Differences in Safety Climate Between Hospital Personnel and Naval Aviators

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Abstract: We compared results of safety climate survey questions from healthcare respondents with those from a high reliability organization, naval aviation. Separate surveys containing a subset of 23 similar questions were conducted among employees from 15 hospitals and from naval aviators from 226 squadrons. For each question a "problematic response" was defined that suggested an absence of a safety climate. Overall the problematic response rate was 5.6% for naval aviators, versus 17.5% for hospital personnel ($p<0.0001$). The problematic response was 20.9% in high-hazard domains such as emergency department or operating room. Problematic response among hospital workers was up to 12 times greater than among aviators on certain questions. While further research on safety climate in health care is warranted, hospitals may need to make substantial changes to achieve a safety climate consistent with the status of high reliability organizations.

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INTRODUCTION

Safety in industries of high intrinsic hazard, such as aviation, military operations, nuclear power, and health care is known to be a property primarily of systems rather than individuals. Organizations that perform successfully under very challenging conditions, with very low levels of failure, are termed "High Reliability Organizations" (HROs) (Gaba, 2001; Roberts, Rousseau, & La Porte, 1994; Rochlin, La Porte, & Roberts, 1987; Sagan, 1993). Based on direct observation of HROs, investigators have determined that a key element of high reliability is a "culture of safety" permeating the organization (Gaba, Howard, & Jump, 1994; Roberts, 1993; Weick, 1987). Such a culture is presumed to depend largely on shared values and norms of behavior articulated by senior management and translated with high uniformity into effective work practices at the front-line. While there is widespread acceptance of cultural influences on safety there has been considerable debate concerning "safety culture" as an independent concept, and whether the attitudes and experiences expressed by personnel on questionnaires measure "culture" versus "climate" (Cox & Flin, 1998; Flin, Mearns, O'Connor, & Bryden, 2000; Guldenmund, 2000; Hale, 2000). According to Flin et al. (2000) "safety climate can be regarded as the surface features of the safety culture discerned from the workforce's attitudes and perceptions at a given point in time. It is a snapshot of the state of safety providing an indicator of the underlying safety culture of a work group, plant or organization." We follow this usage in the remainder of the paper.

Health care institutions strive to be HROs, providing technically challenging and intrinsically hazardous modalities of medical care to patients efficiently and safely (Gaba, 2001). The past twenty years have seen an increased emphasis in health care on human factors and systems oriented approaches to organizational safety that were originally pioneered in the transport and energy sectors (Bogner, 1994; Cooper, Newbower, Long, & McPeek, 1978; Gaba, 1994; Gaba, Maxwell, & DeAnda, 1987; Gosbee, 2002; Helmreich & Merritt, 1998; Kohn, Corrigan, & Donaldson, 1999; Leape, 1994; Lin, Vicente, & Doyle, 2001; Reason, 1995, 2000; Weinger & Englund, 1990; Xiao, Hunter, Mackenzie, Jefferies, & Horst, 1996).

The degree to which these health care organizations have a culture of safety supportive of high reliability and patient safety has only recently been explored. Considerable work has focused on occupational safety for healthcare workers, particularly concerning needlestick exposure to blood-borne pathogens such as HIV (Clarke, Rockett, Sloane, & Aiken, 2002; Gershon et al., 2000; Vredenburgh, 2002). More generally, surveys have been done classifying institutions into pre-defined cultural types (Wakefield et al., 2001) and relating these categorizations of a workplace organizational culture to specific care practices or patient outcome for specific diseases (Shortell et al., 2000; Shortell, Rousseau, Gillies, Devers, & Simons, 1991; Shortell et al., 1994; Zimmerman et al., 1994; Zimmerman et al., 1993). Others have looked at specific issues such as production pressure (Gaba et al., 1994) or teamwork in particular work environments such as the operating room or intensive care unit (Helmreich & Merritt, 1998; Sexton, Thomas, & Helmreich, 2000).

