PATIENT & EMPLOYEE SAFETY CULTURE

Measurement & Agreement

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THE DELIVERY OF HIGH-QUALITY HEALTHCARE and the presence of a strong culture of patient safety are vital to the continued success of a healthcare organization. Failing to provide quality care can have a significant effect on an organization's financial bottom line. As a result, hospitals are focusing increased attention on improving healthcare quality by creating a culture of patient safety. The effect of poor employee safety performance in healthcare may not be as dramatic as large-scale industrial disasters but has the potential to drastically impact employee health and well-being. Increased incidence and severity of workplace injuries can also create negative impacts on patient safety.

Despite efforts to improve patient safety culture (PSC) in U.S. hospitals, employee safety, part of the field of occupational health, often appears to be considered an afterthought. For example, as part of its accreditation survey process, The Joint Commission (2020) requires that results of an organization's most recent safety culture survey be provided. Such survey results, as demonstrated by references to the Agency for Healthcare Research and Quality (AHRQ) Culture of Safety survey, are often focused on patient safety and lack measures related to employee safety (The Joint Commission, 2018).

Safety culture, both employee safety culture (ESC) and PSC, can be considered a part of the overall organizational culture, but with emphasis on beliefs and values that impact employee safety and health, and patient safety, respectively (Clarke, 1999). OSHA (2020) and The Joint Commission (2012) have both released publications indicating a linkage between PSC and ESC. Despite this presumed linkage, the literature is lacking in studies concurrently measuring and evaluating the level of PSC and ESC in a healthcare organization to identify the level of agreement between the two. Researchers in the field agree that additional studies are needed to show that patient safety and employee safety are interrelated (Sokas, Braun, Chenven, et al., 2013). Inadequate evidence exists to determine whether strong PSC correlates well to strong ESC or whether tools designed to measure PSC agree well with tools designed to measure ESC.

PSC surveys, such as those tools developed by AHRQ, are frequently administered to healthcare workers to measure and assess the strength of PSC in the organization. In contrast, ESC surveys are administered less frequently, possibly due to the difficulty of identifying validated survey tools or due to the desire to not overwhelm employees with too many surveys. If the presumed relationship between PSC and ESC exists, then practicing safety professionals could gain valuable information on ESC without

KEY TAKEAWAYS

- **Patient safety culture and employee safety culture are typically considered separate areas of interest, which results in organizations independently assessing them, developing interventions and allocating resources to target each type of culture.**
- **This study evaluates the agreement between measures of patient safety culture and employee safety culture, and the potential to use the measure of one type of safety culture as a surrogate for the other.**
- **Researchers found weak agreement between measures of patient safety culture and employee safety culture.**
- **Organizations that want to measure and improve both employee safety culture and patient safety culture should not assume that measures for one construct provide valid information on the other.**

administering a separate survey tool. The authors hypothesized that PSC and ESC measure related organizational characteristics and that a high level of agreement exists between PSC and ESC.

Methods

Study Approach

The study presented in this article was cross-sectional, with PSC and ESC measurement tools being administered concurrently. The study measured PSC and ESC among employees working in inpatient hospital settings at public hospitals in Texas. Each of these organizations is a comprehensive health system that operates at least one hospital with a Level I trauma center as well as a system of outpatient clinics. Both organizations are academic medical centers with close affiliations with a medical school and have one or more general teaching hospitals. At the time of the study, Site 1 (S1) operated a 716-bed hospital and 26 outpatient clinics. Site 2 (S2) operated a 414-bed hospital, a 40-bed critical access hospital, and about 28 outpatient clinics. Neither study site operates a specialty hospital (e.g., cancer care, children's hospital), but, instead, function as general medical/surgical hospitals. A survey consisting of the combined AHRQ Hospital Survey on Patient Safety Culture and Institute for Work and Health Organizational Performance Metric (OPM) was administered electronically through Qualtrics, a web-based survey administration system.

