Factors Associated With Nurses’ Knowledge of and Perceived Value in Evidence-Based Practices

By Kristin Hittle Gigli, PhD, RN, CPNP-AC, CCRN, Billie S. Davis, PhD, Jennifer Ervin, PhD, and Jeremy M. Kahn, MD, MS

Background Little is known about how the education and specialty certification of intensive care unit nurses influence patients’ outcomes.

Objective To examine the relationships between critical care nurses’ education level and specialty certification, their individual psychosocial beliefs about their place on the intensive care unit team (in relation to 3 factors: professional identity, self-efficacy, and role clarity), and their perceptions of evidence-based practices used in the intensive care unit.

Methods A cross-sectional survey was emailed to nurses in 12 adult intensive care units within 6 hospitals in a single, integrated health care system.

Results Of 268 respondents, 180 (71%) had a bachelor of science degree or higher, and 71 (26%) had critical care certification. Compared with noncertified nurses, certified nurses reported greater knowledge of spontaneous breathing trials (4.6 vs 4.4 on a 5-point scale, \( P = .03 \)) and lung-protective ventilation (4.2 vs 3.9, \( P = .05 \)). Certified nurses reported significantly higher self-efficacy (4.5 vs 4.3 on a 5-point scale, \( P = .001 \)) and role clarity (4.4 vs 4.2, \( P = .05 \)) than noncertified nurses. Certification was also associated with greater perceived value in specific practices (daily interruption of sedation: adjusted odds ratio 2.5 [95% CI, 1.0-6.3], \( P = .05 \); lung-protective ventilation: adjusted odds ratio, 1.9 [95% CI, 1.1-3.3], \( P = .03 \)). Education level was not associated with greater knowledge of or perceived value in evidence-based practices.

Conclusions Nursing specialty certification was associated with nurses’ individual psychosocial beliefs and their perceptions of evidence-based practices in the intensive care unit, whereas education level was not. Supporting nurses in obtaining specialty certification could assist with the adoption of evidence-based practices as a means to improve quality of care in the intensive care unit. (American Journal of Critical Care. 2020;29:e1-e12)
More than 800,000 Americans require invasive mechanical ventilation in the intensive care unit (ICU) each year.1 Many of these patients do not receive care via evidence-based practices that have been proven to save lives, such as daily spontaneous breathing trials to assess readiness to extubate, or lung-protective ventilation to prevent lung injury in patients with acute respiratory distress syndrome.2-5 Efforts are needed to speed the translation of evidence into practice and ensure that patients in the ICU receive the highest quality of care.

One strategy to promote evidence uptake is to leverage the role of ICU nurses. Indeed, robust data suggest that nurses’ education level and attainment of specialty certification are associated with improved outcomes for patients.3-9 This evidence has led to calls to increase the percentages of nurses who have been prepared through baccalaureate programs (ie, a bachelor of science in nursing [BSN] degree) and who have received specialty certification (ie, CCRN certification, awarded by the American Association of Critical-Care Nurses Certification Corporation) as a means for improving the quality of care administered in the ICU.10-13 In response, the number of nurses with a BSN degree has increased, and hospitals are actively working to increase the number of such nurses in their workforce.14 Hospitals are also providing incentives for nurses to attain certification and are participating in efforts to implement evidence-based practices in order to improve the care provided at their institutions.15,16

Given the rising demand for critical care services and the limited supply of nurses, however, it may not be feasible for every ICU nurse to have a BSN degree, nor will it be possible for every nurse to attain specialty certification. Understanding the mechanism by which nurses’ credentials are associated with the adoption of evidence-based practices is meaningful in ICUs where a large proportion of nurses do not have a BSN degree or CCRN certification. A better understanding of the influence of nurses with a BSN degree or CCRN certification on practice change may help speed the implementation of evidence-based practices such as lung-protective ventilation, daily interruption of sedation, and spontaneous breathing trials, which are known to improve outcomes for patients receiving mechanical ventilation but which many eligible critically ill patients do not receive.2,5,5

Thus, we examined the relationship between nurses’ level of education and certification status and (1) selected individual psychosocial beliefs about nurses’ place in the ICU, including professional identity, self-efficacy, and role clarity, as well as the mediating effects of these beliefs on evidence-based practices, that may support a greater role for nurses in delivering evidence-based practices; (2) perceived knowledge of evidence-based practices; and (3) perceived value in specific evidence-based practices that aim to improve care for patients requiring mechanical ventilation in ICUs.