We recently reported data on safety related attitudes and experiences of personnel (i.e., safety climate) in a diverse set of hospitals in or near California, including public and private, for-profit and non-profit, teaching and non-teaching, large and small (Singer, et al., 2003). This survey included a 100% sample of senior management and physicians as well as a 10% sample of all hospital employees in all work units. We found that while the majority of respondents answered in ways indicating a good safety climate, a substantial minority of respondents (18% on average) gave answers that suggested the absence or antithesis of a safety climate; another 18% of respondents were neutral. What do these results mean? Do the findings about the majority suggest the presence of a good safety climate (conducive to a culture of safety) consistent with HRO status, or do findings about the sizable minority indicate an incomplete penetration of HRO principles into the hospital work environment? Zohar argues that safety climate can be assessed in terms of its “strength,” or consistency of response, as well as on its “level” of mean response for specific indicators (Zohar, 2001). Our data on problematic response suggests a low strength of safety culture in health care, but how does this strength compare to that in a recognized HRO?

Aircraft carrier flight operations were the first HRO studied in detail (Roberts et al., 1994; Rochlin et al., 1987). Experts generally consider naval aviation, whether carrier-based or shore-based, to be a classic HRO industry achieving very low rates of catastrophic failure while providing continuous operations in the face of high intrinsic hazard ((Ciavarelli, 2003); Karlene Roberts, personal communication, January 17, 2002). For example, the rate of Class A accidents (fatality or greater than $1 million in damage) in Naval aviation since 1999 has been approximately 1.5 per 100,000 hours flown. This rate has dropped from approximately 50 per 100,000 hours in the 1950s. While greater than the accident rate in commercial aviation, this rate is very low considering the complexity of the aircraft, the missions flown, and the unique demands of carrier-based launch and recovery. The health care sector intends to be a high reliability organization with nearly failure free results, yet the accident rate is not known with certainty. The data available (Kohn et al., 1999; Lagasse, 2002; Leape et al., 1991) suggest the rate is much higher than in military or commercial aviation.

In this paper we describe an exploratory "natural experiment" in which we were able to construct questions concerning safety climate in the health care domain that were highly similar to questions already posed to naval aviators (the Navy uses the term “aviators” for its air crews) in on-going assessments of their safety climate. Because health care institutions may not have fully implemented organizational and cultural aspects of high reliability institutions (Committee On Quality Of Health Care In America, 2001; Gaba, 2001), we hypothesized that the rate of problematic response (answering in ways against a safety climate) to these similar questions would be substantially greater among health care workers than among naval aviators across all aspects of safety climate that the questions addressed. In our study we concentrated on several specific aspects of a safety climate for which data were available for both domains (see table 1) although there are other aspects of safety climate that are not addressed (see for example (Flin et al., 2000).

METHODS

These data are the result of collaboration between ongoing efforts in health care and in naval aviation to assess the climate of safety in the respective domains. The Naval Aviation Command Safety Assessment Survey (CSAS) was developed at the Naval Postgraduate School to aid commanders in assessing the safety climate of naval aviation units. The CSAS is used both by squadron commanders for operational quality management, and by investigators for research at the Naval Postgraduate School. Squadron commanders arrange for squadron personnel to complete the CSAS via the Internet. Often, this is done during a “safety stand-down,” during which regular activities are suspended to allow training concerning safety. The CSAS was based upon a conceptual model of HRO theory (Ciavarelli, Figlock, Sengupta, & Roberts, 2001). The CSAS uses a Likert-type, five-point rating scale. Exploratory and confirmatory factor analyses of the CSAS questionnaire (administered to 1240 aviators) were completed. A three factor solution, using principal components with varimax rotation, was derived. The Cronbach-alpha reliabilities for the three factors were 0.97, 0.94, and 0.89, and these values are well within the range of acceptable measurement reliability. The survey developers are continuing their efforts to validate the survey, using large samples of data from aviation squadrons. The CSAS can be reviewed at http://avsafety.nps.navy.mil/safesurv.htm

The Patient Safety Cultures in Healthcare Organizations (PSCHO) instrument is part of research assessments of work culture influences (safety climate and deeper features) on safety in hospitals. It was initially constructed by the VA Palo Alto Patient Safety Center of Inquiry (PSCI), using questions adapted with permission from five existing surveys from various domains: The Naval CSAS described above (Ciavarelli, Figlock, & Sengupta, 1999; Ciavarelli et al., 2001); Operating Room Management Attitudes Questionnaire (Helmreich & Schaefer, 1994); Anesthesia Work Environment Study (Gaba et al., 1994); Risk Management Questionnaire (Roberts, 1990), and Safety Orientation in Medical Facilities (Augustine, Weick, Bagian, & Lee, 1998). These instruments have partially overlapping questions covering 16 topics. For use in the PSCHO we selected questions from the underlying surveys to cover each of the 16 topics. The PSCHO instrument clearly explained to participants that "patient safety" referred to activities or events harmful to patients and did not relate to the occupational safety of the workers themselves. The complete survey may be viewed at http://healthpolicy.stanford.edu/PtSafety/indexjs.htm