Survey Tool

PSC was measured using the AHRQ Hospital Survey on Patient Safety. Developed in 2004, this survey instrument consists of 51 questions that measure PSC at the unit and organizational levels, as well as outcomes related to patient safety and some respondent demographic information (e.g., employment duration in the hospital and work unit, number of hours worked each week, staff position, length of time in field; Sorra & Nieva, 2004). The OPM was used to measure ESC; it consists of eight questions measuring the frequency with which safety and health practices are observed or practiced (IWH, 2013). Both surveys use a five-point Likert-type scale to measure PSC and ESC. Five questions were added to the combined survey tool to collect demographic information related to employee age, gender, supervisory status, number of employees supervised, and inpatient or outpatient work location status. With the combined surveys and the added questions, the complete survey tool consisted of 64 questions.

Participant Recruitment

This study was approved by the University of Texas Health Science Center at Houston Committee for the Protection of Human Subjects as well as the institutional review boards (IRB) at each study site. Subject recruitment took place through e-mail distribution of the survey via institutional e-mail addresses. An IRB-approved study information sheet was reviewed, and the participant provided implied consent by agreeing to complete and submit the survey. The follow-up communication strategy closely mirrors the strategy recommended by Dillman (2007). Online access to surveys was open for 8 weeks. All data were de-identified and stored in a secure electronic system. Respondents were excluded from analysis based upon exclusion criteria used during the AHRQ survey validation studies (Sorra & Nieva, 2004). Based on estimations of the adequate statistical power for our study, the authors determined that the minimum required sample was 385 respondents.

Analysis

Statistical analysis was conducted to estimate agreement between the level of PSC and ESC, and was performed using Stata IC 12.1 (StataCorp LP, 2011). Several variables [i.e., age, gender, supervisor status, time of employment (at hospital and in-unit), time in specialty] were evaluated to identify potential confounders to ensure that measurements of agreement were as unbiased as possible. Pearson's chi-square test was performed on each survey question, stratified by these potential confounding variables, to identify any statistically significant differences in the distributions. When available, demographic characteristics of respondents were used to stratify safety culture agreement measurements as well as compared to publicly available information on the populations using chi-square testing. Descriptive statistics (number and percent of respondents) were generated from respondent demographic responses with chi-square test performed to determine whether any significant differences existed in the distribution of respondents at the two institutions.

Survey responses were transformed into categories of low, neutral or high with respect to safety culture. For the OPM, the cutoff points for categorization were based on the rating of observed safety practices: High was > 60%, neutral was between 40% and 60%, and low was < 40%. The questions on the AHRQ survey tool include reverse-worded responses, meaning that not all "agree" or "strongly agree" responses indicate a high safety culture rating. Thus, those questions worded in such a way that "agree" or "strongly agree" indicated a poor safety culture characteristic were categorized as low, while those that said "disagree" or "strongly disagree" were categorized as high. Any rating of "neither" was rated as neutral. For those questions that had an "agree" or "strongly agree" to indicate a good safety culture characteristic, the inverse was used to categorize responses into low, neutral or high. Regardless of the survey tool, for each question two potential responses could have been categorized as low, two potential responses could have been categorized as high, and the single middle potential response could have been categorized as neutral. Average scores for each of the PSC and ESC cultural dimensions were calculated and evaluated for aggregated data as well as for each study site.

Scatterplots were generated graphing overall patient safety score against employee safety score, as well as graphing patient safety categories against employee safety scores. Bland-Altman plots were also generated to assess agreement with the mean between multiple tools with continuous measures; measures in agreement and those that might be used interchangeably will tend to have narrow limits of agreement (Mander, 2005). Cohen's kappa-statistic (κ), Cronbach's alpha (α) and Lin's concordance correlation coefficient (ρ_c) were calculated to identify whether those who reported high worker safety culture also reported high employee safety culture (Steichen & Cox, 2010). Interpretation of these agreement measures was based on commonly cited scales (McBride, 2005; Tavakol & Dennick, 2011; Viera & Garrett, 2005). In addition, F-test of equality of means and variances was performed, with nonsignificant *p*-values implying concordance (agreement) between the two measures.

