Psychological Safety in Intensive Care Unit Rounding Teams

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Abstract

Rationale: Psychological safety is the condition by which members of an organization feel safe to voice concerns and take risks. Although psychological safety is an important determinant of team performance, little is known about its role in the intensive care unit (ICU).

Objectives: To identify the factors associated with psychological safety and the potential influence of psychological safety on team performance in critical care.

Methods: We performed daily surveys of healthcare providers in 12 ICUs within an integrated health system over a 2-week period. Survey domains included psychological safety, leader familiarity, leader inclusiveness, role clarity, job strain, and teamwork. These data were linked to daily performance on lung-protective ventilation and spontaneous breathing trials. We used regression models to examine the antecedents of psychological safety as well as the influence of psychological safety on both perceived teamwork and actual performance.

Results: We received 553 responses from 270 unique providers. At the individual provider level, higher leader inclusiveness (adjusted $\beta = 0.32$; 95% confidence interval [CI], 0.24 to 0.41) and lower job strain (adjusted $\beta = -0.07$, 95% CI, −0.13 to −0.02) were independently associated with greater psychological safety. Higher psychological safety was independently associated with greater perception of teamwork (adjusted $\beta = 0.30$; 95% CI, 0.25 to 0.36). There was no association between team psychological safety and performance on either spontaneous breathing trials (incident rate ratio for each 1-unit change in team psychological safety, 0.85; 95% CI, 0.81 to 1.10) or lung-protective ventilation (incident rate ratio, 0.77; 95% CI, 0.57 to 1.04).

Conclusions: Psychological safety is associated with several modifiable factors in the ICU but is not associated with actual use of evidence-based practices.

Keywords: intensive care units; patient care team; psychological safety; organizational culture; organizational behavior

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Clinical practice guidelines recommend that intensive care units (ICUs) are staffed by an interprofessional care team comprising intensivist physicians, nurses, respiratory therapists, pharmacists, and other specialized team members (1). These recommendations are based on robust data showing that intensivist-led, interprofessional care is associated with lower mortality among patients admitted to the ICU (2–4). Yet, in contrast to the large body of work demonstrating the value of interprofessional care teams in critical care, relatively little work has focused on how to make these teams function better. Past research in this area has generally focused on the notion of ICU culture, defined as the shared values and beliefs of the ICU staff (5). However, most studies of ICU culture have demonstrated no association between culture and ICU quality (6–9). ICU culture is also a vague concept, without clearly actionable targets for improvement (10). As a result, interventions designed to improve ICU culture have been largely unsuccessful (11), and ICU managers lack specific strategies for improving teamwork in critical care.

Recently, the notion of psychological safety has arisen as a distinct component of organizational culture and a potentially important determinant of healthcare-team performance (12). Psychological safety is defined as the condition by which team members feel safe to take risks, explore new ideas, and challenge the status quo (13, 14). In the ICU, psychological safety could manifest as team members with a low position on the hierarchy challenging treatment plans or speaking up about failures to deliver evidence-based care (15). Early work on psychological safety in health care suggests that it is associated with greater engagement in quality improvement (16). However, the specific factors that influence psychological safety in critical care and its impact on ICU team performance remain poorly understood (17).

To address this knowledge gap, we performed daily surveys of interprofessional care teams in 12 ICUs within an integrated healthcare system. Our overall goal was to understand the antecedents and consequences of psychological safety among ICU team members. Specifically, we sought to determine *1*) which psychosocial factors are associated with perceptions of psychological safety, *2*) whether perceptions of psychological safety are associated with team members' perceptions of teamwork, and *3*) whether "team psychological safety"—the combined psychological safety perceptions of the daily care team—is associated with actual ICU performance as measured by the use of evidence-based practices for that day's patients.

