The Effects of Aviation Error Management Training on Perioperative Safety Attitudes

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Abstract

*Preventable errors in American hospitals result in the deaths of thousands of patients each year. Studies suggest that the present need for a medical cultural transformation closely parallels that of the aviation community in the 1970s. A*viation crew resource management (CRM) training, based on effective communication and teamwork skills, may translate to healthcare through error management training. *This quasi-experimental, quantitative study observed operating room attitudes about safety and medical errors among perioperative personnel at a major US hospital following an aviation-based team-intervention training program.* Study results suggest a correlation between the CRM intervention and post-intervention changes in perioperative safety attitudes.

INTRODUCTION

A 1999 Institute of Medicine (IOM) report, *To Err is Human: Building a Safer Health System*, revealed that medical error causes as many as 98,000 American deaths each year (Kohn, Corrigan, & Donaldson, 2000). Despite this indictment, few procedural or training changes have occurred since the publication of the IOM report (American Institutes for Research, 2009; Wachter & Shojania, 2004). Notwithstanding the highly publicized IOM medical error report, medical errors resulting in death continue to occur. Although modern medicine utilizes advanced technology and upgraded equipment, safety studies show that from 2005 through 2007 more than 913,000 patient safety incidents resulted in 97,755 in-hospital deaths at a cost of over $6.9 billion (HealthGrades, 2009, p. 2). During this period, 2.26 percent of the study's 38 million acute care population experienced one or more medical errors resulting in a one-in-ten chance of dying (p. 4). A cultural safety transformation is necessary to avoid placing blame on individual medical providers and to focus on the root cause of medical error: the complex healthcare system in which humans function (Rosenthal & Sutcliffe, 2002).

As early as 1994 the medical community began evaluating best practices from the aviation industry as a possible avenue for reducing errors that occur in operating rooms and trauma situations (Thomas, Sherwood, & Helmreich, 2003). Improved attitudes towards safety and effective communication and teamwork skills are aviation successes that may translate to healthcare through error management training. The need for a medical cultural transformation in 2010 closely parallels that of the aviation community in the 1970s (Higdon, 2005), when the National Transportation Safety Board (NTSB) began noting that even highly skilled professional pilots could become involved in aviation disasters (Diehl, 1991). The National Aeronautics and Space Administration (NASA) responded by studying ways to teach workload management and judgment skills to pilots.

NASA researchers Cooper, White, and Lauber (1980) used the term *crew resource management* (CRM) to explain pilot error as caused by poor communication, leadership, and decision-making skills between individuals. While a direct causal relationship between CRM and reduced accidents has not been conclusively determined, studies do indicate CRM training has a positive effect on attitudes toward safety (Diehl, 1991; Helmreich, Merritt, & Wilhelm, 1999). Various organizations have begun to offer aviation-based CRM programs to medical facilities in an attempt to change existing safety cultures and attitudes, much like the successful FAA-mandated CRM training in aviation (Preston, 2007; Safer Healthcare, 2009). Researchers caution that for CRM training to be effective, it must be *translated* to include behavioral markers specific to each high-risk industry (Pizzi, Goldfarb, & Nash, 2001).

The parallels between aviation and medicine are striking: Both professions consist of highly trained individuals who are confident in their abilities, and who go about their profession with little or no supervision (Hamman, 2004). While these characteristics make the work enjoyable for most (Sexton, Thomas, & Helmreich, 2000) it also creates a difficult environment to nurture teambuilding (Thomas, Sherwood, et al., 2003). The similar work environment does make it possible, and even practical, to translate aviation-based CRM into the safety practices of medicine. Although safety is a primary concern for both groups, its scope is different.

Aviation accidents can result in large numbers of fatalities, public outcry, and a rapid response by federal agencies; while medical errors kill thousands of Americans one at a time with little publicity and no standardized reporting mechanism (Helmreich, 2000). Wachter and Shojania (2004) describe medical procedures and aircraft operations as being divided into the "sharp" operational end of a chisel, and the "blunt" end which is the process (p. 43). Accidents can be caused by, and are often blamed on, the sharp side or human element, but are more often the result of administrators who fail to implement procedural changes to the blunt, or systems end (Wachter & Shojania). In addition to systemic problems in medicine, resistance to change exists as a result of group dynamics, paradoxes of power (Person, 2004), and individual attitudes toward safety (Thomas, Sexton, & Helmreich, 2003). The airline captain of the 1970s was the single source of authority in the aircraft. Similarly, in present day, the physician is in command in the operating room (Hamman, 2004). Changing safety attitudes of medical professionals may be as difficult as that experienced by the airline industry. In particular, perceptions regarding infallibility and disclosure of errors are two attitudes readily measurable in both professions. For example, a study in 2000 found that 56% of surgical residents stated they performed well despite feeling fatigued, analogous to pilot responses in pre-CRM surveys (Pizzi et al., 2001; Sexton et al., 2000). Data indicate that organizational, cultural, and individual attitudes may explain the fundamental differences between nurses' and doctors' perceptions of authority and responsibility, much like the fundamental differences between pilots and flight attendants prior to CRM training (Thomas, Sexton, et al., 2003).

METHODOLOGY

Purpose

The purpose of this quasi-experimental, quantitative study was to observe the impact of aviation-based CRM training on the safety attitudes of perioperative (surgical) personnel. The non-random assignment and pre-existing nature of the participants negated the ability to conduct a true experimental study (Creswell, 2002). The study's design of pretest-intervention-posttest closely followed the non-equivalent-groups design of a quasi-experimental research study. Additionally, the goal of this study was to identify nontechnical cognitive and social skills, known as behavioral markers, which may mitigate medical errors caused by high workload, dynamic environment, and inadequate team communication.

The design of this study centered on evidence-based aviation CRM successes: communication, briefings and debriefings, assertion and advocacy, situational awareness, and effective decision-making skills (Klampfer, 2001). These *behavioral markers* were then presented to the study population in the form of intervention training. The intervention was based on the requirements of the population, and tested whether or not the intervention resulted in a measurable change in safety attitude and culture. The research questions related to this study are as follows:

> R1. What is the effect of implementing an aviation-based CRM model intervention on perioperative error reporting and patient safety attitudes?
> R2. What is the effect of implementing an aviation-based CRM model intervention on unit-level perioperative teamwork and communication attitudes?
> R3. What is the effect of implementing an aviation-based CRM model intervention on perioperative organizational-level safety culture attitudes?