Based on results obtained in the preceding analysis, additional exploration of the data was performed to identify any impact that data categorization may have had on measurement agreement. Comparison of items in each survey tool that measure identical or quasi-identical safety culture components was performed to evaluate the inter-reliability of the two responses. This agreement and reliability between PSC and ESC responses were evaluated through kappa, alpha and Lin's concordance correlation coefficient to determine whether a PSC component with a defined quasi-identical ESC component showed an elevated level of agreement between each other.

TABLE 1
PATIENT CONTACT STATUS & HOURS WORKED PER WEEK

		S1	S2	Aggregate
Direct patient contact?	Yes	327 (72.5%)	240 (82.5%)	451 (60.1%)
	No	124 (27.5%)	51 (17.5%)	291 (39.2%)
Hours worked per week	< 20	21 (4.6%)	6 (2.1%)	27 (3.6%)
	20-39	116 (25.4%)	30 (10.3%)	146 (19.5%)
	40-59	286 (62.6%)	215 (74.1%)	501 (67.1%)
	60-79	21 (4.6%)	25 (8.6%)	46 (6.2%)
	80-99	13 (2.8%)	14 (4.8%)	27 (3.6%)

TABLE 2
RESPONDENT GENDER, AGE & SUPERVISOR STATUS

		S1	S2	Aggregate
Gender	Male	129 (28.5%)	67 (23.2%)	196 (26.5%)
	Female	323 (71.5%)	222 (76.8%)	545 (73.5%)
Age	18-24	24 (5.3%)	6 (2.1%)	30 (4.0%)
	25-34	91 (20.0%)	66 (22.9%)	157 (21.1%)
	35-44	108 (23.7%)	62 (21.5%)	170 (22.9%)
	45-54	115 (25.2%)	84 (29.2%)	199 (26.8%)
	55-64	102 (22.4%)	59 (20.5%)	161 (21.6%)
	65-74	14 (3.1%)	11 (3.8%)	25 (3.4%)
	> 75	2 (0.4%)	0 (0.0%)	2 (0.3%)
Supervisor?	Yes	97 (21.4%)	76 (26.2%)	173 (23.3%)
	No	357 (78.6%)	214 (73.8%)	571 (76.8%)

FIGURE 1
PSC VS. ESC AVERAGE SCORES

PSC average versus ESC average scores show positive correlation.

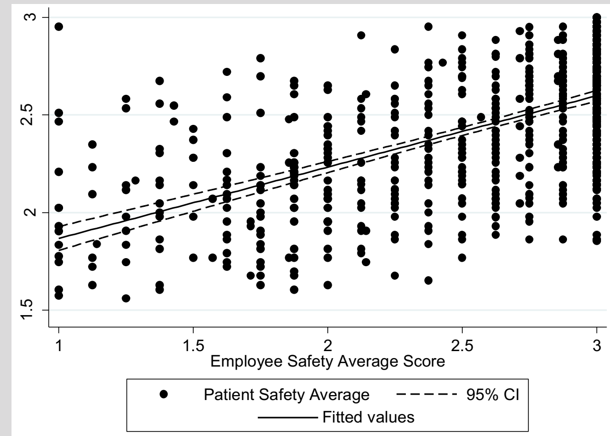
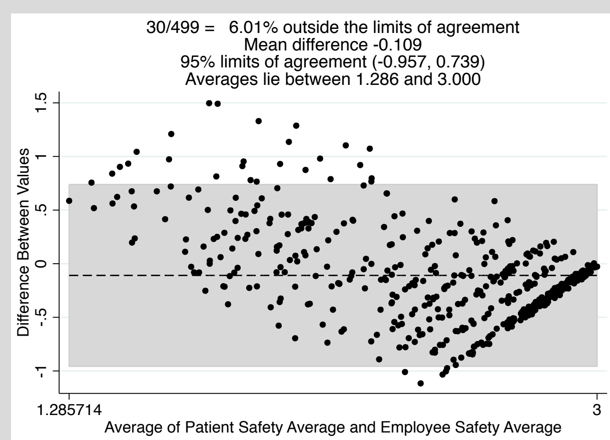


FIGURE 2
AVERAGE PSC VS. ESC SCORE

Bland-Altman plot comparing average PSC score against average ESC score.