Methods

Study Design and Setting

We performed a multicenter survey of ICU providers in the UPMC Health System, an integrated hospital network in Pennsylvania. Because our interest was in interprofessional rounding teams, we limited the study to ICUs that had daily interprofessional rounds. To increase generalizability, we further limited the study to ICUs with a general medical, general surgical, or mixed medical–surgical patient population. The final sample included 12 ICUs across six hospitals. Each ICU participated for a 2-week period during the summer of 2017. During the study period, we surveyed members of the ICU rounding team on each weekday, such that each ICU was surveyed for 10 consecutive weekdays. We performed repeated daily surveys rather than performing a single survey because we were interested in team members' daily experiences, which could change day to day as the team composition changed, rather than in their experiences in the ICU overall.

Survey Development

We developed the survey on the basis of a conceptual model of organizational learning and team effectiveness derived from the organizational-behavior literature (Figure 1) (17). The survey, which was part of a larger study of organizational behavior in critical care, examined a range of individual and team-based psychosocial domains. For this study we focused on six domains: psychological safety, leader familiarity, leader inclusiveness, role clarity, job strain, and teamwork (Table 1). Survey items were obtained from previously developed instruments and were customized for the ICU environment (13, 16, 18–21). The survey instrument was piloted among 22 practicing ICU clinicians who worked in an ICU that did not participate in the main study, with revisions made on the basis of their feedback. The final survey items are provided in the online supplement.

Survey Administration

We fielded the survey over 10 consecutive weekdays in each participating ICU (i.e., Monday through Friday in Week 1 and Monday through Friday in Week 2). The first survey was administered on June 5, 2017, and the last survey was administered on September 22, 2017. We surveyed five types of team members: physician trainees, registered nurses, respiratory therapists, clinical pharmacists, and advanced-practice providers (i.e., nurse practitioners and physician assistants). Although other members of the interprofessional rounding team are also important, we focused on these team members because they make up the team's core members and because their efforts were believed to most strongly influence clinical outcomes for critically ill patients. Although we also surveyed attending physicians, for this analysis, we did not include their responses because, as the *de facto* team leaders, their actions, beliefs, and experiences are potentially distinct from those of the other team members, and, as such, their survey responses might not be reflective of the psychosocial dynamics within the team.

After obtaining permission from each ICU's leadership, study investigators arrived in the ICU on each study morning just before rounds and requested participation among members of the rounding team. Interested team members gave the study team a preferred e-mail address. At 3 P.M. that day, an e-mail was sent to eligible team members with a link to the electronic survey. Up to three follow-up emails were sent later in the evening. The survey was timed to be available only until 7 A.M. the next day, to ensure that the responses reflected the correct day's activity. Respondents could fill out one survey for each day they worked in the ICU during the study period—up to 10 if they worked every day during the study period. Respondents were offered a $5 incentive payment for each survey they completed.

Linkage to Performance Data

In addition to the survey data, we obtained patient-level data on receipt of evidence-based practices from an ongoing ICU registry maintained by the UPMC Health

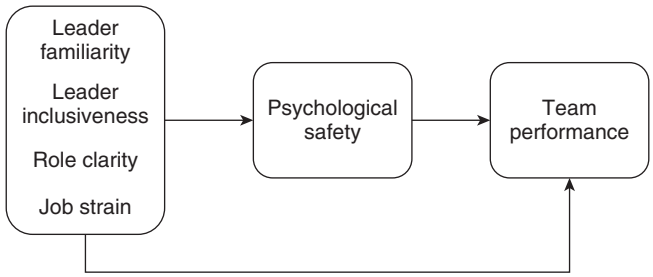

Figure 1. Conceptual model. The conceptual model holds that psychological safety is influenced by leader familiarity, leader inclusiveness, role clarity, and job strain; these factors also influence team performance, partially independently and partially through their effects on psychological safety.