### Methods

#### Study Design and Population

We developed a cross-sectional, electronic survey and administered it to intensive care nurses in 12 adult ICUs within 6 hospitals in a single, integrated health care system. This survey was associated with a larger study examining ICU team function and the delivery of evidence-based practices. All nurses employed in these ICUs were eligible to participate. We obtained a list of the names and email addresses for these individuals from the health care system’s Office for Quality Improvement and Patient Safety.

#### Survey Development

We developed the survey instrument in the spring of 2017. Various theories guided us in this process: theories about the psychosocial underpinnings of organizational performance; the theory of planned behavior, which posits a central role for individual

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**About the Authors**

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Many patients who receive mechanical ventilation do not receive evidence-based care.
We hypothesized that nurses’ professional identity, self-efficacy, and role clarity contribute to beliefs about evidence-based practices.
psychosocial beliefs about nurses’ place on the ICU team.

To enhance the interpretability of the models’ results, we fit all models using logistic regression. Given the response distributions, we dichotomized the measures of nurses’ perceived knowledge of or perceived value in specific evidence-based practices into “high level of knowledge” or “highly valued practice” (a score ≥ 4 on a 5-point scale) or “less high level of knowledge” or “less highly valued practice” (a score < 4 on a 5-point scale). Exponentiated coefficients in the models could then be interpreted as odds ratios for high perceived knowledge of and high perceived value in the practices. The threshold for statistical significance was set at α = 0.05. We performed all statistical analyses in Stata software version 15.0 (StataCorp).

### Table 1

Demographic characteristics of nurses working in adult intensive care units who responded to the survey (N = 268)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%) of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>226 (84.3)</td>
</tr>
<tr>
<td>White race</td>
<td>257 (95.9)</td>
</tr>
<tr>
<td>Bachelor of science in nursing or higher</td>
<td>180 (70.9)</td>
</tr>
<tr>
<td>Critical care nursing certification</td>
<td>71 (26.5)</td>
</tr>
<tr>
<td>Work in a teaching hospital</td>
<td>191 (71.3)</td>
</tr>
</tbody>
</table>

*Mean (SD) age was 33.1 (9.7) years.
*Only 254 nurses responded to this item.

### Results

#### Survey Respondents

A total of 268 nurses working in adult ICUs responded to the survey (Table 1). Respondents were primarily white and female, and most worked in a teaching hospital. Although the majority of the nurses had a BSN or higher degree, only about a quarter of respondents had CCRN specialty certification. Among nurses with a BSN or higher degree, 34.4% (n = 62) also had specialty certification, whereas only 12.5% (n = 9) of those without their BSN had CCCN certification (P = .001).

#### Perceived Knowledge of and Value in Evidence-Based Practices

Respondents reported a high level of perceived knowledge of the 3 evidence-based practices used in caring for patients receiving mechanical ventilation (Table 2). We found no significant differences in nurses’ perceived knowledge of or perceived value in the 3 evidence-based practices related to nurses’ education level. Nurses with specialty certification reported significantly more perceived knowledge of spontaneous breathing trials and lung-protective ventilation and reported greater perceived value in all 3 evidence-based practices than did nurses without CCRN certification.

### Table 2

Nurses’ report of perceived knowledge of and perceived value in specific evidence-based practices in adult intensive care units

<table>
<thead>
<tr>
<th>Category</th>
<th>All nurses (N=268)</th>
<th>Nurses’ education&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Professional certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>BSN or higher (n = 180)</td>
<td>No BSN (n = 74)</td>
</tr>
<tr>
<td>Knowledge of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily interruption of sedation</td>
<td>4.42 (0.61)</td>
<td>4.42 (0.60)</td>
<td>4.44 (0.65)</td>
</tr>
<tr>
<td>Spontaneous breathing trials</td>
<td>4.47 (0.59)</td>
<td>4.50 (0.54)</td>
<td>4.43 (0.65)</td>
</tr>
<tr>
<td>Lung-protective ventilation</td>
<td>4.00 (0.91)</td>
<td>4.01 (0.89)</td>
<td>4.00 (0.91)</td>
</tr>
<tr>
<td>Value in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily interruption of sedation</td>
<td>4.22 (0.81)</td>
<td>4.24 (0.82)</td>
<td>4.18 (0.81)</td>
</tr>
<tr>
<td>Spontaneous breathing trials</td>
<td>4.31 (0.82)</td>
<td>4.30 (0.85)</td>
<td>4.31 (0.74)</td>
</tr>
<tr>
<td>Lung-protective ventilation</td>
<td>4.12 (0.81)</td>
<td>4.11 (0.86)</td>
<td>4.13 (0.67)</td>
</tr>
</tbody>
</table>