Results

The survey was distributed to a total of 9,025 employees at both study sites, with a total of 1,285 responses received (791 collected from S1; 494 from S2). This yielded an overall response rate of 14.2% from both sites (16.4% at S1; 11.8% at S2). AHRQ exclusion criteria were then applied, leaving 750 total responses for analysis (S1 = 459 responses in analysis; S2 = 291 responses in analysis). The number of responses for S2 after application of the AHRQ exclusion criteria (291) was below the calculated minimum required sample size of 350, so agreement analysis was performed with only aggregated data (S1 + S2) as well as S1 data.

Respondents for the survey were predominantly full-time employees that have direct patient contact. Table 1 provides a summary of respondent patient contact role and the number of hours worked each week. Within each organization, respondents provided the staff position/job title that most closely describes their role within the organization. As expected in an inpatient healthcare setting, the largest group represented was registered nurses, making up 36% of all responses (33.9% at S1; 39.2% at S2). Attending technicians (e.g., X-ray, lab), attending/staff physicians and administrators made up the next largest groups of identified job titles. Not surprisingly, a not-insignificant amount of 20% of respondents selected "other" to describe their job title (23.5% at S1; 14.6% at S2).

A summary of respondent gender, age and supervisor status demographics are shown in Table 2. For S2, no statistically significant difference existed between the respondent distributions via chi-square test ($p > 0.05$) as compared to publicly available information on the organization. For S1, no such information was publicly available and thus this comparison could not be performed. For the most part, chi-square evaluation of responses against potential confounding variables showed the variables to be independent of the responses received on the survey. With the exceptions of hours worked per week and staff position, no significant differences existed between demographic and respondent characteristics between the two sites. S1 had a significantly higher percentage of employees working part-time (less than 40 hours per week) compared to S2. For S1, no residents submitted responses to the survey, compared to 23 resident responses at S2. The lack of response among residents at S1 occurred because resident physician e-mail addresses are not issued by the hospital organization but are instead issued through the affiliated university and, therefore, were not included in the survey distribution.

Figure 1 illustrates one of the typical scatterplots observed, in this case comparing the average PSC score against the average ESC score. All scatterplots revealed similar characteristics, with positively sloped fit lines (slopes ≤ 0.514) and data points broadly distributed to both sides of the line and outside of the 95% confidence interval region. Figure 2 presents the Bland-Altman plot of average PSC score against the average ESC score. Other Bland-Altman plots demonstrated similar characteristics across all comparisons.

Table 3 (p. 44) summarizes the calculated agreement statistic values for each agreement comparison. Aggregated data from the two study sites generated $\rho_c < 0.90$. For the Bradley-Blackwood F-test of equality of means and variances, nonsignificant *p*-values were identified for the concordance between employee safety scores and 1) feedback and communication about error ($p = 0.108$); and 2) communication openness ($p = 0.144$). All other comparisons between employee safety ratings and patient safety categories, as well as overall patient safety rating, resulted in $p < 0.05$. Interrater agreement between PSC and ESC measurements resulted in poor agreement based on aggregated data (highest kappa based on aggregated data = 0.278). Internal consistency, as measured by Cronbach's alpha, had the highest value of 0.657. The results were similar when S1 was examined separately.

Results were consistent for all comparisons even when the scale or defined cut-points were changed. Dichotomizing scores into high versus neutral/low or high/neutral versus low did not alter the findings. Concordance coefficient values (ρ_c) showed very poor concordance in the high versus neutral/low comparison, and the ρ_c values that were calculated in this comparison were smaller than that seen in other analyses ($\rho_c < 0.3$). Although the ρ_c values in high/neutral versus low dichotomy comparison were slightly higher, they still indicate poor concordance ($\rho_c < 0.9$).

Discussion

Against the expectation that PSC and ESC would show a high level of agreement between the two constructs, the agreement between the two as measured by these survey tools is poor. This lack of agreement suggests that the organizational characteristics measured by these tools are different constructs. Separate measurement of both PSC and ESC should continue based on these results. The interpretation and application of results from a PSC survey administered by a healthcare organization would be of limited value to a safety professional interested in improving ESC and employee safety outcomes.