Table 1. Survey domains

Domain	Definition	Items	Scale Range	References*
Psychological safety	Team members' beliefs that it was safe to contribute and discuss problems in the team on that day	4	1–5	13
Leader familiarity	How often team members had worked with that day's attending intensivist in the past	1	1–4	16
Leader inclusiveness	Team members' beliefs that the team leader invited and appreciated others' contributions on that day	4	1–5	16
Role clarity	Team members' knowledge of their individual roles and responsibilities that day	3	1–5	18, 19
Job strain	Team members' beliefs that the day's workload negatively affected their performance that day	3	1–5	20
Teamwork	Team members' beliefs that the team collaborated effectively that day	3	1–5	21

*References refer to the original sources for the survey items within each domain. Specific items for each domain from these references were customized to the intensive-care-unit environment by the investigative team. The exact survey items are given in the online supplement. Details about the psychometric properties of the items and information about the process of item reduction are given in Table E2.

System and derived from the health system's electronic health record (Cerner PowerChart; Cerner Corporation). This registry has been used in multiple ICU outcome studies and is described in detail elsewhere (22–24). We obtained data on two evidence-based practices for receiving invasive mechanical ventilation: spontaneous breathing trials (25) and use of lung-protective ventilation in acute respiratory distress syndrome (26). For each day of mechanical ventilation, patients were identified as either eligible or not, and, among those eligible, as having received the practice or not. Complete definitions of the criteria for eligibility and receipt are provided in the online supplement.

Statistical Analyses

We performed standard psychometric evaluations on the final survey responses, including tests of reliability and inter-item correlations (27). We excluded items with low response rates as well as items that, if included, would result in poor psychometric characteristics for the scale. After item reduction we averaged the remaining items for each domain by respondent and by day to create respondent day–level domain scores. We compared domain scores across provider types and across study days by fitting linear regression models in which the dependent variables were the individual survey domains and the independent variables were indicators for provider type and day, respectively. We used generalized estimating equations with an exchangeable correlation matrix to account for repeated measures within providers (28).

We then performed a series of analyses designed to understand the role of psychological safety among ICU care providers on the basis of our conceptual model. First, we examined the factors associated with psychological safety among individual care providers. For this analysis, we fit provider-level linear regression models in which the dependent variable was psychological safety and the independent variables were leader familiarity, leader inclusiveness, role clarity, and job strain. We fit five models: one with each construct individually (to determine individual relationships) and one with all constructs together (to determine the relationships controlling for the other variables).

Second, we examined the association between psychological safety and perceived teamwork. For this analysis, we fit provider-level linear regression models in which the dependent variable was teamwork and the independent variables were psychological safety, leader familiarity, leader inclusiveness, role clarity, and job strain. We fit six models, one with each construct individually (to determine the unadjusted relationships) and one with all constructs together (to determine the relationships controlling for the other variables).

For these two analyses we used generalized estimating equations with an exchangeable correlation matrix to account for repeated measures within providers (28). To assess the degree that different levels of clustering could affect our results, we also performed a *post hoc* sensitivity analysis in which we used a mixed-effects regression model to account for clustering within both teams and ICU.

Third, we examined the association between team psychological safety and actual use of evidence-based practices. Using a method consistent with that of prior work (29), we defined team psychological safety as the average psychological safety score for all respondents within an ICU on a given day (i.e., each ICU could have up to 10 teams, 1 for each study day). We graphically examined the relationship between team psychological safety and use of evidence-based practice by fitting scatterplots. We then fit team-level negative binomial regression models in which the dependent variable was the count of patients receiving the evidence-based practice of interest, the independent variable was team psychological safety, and the exposure variable was the number of eligible patients on that day, with robust standard errors used to account for clustering by ICU. We fit two models, one for spontaneous breathing trials and one for lung-protective ventilation. For each model, we excluded teams in which there were no eligible patients.

Statistical analyses were performed with Stata 16.0 (StataCorp). A P value of <0.05 was considered to indicate significance. All aspects of this study were reviewed and approved by the University of Pittsburgh Human Subjects Protections Office. Survey respondents gave informed consent. Patient data were obtained from a deidentified secondary data source and were considered human subjects exempt.

