Article

The Emergency Medical Services Safety Attitudes Questionnaire

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Abstract

To characterize safety culture in emergency medical services (EMS), the authors modified a validated safety culture instrument, the Safety Attitudes Questionnaire (SAQ). The pilot instrument was administered to 3 EMS agencies in a large metropolitan area. The authors characterized safety culture across 6 domains: safety climate, teamwork climate, perceptions of management, job satisfaction, working conditions, and stress recognition. The feasibility of characterizing safety culture in EMS was evaluated by examining response rate, item missingness, EMS chief administrators' perceptions of the EMS-SAQ, as well as psychometric properties. The results confirm feasibility with a high response rate, acceptable internal consistency, and model fit validity. However, some agencies voiced concerns about respondent burden and the wording and face validity of several EMS-SAQ items. Variation in safety culture scores across EMS agencies within a single geographic area, as well as variation across respondent characteristics, warrants further investigation.

Keywords

prehospital, EMS, safety

Safety culture refers to the collective beliefs and perceptions of workers regarding the organization and safety of their workplace operations. Research in nuclear power, manufacturing, and other high-reliability industries has linked accidents, safety audit scores, and safety behavior to safety culture.[1-3] Recent research has examined safety culture in hospital inpatient settings, intensive care units (ICUs), nursing wards, ambulatory care, and in skilled nursing facilities.[4-7]

Few studies have evaluated workplace safety culture in emergency medical services (EMS). EMS refers to the out-of-hospital medical care provided by emergency medical technicians (EMTs), paramedics, and other similar personnel. EMS personnel provide out-of-hospital care in high-stress, time-sensitive, and error-prone environments. Examples of threats to EMS patient safety include stretchers being dropped, misplaced endotracheal tubes, misdiagnosis of patient signs and symptoms, and deviations from standard treatment protocols.[8-11] Poor perceptions of the occupation relative to other allied health occupations, unfavorable opinions of administration, and poor perceptions of certain patient populations are common among EMS personnel and represent possible additional threats to safety culture in this setting.[12,13]

One of many safety culture instruments,[14] the Safety Attitudes Questionnaire (SAQ) has been widely used in the hospital, operating room, ICU, and ambulatory care environments to characterize workplace safety culture.[4-7] The SAQ was derived from the Flight Management Attitude Questionnaire (FMAQ), a human factors survey widely used to measure commercial aviation cockpit culture.[15,16] The SAQ is distinct from other medical attitudinal surveys in that it maintains continuity with the FMAQ, which has been used for more than 20 years.[15]

In this study, our objectives were to evaluate the feasibility of adapting the SAQ to the EMS setting, examine the psychometric properties (ie, reliability and validity) of the instrument, and evaluate score variation across different EMS agencies in a metropolitan area.

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Methods

Study Design

We performed a cross-sectional survey of 3 EMS agencies in the Pittsburgh, Pennsylvania, area. This study was approved by the University of Pittsburgh Institutional Review Board.

Study Setting and Population

We administered the survey instrument to 3 advanced life support EMS agencies located in the Pittsburgh, Pennsylvania, metropolitan area. Annually, these agencies averaged 4971 emergency dispatches and 3759 patient contacts and served a combined service area of 56.1 square miles. All paramedics and EMTs working at least 1 shift per week were eligible and therefore were asked to complete the survey. We excluded agency directors, medical directors, and other administrative personnel.

Study Protocol

Research personnel disseminated a paper-based anonymous survey instrument to eligible participants during in-service training or other agency staff meetings. Respondents returned all completed surveys directly to research personnel. Chief EMS administrators were not present during survey dissemination. Collection and completion of the survey was voluntary.

Instrument

We developed an Emergency Medical Service Safety Attitudes Questionnaire (EMS-SAQ) by modifying Sexton et al's SAQ.[4] We used the ICU-SAQ version as the basis for the EMS-SAQ because comparative psychometric data come from the ICU-SAQ, and it is the most widely used of all SAQ instruments.[4] We modified the wording of questions to preserve relevance to EMS; for example, we changed "In the ICU, it is difficult to discuss mistakes" to "At this EMS agency, it is difficult to discuss mistakes." We preserved the core 30 questions used to calculate core domain scores. We replaced selected additional questions with questions directly relevant to EMS. All responses were recorded using a 5-point Likert-type scale (*Strongly Agree* to *Strongly Disagree*). We incorporated a limited number of demographic questions and printed the survey on Scantron bubble sheets. (The instrument is available from the corresponding author upon request.)