Graphical analysis of the data provided some interesting insight into the collected data. The positive slope of the fit lines indicates that a positive correlation appears to exist between PSC component measures and average ESC scores, but with a considerable amount of scatter around the line. This indicates that if an agreement exists between the two variables, it is weak as reflected by the small slope of the fit line. Higher PSC score comparisons are positively, but weakly, associated with an increase in ESC average scores. The Bland-Altman plots yielded wide limits of agreement, with the plots indicating disagreement increasing slightly as the scores increase. This trend was observed across all the comparisons and indicated that responses tended to disagree the most among respondents' rankings of positive safety culture component scores.

Nearly all comparisons (kappa, alpha, Lin, F-test) involving aggregated data showed poor interrater agreement between the two measures. The only two comparisons using aggregated data that showed higher levels of agreement were both related to communication (feedback and communication about error and communication openness), however, the subsequent low ρ_c indicates any such agreement is poor (Iannaccone & Hynan, 2003). This lack of agreement was verified by visual observation of the relationship between these two variables. Despite weak concordance, this analysis may provide evidence that organizational communication related to patient safety and employee safety share similar characteristics and mechanisms within an organization. At least one study has demonstrated how effective communication can improve employee safety performance within an organization (Vecchio-Sadus, 2007).

Potential Causes of Disagreement Between PSC & ESC

Observed disagreement may be due to differences in the way that individuals interpreted and scored responses to the questions (e.g., thinking of PSC when the question asked about ESC). Review of the free-text comments submitted with the survey showed that when asked about employee safety, some respondents provided answers related to patient safety. This misinterpretation of the focus of certain questions by some respondents may have impacted this disagreement, especially

TABLE 3

AGREEMENT STATISTICS COMPARING PSC RATINGS AGAINST ESC AVERAGE RATING (AGGREGATED DATA)

Scored item	Lin's ρ_c	*p*-value (Bradley-Blackwood F)	Kappa (κ)	Chronbach's alpha (α)
PSC overall score	0.487	< 0.001	0.278	0.657
Teamwork within units	0.199	< 0.001	0.121	0.338
Supervisor expectations	0.294	< 0.001	0.136	0.454
Organizational learning	0.307	< 0.001	0.193	0.473
Management support	0.459	< 0.05	0.178	0.624
Overall perceptions	0.327	< 0.001	0.129	0.510
Feedback and communication	0.398	0.108	0.223	0.554
Communication openness	0.307	0.144	0.155	0.464
Frequency of events reported	0.330	< 0.001	0.186	0.500
Teamwork across units	0.328	< 0.001	0.134	0.523
Staffing	0.248	< 0.001	0.107	0.460
Handoffs and transitions	0.251	< 0.001	0.094	0.487
Nonpunitive response	0.193	< 0.001	0.096	0.389

at the higher scale of the score. Although the raw scores for PSC and ESC are similar, this misinterpretation might also have resulted in the notable differences in variability of the responses between PSC and ESC measures, with the standard deviation calculated for ESC measures being nearly double that of PSC measures.

The study hypothesis is presupposed on the assumption that the actual operationalization within the organization of PSC and ESC (i.e., safety climate) are in fact at the same levels. Measures of disagreement in this study may be due to a true difference between the level of PSC and ESC at these two organizations, and the perceived differences are greatest at the high end of the scoring scale. The possibility that these organizations have PSC and ESC that are inherently different (i.e., strong PSC but poor ESC) from each other would explain this disagreement. If these organizations have differences between PSC and ESC measures, then it would be expected that there would be some disagreement between the two measures. At least one study does not support this possibility as a likely cause (Yassi & Hancock, 2005). Within the results of this project, calculation of PSC and ESC raw scores shows that the overall ratings for each domain are similar, supporting the conclusion that it is unlikely that an organization will have PSC and ESC with such stark dissimilarity.

> The weak relationship between patient safety culture and employee safety culture as measured through safety culture surveys should not imply that they should be treated in isolation. Instead, healthcare organizations can take steps to approach them as complementary parts to an overall culture of safety.