Participants

The study population, or sampling frame, consisted of approximately 900 perioperative staff at a major Midwestern United States hospital which employs approximately 4,000 people. The perioperative operational definition refers to the *preoperative*, *intra-operative*, and *postoperative* phases of surgery. Of this group, all received invitations to participate; however, a large percentage was unavailable as a natural result of schedule requirements or other conflicts. To achieve a power of .80, with a medium effect size, at alpha of .05, a minimum sample of 30 participants was desired (Cohen, 1988). The resulting intervention group, or sample, consisted of approximately 100 surgeons, anesthesia providers, nurses, and technicians who were directly involved in the surgery phase of patient care at the study hospital. This study excluded approximately 3,000 allied health professionals and hospital support staff who were without direct perioperative patient contact, and those who choose not to participate in the study. The study received verbal commitment from senior facility administrators and physician-nurse leaders who encouraged staff to actively participate in this research. With respect to the facility administrator's implicit support, extreme care was taken to ensure the voluntary nature of the study, and each person's right of non-participation.

Survey Instrument

The survey instrument (Appendix) is a product of the U.S. Department of Health and Human Services (DHHS) and the Agency for Healthcare Research and Quality (AHRQ). The survey, *Hospital Survey on Patient Safety Culture* was appropriate for the proposed study in that it was designed for "assessing the safety culture of a hospital as a whole, or for specific units within hospitals" (Sorra & Nieva, 2004, p. iii). The survey was originally intended to reveal safety attitudes at all department levels such as security and other support staff, managers, and medical personnel; however, this study intervention group contained only staff with direct patient contact in the perioperative environment. The survey's reliability and validity was established during the AHRQ design phase based on more than 7,000 Veteran's Health Administration (VHA) participants at more than 200 hospitals "as well as the factor structure of the survey through exploratory and confirmatory factor analyses" (Sorra & Nieva, 2004, p. 2). Additionally, the survey is in the public domain, so that the instrument is readily available for use in correlating results or in subsequent research.

Procedure

This study utilized a quasi-experimental quantitative method of research to examine the effects of an intervention of aviation-based CRM on the safety attitudes of perioperative personnel. The study consisted of participants first completing a preintervention survey, which measured perioperative teamwork and communication attitudes, perioperative error reporting and patient safety attitudes, and perioperative organizational-level safety culture attitudes. Next, the participants attended intervention training, consisting of 4-hour core skills workshops. The core skills, or behavioral marker training, consisted of communication, briefing and debriefing, assertion, verifying, situational awareness, and improved decision making. Intervention content mirrored the main categories as measured in the survey and described by the behavioral markers. Finally, after a period of approximately 30 days, the study participants completed a post-intervention survey. Data collection and analysis followed, comparing the two survey results.

Limitations

A limitation of the quasi-experimental design used, in which the researcher used existing groups, includes less precise understanding of the dependent variable differences that were discovered (Salkind, 2003). Additionally, the perioperative study population was preexisting by the nature of their duties, and randomly assigning groups by the researcher would have been impractical. In the case of the present study, safety attitude changes observed in the examination of survey responses may be in part attributed to the study's mortality rate. Problems identified in the literature related to this design include effects of maturation, mortality, instrumentation, and regression (Cooper & Schindler, 2003; Creswell, 2002). When these factors are properly addressed the quasi-experimental design is often preferred when engaged in research of ethical, moral, and practical issues, and may be adequate to establish causality (Gay, 1987; Salkind, 2003). Although these factors may be seen as having a limited effect on these survey results, participant dropout rate, or mortality, may have influenced survey results even if the intervention did not. Absent a control group, the attrition rate may have contributed to the significant findings obtained, including the shift of positive attitudes noted in the post surveys. Another limitation of this study may be whether or not the sample adequately represents the population. For example, some physicians spend a majority of their time seeing patients in an out-patient setting, but have privileges at hospitals. Physicians in this category may not have the opportunity to experience the safety culture that evolves at an institution; therefore, every attempt was made to exclude them from the sample.

RESULTS

Hypotheses Organization

To examine differences on variables by dimensions, three hypotheses were categorized into three sections: differences on Outcome measures related to research question 1 (Frequency of Event reporting, Overall perceptions, Patient safety grade, and Number of events reported); Unit-level Safety Culture dimensions related to research question 2 (Supervisor/manager expectations and actions promoting safety, Organization learning, Teamwork within the Hospital Units, and Communication Openness, Feedback and communication, Nonpunitive response to errors, Staffing, and Hospital management support for patient safety); and Hospital-wide Safety Culture dimensions related to research question 3 (Hospital management support, Teamwork across hospital units, and Hospital Hand-offs/transitions). After each data analysis, a decision was made to either reject or fail to reject the null hypothesis for each of the dimension variables.

Rejecting the null hypothesis for the dimension variables would mean significant evidence exists to suggest a correlation between the CRM intervention training, and the change in safety attitude for that dimension variable. Failing to reject the null hypothesis for the dimension variables presented means the data analysis did not indicate a significant association or difference in safety attitude after CRM intervention training.

Composite scores

To further examine the hypotheses, composite scores were computed after reverse coding particular survey questions. Frequency of event reporting is comprised of the average of questions D1-D3; Overall perceptions of safety is the average of A10, A15, A17, and A18; Supervisor/manager expectations and actions promoting safety is the average of B1-B4; Organization learning is the average of A6, A9, and A13; Teamwork within the hospital units is the average of A1, A3, A4, and A11; Communication openness is the average of C2, C4, and C6; Feedback and communication is the average of C1, C3, and C5; Nonpunitive response to errors is the average of A8, A12, and A16; Staffing is the average of A2, A5, A7, and A14; Hospital management support for patient safety is the average of F1, F8, and F9; Teamwork across hospital units is the average of F2, F4, F6, and F10; Hospital hand-offs and transitions was comprised of the average of F3, F5, F7, and F11.

Hypothesis 1, Related to Research Question 1

The first hypothesis considered the effect of implementing an aviation-based CRM model intervention on perioperative error reporting and patient safety attitudes. The null hypothesis states: *The implementation of an aviation-based CRM model intervention will have no effect on improving perioperative error reporting and patient safety attitudes*. Four Outcome measures (Frequency of Event reporting, Overall perceptions of Safety, Patient safety grade, and Number of events reported) were examined for differences by group (pretest vs. posttest). A composite scores analysis was used which resulted in data presented in Figure 1.

Figure 1. Outcome measures—Hypothesis 1.