As prescribed by Sexton et al, we converted responses to a 100-point measurement as follows: *Disagree strongly* = 0, *Disagree slightly* = 25, *Neutral* = 50, *Agree slightly* = 75, *Agree strongly* = 100.[4] We reversed the valence of the 2 negatively worded items. For respondent surveys with ≤4 missed or skipped items, we used item mean substitution to impute the item mean for the respondent's agency—one of many accepted techniques for completing missing data in survey research.[17]

The EMS-SAQ combines responses to the 30 core domains to elicit ratings for 6 safety culture domains: (*a*) safety climate, (*b*) job satisfaction, (*c*) perceptions of management, (*d*) teamwork climate, (*e*) working conditions, and (*f*) stress recognition. We analyzed EMS-SAQ scores in 2 ways. We calculated the mean domain score by totaling domain item scores and dividing by the total number of domain items. We also calculated the percentage of positive responses by identifying the proportion of respondents with an average score of ≥75 for each domain.

Feasibility

We evaluated respondent burden by examining EMS-SAQ response rate and item missingness. We solicited candid comments from EMS chief administrators on the utility of survey results, the survey itself, and the survey process.

Reliability and Validity

We confirmed internal consistency using Cronbach's α. We used confirmatory factor analysis (CFA) to validate the 6 domain structures of core SAQ items modified for this study. We used 3 validity (model fit) measures: the chi-square/degrees of freedom ratio (CSDFr), Bentler's comparative fit index (CFI), and the Bentler and Bonett nonnormed index (NNFI). We defined CSDFr less than 2.0 and CFI and NNFI >0.9 cut points for good model fit.[18] Poor model fit (validity) measurements would indicate poor transferability of the SAQ to the EMS setting.

Variation in EMS-SAQ scores

We compared domain scores across EMS agencies and respondent characteristics using analysis of variance and *t* tests. We used Fisher's exact tests to identify differences in the proportion of respondents across EMS agencies and respondent characteristics with a percentage positive score ≥75 in each of the 6 EMS-SAQ domains. We controlled for the within-cluster correlation among EMS agency respondents and carried out all statistical procedures using SAS version 9.2 (SAS Institute, Inc, Cary, NC). Statistical significance was based on *P* values < .05.

Results

Study Sample

Across the 3 EMS agencies, the most common age stratum was 18 to 30 years of age (32.8%); 71.8% of respondents

Table 1. Differences in EMS-SAQ Domain Scores Across EMS Agencies and Respondent Characteristics

		Safety Climate, Mean (SD)	Teamwork Climate, Mean (SD)	Perceptions of Management, Mean (SD)	Job Satisfaction, Mean (SD)	Working Conditions, Mean (SD)	Stress Recognition, Mean (SD)
Respondent age category							
18-30	33.8% (n = 24)	70.7 (18.8)	67.2 (17.6)	65.2 (21.2)	70.2 (24.4)	68.5 (17.6)[a]	51.6 (24.2)[a]
31-40	25.4% (n = 18)	65.5 (22.9)	63.9 (21.6)	67.7 (19.2)	67.5 (28.4)	57.9 (21.7)[a]	68.5 (19.1)[a]
41-50	26.8% (n = 19)	73.6 (17.0)	68.0 (19.8)	70.4 (19.9)	76.1 (17.8)	64.8 (19.3)[a]	65.8 (14.8)[a]
≥51	14.1% (n = 10)	80.9 (14.2)	78.9 (20.9)	82.2 (9.3)	91 (7.7)	81.8 (14.2)[a]	51.3 (19.9)[a]
Respondent sex							
Male	71.8% (n = 51)	70.8 (19.0)	66.9 (19.5)	69.0 (19.8)	71.3 (25.1)	66.1 (18.2)	61.2 (21.4)
Female	28.2% (n = 20)	73.4 (19.9)	71.5 (20.7)	71.4 (19.0)	81.0 (15.9)	68.4 (23.9)	55.7 (20.6)
Respondent job type							
Paramedic	49.3% (n = 35)	69.4 (18.8)	66.4 (20.1)	66.2 (20.9)	71.3 (23.6)	63.9 (19.2)	65.4 (19.6)[a]
EMT	50.7% (n = 36)	73.7 (19.5)	70.0 (19.6)	72.9 (17.6)	76.7 (22.8)	69.4 (20.3)	54.0 (21.5)[a]

Abbreviations: EMS-SAQ, emergency medical services Safety Attitudes Questionnaire; EMS, emergency medical services; EMT, emergency medical technician.
[a] $P < .05$, ANOVA.

were male (Table 1). There were equal proportions of EMTs and paramedics.