A preliminary paper form of the PSCHO survey instrument was tested in two pilot studies of approximately 600 personnel each. Based on feedback from the pilot studies, the survey instrument was modified and revised, for example to make the questions more concrete. The revised version containing 94 questions was used in mailing waves 1 and 2 of the PSCHO administration discussed in this paper. A 34-question version was mailed to non-responders in a third wave. Unless otherwise specified, results reported here are from the 94-question tool used in the first and second wave. Principal components factor analysis was conducted on the responses to the 94-question survey (with a varimax rotation to maximize the loadings on each factor). This yielded five factors, which accounted for 80% of the systematic variation across questions. Based on the questions that loaded most heavily to each factor, we labeled these factors as “organization”, “department”, “production”, “reporting/seeking help”, "and shame/self-awareness” (Singer et al., 2003). Note that the factor analyses of the complete CSAS and PSCHO instruments cannot be extrapolated directly to the sub-set of similar questions discussed in this paper.

Derivation of Similar Questions from the CSAS to the PSCHO

Twenty-three (23) questions on the PSCHO instrument were derived directly from the CSAS instrument that had already been in use for two years in the Navy. Questions were chosen that seemed possible to adapt to the health care environment and that covered as many of the PSCHO topics as possible. The wording of CSAS questions was modified by the healthcare and naval researchers to make it appropriate for a hospital setting. For example, the term "command leadership" is used frequently in the Navy questions. This term is not applicable in health care. Depending on the question (and to meet other needs of the PSCHO survey) this term was translated either as "senior management" or as "my department".

Survey Administration, Sampling, and Response Rates

The CSAS and the PSCHO were administered in different fashions and over different periods of time. The sample for the Navy CSAS survey was not randomly drawn from the population of US Naval Aviation units. Rather, squadron commanders voluntarily requested this organizational safety assessment. Results reported here are from surveys of 226 squadrons (of approximately 450 eligible Navy and Marine Corps squadrons). During the period 1998 to 2001, on one or more days chosen by each squadron commander, all of the squadron's aviators were asked to complete the CSAS anonymously (identified only by squadron) via the Internet. Respondents returned 6,901 surveys. The overall response rate was approximately 80%, with no less than a 65% return for any squadron.

The sample of participating hospitals was also not random. Rather, hospitals were participants in the Patient Safety Consortium, selected for their initiative in promoting patient safety, their geographic location (mostly in Northern California), and their diversity in size, type of hospital, and hospital system affiliation. Within the 15 participating hospitals, the intended survey sample included 100% of attending physicians, 100% of senior management (department head or above), and a 10% random sample of all other hospital employees. We surveyed 100% of senior management because this employee group is a small fraction of the whole. We surveyed 100% of physicians because they are fewer in number than nurses and other employees, and the response rate of physicians was expected to be relatively low based on our pilot surveys. This sampling strategy allowed us to achieve an adequate number of respondents for each class of employees.

The total number of eligible, unique individuals receiving survey packets was 6,312, across all 15 hospitals. The initial mailing list included 6906 names; however, 347 duplicate names were removed from the list as well as 227 surveys that were returned to us as undeliverable (e.g., employee retired, was a temporary worker, no longer employed). For logistical reasons two hospitals surveyed 25% and 21% of their physicians respectively; and a third hospital surveyed too few physicians to analyze separately. Respondents returned 2,989 anonymous surveys, for an overall response rate of 47.4%. The response rate excluding physicians was 62%; the response rate for physicians was 33%.

Hospitals distributed the surveys to hospital employees via inter-office mail or US mail in three separate waves between April and June 2001. Successive mailings were separated by about four weeks. The survey packet included a cover letter co-signed by a research investigator and a senior executive from the respective hospital, a paper version of the survey instrument, a business-reply return envelope, instructions for completing the survey on the Internet if desired, and a separate questionnaire completion notification (QCN) card. We asked respondents to return the QCN postcards separately; this allowed us to discontinue sending additional survey packets to individuals who had responded to the survey without compromising the anonymity of the survey. Additional details about the development and results of this survey are reported in a previous publication (Singer et al., 2003).