Results

Characteristics of study ICUs are shown in Table E1 in the online supplement. In total, we received 553 responses, resulting in a 39% response rate (*see* flow diagram in Figure E1). Responses were from 270 unique

providers; among them, 198 (73.3%) were nurses, 30 (11.1%) were respiratory therapists, 28 (10.4%) were physician trainees, 11 (4.1%) were clinical pharmacists, and 3 (1.1%) were advanced-practice providers. Of these providers, 134 (49.6%) took the survey once, 75 (27.8%) took it twice, 29 (10.7%) took it three times, and 32 (11.8%) took it four or more times.

The psychometric properties of the survey are shown in Table E2. All domains had acceptable internal consistency after four items with poor psychometric properties were excluded (two psychological-safety items, one role-clarity item, and one teamwork item). Specifically, after item exclusion, the values for Cronbach α were as follows: psychological safety, 0.69; leader inclusiveness, 0.93; role clarity, 0.66; job strain, 0.86; and teamwork, 0.88.

The distributions of the final constructs are shown in Figure 2. Perceptions were generally high for psychological safety (mean and standard deviation, 4.2 ± 0.6), leader inclusiveness (4.3 ± 0.6), role clarity (4.5 ± 0.6), and teamwork (4.3 ± 0.5). Perceptions were not as high for leader familiarity (2.6 ± 0.7) and job strain (2.6 ± 0.9). A correlation matrix showing the relationship among all items is shown in Table E3. With regard to differences between provider types, there were no statistically significant differences in perceptions of psychological safety, leader familiarity, role clarity, or teamwork, but there were statistically significant differences for leader inclusiveness ($P = 0.04$; with generally higher ratings from advanced-practice providers) and job strain ($P < 0.01$; with generally higher ratings from clinical pharmacists) (Table E4). With regard to of differences between study days, there were no significant differences for any of the domains (Table E5).

The factors associated with provider-level psychological safety are shown in Table 2. In both the unadjusted models and the adjusted model, leader inclusiveness was positively associated with psychological safety (i.e., greater leader inclusiveness was associated with greater psychological safety), whereas perceived job strain was negatively associated with psychological safety (i.e., greater perceived strain was associated with less psychological safety). The relationship between psychological safety and perceived teamwork is also shown in Table 2. In both the unadjusted and adjusted models, psychological safety and leader inclusiveness were positively associated with perceived teamwork, whereas job strain was negatively associated with perceived teamwork. Role clarity was associated with psychological safety and teamwork in the unadjusted analysis but not in the adjusted analysis. Leader familiarity was not associated with either psychological safety or teamwork.

In the *post hoc* sensitivity analysis in which we used a mixed-effects model to account for clustering at the level of the team and ICU, we found similar results for both the factors associated with psychological safety and the relationship between psychological safety and teamwork (Table E6).

The analyses examining team psychological safety and use of evidence-based practice was performed at the ICU-day level. Of the 120 possible teams (10 days at each of 12 hospitals), 112 had at least one survey respondent. Of these, 40 teams contained at least one respondent from respiratory therapy. For the analysis of lung-protective ventilation, 5 teams were excluded for having no eligible patients, leaving 107 teams. For the analysis of spontaneous breathing trials, 8 teams were excluded for having no eligible patients, leaving 104 teams in the analysis. Teams varied only moderately in psychological safety (median and interquartile range, 4.25, 4.03–4.50). Teams varied substantially in the

