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Improving safety culture on adult medical units through multidisciplinary teamwork and communication interventions: the TOPS Project

M A Blegen,¹ N L Sehgal,² B K Alldredge,³ S Gearhart,¹ A A Auerbach,² R M Wachter²

ABSTRACT

Aim The goal of this project was to improve unit-based safety culture through implementation of a multidisciplinary (pharmacy, nursing, medicine) teamwork and communication intervention.

Method The Agency for Healthcare Research and Quality Hospital Survey on Patient Safety Culture was used to determine the impact of the training with a before–after design.

Results Surveys were returned from 454 healthcare staff before the training and 368 staff 1 year later. Five of eleven safety culture subscales showed significant improvement. Nurses perceived a stronger safety culture than physicians or pharmacists.

Conclusion While it is difficult to isolate the effects of the team training intervention from other events occurring during the year between training and postevaluation, overall the intervention seems to have improved the safety culture on these medical units.

When the healthcare community and our patients were made aware of the alarming incidence of errors in healthcare,¹ frantic efforts to understand the problem and devise solutions began. Beginning in 2005, descriptions of safety culture, its importance in the patient safety movement and the role it potentially plays in improving patient care emerged. Safety culture is thought to be the shared values, attitudes and behaviour of all staff in health facilities in regard to giving safety priority over efficiency, improving care provider communication and collaboration, and creating a system that learns about and learns from errors and problems. Measures of safety culture through questionnaire surveys are often called climate measures and several have been developed in recent years.²–⁵ Articles have reported the effects of interventions intended to change culture,⁶–⁹ and a few evaluate the links between safety culture and patient outcomes.¹⁰–¹² Studies show that there are differences in safety culture across units and across disciplines, supporting the notion that culture is a local phenomenon.⁹ ⁶ ¹¹–¹⁷ We expand on this research base by reporting the results of a demonstration project that sought to improve safety culture through interdisciplinary training in communication and team work.

Given the broad nature of safety culture, strategies to address it have focused on developing teamwork and communication among all providers to foster a positive safety culture. Teamwork and communication failures are widely reported and thought to be a common cause of patient harm.¹⁸–²⁰ If providers practiced more effective teamwork and communication, our hypothesis is that safety culture would improve and errors would decrease.

The project targeted general medical units, the types of units on which, to our knowledge, no one has reported attempts to change safety culture, and selected hospitals with very different characteristics to provide further challenge to the intervention. Challenges to teamwork and communication on medical units are many. First, there is no one stable team working on these units as there is in operating rooms, labour and delivery areas, emergency rooms and even intensive care units. While the nurses are unit based, they work combinations of schedules and shift lengths; the physicians caring for patients on general medical units typically have responsibility for patients admitted to several units or even several hospitals; and the pharmacists are often located in the central pharmacy and interact with physicians and nurses throughout the hospital. Overall, we sought to improve the safety culture in a challenging environment for interdisciplinary teamwork in hospitals.

The purposes of this project were to develop and pilot test (a) an interdisciplinary team training intervention, (b) a unit-based safety team to continue the safety-focused teamwork and (c) a method for engaging patients with the multidisciplinary team, by conducting an evaluation of the impact of these activities on the safety culture of the unit, administrative outcomes and patient experiences with care on those units. In this article, we report the impact on perceived safety culture in adult inpatient medical units. We provide a brief overview of the Triad for Optimal Patient Safety (TOPS) project, its rationale and interventions, and then report the preintervention and post-intervention safety culture assessment.

METHODS

The goal of the TOPS project was to improve unit-based safety culture through implementation of teamwork and communication interventions. The project was designed, implemented and evaluated by a multidisciplinary leadership team from the Schools of Medicine, Nursing and Pharmacy at the University of California, San Francisco (UCSF).²¹

Teamwork and communication interventions

The project took place on one inpatient medical unit from each of three diverse hospital settings: an academic university medical centre (UCSF Medical
Center), a non-teaching community hospital (El Camino Hospital in Mountain View, California, USA) and an integrated healthcare system hospital (Kaiser Permanente-San Francisco Hospital, San Francisco, California, USA). All were medium-sized hospitals in the San Francisco Bay Area and largely cared for patients who had health insurance. These units were of similar size (26–54 beds) and had very similar nurse staffing (one registered nurse for every four to five patients). Physician care models differed (community-based physicians, physicians employed by managed care organisation and physicians based on medical schools); pharmacy presence on the unit differed (one unit-based clinical pharmacist, one service-based pharmacy model and one central pharmacy services model); and the use of health information technology differed (one with no electronic record or order entry, one with electronic health record only, and one with electronic record and electronic order entry). All of the project efforts were supported centrally at UCSF by a multidisciplinary project leadership team and locally by a team of nursing, physician and pharmacy project champions. The TOPS project was reviewed and approved by the UCSF Committee on Human Research and the El Camino and Kaiser institutional review boards.