Data Analysis

We compared the aggregate responses to the similar questions in the hospital PSCHO to those in the Navy CSAS. Because the hospital personnel in the overall sample included many different job types we also conducted an analysis comparing responses of the aviators to the subset of hospital personnel from areas with particularly dynamic, high-hazard work characteristics (operating room, emergency department, intensive care unit, pediatric intensive care unit). Respondents from these areas, mostly nurses and physicians who deal with situations of high intrinsic risk on a regular basis, should have the closest parallels in the cognitive work environment to that of naval aviators.

For all comparisons, we defined as “problematic response” the proportion of responses (agreement or disagreement depending on the question) suggesting a lack of or antithesis to safety climate. Neutral responses were not included as problematic. For each question, we determined whether the difference in proportion of problematic response between the groups was statistically significant using Chi-square analysis. To correct for multiple comparisons we required $p<0.001$ for any comparison to consider it significant. We also computed the ratio between the problematic response of health care personnel (all respondents) to that of naval aviators (Table 1B).

Non-response Bias: Data presented here for both surveys are raw un-weighted values with no correction for unit non-response. We did not have access to demographic profiles of hospital personnel to compare the characteristics of the responders versus the non-responders. In Singer et al. (2003) we used weighting of PSCHO data to account for the differential sampling by job-type and for non-response bias. For all questions the rate of problematic response in the un-weighted data presented here is very close to that in the weighted analyses. Also in Singer et al (2003) we presented sensitivity analyses for potential non-response bias in the PSCHO data, comparing by wave of survey response (Dillman, Eltinge, Groves, & Little, 2001; Platek & Gray, 1983). This suggested no significant effect of response bias on the overall results. Finally, for the current analysis, we consider the effect of the worst-case non-response bias. Even assuming that all PSCHO non-responders would have answered all questions in a "non-problematic" way (a very unlikely occurrence), the overall rate of problematic response by health care workers would be reduced by approximately a factor of two (since the response rate was approximately 50%). Such a reduction would not change the fundamental conclusions of this paper.

RESULTS

Naval aviators compared to hospital personnel overall

Table 2 shows problematic response by the naval aviators and the hospital employees for the 23 questions that were directly linked between the two surveys. Average overall problematic response for the naval aviators was 5.6%, compared to 17.5% for hospital personnel, an aggregate difference of 11.9%. Problematic response to individual questions ranged from 1.2% to 29.5% for naval personnel, and from 1.9% to 55.1% for hospital workers. Problematic response among hospital workers was up to 12 times greater than among aviators (Table 1B). Differences between the groups were statistically significant for all questions ($p<0.0001$). The responses to the 11 matched questions that were retained in the abridged survey used in the third mailing wave of the hospital PSCHO was slightly less problematic on average than in the first two waves, making the three-wave problematic response for this subset of questions 20.4% (versus 21.7% for wave 1& 2 only). There was only 7.7% problematic response by naval aviators to these 11 questions, yielding a 12.7 percentage point difference.

Professionals in high-hazard health care domains compared to Navy aviators

Problematic response to individual questions from those in high hazard hospital domains ranged from 2.6% to 59.4%, with an average of 20.9%. This was significantly more problematic than for hospital workers as a whole ($p<0.001$). Problematic response among high-hazard hospital workers was up to 16 times greater than among aviators (Table 2).

DISCUSSION

Respondents to the Patient Safety Cultures in Healthcare Organizations survey were three times as likely on average to give a problematic response to similar questions than were naval aviators taking the Command Safety Assessment Survey. These findings were true both for the aggregate of all health care respondents, and even more strikingly, for respondents from particularly hazardous health care arenas.

We found a few similarities between hospital personnel and navy aviators regarding specific safety climate features covered by the matched questions (Table 1B). In both sectors respondents were highly uniform in their belief that their institution is committed to and has a good reputation for safety. They both express concern about the level of resources provided for them to accomplish their jobs, although health care workers are even more concerned than aviators about the effect of the loss of experienced personnel on safety (Q2). Nonetheless, for most questions on all aspects of safety climate we saw low rates of problematic response by naval aviators (generally under 10%) and a higher rate of problematic response in health care workers, by a factor of three or more (Table 1B).