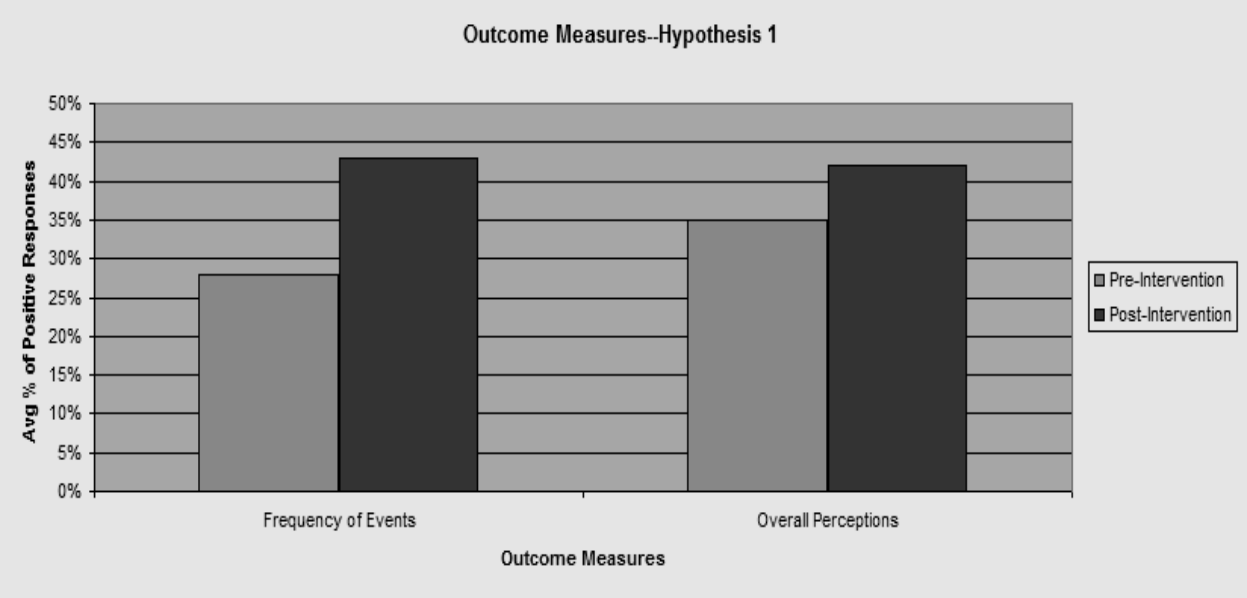


Figure 1. Outcome measures—Hypothesis 1

The increase of positive responses in Outcome measures indicates a change in respondents' attitude regarding both error reporting and perceptions of patient safety; however, the composite results are not supported by the individual component data analysis which follows. While the composite results reflected in Figure 1 are useful in indicating broad trends, a more detailed analysis is necessary to accept or reject the null hypothesis. A doubly multivariate (pretest-posttest) MANOVA and three ANOVAs examined differences on Outcome Measures, which consisted of Frequency of event reporting, Overall perceptions of safety, and Grade by group. The assumptions of these tests were met by examining Box's M and the Levene tests. The MANOVA was not statistically significant, F (3, 104) = 1.26, *ns* (Eta=.035, power=.329). Table 1 shows the univariate ANOVAs, where no differences on these variables by group were noted thereby supporting the null hypothesis.

Table 1: *ANOVAs on Frequency of Outcome Measure Items by Group*

Source	Dependent Variable	df	F	Sig.	Eta	Power
Group	Frequency of event reporting	1	2.134	.147	.020	.305
	Overall perceptions of safety	1	.375	.383	.004	.093
	Safety grade	1	2.250	.137	.021	.318
Error	Frequency of event reporting	106	(.686)			
	Overall perceptions of safety	106	(.574)			
	Safety grade	106	(.582)			

Note. Numbers in parentheses represent mean square errors.

To assess the relationship between group and Number of events, the fourth Outcome measure, a chi-square was conducted and did not reveal any statistical relationship, X^2 (4) = 3.68, p = .452. Review of the data provides insufficient evidence to reject the null hypothesis, meaning the analysis failed to detect any association or difference among the variables. This supports the hypothesis that implementation of an aviation-based CRM model intervention will have no effect on improving perioperative error reporting and patient safety attitudes.

Hypothesis 2, Related to Research Question 2

The second hypothesis considered the effect of implementing an aviation-based CRM model intervention on perioperative unit-level safety culture. The null hypothesis states: *The implementation of an aviation-based CRM model intervention will have no effect on improving unit-level perioperative teamwork and communication attitudes.* Seven aspects of safety culture (Supervisor/manager expectations and actions promoting safety, Organization learning, Teamwork within the hospital units, and Communication openness, Feedback and communication, Nonpunitive response to errors, and Staffing) were measured by group (pretest vs. posttest). Figure 2 shows that the composite Unit-level safety culture average percent of positive responses increased in each of the seven safety dimensions. There were significant positive changes (> 20%) after the CRM intervention training in Supervisor expectations (24%), and Communication openness (20%); and some positive change noted in Teamwork within units (17%), and Nonpunitive response to error (16%). Comparative analysis of Unit-level safety culture showed little change after intervention training in Organizational learning, Feedback and communication about error, and Staffing, however remained consistent with the univariate described next.

Figure 2. Unit-Level Safety Culture—Hypothesis 2.

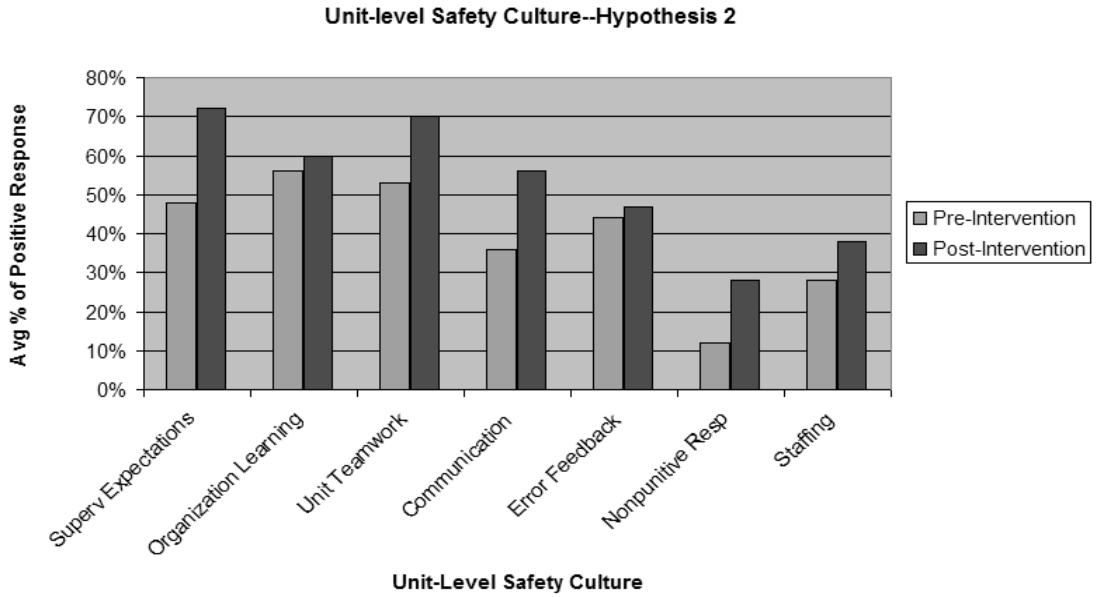


Figure 2. Unit-Level Safety Culture—Hypothesis 2.

