- Role-playing activities among the team using emergent situation scenarios, including the patient who may be in a prone position.

- Identifying areas of strengths and weaknesses among the team and suite environment: The staff recognized and identified areas of improvement and the need for added equipment.
- The nursing project team providing hands-on simulation education and following up with a re-evaluation of "what if" simulation situations.
- The nurse project team providing hands-on training on equipment usage in the room and code cart, including setting up suction, reviewing the code cart and emergent medications, and using The Joint Commission (2017) crash-cart preparedness guidelines.

The scenario allowed the IR team to partake in an emergent situation where participants learned to locate and use equipment appropriately, to activate an actual code blue, and to clarify each team member's role and responsibility.

Test of change 2, creation of resources on the unit, took approximately 4 weeks to complete, from August 2017 to September 2017. Data were collected before and after capturing the continued progress in improving the code experience. Test of change 2 project steps are as follows:

- Creating a checklist of items that should be reviewed in a code blue or emergent simulation situation.
- Creating emergency locked medication boxes that should be used in an emergent situation, housed in each IR suite and CT scan procedural area. In addition, the staff requested for monthly medication check for expiration dates with checklist.
- Creating an IR staff role and responsibilities handout and a code blue folder containing American Heart Association (AHA) code blue algorithms to be housed in each IR suite and CT scan procedural area.
- Reviewing the suction equipment education and "hands-on" training exercise to ensure that each staff member had a clear understanding on how to set up, properly use, and dispose the suction equipment after use.
- The nurse project team providing education on the oxygen equipment usage in the room, including airway management and the proper way to use an oral airway with hands-on return demonstration.
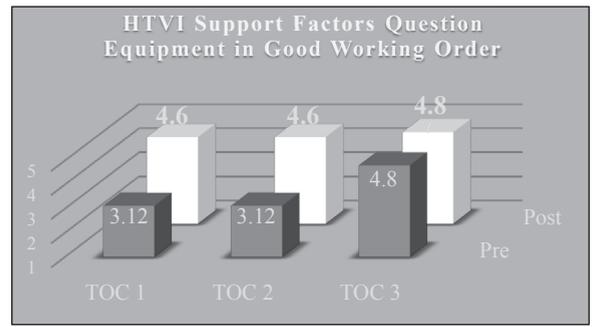
Test of change 3, refined mock code blue simulation, took approximately 4 weeks to complete, from September 2017 to October 2017. A third set of HTVI data was collected before and after simulation. Test of change 3 project steps which incorporated all new measures in the mock code blue simulation are as follows:

- Recreating simulation emergent/code blue environment in one of the IR suites.
- Role-playing activities among the team using emergent situation scenarios.
- Greater emphasis on "what if" simulation situations.
- Observation of prior hands-on training of equipment and code cart.

The IR team completed a refined mock code simulation with the understanding of each team members' role and responsibility. All team members reenacted a seamless mock code blue situation. The HTVI key factors were further discussed focusing on support factors, staff engagement and empowerment, patient care transitions, and team communication. At this time, the final roles and responsibilities table and emergency contact phone number list were added to the code blue folder in each IR suite and the CT scan room.
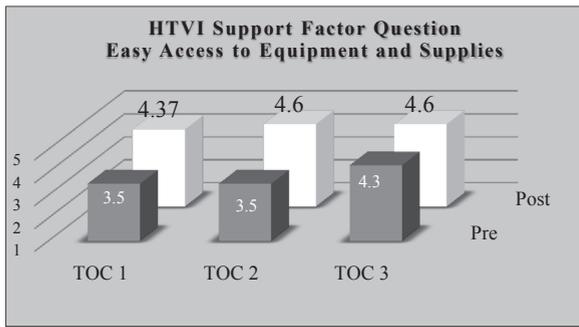
Graph 1. Results from the question, easy access to equipment and supplies. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.