Limitations of the Study

Representativeness of the Data: The data from the PSCHO are a very comprehensive assessment about a broad set of attitudes and experiences of workers in the diverse set of hospitals studied. It used a rigorous sampling methodology and targeted a wide cross section of health care workers including senior management. Nonetheless, the survey was sent to only 6,312 individuals, with slightly less than 3,000 of them responding. While a variety of hospital types were studied, the number of hospitals was too few to represent a complete sample of all institutions. The CSAS has been administered to about half of eligible naval aviation squadrons.

A problem for both surveys is that participation of the target organization is completely voluntary. Hospitals surveyed belong to a Patient Safety Consortium interested in improving patient safety in their organizations. We presume that these are leading institutions rather than laggards, although it is possible that some participate because they wish to correct serious, known deficiencies. Similarly, squadron commanders requesting the CSAS are presumed to be enlightened leaders seeking organizational improvement, although we cannot rule out that some participated to find solutions to serious command problems. We thus assume that the data from these surveys are closer to the “best case” rather than to the “worst case” for organizations in their domain. The assumption that participating organizations were relative safety leaders can only be confirmed by studying a larger sample and more complete cross-section of organizations (from good to bad), with comparisons to external “gold-standard” performance criteria if they can be delineated.

Differences in the Method of Survey Administration and the Population Surveyed: The timing and method of administration of the surveys differed between the domains. The Navy survey was administered to different squadrons over a three-year period, the hospital surveys over six months toward the end of the naval sampling. Perhaps more importantly, the naval surveys were often administered as part of a safety stand-down when issues of safety would be more salient to the respondents. Health care has no equivalent of safety stand-downs (itself a potentially significant organizational difference) and the surveys were administered by mail directly to participants in multiple waves.

The wording of questions was not perfectly matched between the domains. The terms "command leadership" and "my command" used in the Navy are not as specific as the terms "senior management" or "my department" (or for one question "supervisors") used in health care. If, for example, naval aviators considered the command leadership to consist only of their squadron leaders (which is made up mostly of active aviators) the rest of the unit is likely to feel that they know what is going on with the squadron's actual operations. In contrast, the senior managers in health care are more removed from the front-line workers (although some are active clinicians themselves). In the detailed analysis of the PSCHO data we found that managers who were clinicians responded closer to front-line clinicians than did managers who were not clinicians (Singer et al., 2003).

These differences in method of administration might account for some of the results, but we believe that they are unlikely to account for the profound (three-fold) differences seen between the groups. Moreover, comparison between the most analogous sub-groups (aviators vs. hospital workers in particularly hazardous domains) showed even greater disparities.

Previous Research

While previous research has explored related issues, findings from this study substantially expand the knowledge base about safety climate in healthcare organizations. Neal and Griffin (2000) tested a model of hypothesized causal elements for safety performance (organizational climate and safety climate leading to safety knowledge and safety motivation, and then to safety compliance and safety program participation) using data from 525 employees in a single Australian hospital. While the structural equation modeling was able to verify most aspects of their causal model they do not provide scale-level or question-level data on the results from healthcare workers comparable to our results. A study by Gershon et al. (2000) of attitudes regarding hospital safety climate and occupational safety related to blood-borne pathogens had some questions similar to those in the PSCHO and CSAS. For example, 67.9% of their respondents agreed or strongly agreed that "On my unit there is open communication between supervisors and staff" (they do not provide data for the two categories of "disagree"). Respondents to the PSCHO answered analogous questions similarly (Q3a/Q3b) with 61.9% agree or strongly agree, and 19.3% problematic, whereas the naval aviators had a 10.8% problematic response.

Some analogous work has been published by Helmreich, Sexton, and others looking at team behaviors and attitudes in surveys of physicians and nurses in anesthesia, surgery, and ICU as compared to equivalent data from cockpit crewmembers in commercial aviation (Helmreich & Merritt, 1998; Sexton et al., 2000). The Operating Room Management Attitudes Questionnaire (ORMAQ) and the Intensive Care Management Attitudes Questionnaire (ICUMAQ) contain 23 items matched to the Cockpit Management Attitudes Questionnaire (CMAQ) that has been administered to over 30,000 airline pilots (with response rates across different airlines averaging 45%). A few questions partially relate to safety culture issues. Data from only a handful of the matched questions have been reported in the literature. The results are similar to our own. A higher fraction of physicians and nurses provided a "problematic response" compared to that for pilots for four questions about teamwork and stress (Sexton et al., 2000). In these studies the differences among the healthcare disciplines were much larger than the differences between the aggregate of health care workers versus the pilots. In contrast, our comparison of the PSCHO to the CSAS found much greater differences (three-fold on average) between healthcare workers and aviators than we found among hospitals, job classes, or between clinicians vs. non-clinicians in health care (Singer et al., 2003).