A doubly multivariate (pretest-posttest) MANOVA and seven ANOVAs examined differences on these variables by group. The assumptions of these tests were examined with Box's M (which was significant; however, this is not uncommon in real data), and the Levene tests which were all nonsignificant. The MANOVA was statistically significant, F (7, 114) = 2.94, p < .007 (Eta=.153, power=.919). Table 2 shows the univariate ANOVAs, where significant differences (< .05) were found on Supervisor expectations promoting patient safety, Teamwork within units, Communication openness, Nonpunitive response to error culture variables, and marginally in Staffing. These results correspond with the behavioral markers targeted by the intervention training, and demonstrate a change in safety attitude as measured by the AHRQ survey.

Table 2: *ANOVAs on Unit-level Safety Culture variables by Group*

Source	Dependent Variable	df	F	Sig.	Eta	Power
Group	Expectations promoting patient safety	1	8.710	.004	.068	.833
	Organizational learning	1	.545	.462	.005	.113
	Teamwork within units	1	4.089	.045	.033	.518
	Communication/openness	1	8.906	.003	.069	.841
	Feedback communication about errors	1	.118	.732	.001	.063
	Nonpunitive response to error	1	11.257	.001	.086	.914
	Staffing	1	3.714	.056	.030	.481
Error	Expectations promoting patient safety	120	(.514)			
	Organizational learning	120	(.381)			
	Teamwork within units	120	(.448)			
	Communication/openness	120	(.553)			
	Feedback communication about errors	120	(.518)			
	Nonpunitive response to error	120	(.648)			
	Staffing	120	(.414)			

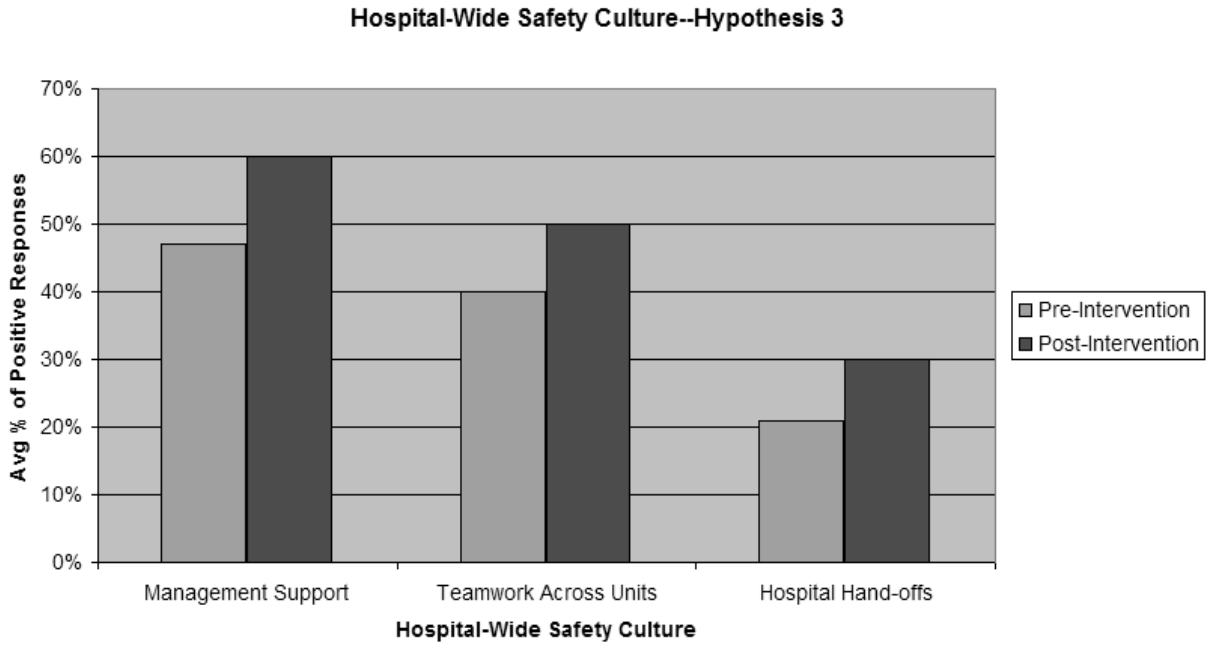
Note. Numbers in parentheses represent mean square errors.

Review of these data indicates that sufficient differences and associations were detected between the variables to reject the null hypothesis. Therefore, the data fails to support the hypothesis that implementation of an aviation-based CRM model intervention will have no effect on improving unit-level perioperative teamwork and communication attitudes.

Hypothesis 3, Related to Research Question 3

The third hypothesis considered the effect of implementing an aviation-based CRM model intervention on hospital, or organizational-level aspects of safety culture. The null hypothesis states: *The implementation of an aviation-based CRM model intervention will have no effect on improving perioperative organizational-level safety culture attitudes*. Three hospital-level (organizational) aspects of safety culture were examined by group (pretest vs. posttest). Figure 3 shows composite Hospital-level safety culture average percent of positive responses for each of three safety dimensions.There was some positive change noted after the CRM intervention training: Management support for patient safety (13%), Teamwork across hospital units (10%), and Hospital hand-offs and transitions (9%). Comparative analysis remained consistent to the extent that Management support and Hospital hand-offs (transitions) supported the univariate analysis. The Teamwork across units dimension does not.

Figure 3. Hospital-wide safety culture—Hypothesis 3.



A doubly multivariate (pretest-posttest) MANOVA and seven ANOVAs examined differences on the three safety culture dimensions variables by group. The assumptions of these tests were examined with Box's M and the Levene tests were all nonsignificant. The MANOVA was not statistically significant, F (3, 131) = 2.15, *ns* (Eta=.047, power=.538). Table 3 shows the univariate ANOVAs, where differences were found on Management support and Hand-offs by group.