Abbreviation: BSN, bachelor of science in nursing.
*Data are mean (SD) unless otherwise indicated.
*Only 254 nurses responded to the item regarding education.
Individual Psychosocial Beliefs

Scores of the 3 individual psychosocial beliefs thought to be associated with the selected evidence-based practices are presented in Table 3. Overall, nurses reported strong professional identity, self-efficacy, and role clarity, all with mean scores greater than 4.0; for professional identity and self-efficacy, scores ranged from 2.5 to 5.0, and for role clarity, scores ranged from 1.7 to 5.0. We found no significant differences in reports of the individual psychosocial beliefs based on nurses’ level of education. With regard to specialty certification, however, we did find significant differences, with higher levels of self-efficacy (P = .001) and role clarity (P = .05) among nurses who reported having specialty certification (Table 3).

Relations Between Nurse Characteristics and Perceptions About Evidence-Based Practices

Perceived Knowledge of Evidence-Based Practices

Analysis of unadjusted effects indicated no significant associations between nurses’ education level or certification status and perceived knowledge of evidence-based practices (Table 4). In our full model, we did not find significant associations between education level and perceived knowledge of the evidence-based practices or between certification status and perceived knowledge of the practices (Table 4). The 3 individual psychosocial beliefs were inconsistently associated with nurses’ perceived knowledge of or perceived value in evidence-based practices. In the full model, among the 3 individual psychosocial beliefs, professional identity was most often associated with nurses’ perceived knowledge of evidence-based practices (Table 4).

Perceived Value in Evidence-Based Practices

Analysis of unadjusted effects indicated no significant associations between nurses’ education level and perceived value in evidence-based practices. We did, however, find that certification status was associated with the perceived value in 2 of the 3 evidence-based practices for patients receiving mechanical ventilation: daily interruption of sedation and lung-protective ventilation (Table 4). These associations persisted in the full model (Table 4). In addition, a nurses’ professional identity was significantly associated with perceived value in spontaneous breathing trials among nurses with their CCRN, but overall, we found no significant differences in the perceived value in this practice between nurses with and nurses without CCRN certification (Table 4).

Discussion

In a cross-sectional study of ICU nurses, we examined the associations between nurses’ education level and certification status, and their perceived knowledge of and perceived value in specific evidence-based practices used to care for patients receiving mechanical ventilation. We explored whether 3 individual psychosocial beliefs (professional identity, self-efficacy, and role clarity) were important mediators of the relationships between nurse education or certification and perceived knowledge of and value in evidence-based practices. We found that ICU nurses’ specialty certification status was strongly associated with perceived knowledge of and perceived value in the use of these evidence-based practices, whereas nurses’ educational level was not. The nurses’ place on the ICU team, assessed via 3 psychosocial beliefs, had an inconsistent mediating effect on nurses’ reported perceived knowledge of and perceived value in evidence-based practices. These findings have important implications for nurses when delivering care in the ICU and adopting evidence-based practices in caring for patients receiving mechanical ventilation. Adoption of evidence-based practice is a strategy proven to improve outcomes.5,16,28 Many evidence-based practices remain...
Table 4
Results of the multivariable regression analyses examining associations of education and certification with perceived knowledge of and perceived value in evidence-based practices

<table>
<thead>
<tr>
<th>Category</th>
<th>Base model</th>
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<th>Full model</th>
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<td>P</td>
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<tr>
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</tr>
<tr>
<td>BSN</td>
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<td>0.46-5.32</td>
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<td>.07</td>
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<tr>
<td>CCRN</td>
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<td>1.17</td>
<td>0.52-2.65</td>
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</table>
The strong association we found between specialty certification and nurses’ perceived knowledge of and value in specific evidence-based practices is consistent with current knowledge regarding the value of specialty certification and supports the value of nurses with specialty certification, especially among institutions that aim to increase the adoption of evidence-based practices.