Results

Throughout the three tests of change, the sample of 18 completing the HTVI survey consisted of nine registered nurses and nine radiology technologists from one IR department. All the nurses are AHA ACLS certified and technologists, at a minimum, with AHA basic life support certification. Advanced practice registered nurses and interventional radiologists did not participate in the training or survey. Using exploratory factor analysis of the HTVI, conducted on a 5-point Likert scale, found that the pretest of change 1 HVTI average mean score was 3.36. The posttest of change 1 mean score rose to 4.56. Pretest of change 2 scores had an overall lower pre-test of change 1 mean score of 3.15, yet rose to the post-test of change 2 score of 4.6. Test of change 3 overall pre-test of change HVTI was 4.45, reaching highest score post-test of change 3 of 4.74, indicating the sustainability and ability to continue to improve team vitality. Scores on ability to communicate complete information during handoffs changed from the lowest (M = 2.25) to one of the highest posttest of change mean scores of 4.63. Graphs 1 through 10 represent the individual HVTI questions depicting pretest and posttest of change scores of the 18 participants.

Test of Change 1 Results

Test of change 1, mock code blue simulation, overall pretest of change HVTI survey mean score was 3.36. The items with the lowest pretest of change HVTI average scores are as follows:

Care professionals communicate complete information during handoff, M = 2.13 (Graph 10).
Important patient information is exchanged during shift changes, M = 2.88 (Graph 9).

Care team members on this unit feel free to question the decisions or actions of those with more authority, M = 2.94 (Graph 5).

The items with the highest pretest of change HVTI average scores are as follows:

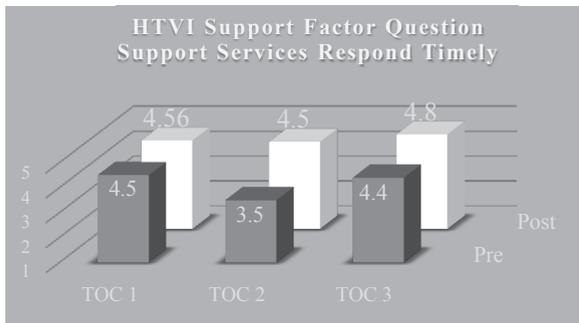I speak up if I have a patient safety concerns, M = 4.6 (Graph 8).
The support services to this unit respond in a timely way, M = 4.50 (Graph 2).
I can discuss challenging issues with care team members on this unit, M = 4.31 (Graph 7).

Test of change 1 posttest of change mean total score for the HTVI survey was 4.56. The items with the lowest posttest of change HVTI average scores are as follows:

I have easy access to supplies and equipment I need to do my work on this unit, M = 4.38 (Graph 1).
Important patient information is exchanged during shift changes, M = 4.44 (Graph 9).

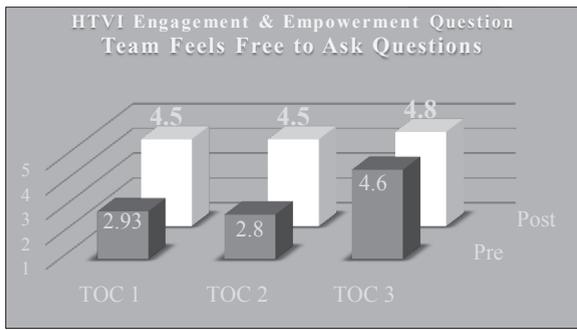The items with the highest post-test of change HVTI average scores are as follows:

Care professionals communicate complete information during handoffs, M = 4.62 (Graph 10).
I speak up if I have patient safety concerns, M = 4.62 (Graph 8).
I can discuss challenging issues with care team members on this unit, M = 4.6 (Graph 7).
Essential patient equipment is in good working conditions on this unit, M = 4.6 (Graph 3).

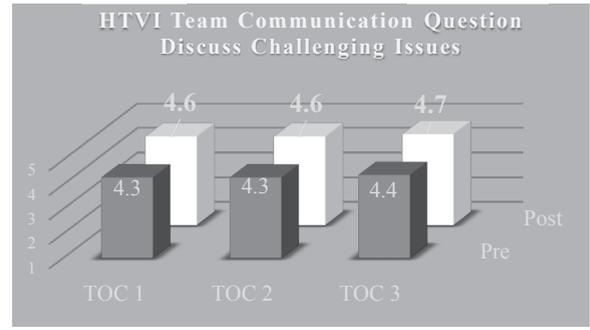**Graph 3.** Results from the question, equipment in good working order. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.