**TOPS training sessions**

We delivered 4 h multidisciplinary teamwork training sessions that combined: (a) an introduction to safety culture and local problems from a recognised leader in that setting; (b) a presentation using the “First, Do No Harm” video and facilitated discussion of the ways in which individual behaviours and systems can contribute to medical errors; (c) a didactic presentation on teamwork behaviours and communication skills presented by a consultant from aviation safety; (d) small-group role-playing clinical scenarios to provide participants an opportunity to practice new skills and engage in multidisciplinary dialogue; and (e) a facilitated closing session to discuss lessons learnt and next steps. Participants in the training sessions included unit-based providers and staff (eg, nurses, nursing assistants and unit clerks) and service-based providers (eg, physicians, pharmacists, respiratory therapists and case managers). Training took place off the unit but in the facility, and all staff were relieved from duty and compensated for their time.

**Unit-based safety team**

Following the TOPS training, project champions and other unit providers (invited or volunteers) formed a multidisciplinary unit-based safety team to serve as the local agents for change and safety awareness on the unit. While the project champions had time supported these activities, the other members did not. These Triad Unit Safety Teams (TrUSTs) were intended to reinforce, sustain and extend the learning from TOPS training, and develop new mechanisms to foster interdisciplinary collaboration around patient safety issues arising on each unit. The specific activities of the TrUSTs differed by hospital site, but their core function was to identify and capture unit-based safety issues through web-based, paper-based or verbal reports from staff (not replacing incident reporting systems); respond to these issues through direct action or policy recommendations; serve as a local think tank and catalyst for quality and safety improvement activities; and serve as role models for teamwork and collaboration. In addition, the TrUSTs organised and delivered a number of educational activities that included large multidisciplinary patient safety conferences and small-group skill sessions to reinforce teamwork behaviours and communication skills.

**Patient engagement**

We developed a programme to solicit patients’ goals for the day. A tent card was placed at the bedside of every patient on the unit and the nurse assigned to the patient discussed this with the patient and family members, assisting them in determining and describing their goals, completing the card and then placing the information on the white board in each patient’s room. The patients’ goals were then available to all providers interacting with the patient.

**Measuring safety culture**

We administered the Agency for Healthcare Research and Quality (AHRQ) Hospital Survey on Patient Safety Culture (HSOPSC) to all participants in the 15 min before the TOPS training sessions began (March through June 2006), and again after the three project interventions had been implemented during staff meetings and through inter-office mail (March 2007). Because surveys were completed anonymously, we could not match responses at the individual level from these two periods. The AHRQ HSOPSC was selected in part because data produced by this tool were being captured and presented publicly as benchmark information for US hospitals (AHRQ, 2008). Four previous studies have reported using this tool for research projects.

Individual responses from the paper questionnaires were entered in a database and evaluated using SPSS version 15 software. Mean values for each dimension of the survey were computed, after reverse coding for the negatively worded items, producing scores that ranged between 1 and 5 (5 being best culture). Psychometric evaluation was completed and is reported in detail in a separate article. All subscales in the AHRQ HSOPSC had inter-item reliability coefficients (Cronbach’s α) above 0.6 except the staffing subscale. We report here only the 11 subscales with acceptable reliability (see table 2 for list of subscales). Multiple analysis of variance (MANOVA) was used to minimize the possibility of type I errors arising from multiple independent analyses. Scores on the 11 dimensions were compared over time and hospital site, and the interaction of site and time was tested. Because many of these interactions were statistically significant, MANOVA was repeated, deleting the site that was the source of the significant interaction. Difference in subscale scores across disciplines were also calculated using ANOVA; post hoc tests (Scheffe) were done when the ANOVA showed significant differences.

**RESULTS**

TOPS multidisciplinary training was provided to 454 healthcare staff practicing on three units. Safety culture surveys were completed by 434 individuals before the training (96% response rate) and by 368 individuals (81%) at the end of the evaluation period (see table 1). Response rates were lower for the post-tests because survey questionnaires were distributed through various staff meetings and inter-office mail and returned by inter-office mail rather than during large group meetings.