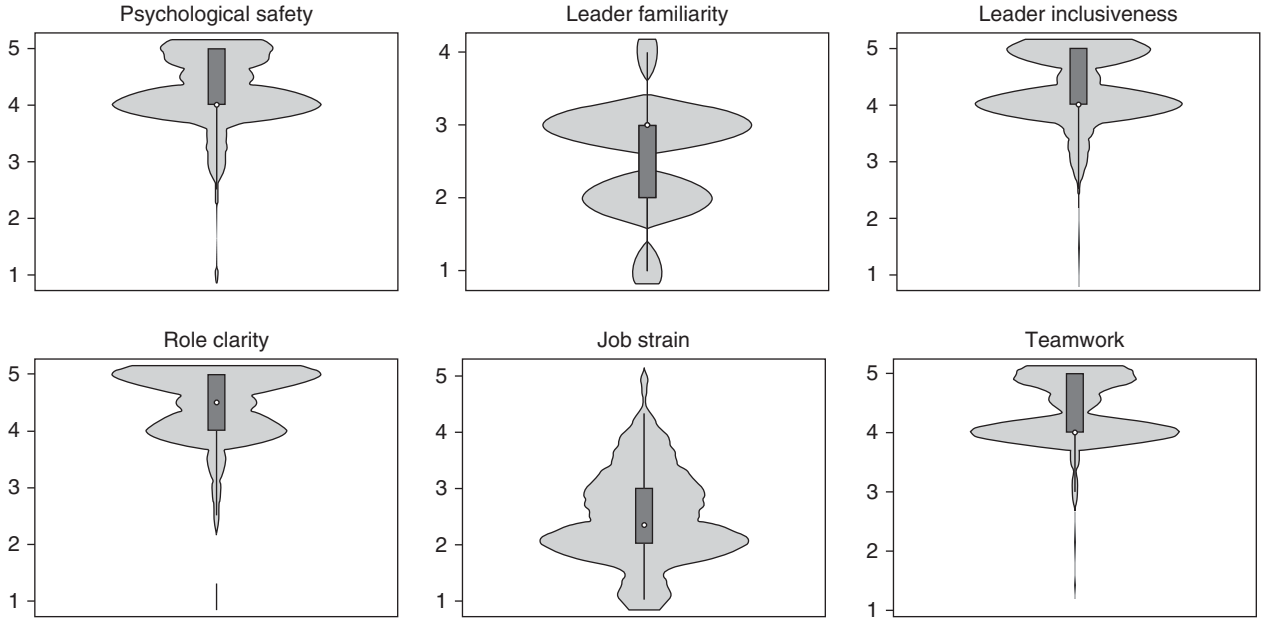

Figure 2. Distributions of key psychosocial constructs. The figure shows violin plots for each of the constructs of interest. Plot components include the median (white dot), interquartile range (dark gray box), 1.5 times the interquartile range (center line), outliers (dots on center axis), and a kernel density estimation (light-gray shaded area). For the kernel-density estimation, a wider area means a greater number of responses at the given value.

Table 2. Association among individual psychosocial constructs, psychological safety, and teamwork among intensive care providers

Dependent Variable	Independent Variables	Unadjusted Models [β (95% CI)]	Adjusted Models [β (95% CI)]
Psychological safety	Leader familiarity	0.03 (−0.05 to 0.11)	−0.01 (−0.09 to 0.07)
	Leader inclusiveness	**0.34 (0.26 to 0.42)**	**0.32 (0.24 to 0.41)**
	Role clarity	**0.12 (0.03 to 0.21)**	0.03 (−0.06 to 0.12)
	Job strain	**−0.09 (−0.14 to −0.03)**	**−0.07 (−0.13 to −0.02)**
Teamwork	Psychological safety	**0.37 (0.31 to 0.43)**	**0.30 (0.25 to 0.36)**
	Leader familiarity	−0.01 (−0.07 to 0.05)	−0.04 (−0.10 to 0.02)
	Leader inclusiveness	**0.32 (0.25 to 0.38)**	**0.20 (0.14 to 0.27)**
	Role clarity	**0.15 (0.08 to 0.22)**	0.07 (0.00 to 0.14)
	Job strain	**−0.11 (−0.15 to −0.07)**	**−0.06 (−0.10 to −0.02)**