Table 3: *ANOVAs on Hospital-level Safety Culture Scores by Group*

Source	Dependent Variable	df	F	Sig.	Eta	Power
Group	Hospital mgt support for patient safety	1	4.690	.032	.034	.575
	Teamwork across hospital units	1	.002	.966	.000	.050
	Hospital hand-offs	1	4.003	.047	.029	.511
Error	Hospital mgt support for patient safety	133	(.590)			
	Teamwork across hospital units	133	(.178)			
	Hospital hand-offs	133	(.430)			

Note. Numbers in parentheses represent mean square errors.

The analysis detected no difference in the Teamwork dimension thereby supporting the null hypothesis although there remains sufficient data between the two remaining dimensions to reject the null hypothesis. Therefore, the data fails to either support or reject the hypothesis that implementation of an aviation-based CRM model intervention will have no effect on improving perioperative organizational-level safety culture attitudes.

Additional Data

Although included as part of the four *Outcome* composite dimensions contained in research question 1, Events Reported and Patient Safety Grades are discussed separately here. Events reported, (AHRQ item G1), reflects how many patient safety error reports the respondent submitted in the previous 12 months. Additionally, the survey instrument permits participants to grade their facility's overall safety (AHRQ item E1). Figure 4 shows the pre- and post-intervention results with no significant differences noted. These data are inconclusive due to insufficient evidence of correlation between the intervention training and the tendency to report, or not report, errors. The effect of mortality and how extreme-scoring study participants who dropped out affect the reported shift is also of concern.

Figure 4. Number of events reported.

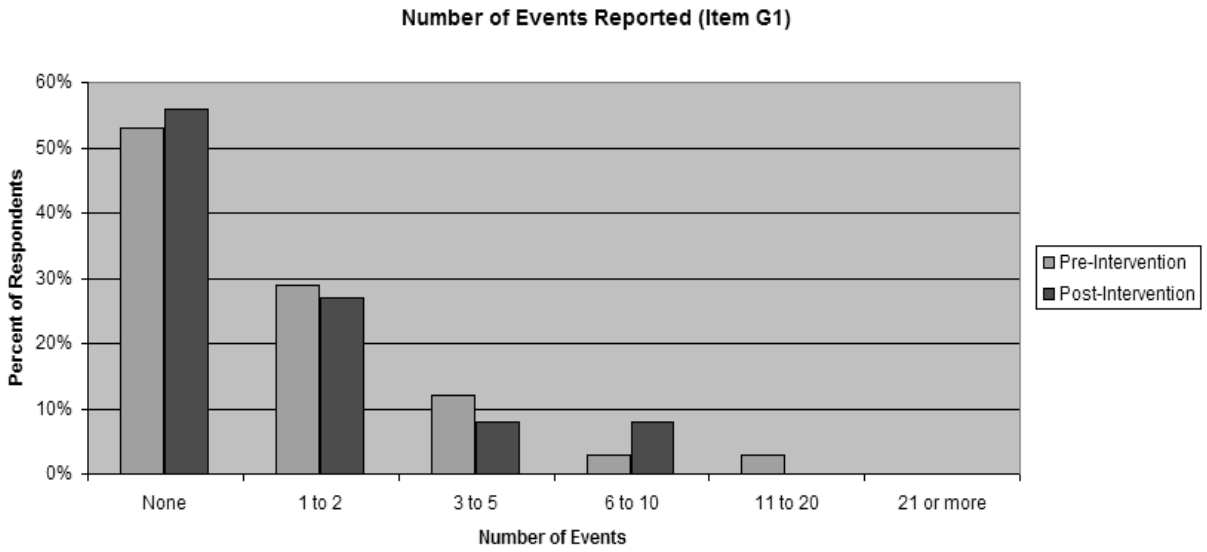
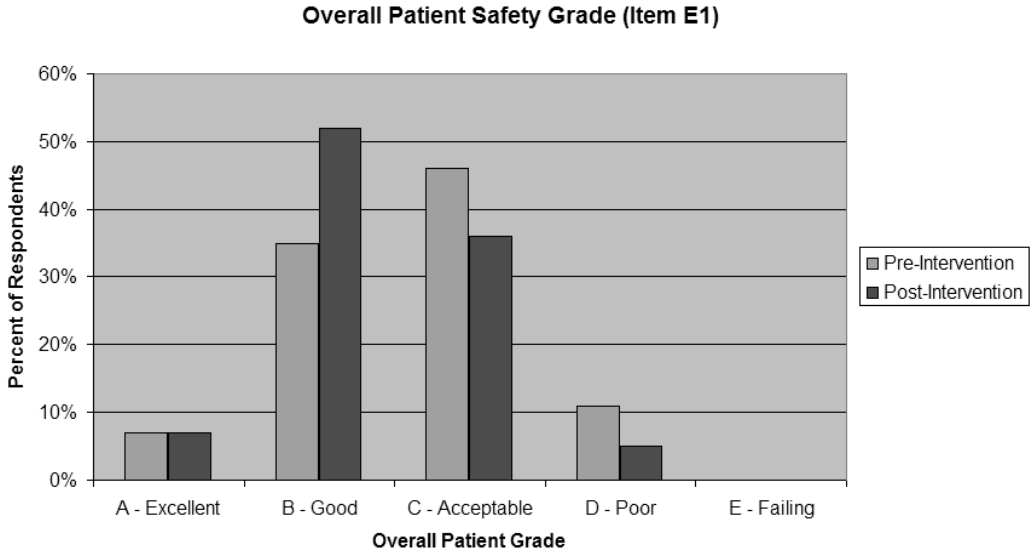


Figure 5 represents the frequency of response by overall patient grade prior to and following the CRM intervention.

Figure 5. Overall patient safety grade.



Review of these data indicates a decrease in frequency of response from the *poor* and *acceptable* grades toward the *good* grade. In particular, the shift of response in the *good* category from 35% to a post-intervention frequency of 52% indicates a possible correlation between the CRM intervention training and a change in overall patient safety grade. However, the shift toward positive responses could also be the result of participants who provided negative responses dropping out, while the attitudes of those who participated remained the same. These data are listed separately here as a result of the cumulative, qualitative nature of this survey question.

Summary

The mixed results of the analysis may be explained by the nature of the hypothesis as compared to the data gathered. The research question asks if the CRM intervention will have an effect on the safety culture at the hospital-level. While the intervention syllabus addresses factors such as teamwork, and elements of teamwork such as leadership, roles and responsibilities as well as resource management, there was no component of intervention that involved hospital management directly. Indeed, the participants were not of senior management position, and this may have influenced perceptions and responses regarding the Teamwork across hospital units dimension.