Graph 2. Results from the question, support services respond timely. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.
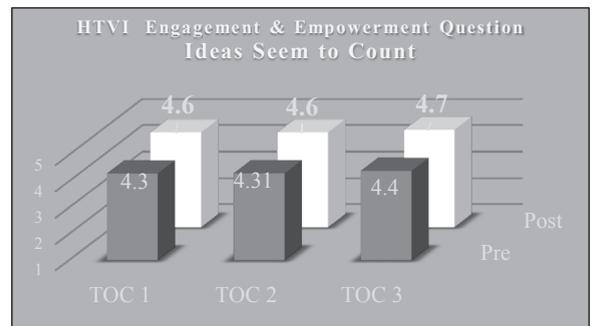
Graph 4. Results from the question, ideas seem to count. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.

Graph 5. Results from the question, team feels free to ask questions. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.

Graph 7. Results from the question, discuss challenging issues. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.

The mean scores of all the items increased in the posttest of change survey, with team communication pretest and posttest of change remaining the highest scores.

Test of Change 2 Results

Test of change 2, creation of resources on the unit, overall pretest of change HVTI mean score for all items was 3.15. The items with the lowest pretest of change HVTI average scores are as follows:

Care professionals communicate complete information during handoff, M = 2.12 (Graph 10).
Important patient information is exchanged during shift changes, M = 2.91 (Graph 9).
Care team members on this unit feel free to question the decisions or actions of those with more authority, M = 2.8.

The items with the highest pretest of change HVTI average scores are as follows:

I can discuss challenging issues with care team members on this unit, M = 4.31(Graph 7).
If I have an idea to make things better, my manager and others are willing to try it, M = 3.12 (Graph 6).
My ideas really seem to count on this unit, M = 3.25 (Graph 4).

Test of change 2 posttest of change HVTI mean total score was 4.56. The items with the lowest two posttest of change HVTI scores are as follows:

I have easy access to supplies and equipment I need to do my work on this unit, M = 4.37.
Important patient information is exchanged during shift changes, M = 4.44.

Four items that had the same highest posttest of change HVTI scores of 4.6 are as follows:

I can discuss challenging issues with care team members on this unit, M = 4.6 (Graph 7).
My ideas really seem to count on this unit, M = 4.6 (Graph 4).
Care professionals communicate complete information during handoffs, M = 4.68 (Graph 9).
Essential equipment is in good working condition on this unit, M = 4.6 (Graph 3).

The mean scores of all the items increased in the post-test of change 2 survey, similar to that after test of change 1.
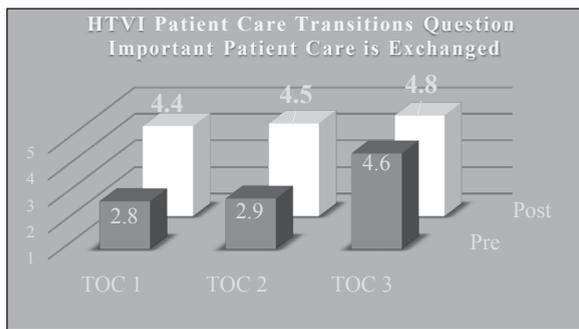
Test of Change 3 Results

Test of change 3, conducting a refined mock code blue simulation, overall pretest of change HVTI survey mean score for all items was 4.45. Test of change 3 posttest of change HVTI score was 4.74. Six items scored a mean of 4.8. The mean scores of all the items increased in the posttest of change survey. The lowest pretest of change HVTI score was a mean of 4.6, which is for the item, "I have easy access to supplies and equipment I need to do my work on this unit, M = 4.3 (Graph 1)".
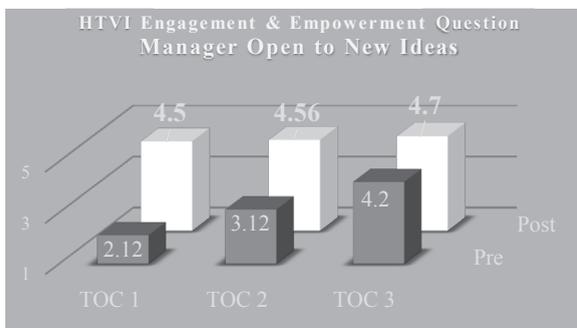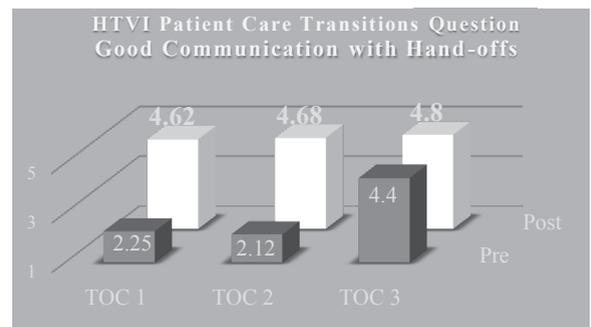