Definition of abbreviation: CI = confidence interval.
Regression estimates are interpreted as the unit change in the dependent variable for every 1-unit change in the independent variable. Unadjusted models include only the listed independent variables. Adjusted models include all the listed independent variables—the regression estimates for these models are interpreted as the effect of each covariate controlling for the other covariates. Statistically significant results at the $P < 0.05$ threshold are in bold.

percentage of eligible patients receiving lung-protective ventilation (median and interquartile range, 55.6%, 28.6–85.6%). Teams also varied in the percentage of eligible patients receiving a spontaneous breathing trial, although the majority of teams had perfect performance (median and interquartile range, 100%, 66.7–100%). Scatterplots showing the association between psychological safety and evidence-based practice are shown in Figure 3. In the regression analyses, team psychological safety was not significantly associated with either receipt of lung-protective ventilation (incident rate ratio for each 1-unit change in team psychological safety, 0.77; 95% confidence interval [CI], 0.57–1.04; $P = 0.08$) or receipt of spontaneous breathing trials (incident rate ratio for reach 1-unit change in team psychological safety, 0.85; 95% CI, 0.81–1.10; $P = 0.47$).

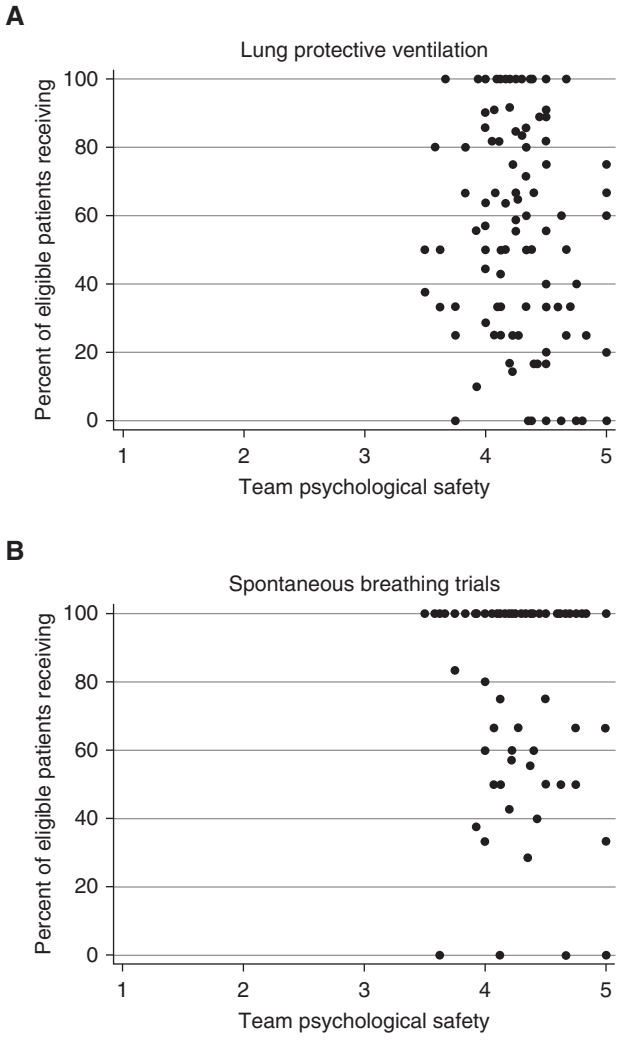

Figure 3. Scatterplots demonstrating the relationship between team psychological safety and use of (*A*) lung-protective ventilation and (*B*) spontaneous breathing trials. Each dot represents an individual day for an individual intensive care unit.

Discussion

In a multicenter study of ICU rounding teams, we found that team members' beliefs about psychological safety were positively associated with perceived leader inclusiveness and negatively associated with experiences of job strain. Team members' beliefs about of psychological safety were also positively associated with greater perceived teamwork in the ICU, although they were not associated with actual team performance as measured by use of two evidence-based practices for patients receiving mechanical ventilation. Role clarity was associated with both psychological safety and teamwork in unadjusted analyses, although not after

adjusting for the other factors, whereas leader familiarity was associated with neither psychological safety nor teamwork.

These results have important implications for efforts to improve the functioning of ICU teams. Primarily, by defining the key role of leader inclusiveness, we identify a strategy for improving psychological safety and teamwork by increasing inclusive behaviors of attending intensivists on rounds. Inclusive behaviors might include pausing during discussions to give space for others' contributions, actively soliciting input from other team members, explicitly justifying key decisions so team members understand their rationale, and vocally admitting when uncertainty exists to create a safe place for disagreement (30). In theory, these behaviors can be taught, learned, and reinforced through practice, potentially leading to improved team-member collaboration.

Our results also provide insight into the various ways in which job strain might impact the quality of critical care (31). Time pressure is known to impact individual decisional capacity (32). Time pressure also impacts team performance, potentially by reducing the time available for interaction (33). Through these mechanisms, job strain in the ICU might negatively impact teamwork both directly (e.g., by reducing time for effective collaboration) and indirectly (e.g., by reducing the time for behaviors that engender psychological safety). These mechanisms are supported by our results, which indicate that job strain is independently associated with worsened perceptions of teamwork, even after controlling for psychological safety.

Our results also provide reassurance that leader familiarity is not necessary for effective teamwork. ICU teams are typically *ad hoc*, in that team composition is not planned, and are of low temporal stability, in that team members frequently rotate on and off the team (17). In this context, leader familiarity is not easily modifiable. Our finding that low leader familiarity is not associated with either psychological safety or perceived teamwork supports the continued use of *ad hoc* teams in the ICU and strengthens the rationale for promoting effective ICU teams through other mechanisms.

Although we found evidence that psychological safety was strongly associated with perceived teamwork, we did not find evidence that it was associated with actual team performance, at least as measured by the use of evidence-based practices for mechanical ventilation. There are several potential explanations for this finding. Given that psychological safety was generally high, there might not have been sufficient variation to detect an association. It may also be that the two practices we chose were not as dependent on team performance as we hypothesized. Instead, they may be more dependent on individual performance, such as the individual performance of a respiratory therapist. It is also possible that, in the study ICUs, ventilator management was highly protocolized to the point that receipt of these practices was not dependent on teamwork. Future work is necessary to better define the relationship among psychological safety, perceived teamwork, and actual quality of care.

Limitations

Our study has several limitations. Because this was an observational study, we cannot infer causation, nor can we infer the direction of causality within the observed associations. Although past work in this area suggests that leader inclusiveness leads to psychological safety, which in turn leads to good teamwork, it is possible that all three factors share a common unmeasured antecedent or that good teamwork leads to perceptions of better leader inclusiveness and psychological safety rather than the other way around. It is also possible that measurement error affected our results, although we used validated constructs with well-defined psychometric properties. We did not examine patient-centered outcomes like mortality or provider-focused outcomes like burnout, which were outside the scope of this study. Lastly, as with all survey research, our results could be affected by nonresponse bias. In particular, only a minority of teams in our analysis contained at least one respondent from respiratory therapy, a group that may be particularly influential, given that our evidence-based practices both relate to ventilator care.

Conclusions

Our study provides preliminary evidence in support of the value of psychological safety in ICU rounding teams and identifies several potential strategies to improve psychological safety and team functioning. Future work should more specifically examine the relationship between psychological safety and other outcomes, such as provider well-being and patient mortality. Future work should also examine the effectiveness of strategies to promote psychological safety, particularly strategies to increase the use of inclusive behaviors among ICU team leaders. Ultimately, such research could provide a necessary evidentiary foundation for teamwork as an actionable target for improving patient outcomes in the ICU. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

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