Feasibility

We received 77 of 91 surveys, corresponding to a response rate of 85%. We excluded 6 surveys that were missing age, sex, and job type, leaving 71 surveys for analysis, or 78% of total respondents. Approximately 27% of respondents missed or skipped 1 to 4 items. The most commonly missed or skipped items were "A confidential reporting system is helpful for improving patient safety" and "I am often fatigued when I am working." Each item was missed or skipped a total of 3 times.

Feedback regarding instrument utility was generally positive. The EMS-SAQ survey tool "opened our eyes," responded one EMS chief administrator. Some responses from EMS chief administrators, however, highlighted several aspects of the survey and process that may benefit from modification. For example, 2 EMS chief administrators felt that the survey instrument was too long and included some items that may have "nothing to do with safety issues." One chief administrator commented that many questions were similar and may benefit from rewording.

Reliability and Validity

Evaluation of the 6 domain structures using CFA revealed acceptable model fit and validity (CSDFr = 1.2; CFI = .95; and NNFI = .92). Comparable with previous adaptations of the SAQ,[6] internal consistency (reliability) was acceptable for 5 of the 6 scales: safety climate (α = .83), teamwork climate (α = .80), stress recognition (α = .71),

working conditions (α = .71), and job satisfaction (α = .88). Internal consistency for perceptions of management was .65.

Variation in EMS-SAQ scores

Mean scores for safety climate, teamwork climate, perceptions of management, job satisfaction, and stress recognition varied across EMS agency ($P < .05$; Figure 1A-F). Based on the definition of a positive perception as an average score of ≥75 for all items in a domain, the majority of respondents had positive perceptions of safety climate, job satisfaction, and perceptions of management (Figure 2A-F). Fewer than half of all respondents had positive perceptions of teamwork climate, working conditions, and stress recognition. The proportion of positive perceptions varied significantly ($P < .05$) across EMS agency sites for the following domains: safety climate, teamwork climate, perceptions of management, job satisfaction, and working conditions. A higher proportion of paramedics had positive perceptions of stress recognition than EMTs (Table 2, $P < .05$).