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Strengths & Limitations

To the authors' knowledge, this study was the first to concurrently measure both PSC and ESC in a sample of healthcare workers in an inpatient hospital setting. This concurrent measurement allowed for agreement estimation at the individual level. In addition, the large size of the hospitals participating in the study allowed for the collection of a larger sample, thus increasing the external validity of the study to other hospitals within and outside of Texas.

One limitation of this study is that response rates to the survey were below those rates reported by other organizations (Sorra, Famolaro, Dyer, et al., 2012). Response rates appeared to be impacted based on whether an internal organization employee distributed the survey or if the survey appeared to come from an outside entity. In addition, had the AHRQ exclusion criteria been applied prior to survey distribution (i.e., target only those members of the population that would qualify for analysis), the overall response rate would likely have been higher. Despite this limitation, it is difficult to envision how biased sampling of the total workforce would result in overrepresentation of respondents for whom there is no agreement between PSC and ESC. Future studies could administer the ESC survey tool independently to maximize response rate and instead use institutionally collected PSC survey data. Consideration should also be given to supplementing survey data with outcome measures of ESC and PSC (e.g., employee injury data, patient incident report volume) as well as comparing healthcare worker ESC to nonhealthcare worker ESC scores.

Self-selection bias was a potential issue, in that individuals who decided to participate in the study may differ in some way from those who decided not to participate. However, respondent demographic distributions at S2 were not significantly different from the expected distribution in the total population, lending support that respondents shared some similarity with the population of interest. It is not known whether these results are generalizable to employees working in private or specialty hospitals, or in hospitals outside of Texas, as they were not included in the sample. Recent studies using the AHRQ survey tool have evaluated the effect of hospital characteristics and show a conflicting effect on PSC measures (Al-Ahmadi, 2009; Raeissi & Shakibaei, 2015). As a result, differences in agreement may exist between PSC and ESC measures in other types of hospitals or other geographic regions.

Conclusion

This study is the first to concurrently measure both PSC and ESC using a single, combined survey tool. The AHRQ Hospital Survey on Patient Safety and the OPM are two valuable tools that can be used to measure the level of PSC and ESC in a healthcare organization, but the agreement between the two measures, as evaluated through both statistical and visual analysis, is weak. Questions related to communication provided results that imply a higher, although still poor, amount of agreement between those patient safety categories and overall employee safety rating. However, this finding may provide evidence that communication related to patient safety and employee safety share similar characteristics or organizational mechanisms that may warrant further investigation.

The weak relationship between PSC and ESC as measured through safety culture surveys should not, however, imply that PSC and ESC should be treated in isolation. Instead, healthcare organizations can take steps to approach PSC and ESC as complementary parts to an overall culture of safety. In taking this approach, patient safety and employee safety practitioners can assess and tackle safety issues from a cooperative perspective that considers both patient safety needs and employee safety needs. In trying to foster the overall culture of safety, organizational leaders might consider the creation of joint task forces or committees that evaluate safety culture issues holistically. In addition, communication strategies used should emphasize the effect that poor patient safety practices might have on employee safety, and vice versa, to ensure that workers do not perceive one area of safety as having priority over the other. One study site (S2) is currently undertaking this approach through the creation of an organizational culture of safety committee tasked with fostering the creation of a shared safety culture that meets both patient safety and employee safety needs.

The results indicate that although correlation exists, the agreement between the two survey tools is weak. Thus, the use of the PSC to draw assumptions about ESC, or vice versa, would not be appropriate at the individual level. Additional studies would also be necessary to determine whether the reported disagreement between PSC and ESC is based on perceptions or on facts (safety outcomes). With the actions being taken by S2 focused on improving the overall culture of safety in the organization, additional post-intervention analysis is planned not only to determine the effectiveness of these actions in improving PSC and ESC measures, but also to evaluate their potential to increase agreement between these measures. However, without further studies, safety professionals focused on improving employee safety culture should continue to administer a separate ESC survey tool designed to measure this construct specifically to gain information they can use to direct their efforts. **PSJ**

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