Graph 6. Results from the question, manager open to new ideas. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.
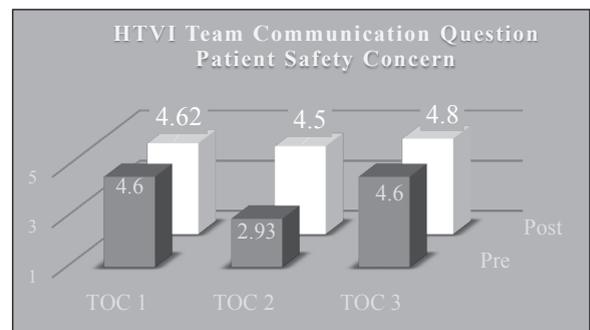
Graph 8. Results from the question, patient safety concern. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.

Graph 9. Results from the question, important patient care is exchanged. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.

Graph 10. Results from the question, good communication with handoffs. HTVI, Healthcare Team Vitality Instrument; TOC, test of change.

Discussion

Using exploratory factor analysis, without inferential statistics, allowed the researchers to explore this small "real-world" data set and conclude that the rise in scores indicates team vitality improved throughout the project. Test of change 1 had the greatest impact on the nurses' and radiology technologist's ability to communicate complete information during handoffs, with the pretest of change mean score of 2.25 changing from the lowest to one of the highest posttest of change mean score of 4.63 (Graph 10). The item with the least, yet significant, improvement was important information is exchanged during shift changes, with a pretest of change mean score of 2.83 and posttest of change mean score of 4.44 (Graph 9), indicating an area of improvement to focus on in the next test of change.

After sharing the pretest and posttest of change 1 findings with the team, they were inspired to move forward with test of change 2, creating resources specific to the IR department. Pretest of change 2 scores were overall lower than pretest of change 1 scores. Staff were comfortable with the HVTI questions and more aware of the impact of their results on the planning of test of change 2. The success of the team work in creating the emergency locked medication boxes, the IR staff role and responsibilities handout, and code blue algorithms folder and in undergoing "hands-on" training with suction equipment, airway management, and use of an oral airway are reflected in the improved HVTI scores. The test of change 2 posttest of change HVTI mean total score remained the same at 4.56. The improved team vitality, as reflected in the HTVI scores and antidotal observations of the team feeling proud and optimistic, initiated an interest to conduct test of change 3, repeating the mock code scenarios.

Test of change 3 reinforced that role playing, asking for feedback, and hands-on trainingdeveloped the IR staff to be more comfortable in an emergent situation. By placing more emphasis on framing the test of change activities to incorporate Peplau's roles of stranger, teacher, leader, surrogate, and counselor, the scenarios were developed to impact interpersonal relations. Beginning with the pretest of change HVTI average score of 4.6 and ending with a posttest of change HVTI average score of 4.74 indicates the sustainability and ability to continue to improve team vitality.

Sustained HVTI scores attracted positive attention to the IR team, and other teams around the hospital sought out this appealing method to deliver content in a way that recognizes team vitality is as important as retaining the skill. The IR team concluded that the next step to explore was to measure the implications of supportive, small-group training in relation to lifesaving impact in actual codes and emergent situations.

Conclusion

This performance-improvement project measured the IR team vitality before and after three tests of change centering on code blue emergent situation training, using the HVTI. HTVI was developed as part of the national initiative to measure dimensions related to front-line perception of a work environment supportive of safe and high-quality patient care, staff empowerment and engagement, team collaboration, and effective communication. Registered nurses and licensed technologists working as part of an IR team participating in repeated, regular measurement to assess the impact their tests of change found increased team vitality. Drawing substantive conclusions based on exploratory factor analyses, in combination with confirmatory latent changes in the environment, such as smiling and positive talk, allows researchers to conclude that mock code blue and emergent training, designed with staff input and collaboration, is useful to improve this IR team's work environment.

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