Discussion

In this study, we established the feasibility of characterizing safety culture in EMS. This is one of the first efforts to characterize EMS safety culture. A potential value of the EMS-SAQ is as a tool to evaluate the impact of safety improvement initiatives and individual programs. Evaluation of safety culture prior to and immediately following programs may provide an indirect measure of the success of such initiatives.[19]
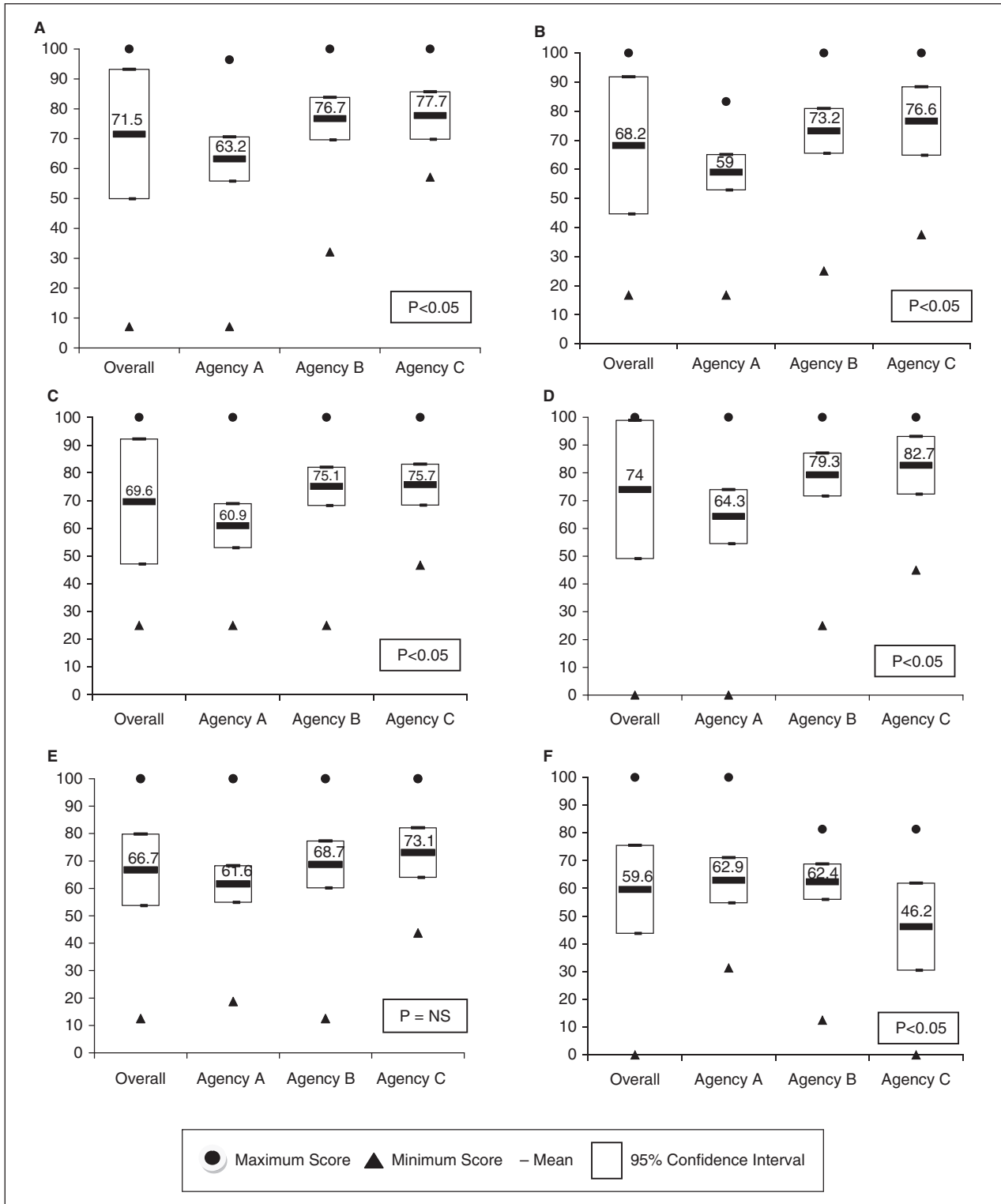
Figure 1. (A) Safety climate. (B) Teamwork climate. (C) Perceptions of management. (D) Job satisfaction. (E) Working conditions. (F) Stress recognition.