Organizational Aspects of Each of the Domains

We are confident that despite some of the differences in methodology, timing, and wording of the instruments used in this exploratory natural experiment, the overall pattern of results do stem primarily from actual differences between the organizational practices and cultures of the industries. Hospitals <u>are</u> organized differently than are naval aviation units, and have notably different operational characteristics. We have previously articulated differences between the structure and organization of healthcare as an industry in comparison to other industries such as commercial aviation (Gaba, 2001). The same dissimilarities are equally applicable in comparison to naval aviation.

Naval aviation is a highly-controlled, centralized industry. There is only one "parent company" (the United States Navy) with many diverse "firms," (e.g. "fleets" or "commands") each containing many facilities and work groups. There are substantial economies of scale. The company and firms exert strong controls on safety procedures, and personnel qualifications, training, and assignments. Naval aviators are a very homogenous population with strong cultural values regarding professionalism and command and peer loyalty. Hospitals, on the other hand, are not under a single command authority. Even within a single hospital there is fairly weak control of procedures and personnel. In some hospitals certain key personnel (e.g. physicians) are even private firms of their own, working under the umbrella of the hospital, not under its direct control. The survey data show that aviators believe that their command exerts strong control over issues such as resources, safety procedures, and process auditing, while a substantial fraction of health care workers believe that their hospitals or departments do not. Health care is not a "total institution" like the military, in which "… members are isolated from a wider society and can therefore be more intensely socialized and trained," (quotation of Goffman in Sagan, 1993, p. 23). Further studies of different types of organizations in different industrial domains will be needed to determine if a uniform safety climate can be achieved without the level of control of personnel and procedures imposed by the military.

There is strong reason to believe that health care institutions can improve their organization without military controls (Committee on Quality of Health Care in America, 2001; Kohn et al., 1999). Specific work units termed clinical "microsystems" have been a recent focus for analysis. Some microsystems have been found to operate with apparently greater efficiency, safety, and resolve than many of their counterparts (Donaldson & Mohr, 2000; Mohr & Batalden, 2002; Nelson et al., 2002). In fact, in the empirical studies of microsystems, “leadership," "culture," and "organizational support" were found to be three of nine key characteristics of success. The characteristics of these successful small units may be expanded to encompass more units within hospitals, and to hospitals as a whole.

Further research

Our results indicate that further studies comparing healthcare organizations, naval aviation, and other high-hazard domains may be fruitful. We are attempting to relate results on the PSCHO to statistical markers of clinical quality and patient outcome in hospitals. This would assess the predictive validity of the safety climate assessments. Because the PSCHO to date has been administered in only 15 hospitals, data are needed from more institutions of greater diversity, geographic spread, and level of safety performance. It would also be useful to have analogous data from military hospitals. Unlike their civilian counterparts these hospitals share with naval aviation certain elements of military organization including tighter institutional control of personnel and considerations of military rank.

Within the non-health care components of the military, data are needed across more disciplines and departments, and especially from the senior managers of large organizations, such as the command structure of an entire ship or base rather than just of a squadron. In the future we hope to acquire data from entire naval battle-groups and possibly from samples of an entire branch of the military (e.g. the Marine Corps).

Other non-military hazardous industries offer other interesting organizational and structural comparisons both to naval aviation and to health care. Commercial aviation has a safer accident record than does naval aviation, and does not have the regimented control of the military.

Nuclear reactor operators in the civilian sector could be compared to their naval counterparts. Non-aviation transport industries such as maritime, railroads, and trucking may offer different perspectives. The chemical manufacturing industry has a wide spectrum of firm sizes that may mirror the diversity in size of organizations found in health care. The further exploration of safety climate, and ultimately safety culture, in healthcare will be valuable in its own right and also as component of a generalized theory of operational safety for all hazardous domains.

What Can Health Care Institutions Do?