Contrary to our hypothesis, we did not find a significant relationship between nurses’ education level and perceived knowledge of or perceived value in evidence-based practices. Nurses in this sample were highly educated, which could be a factor contributing to the null findings. In addition, characteristics of individual psychosocial beliefs, based on 3 measures, had only a small association with perceived knowledge of and perceived value in these practices. Prior studies have suggested that these factors are associated with improved outcomes for patients. However, given the limited associations with perceived knowledge of and perceived value in evidence-based care among ICU nurses found in this study, future studies are needed in order to elucidate better the clinical significance of these findings and to determine the mechanisms that result in improved outcomes for patients. Future studies of processes by which to increase the value nurses give to evidence-based practices may speed the implementation of these practices by institutions.

As an important next step, researchers should examine how ICU nurses’ knowledge of and value in evidence-based practices translate to the delivery of evidence-based care—not just their perceptions of those practices, as measured here. Prior studies demonstrate that knowledge and perceived value alone are not enough reason to adopt evidence-based practices, and thus future studies should evaluate similarities and differences among nurses’ practices. Efforts to identify barriers to the use of evidence-based care in practice will allow for targeted interventions to address such barriers, to increase the adoption of condition-specific evidence-based practices such as those used with patients who require mechanical ventilation, and to improve the quality of care delivered in the ICU.

**Limitations**

This study has several limitations. First, it was conducted within a single health care system, and thus the results may not generalize to ICU nurses working at other institutions or in other regions of the country. Our measure of self-efficacy asked about a nurse’s general ability to perform tasks and may not be sensitive enough to detect true relationships

| Category | Base model | | | Full model | | |
| --- | --- | --- | --- | --- | --- |
|  | Odds ratio | 95% CI | P | Odds ratio | 95% CI | P |
| Daily interruption in sedation<sup>a</sup> |  |  |  |  |  |  |
| CCRN | 2.75 | 1.14-6.64 | .03 | 2.50 | 1.00-6.30 | .05 |
| Age | 1.00 | 0.99-1.00 | .81 | 1.00 | 0.99-1.00 | .30 |
| Professional identity | 2.42 | 0.97-6.07 | .06 | 2.88 | 0.89-9.35 | .08 |
| Self-efficacy | 0.74 | 0.29-1.95 | .56 |  |  |  |
| Role clarity | 2.42 | 0.56 | 0.30 | 0.81-7.48 | .03 | 2.75 | 0.12 | 0.02 | 1.06-3.29 | .10 | 0.89-9.35 | .03 | 2.06 | 0.55 | 0.28 | 95% CI | 0.99-1.00 | 1.87 | 1.00 | 0.99-1.01 | 0.97-6.07 |
| Spontaneous breathing trials<sup>b</sup> |  |  |  |  |  |  |
| CCRN | 2.44 | 0.85-7.00 | .10 | 2.47 | 0.81-7.48 | .11 |
| Age | 1.00 | 0.99-1.00 | .55 | 1.00 | 0.99-1.00 | .28 |
| Professional identity | 3.15 | 1.35-7.36 | .008 | 3.15 | 1.35-7.36 | .008 |
| Self-efficacy | 1.64 | 0.45-6.04 | .46 | 1.64 | 0.45-6.04 | .46 |
| Role clarity | 0.80 | 0.31-2.09 | .65 | 0.80 | 0.31-2.09 | .65 |
| Lung-protective ventilation<sup>c</sup> |  |  |  |  |  |  |
| CCRN | 2.06 | 1.14-3.72 | .02 | 1.87 | 1.06-3.29 | .03 |
| Age | 1.00 | 0.99-1.01 | .72 | 1.00 | 0.99-1.01 | .76 |
| Professional identity | 1.60 | 0.88-2.91 | .12 | 1.60 | 0.88-2.91 | .12 |
| Self-efficacy | 1.68 | 0.93-3.04 | .09 | 1.68 | 0.93-3.04 | .09 |
| Role clarity | 1.20 | 0.56-2.60 | .64 | 1.20 | 0.56-2.60 | .64 |

Abbreviation: BSN, bachelor of science in nursing.

<sup>a</sup>These odds ratios can be interpreted as the odds of a respondent with a BSN or higher degree reporting a high level of knowledge of the evidence-based practice compared with a respondent without a BSN.