The most striking observation was the variation in domain scores across the 3 sites. Although these agencies are located in the same county and serve the same metropolitan area, they exhibited very different attitudes toward safety. This observation highlights the variation in EMS workplace culture, even within a defined geographic
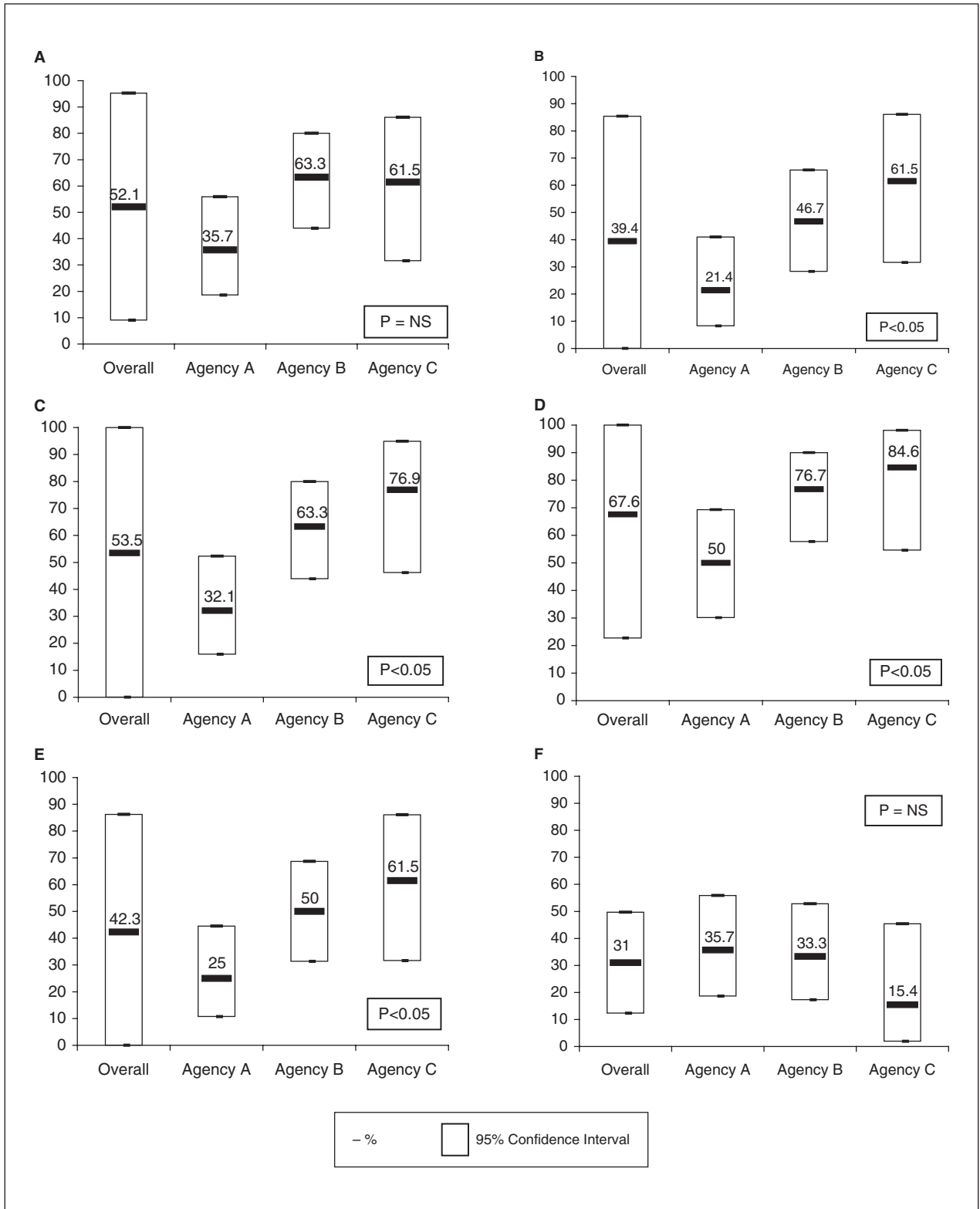
Figure 2. (A) Percent positive safety climate across agencies. (B) Percent positive teamwork climate across agencies. (C) Percent positive perceptions of management across agencies. (D) Percent positive job satisfaction across agencies. (E) Percent positive working conditions across agencies. (F) Percent positive stress recognition across agencies.

Table 2. Proportionate Differences in Positive Perceptions Across EMS-SAQ Domains and EMS Agencies and Respondent Characteristics[a]

	Safety Climate, % (Exact 95% CI)	Teamwork Climate, % (Exact 95% CI)	Perceptions of Management, % (Exact 95% CI)	Job Satisfaction, % (Exact 95% CI)	Working Conditions, % (Exact 95% CI)	Stress Recognition, % (Exact 95% CI)
Respondent age category						
18-30	37.5% (18.8-59.4)	29.2% (12.6-51.1)	45.8% (25.6-67.2)	54.2% (32.8-74.5)	54.2% (32.8-74.5)[b]	16.7% (4.7-37.4)
31-40	50.0% (26.0-73.9)	44.4% (21.5-69.2)	50.0% (26.0-73.9)	66.7% (41.0-86.7)	27.8% (9.7-53.5)[b]	38.9% (17.3-64.2)
41-50	57.9% (33.5-79.8)	36.8% (16.3-61.6)	47.4% (24.5-71.1)	68.4% (43.5-87.4)	21.1% (6.1-45.6)[b]	42.1% (20.3-66.5)
≥51	80.0% (44.4-97.5)	60.0% (26.2-87.8)	90.0% (55.6-99.8)	100% (69.2-100)	80.0% (44.4-97.5)[b]	30.0% (6.7-62.3)
Respondent sex						
Male	49.0% (34.8-63.4)	37.3% (24.1-51.9)	49.0% (34.8-63.4)	66.7% (52.1-79.2)	39.2% (25.8-53.9)	33.3% (20.8-47.9)
Female	60.0% (36.1-81.0)	45.0% (23.1-68.5)	65.0% (40.8-84.6)	70.0% (45.7-88.1)	50.0% (27.2-72.8)	25.0% (8.7-49.1)
Respondent job type						
Paramedic	48.6% (31.4-66.0)	37.1% (21.5-55.1)	42.9% (26.3-61.0)	60.0% (42.1-76.1)	31.4% (16.9-49.3)	45.7% (28.8-63.4)[b]
EMT	55.6% (38.1-72.1)	41.7% (25.5-59.2)	63.9% (46.2-79.2)	75.0% (57.8-87.9)	52.8% (35.5-69.6)	16.7% (6.4-32.8)[b]