While these exploratory data do not by themselves prove that health care lacks an appropriate climate of safety, it appears that naval aviation – an acknowledged HRO – has gone much farther in generating a uniform set of safety-oriented beliefs and norms amongst its practitioners. If these data are true what could hospitals do to change their safety climate? The data indicate that hospital leaders' avowed commitment to safety has not translated sufficiently into a climate in which safety and organizational processes aimed at safety are valued uniformly. In hospitals more than in naval aviation, the organization does not strongly manage day-to-day operations from a safety standpoint. There are several strategies to address these and other issues of bolstering the safety climate.

Top Down Strategies: The survey results suggest that management in health care is viewed by too many workers as isolated from the front lines and ignorant of the true hazards and demands that exist. There are a variety of interventions that might help senior managers better understand the clinical world, and better translate their commitment to safety to the front-line. Our group has developed an intervention (termed Inward Bound: Workplace Expeditions for Executives) modeled after the business technique of Management by Walking Around (Peters & Waterman, 1982). This program has executives making one-on-one visits to front-line workers to watch them (and assist if feasible) as they do their daily work. Another intervention termed WalkRounds™ (Frankel et al., 2003) has executives conducting patient safety meetings in the clinical workplace so as to hear from large numbers of front-line workers. The effectiveness of these interventions is not yet established however.

A longer-term top-down strategy would require more intensive prospective safety management of health care work by the institution, with increased auditing of adherence to standard operating procedures and standards. This kind of involvement may be seen in the exemplar clinical microsystems that have been studied (Donaldson & Mohr, 2000; Mohr & Batalden, 2002; Nelson et al., 2002). Considerable work remains to be done to determine the applicability and limits of this approach.

Bottom up strategies: One study of occupational safety in hospitals suggests that the most effective strategy was careful selection and training of new hires coupled with verification of safe procedures in the work environment (Vredenburgh, 2002). Another strategy being explored is to provide training to employees (especially those with direct patient contact) on human factors and teamwork issues in health care (Barrett, Gifford, Morey, Risser, & Salisbury, 2001; Bower, 2002; Firth-Cozens, 2001; Morey et al., 2002). In some cases this is accomplished using very realistic simulations for clinicians in high-hazard domains (Gaba, Howard, Fish, Smith, & Sowb, 2001; Holzman et al., 1995; Howard, Gaba, Fish, Yang, & Sarnquist, 1992; Kurrek & Fish, 1996; Marsch, 1998; Sica, Barron, Blum, Frenna, & Raemer, 1999; Small et al., 1999). Such bottom-up efforts are expected to have direct effects on teamwork, redundancy, and adherence to safe practices. They could also have indirect effects on improving the uniformity of the safety climate, by providing concrete exercises to relate abstract cultural concepts to the operational world of clinical work. Studies are currently underway to determine whether changes in safety climate do in fact result from teamwork-oriented simulation training.

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Table 1A and 1B: Aspects of Safety Climate

Table 1A		Table 1B
Aspect of Safety Climate	Question Number*	Ratio of problematic response in health care / naval aviation (All health care workers)
Senior leadership articulates an institutional commitment to safety and conveys it uniformly to throughout the organization	Q5 Q14 Q16 Q19 Q23	3.6 6.1 2.3 8.5 1.6
Following standard operating procedures and safety rules is a part of the behavioral norms.	Q6 Q10	3.1 3.3
The organization proactively manages safety and carefully monitors ongoing safety processes and operating procedures	Q4 Q7 Q8 Q12 Q18 Q22 Q21	4.7 2.5 3.1 5.3 7.1 6.5 4.6
Resources and redundancy are provided to allow safe operations	Q1 Q2 Q15 Q17	1.1† 3.0† 8.7 5.1
Communication between workers and across organizational levels is frequent and candid	Q3a/3b Q20	1.8† 11.6
There is openness about errors and problems; they are reported when they occur	Q9	2.5

* See Table 2 for the individual question wording and data

† Problematic response of naval aviators is greater than 10%

Table 2. Percent problematic response to Navy CSAS and Hospital PSCHO questions by naval aviators, hospital personnel, and personnel in high hazard health care domains