Likewise, the study hospital management's implied consent of the intervention training may have influenced data on the remaining two dimensions. Analysis of the data indicates sufficient change to warrant further research; however, the intervention and participants may need to be adjusted to address these concerns.

CONCLUSION

The premise of CRM is to recognize that human error may never be completely eliminated; however, team members can be taught to manage threats and errors that present hazards. A major concern of medical industry is a leadership structure that currently permits medical errors to remain unacceptably high. A goal of this study was to provide research data which may contribute to the "strong leadership, specification of goals and mechanisms for tracking progress, and an adequate knowledge base" recommended by the 1999 IOM report (Kohn et al., 2000, p. 69). The medical profession's training and leadership may benefit from CRM training programs that have resulted from aviation's lessons learned (Kuhn & Youngberg, 2002). Studying the behavioral markers, or benchmarks, that effectively translate CRM to safer attitudes enhances the body of leadership knowledge. The resulting knowledge may be applied to a particular medical profession and then participants surveyed to measure safety attitudes.

After examining post-intervention data of this study, results suggest that targeted aviation-based behavioral markers applied through CRM training result in a positive change in most of the safety attitudes of perioperative personnel surveyed. While this may not result in a direct reduction of error, comparative CRM programs in aviation *have* resulted in error mitigation over time (Diehl, 1991). However, the cultural transformation cannot consist of CRM training alone; the organization's leadership must endorse the new belief system in order to change the very "ideological underpinnings of the culture" (Rosenthal & Sutcliffe, 2002, p. 97). The results of this research study may help healthcare leaders institute the training and cultural changes that are lacking, to make safety paramount, and to truly create an organizational culture of safety (American Institutes for Research, 2009).

REFERENCES

Agency for Healthcare Research and Quality (AHRQ). (2006). Guide to patient safety indicators. *Department of Health and Human Services.* Retrieved December 30, 2010, from http://www.qualityindicators.ahrq.gov/archives/psi/psi_guide_rev1.pdf

American Institutes for Research. (2009). *Medical teamwork and patient safety: The evidence-based relation.* Agency for Healthcare Research and Quality (AHRQ). Retrieved October 25, 2010, from www.ahrq.gov/qual/medteam

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cooper, D. R., & Schindler, P. S. (2003). *Business research methods* (8th ed.). Boston: Irwin.

Cooper, G. E., White, M. D., & Lauber, J. K. (1980). *Resource management on the flightdeck: Proceedings of a NASA/Industry workshop.* (NASA CP-2120). Moffett Field, CA:NASA-Ames research Center.

Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson.

Diehl, A. E. (1991, November). *Does cockpit management training reduce aircrew error?* Paper presented at the 22nd International Seminar, International Society of Air Safety Investigators, Canberra, Australia. Retrieved December 29, 2010, from http://www.crm-devel.org/resources/paper/diehl.htm

Gay, L. R. (1987). *Educational research: Competencies for analysis and application* (3rd ed.). Columbus, OH: Merrill Publishing.

Hamman, W. R. (2004). The complexity of team training: What we have learned from aviation and its applications to medicine. *Qual Saf Healthcare, 13,* i72-i79. Retrieved October 29, 2010, from http://qhc.bmjjournals.com/cgi/content/full/13/suppl_1/i72

HealthGrades. (2009, April). *Sixth annual HealthGrades patient safety in American hospitals study.* Retrieved January 5, 2011, from http://www.healthgrades.com/business/img/ PatientSafetyInAmericanHospitalsStudy2009.pdf

Helmreich, R. L. (2000). On error management: Lessons from aviation. *British Medical Journal, 320,* 781-785. Accessed May 1, 2010 http://www.bmj.com/content/320/7237/781.full

Helmreich, R. L., Merritt, A. C., & Wilhelm, J. A. (1999). The evolution of crew resource management training in commercial aviation. *International Journal of Aviation Psychology*, 9(1), 19-32. Retrieved May 12, 2009, from EBSCOhost database.

Higton, P. (2005, July). Safety lessons from aviation. *Purfusion*, *20*(4), 191-193. Retrieved May 21, 2009, from http://prf.sagepub.com/content/20/4/191.long

Institute of Medicine. (2006, July). *Preventing medication errors: Quality chasm series.* Retrieved December 5, 2011, from http://books.nap.edu/openbook.php?record_id=11623

Klampfer, B., Flin, R., Helmreich, R. L., Hausler, R., Sexton, B, Fletcher, G., et al. (2001). Enhancing performance in high risk environments: Recommendations for the use of behavioral markers. *Kolleb Group Interaction in High Risk Environments (GIHRE).* Zurich, Switzerland: Gottleib Daimler and Karl Benz Foundation. Retrieved December 29, 2010, from http://homepage.psy.utexas.edu/homepage/group/HelmreichLAB/ Publications/pubfiles/Pub262.pdf

Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (Eds.). (2000). *To err is human: Building a safer healthcare system*. Washington, DC: National Academy Press.

Kuhn, A. M. & Youngberg, B. J. (2002). The need for risk management to evolve to assure a culture of safety. *Qual Saf Healthcare, 11,* 158-162. Retrieved December 29, 2010, from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1743589/pdf/v011p00158.pdf

Person, E. S. (2004,). When the weak confront the strong: How groups effect change. *International Journal of Group Psychotherapy, 54*(1), 83-102.

Pizzi, L., Goldfarb N., & Nash, D. (2001). Crew resource management and its applications in medicine. *Making healthcare safer*. Retrieved December 29, 2010, from http://archive.ahrq.gov/clinic/ptsafety/chap44.htm

Preston, P. G. (2007). Patient safety in labor and delivery: A team approach to high reliability. *American Society of Anesthesiologists, 71*(2). Retrieved May 14, 2009, from http://www.saferpatients.com/patient-safety-newsletter_june.htm

Rosenthal, M. M., & Sutcliffe, K. M. (Eds.). (2002). *Medical error: What do we know? What do we do?* San Francisco, CA: Jossey-Bass.