Abbreviations: EMS-SAQ, emergency medical services Safety Attitudes Questionnaire; EMS, emergency medical services; CI, confidence interval; EMT, emergency medical technician.
[a]We used Fisher's exact test to test for differences in group proportions and calculated exact 95% confidence intervals.
[b]$P < .05$.

area. Prior studies of hospital settings have identified variations in SAQ scores across wards, departments, or organizations.[4,5] Studies with multiple EMS agencies across metropolitan and nonmetropolitan areas are needed to better understand the magnitude and extent of culture variation and the salient system-level associations.

Given these observations regarding workplace culture, an important unanswered question is how to facilitate change.[20] Corrective efforts might focus on specific domains.[5] For example, our observations suggest focused attention to teamwork climate, working conditions, and stress recognition. Examples of potential actions in an EMS agency may include teambuilding and stress recognition/reduction exercises. With respect to working conditions, agency leaders may need to take time to explore in great detail the sources of low scores in this domain.[21] EMS agencies could consider a range of organization-level initiatives to improve safety. Several common examples include a blameless error-reporting system, a patient safety work plan or safety learning report program, and medication safety feedback forms.[22] Another possibility is that the substandard score in 1 or more domains reflects shortcomings in the culture as a whole. In this situation, corrective action might encompass a range of operational areas.

We confirmed the psychometric properties of the pilot EMS-SAQ. However, we also observed minor response variations, signaling the need for additional instrument refinement. For example, one quarter of all respondents missed or skipped EMS-SAQ items. EMS chief administrators suggested that the instrument was too long and that some items were repetitive. With early identification of these and

other issues, future versions and studies may see improved survey completion and response rates. Qualitative approaches, such as in-depth interviews or focus groups, would facilitate swift and cost-efficient modification of EMS-SAQ items, as opposed to additional rounds of surveying.

Despite possible structural and item wording challenges, the overall response rate for this first administration of the EMS-SAQ was high. Typical response rates for EMS workers and other allied health professionals range from a low of 32% to a high of 78%.[23] Administration of the EMS-SAQ in person, the strategy most preferred by Sexton and colleagues, most likely contributed to the high response rate. Despite the potential lower response rate associated with mail and Web-based approaches, the resource burden associated with in-person survey administration and collection is often too great for large multisite studies. Future studies of national or international magnitude will most likely require a combination of these and other survey strategies.

Limitations

The generalizability of our results is limited by the 3 EMS agency sample from the Pittsburgh, Pennsylvania, area. A study with a broader range of EMS agencies could provide important additional perspectives. Our findings are further limited to EMS personnel who spend at least 1 shift per week at the EMS agency. Safety culture among members of the volunteer workforce and the occasional employee are not well represented by this study design. Our study did not include steps to document the multiple structural

characteristics of participating agencies or respondent-level factors that may explain EMS-SAQ score variations. Our study was designed to examine the feasibility of measuring and characterizing safety culture in the EMS setting. Our study was not designed to examine factors responsible for variations in agencies and respondents.

Conclusions

Patient safety in the EMS setting has received little study and thus is poorly understood. We successfully adapted a popular safety culture instrument for use in the EMS setting as part of research or quality improvement initiatives. Variation in safety culture scores across EMS agencies within a single geographic area, as well as variation across respondent characteristics, warrants further investigation.

Authors' Note

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Declaration of Conflicting Interests

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