		Problematic Response (%)		
Question	**Question Text [Navy / Healthcare]**	**Naval Aviators**	**All Hospital Personnel**	**Personnel in High Hazard Health Care Domains**
	Unweighted N	6901	2125	632
1	I am provided adequate resources ([time, staffing, / personnel] budget, and equipment) to [accomplish my job / provide safe patient care]*	29.5	33.7	36.7
2	[Lack / Loss] of experienced personnel has [adversely / negatively] affected [my command's / my] ability to [operate safely / to provide high quality patient care]*	18.5	55.1	59.4
3a	Within my command, good communications flow exists up and down the chain of command / Good communication flow exists down the chain of command regarding patient safety issues*	10.8	19.0	21.6
3b	Within my command, good communications flow exists up and down the chain of command / Good communication flow exists up the chain of command regarding patient safety issues*	10.8	19.7	23.5
4	[My command /Senior management] does not hesitate to temporarily restrict [from flying individuals /clinicians] who are under high personal stress	7.8	37.1	45.4
5	[Command leadership / Senior management] reacts well to unexpected changes to its plans	7.4	26.8	34.8
6	In [my command, peer influence is effective at discouraging violations of standard operating procedures, or safety rules / In my department, there is significant peer pressure to discourage unsafe patient care	5.6	17.2	17.7
7	My command ensures the uniform enforcement of all operating standards among unit members / My department uniformly prescribes performance standards to ensure patient safety	5.5	13.8	17.0
8	[My command has a defined process to set training goals and to review performance / My department follows a specific process to review performance against defined training goals*	5.1	16.0	16.8
9	Individuals in [my command / my department] are willing to report [safety violations, unsafe behaviors or hazardous conditions / behavior which is unsafe for patient care]*	4.2	10.4	13.5
10	In [my command / my department],[violations of operating procedures, flying regulations, or general flight disciplines / disregarding policy and procedures] is rare*	4.0	13.3	13.2
11	[Safety / Patient Safety] decisions are made at the proper levels, by the most qualified people [in my command]*	4.0	18.5	22.2
12	[My command / my department] closely monitors [proficiency and currency standards / performance] to ensure [aircrew are qualified to fly / clinicians are qualified]	3.3	17.3	21.0
13	[Command leadership / People in leadership positions] sets the example for compliance with [flight standards / policies and procedures that promote safe patient care]	3.0	12.3	15.7
14	[My command / Senior management] provides a [positive command climate / positive climate] that promotes [safe flight operations / patient safety]*	2.7	16.1	21.6
15	[My command /Senior management] provides adequate safety backups to catch possible human errors during high-risk [mission / patient care activities]	2.7	23.7	31.5
16	[My command / This facility] has a reputation for high-quality performance	2.4	5.5	4.9
17	I am adequately trained to safely conduct all of my flights / Staff are provided with the necessary training to safely provide patient care*	2.2	11.3	12.9
18	[My command / Supervisors] conduct adequate reviews and updates of [safety standards and	2.1	14.9	19.3

Question	Question Text [Navy / Healthcare]	Problematic Response (%)		
		Naval Aviators	All Hospital Personnel	Personnel in High Hazard Health Care Domains
	operating procedures / patient safety practices]			
19	[Command leadership / Senior management] is successful in communicating its [safety / patient safety goals] to [unit personnel / hospital/clinic personnel]	2.0	16.6	18.9
20	[Command leadership / Senior management] has a clear picture of the risks associated with [its flight operations / patient care]*	1.9	21.9	30.6
21	[My command / My department] does a good job managing risks [associated with its flight operations / to ensure patient safety]*	1.9	8.5	11.8
22	[My command / My department] takes the time to identify and assess risks [associated with its flight operations / to patient safety]	1.6	10.1	12.5
23	[My command / Staff] is genuinely concerned about [safety / patient safety]	1.2	1.9	2.6
	AVERAGE	5.6	17.5	20.9

The Navy CSAS combines questions 3a and 3b into one while the PSCHO survey includes two separate questions. To calculate the aggregate problematic response for each industry, the total problematic response percentage for questions 3a and 3b for hospital personnel was divided by two and the problematic response for naval aviators to the combined question 3a/3b was included as is.

"High hazard areas" include emergency room/urgent care, intensive care unit, and operating room/post-anesthesia care unit.

All differences observed between naval aviators and hospital personnel are significant, with $p<.0001$ for each question.

* Indicates this question was included in all three waves of PSCHO survey mailing.

** Percent problematic response is based on responses to the PSCHO survey from waves 1 and 2 only.

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