Safer Healthcare. (2009). *Patient safety and a just culture.* Retrieved May 21, 2009, from http://www.saferhealthcare.com/cat-shc/patient-safety-and-a-just-culture

Salkind, N. J. (2003). *Exploring research* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Sexton, J. B., Thomas, E. J., & Helmreich, R. L. (2000). Error, stress, and teamwork in medicine and aviation: Cross sectional surveys. *British Medical Journal, 320, 745-749.* Retrieved May 12, 2009, from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC27316/pdf/745.pdf

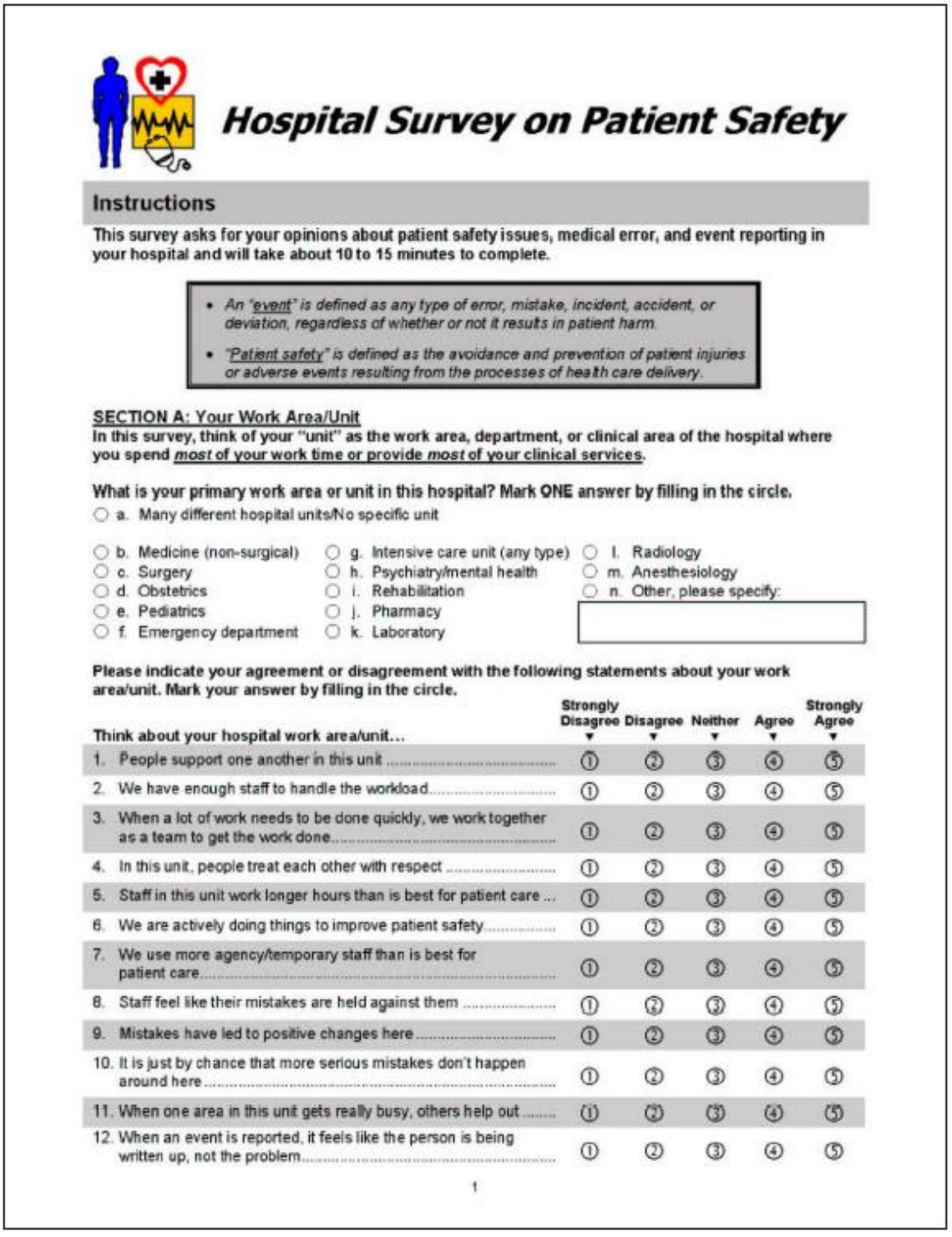
Sorra, J. S., & Nieva, V. F. (2004, September). *Hospital survey on patient safety culture.* AHRQ Publication No. 04-0041. Rockville, MD: Agency for Healthcare Research and Quality (AHRQ). Retrieved April 21, 2009, from http://www.ahrq.gov/qual/patientsafetyculture/ hospcult.pdf

Thomas, E. J., Sexton, J. B., & Helmreich, R. L. (2003). Discrepant attitudes about teamwork among critical care nurses and physicians. *Critical Care Medicine, 31*(3), 956-959.

Thomas, E. J., Sherwood, G. D., & Helmreich, R. L. (2003). Lessons from aviation: Teamwork to improve patient safety. *Nursing Economics, 21*(5), 241-243. Retrieved December 29, 2010, from http://findarticles.com/p/articles/mi_m0FSW/is_5_21/ai_n18616454/

Wachter, R. M., & Shojania, K. G. (2004) *Internal bleeding: The truth behind America's terrifying epidemic of medical mistakes* (1st ed.). New York: Rugged Land, LLC.

APPENDIX: AHRQ SURVEY



Hospital Survey on Patient Safety

Instructions

This survey asks for your opinions about patient safety issues, medical error, and event reporting in your hospital and will take about 10 to 15 minutes to complete.

- *An "event" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient harm.*
- *"Patient safety" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery.*

SECTION A: Your Work Area/Unit

In this survey, think of your "unit" as the work area, department, or clinical area of the hospital where you spend *most* of your work time or provide *most* of your clinical services.

What is your primary work area or unit in this hospital? Mark ONE answer by filling in the circle.

○ a. Many different hospital units/No specific unit

○ b. Medicine (non-surgical)
○ c. Surgery
○ d. Obstetrics
○ e. Pediatrics
○ f. Emergency department
○ g. Intensive care unit (any type)
○ h. Psychiatry/mental health
○ i. Rehabilitation
○ j. Pharmacy
○ k. Laboratory
○ l. Radiology
○ m. Anesthesiology
○ n. Other, please specify:

Please indicate your agreement or disagreement with the following statements about your work area/unit. Mark your answer by filling in the circle.