Healthcare providers working on the three units in this study rated the safety culture dimensions higher after the TOPS interventions than before. This varied by site and, as indicated in table 2, there were significant interactions between site and time for seven of the eleven dimensions. Upon inspection of the means, it was apparent that the scores from the respondents at one of the hospitals in the study had not changed or changed in the opposite direction over time. Analyses were redone, omitting the hospital that was the source of the interaction from the analyses. Both sets of results are presented in table 2. With all
Education and training

Table 1 Healthcare staff participants surveyed

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Total sample</td>
<td>434</td>
<td>368</td>
</tr>
<tr>
<td>Registered nurses</td>
<td>132 (30%)</td>
<td>120 (33%)</td>
</tr>
<tr>
<td>Other nursing care providers</td>
<td>50 (12%)</td>
<td>20 (5%)</td>
</tr>
<tr>
<td>Physicians—attending</td>
<td>43 (10%)</td>
<td>47 (13%)</td>
</tr>
<tr>
<td>Physicians—in training</td>
<td>102 (24%)</td>
<td>100 (27%)</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>53 (12%)</td>
<td>44 (12%)</td>
</tr>
<tr>
<td>Therapists (respiratory, physical)</td>
<td>23 (5%)</td>
<td>21 (6%)</td>
</tr>
<tr>
<td>Administrators, managers, directors</td>
<td>9 (2%)</td>
<td>8 (2%)</td>
</tr>
<tr>
<td>Other</td>
<td>22 (5%)</td>
<td>8 (2%)</td>
</tr>
</tbody>
</table>

In the analysis, there were six dimensions with statistically significant interactions between site and time. Even with these interactions, live safety culture dimension scores postintervention were higher than preintervention (p < 0.05): supervisor manager expectations, organisational learning, communication openness, hospital handoffs and transitions, and non-punitive response to error. When the results from the two hospitals were included, there was only one significant interaction between site and time. The increases in scores for the two hospitals from preintervention to postintervention were statistically significant (p < 0.05) for 10 dimensions: teamwork within units, supervisor/manager expectation, hospital management support, organisational learning, overall perceptions of safety, error feedback and communication, communication openness, teamwork across units, hospital handoffs and transitions, and non-punitive response to error.

For the comparison of safety culture perceptions across the major disciplines (table 3), we used the scores after the intervention. The pretest score differences were similar; results are available upon request. In contrast to previous research, the nurses in our study rated 75% of the dimensions of safety culture more highly than physicians and pharmacists. Dimensions for which the differences were statistically significant across disciplines show the registered nurse scores to be consistently highest and different from at least one of the other discipline groups. Occasionally, there are significant differences between the scores of the attending physicians, physicians in training and pharmacists.

**DISCUSSION**

The TOPS project, through its sequential series of interventions focused on teamwork and communication, produced an impact on the safety culture for the three participating medical units. The unit dimensions with consistent meaningful increases were as follows: organisational learning, supervisor/manager expectations, communication openness and non-punitive response to errors. The TOPS intervention could be expected to most closely address teamwork within the unit and communication. The teamwork within the unit subscale was scored quite highly at the beginning of the project, and the improvement after the intervention was small. The improvement in communication openness was more marked. Respondents also indicated their overall perceptions of safety were greater after the intervention.

Three previous reports of the impact of unit-based team training corroborate our findings. Pronovost et al. implemented a multifaceted unit-based safety programme that produced increases in scores on safety culture, decreases in medication errors on transfer and improvements in length of stay in intensive care units. Their intervention emphasised ongoing unit activities but did not begin with team training. On the other hand, Grogan et al. reported immediate positive effects on existing clinical team members’ attitudes toward crew resource management after a day of training. An intervention that combined training and an ongoing support of teamwork was evaluated by Morey et al. They used direct observation to determine that teamwork had improved and errors had decreased, and a questionnaire survey to show improved attitudes.

Regarding the differences in safety culture scores across disciplines, our findings concurred more with Grant and Sherer than with the bulk of studies reporting that physicians perceived better teamwork and culture than nurses did. The only previous report of pharmacists’ perceptions is the AHRR benchmarking data reports, making it difficult to say whether pharmacists’ relatively low scores are also found in other hospitals. Without comparison culture survey data from other inpatient medical units, we also cannot say whether our units were similar or different.