<sup>b</sup>These odds ratios can be interpreted as the odds of a respondent with specialty certification reporting a high level of knowledge of the evidence-based practice compared with a respondent without specialty certification.

<sup>c</sup>These odds ratios can be interpreted as the odds of a respondent with specialty certification reporting a high level of perceived value in the evidence-based practice compared with a respondent without specialty certification.

<sup>d</sup>These odds ratios can be interpreted as the odds of a respondent with specialty certification reporting a high level of perceived value in the evidence-based practice compared with a respondent without specialty certification.
between nurses’ characteristics and their ability to implement specific evidence-based practices. These data are self-reported, and the respondents’ perceived knowledge of and perceived value in evidence-based practices may not reflect the attitudes of all nurses working in ICUs, especially given the high number of nurses with a BSN degree in this sample. We did not gather information regarding nurses’ years of experience or about certifications other than CCRN. These factors could be associated with nurses’ individual psychosocial beliefs and could relate to their perceptions of evidence-based practices. In addition, because we administered this survey through the institution that employed the nurses, a risk of acquiescence existed; in an effort to reduce this effect, however, we administered the survey through a web-based platform, and responses were anonymous. Finally, the responses from nurses with different education levels and certification statuses showed minimal variation, which limits our ability to assess relationships among outcomes.

Conclusions

This study increases our knowledge of the role of education, certification, and professional identity among ICU nurses in their implementation of evidence-based practices for patients requiring mechanical ventilation. Specialty certification was associated with greater professional identity and higher perceptions of knowledge of and value in evidence-based practices used in the ICU, whereas education level was not. Supporting specialty certification among nurses is a plausible way to assist with the adoption of evidence-based practices as a means to improve ICU quality and should be evaluated further.

ACKNOWLEDGMENT

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FINANCIAL DISCLOSURES

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REFERENCES

13. An act to amend the education law, in relation to the educational preparation, certification, and professional identity among outcomes.

To purchase electronic or print reprints, contact American Association of Critical-Care Nurses, 101 Columbus, Aliso Viejo, CA 92656. Phone, (800) 897-1712 or (949) 362-2050 (ext 552); fax, (949) 362-2049; email, reprints@aacn.org.
Welcome to our survey!

You've taken the first step by clicking on our survey link, so we want to start off and say thanks for that! We'll try to make sure that you don't regret it.

Just a reminder, this survey should take about 10 minutes. We appreciate you taking the time to complete the survey. You probably have a million other things you would rather be doing right now. Honestly, we get it. But there is much to learn about team-work in the ICU, and we need your help!

We want to hear about your opinions and experiences; our ultimate goal is to understand how ICU teams function so that we can improve patient care in your hospital.

Please click on the icon below and to the right so we can get started!

PROF_ID1 When others of the same professional background as me are recognized for their accomplishments, I feel like I have accomplished something too. By "professional background," we mean someone's status as a nurse, physician, respiratory therapist, care manager, etc.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

PROF_ID2 My professional background is an important reflection of who I am.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

PROF_ID3 The work I do is very important to me.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

SELF_EFFICACY1 I have the training necessary to carry out the everyday tasks in my job.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

SELF_EFFICACY2 I am confident about my ability to do my job.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

ROLE_CLARITY_GEN1 I know what my job responsibilities are.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

ROLE_CLARITY_GEN2 I know exactly what is expected of me in this ICU.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

ROLE_CLARITY_GEN3 I feel certain about how much decision-making authority I have on this job.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

Evidence-Based Practice (EBP)

ATT_GEN_EBP1 Evidence-based practice improves the quality of patient care.

- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

Supplement 1 Survey Used in the UNITED Study of Teamwork in Intensive Care Units.
ATT_GEN_EBP2 Research findings are useful in my day-to-day practice.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

ATT_GEN_EBP3 I am willing to invest the time necessary to incorporate new evidence into my practice.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

MV_EBP_KNOW_DIS I am confident in my understanding of interruptions in sedation for mechanically ventilated patients.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

MV_EBP_KNOW_SBT I am confident in my understanding of spontaneous breathing trials for mechanically ventilated patients.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

MV_EBP_KNOW_LPV I am confident in my understanding of lung-protective ventilation for mechanically ventilated patients.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

ATT_MV_EBT_DIS_NR There is little value in interrupting mechanically ventilated patients' sedation levels on a daily basis.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

ATT_MV_EBT_SBT_NR There is little value in performing daily spontaneous breathing trials for mechanically ventilated patients.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

ATT_MV_EBP_LPV_NR There is little value to performing lung-protective ventilation for mechanically ventilated patients.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

End of Block: EBP

Supplement 1 Continued
FAM. 4 Family member presence on daily rounds prevents the team from talking about important medical issues.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

End of Block: Rounding Team Composition and Attitudes

Start of Block: Work Environment

Instructions 5
Please keep going, you’re almost done! There are just a few more things we’d like to know.
For these next items we’d like you to think about the hospital in which you work, not just the ICU. If you work for multiple hospitals, please only think about the one in which you work most frequently.

WORK_ENVIRONMENT1 In this hospital, employees have the opportunity to participate in hospital policy decisions.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

WORK_ENVIRONMENT2 In this hospital, employee concerns are addressed.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

WORK_ENVIRONMENT3 It’s clear that this hospital has high standards for patient care.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

WORK_ENVIRONMENT4 Hospital employees are regularly praised and recognized for a job well done.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

WORK_ENVIRONMENT5 The ICUs in this hospital are staffed with enough people to provide high quality patient care.
- Strongly Disagree (1)
- Disagree (2)
- Neither Agree nor Disagree (3)
- Agree (4)
- Strongly Agree (5)

End of Block: Demographics

Start of Block: Demographics

Instructions 6
This is the last page! And yes, by last we mean this is the final set of information we need from you.
Please be as honest as possible when responding to these items.

AGE What is your age? ____________________________

SEX What is your gender?
- Male (1)
- Female (2)
- Other (3)

ETHNICITY Please specify your ethnicity. Select all that apply.
- White (1)
- Hispanic or Latino (2)
- Black or African American (3)
- American Indian or Alaska Native (4)
- Asian (5)
- Native Hawaiian or Pacific Islander (6)
- Other (please specify) (7) ____________________________

CURRENT_POSITION What is your current position in this ICU?
- Intensivist Physician (1)
- Attending Physician but not an Intensivist (2)
- Resident, Fellow, or other Physician-in-Training (3)
- Bedside Nurse (4)
- Respiratory Therapist (5)
- Clinical Pharmacist (6)
- Nutritionist (7)
- Social Worker (8)
- Physician Assistant (9)
- Nurse Practitioner (10)
- Other (please specify) (12) ____________________________

BEDSIDE_NURSE_EDU What is your highest level of education in nursing?
- Associate’s degree (1)
- Bachelor’s degree (2)
- Master’s degree (3)
- Doctorate (DNP or PhD) (4)

BEDSIDE_NURSE_CCRN Do you currently hold a CCRN certification from the American Association of Critical-Care Nurses?
- Yes (1)
- No (2)

End of Block: Demographics

Start of Block: End thanks

Q60 Thank you so much for participating in this study! We value your time (and of course your responses).

To receive compensation, please complete the WePay information if you have not already. You only need to complete this one time.

https://pitt.co1.qualtrics.com/jfe/form/SV_3sHSVkDyVI3EzCB

Should you have any questions, comments, or concerns, please feel free to contact us at UNITEDStudy@pitt.edu.

We hope you have a great rest of your day!

End of Block: End thanks
**Supplement 2**

Psychometric testing for composite items in the UNITED study of teamwork in intensive care units

<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
<th>No. of items</th>
<th>Scale range $^a$</th>
<th>Score, mean (SD)</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional identity</td>
<td>The clinician’s professional self-concept based on attributes, beliefs, values, motives, and experience</td>
<td>4</td>
<td>1-5</td>
<td>4.14 (0.5)</td>
<td>$\alpha = 0.73$</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>The clinician’s perceived ability to successfully perform their job</td>
<td>2</td>
<td>1-5</td>
<td>4.36 (0.5)</td>
<td>$r = 0.70$</td>
</tr>
<tr>
<td>Role clarity</td>
<td>Knowledge of one’s own roles and responsibilities</td>
<td>3</td>
<td>1-5</td>
<td>4.23 (0.6)</td>
<td>$\alpha = 0.80$</td>
</tr>
</tbody>
</table>

$^a$ All items were scaled so that higher scores indicate strong agreement.