Think about your hospital work area/unit…	Strongly Disagree ▼	Disagree ▼	Neither ▼	Agree ▼	Strongly Agree ▼
1. People support one another in this unit	①	②	③	④	⑤
2. We have enough staff to handle the workload	①	②	③	④	⑤
3. When a lot of work needs to be done quickly, we work together as a team to get the work done	①	②	③	④	⑤
4. In this unit, people treat each other with respect	①	②	③	④	⑤
5. Staff in this unit work longer hours than is best for patient care	①	②	③	④	⑤
6. We are actively doing things to improve patient safety	①	②	③	④	⑤
7. We use more agency/temporary staff than is best for patient care	①	②	③	④	⑤
8. Staff feel like their mistakes are held against them	①	②	③	④	⑤
9. Mistakes have led to positive changes here	①	②	③	④	⑤
10. It is just by chance that more serious mistakes don't happen around here	①	②	③	④	⑤
11. When one area in this unit gets really busy, others help out	①	②	③	④	⑤
12. When an event is reported, it feels like the person is being written up, not the problem	①	②	③	④	⑤

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SECTION A: Your Work Area/Unit (continued)

Think about your hospital work area/unit…	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
13. After we make changes to improve patient safety, we evaluate their effectiveness	①	②	③	④	⑤
14. We work in "crisis mode" trying to do too much, too quickly	①	②	③	④	⑤
15. Patient safety is never sacrificed to get more work done	①	②	③	④	⑤
16. Staff worry that mistakes they make are kept in their personnel file	①	②	③	④	⑤
17. We have patient safety problems in this unit	①	②	③	④	⑤
18. Our procedures and systems are good at preventing errors from happening	①	②	③	④	⑤

SECTION B: Your Supervisor/Manager

Please indicate your agreement or disagreement with the following statements about your immediate supervisor/manager or person to whom you directly report. Mark your answer by filling in the circle.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	①	②	③	④	⑤
2. My supervisor/manager seriously considers staff suggestions for improving patient safety	①	②	③	④	⑤
3. Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	①	②	③	④	⑤
4. My supervisor/manager overlooks patient safety problems that happen over and over	①	②	③	④	⑤

SECTION C: Communications

How often do the following things happen in your work area/unit? Mark your answer by filling in the circle.

Think about your hospital work area/unit…	Never	Rarely	Some-times	Most of the time	Always
1. We are given feedback about changes put into place based on event reports	①	②	③	④	⑤
2. Staff will freely speak up if they see something that may negatively affect patient care	①	②	③	④	⑤
3. We are informed about errors that happen in this unit	①	②	③	④	⑤
4. Staff feel free to question the decisions or actions of those with more authority	①	②	③	④	⑤
5. In this unit, we discuss ways to prevent errors from happening again	①	②	③	④	⑤
6. Staff are afraid to ask questions when something does not seem right	①	②	③	④	⑤

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SECTION D: Frequency of Events Reported

In your hospital work area/unit, when the following mistakes happen, *how often are they reported?*
Mark your answer by filling in the circle.

	Never	Rarely	Some-times	Most of the time	Always
1. When a mistake is made, but is *caught and corrected before affecting the patient*, how often is this reported?	①	②	③	④	⑤
2. When a mistake is made, but has *no potential to harm the patient*, how often is this reported?	①	②	③	④	⑤
3. When a mistake is made that *could harm the patient*, but does not, how often is this reported?	①	②	③	④	⑤

SECTION E: Patient Safety Grade

Please give your work area/unit in this hospital an overall grade on patient safety. Mark ONE answer.

A	B	C	D	E
Excellent	Very Good	Acceptable	Poor	Failing

SECTION F: Your Hospital

Please indicate your agreement or disagreement with the following statements about your hospital.
Mark your answer by filling in the circle.

Think about your hospital…	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. Hospital management provides a work climate that promotes patient safety	①	②	③	④	⑤
2. Hospital units do not coordinate well with each other	①	②	③	④	⑤
3. Things "fall between the cracks" when transferring patients from one unit to another	①	②	③	④	⑤
4. There is good cooperation among hospital units that need to work together	①	②	③	④	⑤
5. Important patient care information is often lost during shift changes	①	②	③	④	⑤
6. It is often unpleasant to work with staff from other hospital units	①	②	③	④	⑤
7. Problems often occur in the exchange of information across hospital units	①	②	③	④	⑤
8. The actions of hospital management show that patient safety is a top priority	①	②	③	④	⑤
9. Hospital management seems interested in patient safety only after an adverse event happens	①	②	③	④	⑤
10. Hospital units work well together to provide the best care for patients	①	②	③	④	⑤
11. Shift changes are problematic for patients in this hospital	①	②	③	④	⑤

SECTION G: Number of Events Reported

In the past 12 months, how many event reports have you filled out and submitted? Mark ONE answer.

- ○ a. No event reports
- ○ b. 1 to 2 event reports
- ○ c. 3 to 5 event reports
- ○ d. 6 to 10 event reports
- ○ e. 11 to 20 event reports
- ○ f. 21 event reports or more

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SECTION H: Background Information

This information will help in the analysis of the survey results. Mark ONE answer by filling in the circle.

1. How long have you worked in this hospital?
   - ○ a. Less than 1 year
   - ○ b. 1 to 5 years
   - ○ c. 6 to 10 years
   - ○ d. 11 to 15 years
   - ○ e. 16 to 20 years
   - ○ f. 21 years or more

2. How long have you worked in your current hospital work area/unit?
   - ○ a. Less than 1 year
   - ○ b. 1 to 5 years
   - ○ c. 6 to 10 years
   - ○ d. 11 to 15 years
   - ○ e. 16 to 20 years
   - ○ f. 21 years or more

3. Typically, how many hours per week do you work in this hospital?
   - ○ a. Less than 20 hours per week
   - ○ b. 20 to 39 hours per week
   - ○ c. 40 to 59 hours per week
   - ○ d. 60 to 79 hours per week
   - ○ e. 80 to 99 hours per week
   - ○ f. 100 hours per week or more

4. What is your staff position in this hospital? Mark ONE answer that best describes your staff position.
   - ○ a. Registered Nurse
   - ○ b. Physician Assistant/Nurse Practitioner
   - ○ c. LVN/LPN
   - ○ d. Patient Care Assistant/Hospital Aide/Care Partner
   - ○ e. Attending/Staff Physician
   - ○ f. Resident Physician/Physician in Training
   - ○ g. Pharmacist
   - ○ h. Dietician
   - ○ i. Unit Assistant/Clerk/Secretary
   - ○ j. Respiratory Therapist
   - ○ k. Physical, Occupational, or Speech Therapist
   - ○ l. Technician (e.g., EKG, Lab, Radiology)
   - ○ m. Administration/Management
   - ○ n. Other, please specify:

5. In your staff position, do you typically have direct interaction or contact with patients?
   - ○ a. YES, I typically have direct interaction or contact with patients.
   - ○ b. NO, I typically do NOT have direct interaction or contact with patients.

6. How long have you worked in your current specialty or profession?
   - ○ a. Less than 1 year
   - ○ b. 1 to 5 years
   - ○ c. 6 to 10 years
   - ○ d. 11 to 15 years
   - ○ e. 16 to 20 years
   - ○ f. 21 years or more

SECTION I: Your Comments

Please feel free to write any comments about patient safety, error, or event reporting in your hospital.

THANK YOU FOR COMPLETING THIS SURVEY.

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