Table 2 AHRQ hospital culture survey: multivariate ANOVA (all multivariate tests were statistically significant (p < 0.05) for intercept, site, time and site × time interaction) (N = 694)

<table>
<thead>
<tr>
<th>Unit dimensions</th>
<th>Three hospitals Means</th>
<th>Probability</th>
<th>Two hospitals Means</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork within units</td>
<td>3.81</td>
<td></td>
<td>3.82</td>
<td></td>
</tr>
<tr>
<td>Organisational learning</td>
<td>3.61</td>
<td></td>
<td>3.80</td>
<td></td>
</tr>
<tr>
<td>Supervisor/manager expectations and actions promoting patient safety</td>
<td>3.53</td>
<td></td>
<td>3.73</td>
<td></td>
</tr>
<tr>
<td>Hospital management support for safety</td>
<td>3.49</td>
<td></td>
<td>3.55</td>
<td></td>
</tr>
<tr>
<td>Communication openness</td>
<td>3.45</td>
<td></td>
<td>3.56</td>
<td></td>
</tr>
<tr>
<td>Error feedback and communication</td>
<td>3.40</td>
<td></td>
<td>3.46</td>
<td></td>
</tr>
<tr>
<td>Non-punitive response to error</td>
<td>2.88</td>
<td></td>
<td>3.08</td>
<td></td>
</tr>
<tr>
<td>Hospital dimensions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teamwork across units</td>
<td>3.33</td>
<td></td>
<td>3.39</td>
<td></td>
</tr>
<tr>
<td>Hospital handoffs and transitions</td>
<td>2.71</td>
<td></td>
<td>2.87</td>
<td></td>
</tr>
<tr>
<td>Safety outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall perceptions of safety</td>
<td>3.07</td>
<td></td>
<td>3.17</td>
<td></td>
</tr>
<tr>
<td>Frequency of event reported</td>
<td>3.28</td>
<td></td>
<td>3.32</td>
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</tbody>
</table>

X, interaction with site is statistically significant.
The surprising finding that nurses in this study perceived a higher safety culture than others may be due in part to the nature of the TOPS project and its attempts to have the three disciplines involved equally at all levels of planning and implementation of the project. It may also be because the context for this study, unlike most previous studies, was a medical inpatient unit. With the exception of the Vazirnai et al study on a medical unit, all the previously reported intervention studies took place in areas with stable physician-led teams, such as labour and delivery, intensive care, trauma and emergency areas. On medical units, nurses are the relatively permanent and stable staff members while the physicians and often the pharmacists are visitors. Nurses "own" these units unlike other areas such as operating rooms, emergency departments, and labour and delivery areas. In addition, nurses are more central to the safety processes on medical units and are in charge of the setting 24 h of the day. For these reasons, these nurses may not see the ongoing safety problems in the same way that physicians may not see these problems in safety and communication in settings where they are routinely in charge, such as operating rooms, emergency departments, and labour and delivery areas.

Implementing our intervention in three hospitals with very different organisational characteristics was a challenge that was met with the help of the site champions. The team training intervention was carried out separately for the staff at each hospital but followed the same format and the all disciplines trained together. The unit-based safety teams (TrUSTs) differed as they worked with the different staff configurations and clinical concerns at each site. As noted, the staff at one of the three hospitals responded very differently over time to the safety culture survey. We do not have an empirically based explanation for this. There were major changes at the executive level in two of the hospitals during the study, and major changes at the unit level in two hospitals. However, these changes did not clearly correspond to higher or lower scores. Future studies using multiple sites need to anticipate possible interactions and collect the data needed to explain differential response.

As with most quality improvement projects, there are limitations in the validity and generalizability of the findings. While culture improved, we cannot attribute it specifically to one of the interventions. Whether the multidisciplinary team training or the unit-based safety teams could have produced the changes in safety culture alone cannot be determined in this project. The team felt strongly that both parts of the intervention were needed to produce and then maintain changes in teamwork. The project was conducted on medical inpatient units and differed from previous findings for other types of units. The hospitals in the study, while located in one metropolitan area, represented academic, managed care and private institutions.

In addition to the large country-wide changes in healthcare and the increasing concern with patient safety, there were other events occurring at each of the three hospitals that may have impacted the culture scores in a way that are difficult to estimate. As noted, two of the hospitals underwent significant changes in their executive leadership during the project timeline; one had significant turnover in their pharmacy leadership, and two of the hospitals adopted new information technologies (computerised order entry and electronic health records) that likely affected teamwork, communication and safety culture.

In conclusion, the TOPS project successfully implemented multidisciplinary team training and communication interventions, and there was an improvement in safety culture on hospital medical units. Safety culture was perceived to be better a year after the team training activities by the nurses, physicians, pharmacists and others responding to the survey. The impact of the interventions differed across the three hospitals, and further study is needed to explain those differences.
Delphina Payer, Janie Lowe PharmD, Kaiser Permanent San Francisco champions were Rachel Mueller RN, Clarissa Johnston, MD, Paul Preston, MD.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES