Implementing Automated Prone Ventilation for Acute Respiratory Distress Syndrome via Simulation-Based Training

By Armeen D. Poor, MD, Samuel O. Acquah, MD, Celia M. Wells, PhD, RN, Maria V. Sevillano, RN, CWCN, Christopher G. Strother, MD, Gary G. Oldenburg, MS, RRT-NPS, and S Jean Hsieh, MD, MS

Background Prone position ventilation (PPV) is recommended for patients with severe acute respiratory distress syndrome, but it remains underused. Interprofessional simulation-based training for PPV has not been described.

Objectives To evaluate the impact of a novel interprofessional simulation-based training program on providers' perception of and comfort with PPV and the program's ability to help identify unrecognized safety issues ("latent safety threats") before implementation.

Methods A prospective observational quality improvement study was done in the medical intensive care unit of an academic medical center. Registered nurses, physicians, and respiratory therapists were trained via a didactic session, simulations, and structured debriefings during which latent safety threats were identified. Participants completed anonymous surveys before and after training.

Results A total of 73 providers (37 nurses, 18 physicians, 18 respiratory therapists) underwent training and completed surveys. Before training, only 39% of nurses agreed that PPV would be beneficial to patients with severe acute respiratory distress syndrome, compared with 96% of physicians and 70% of respiratory therapists ($P<.001$). Less than half of both nurses and physicians felt comfortable taking care of prone patients. After training, perceived benefit increased among all providers. Comfort taking care of proned patients and managing cardiac arrest increased significantly among nurses and physicians. Twenty novel latent safety threats were identified.

Conclusion Interprofessional simulation-based training may improve providers' perception of and comfort with PPV and can help identify latent safety threats before implementation. (*American Journal of Critical Care.* 2020;29:e52-e59)

CE 1.0 Hour

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Prone position ventilation (PPV) improves survival in patients with severe acute respiratory distress syndrome (ARDS)[1-4] and is strongly recommended by consensus guidelines.[5,6] Nonetheless, PPV remains underused in intensive care units (ICUs) around the world.[7,8] Possible barriers to implementation include lack of perceived benefit, lack of preparation and protocols, and concern for patient safety and potential complications.[9-11]

The use of simulation-based training has grown in health care and has numerous benefits, including improved skill retention, interprofessional collaboration, and patient outcomes.[12,13] Simulation-based training is increasingly employed in the ICU and has been well received by critical care providers.[14] Studies in critical care have used high-fidelity simulation-based training and interprofessional debriefings to identify unrecognized systems errors threatening patient safety, also known as latent safety threats (LSTs).[15,16]

Prone position ventilation is a complex procedure requiring collaboration among physicians, registered nurses, and respiratory therapists.[17] The use of interprofessional simulation-based training before implementation of PPV has not been previously reported, with most studies focusing on training nurses.[18-20] Therefore, we sought to determine the impact of an interprofessional simulation-based training program on the perception of benefit and comfort with PPV among registered nurses, physicians, and respiratory therapists and to see whether such a program can help identify LSTs before implementation.

Materials and Methods

Study Design and Setting

This prospective observational quality improvement study was conducted in the academic medical ICU (MICU) at Mount Sinai Hospital in New York City, which had no previous experience with PPV. The study was exempted by the institutional review board (IRB number 17-02608) and approved by the Mount Sinai Hospital Department of Medicine Quality Improvement Committee in July 2018.

After a review of ARDS guidelines[5] and estimated prevalence of severe ARDS in the hospital's MICU, the ICU leadership decided to implement PPV. An interprofessional PPV implementation task force was assembled. This group consisted of the director of the MICU (S.O.A.), the senior director of nursing (C.M.W.), the MICU nursing manager, the lead and senior authors of this article (A.D.P., S.J.H.), and the directors of respiratory therapy (G.G.O.), nursing education, wound care nursing (M.V.S.), physical therapy, and nutrition. At the initial meeting, it was decided to proceed with an automated PPV program. Although the vendor (Arjo Inc) provided the didactic session and a demonstration of routine placement (see "Training Initiative"), we helped tailor the content to topics identified in our needs assessment. The vendor had no role in the development of the simulations, debriefings, PPV protocol, or checklists. The vendor also had no input into the design of our study, data collection, data analysis, or preparation of the manuscript.

> Interprofessional simulation-based training before implementation of prone position ventilation has not been reported before.

Over the course of 4 monthly interprofessional meetings, we developed a protocol and checklists (provided as a Supplement to this article) and made plans for initiating interprofessional training. Before training, participants completed anonymous surveys (provided as a Supplement to this article) assessing perception of and comfort with PPV using a 5-item Likert scale, in addition to preferences for training modalities. Latent safety threats were classified a priori into the following categories: equipment, procedure/protocol, personnel, and communication.

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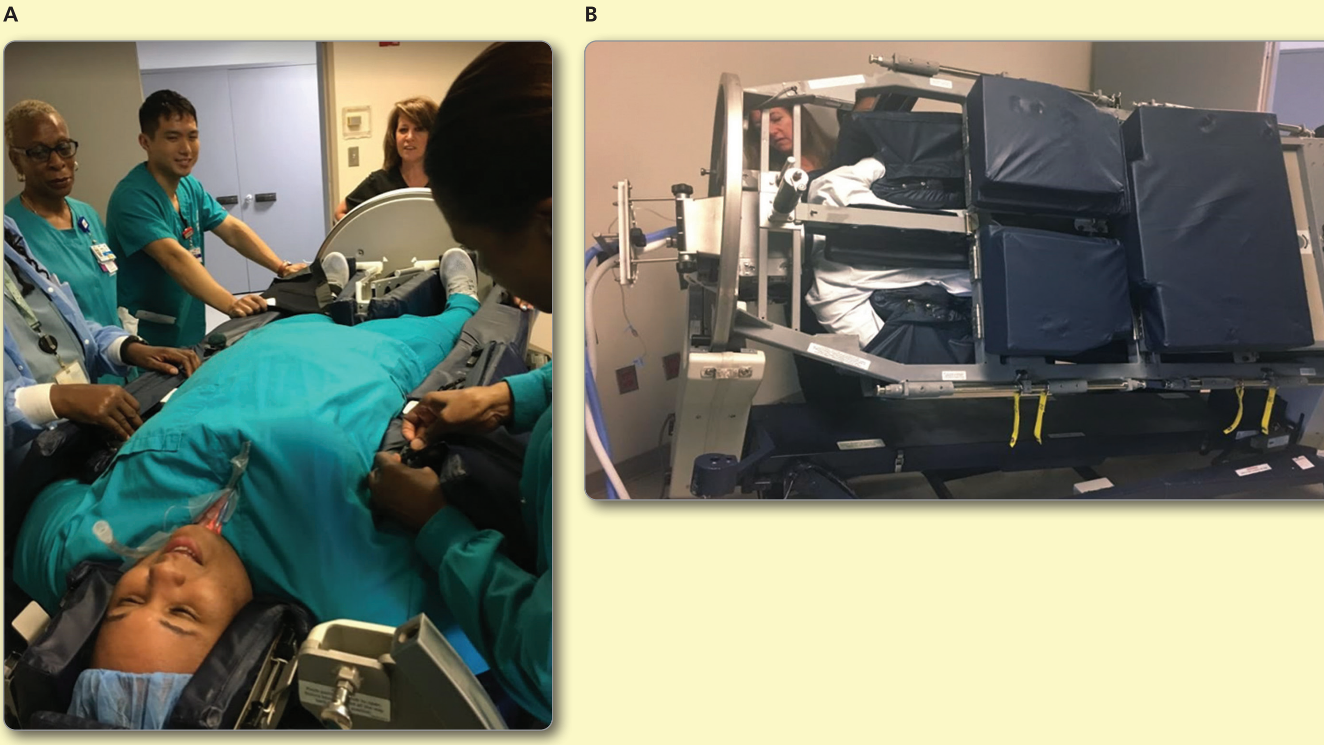

Figure 1 (A) Interprofessional placement of volunteer and (B) automated proning of volunteer.

Training Initiative

Study participants underwent a 2-hour interprofessional training session. Physician participants included practicing attending physicians with combined pulmonary and critical care medicine training and fellows participating in a pulmonary and critical care medicine fellowship accredited by the Accreditation Council for Graduate Medical Education; residents were not included. Training sessions consisted of a didactic session, simulated placement of volunteers with different body types in the prone position (Figure 1), simulated emergency scenarios (including cardiac arrest and bed malfunction), and a structured debriefing during which interprofessional input and LSTs were elicited (Figure 2). Training on how to speak with next of kin was not included. Checklists containing core competencies and essential steps guided the simulations (see Supplement). Sessions emphasized the importance of interprofessional audible communication, with use of read-back during routine placement and emergency scenarios. Physicians led cardiac arrest simulations and were given specific instruction on the differences between leading a code for a prone patient versus a standard ICU patient.

All sessions and debriefings were attended by the lead and/or senior author (A.D.P., S.J.H.), who recorded feedback about the training from the participants, including identification of LSTs and possible solutions. The structured debriefing format was adapted from quality improvement literature evaluating LSTs in simulation training.[15,16] Information gathered at debriefings was incorporated into the protocol and subsequent training sessions. Participants completed anonymous posttraining surveys.

Outcomes

The primary outcomes of interest were perception of benefit and comfort related to PPV, including comfort caring for patients receiving PPV, managing cardiac arrest in PPV patients, and speaking to next of kin about PPV. Nurses were asked about comfort levels with routine nursing care such as cleaning, feeding, and administering medications. Before training, providers were also surveyed about preferences for further training modalities. Novel and total LSTs identified during training were recorded during debriefings.

Statistical Analysis

Descriptive statistical analyses were used to compare providers' experience, perception, and comfort related to PPV before and after training, in addition to preferred training modalities. Kruskal-Wallis 1-way analysis of variance was used to compare provider groups with each other before training. The χ^2 test was used to evaluate for pre-post changes within each provider group. A priori responses consisting of "Agree" and "Strongly agree" were grouped together as "Agree," and responses consisting of

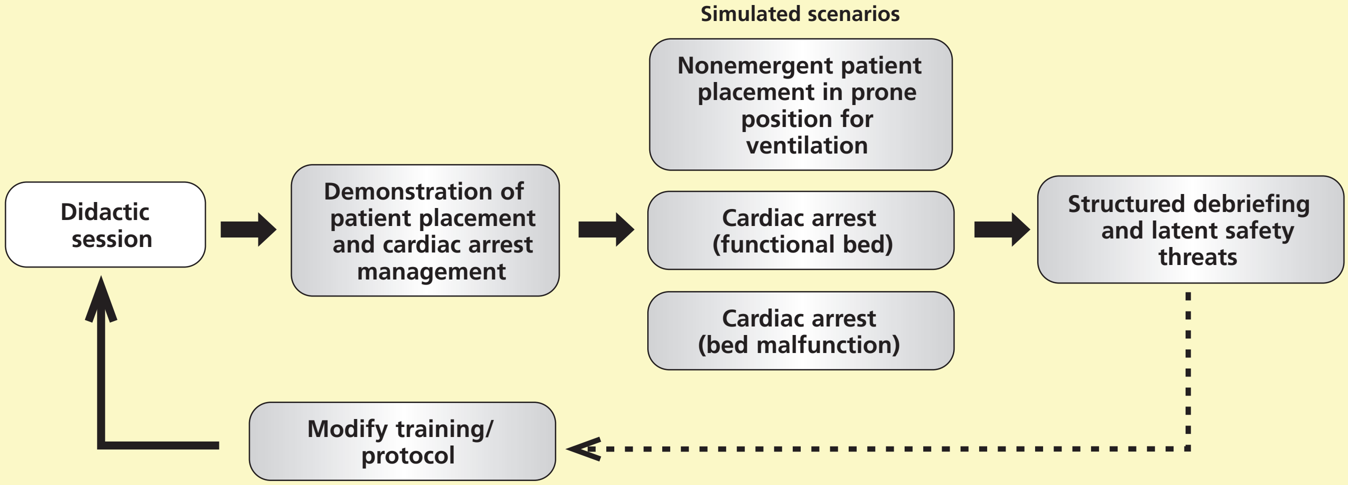

Figure 2 Process improvement pathway. Registered nurses, physicians, and respiratory therapists underwent 2-hour interprofessional training sessions consisting of a didactic session, simulated placement of volunteers in prone position, simulated emergency scenarios, and structured debriefing during which interprofessional input and latent safety threats were elicited. Iterative learning was used to modify the training initiative and protocol. Solid line = training pathway; dashed line = iterative component of process improvement pathway.

"Disagree" and "Strongly disagree" were grouped together as "Disagree." Statistical significance was defined as a *P* less than .05. The references to LSTs were counted and categorized; the mean number of novel LSTs also was calculated. Analyses were performed by using STATA/MP version 13 (StataCorp).

Results

Provider Demographics

A total of 82 providers underwent training, and 73 (89%) completed posttraining surveys (37 nurses, 18 physicians, 18 respiratory therapists; Table 1). Training occurred over the course of 12 separate 2-hour sessions in 3 days in June 2018. Providers had minimal previous PPV experience, with most having proned 5 or fewer patients. No significant differences were found in the characteristics of providers surveyed before and after training.

Before Training

Before training, only 39% of nurses agreed that PPV would be beneficial to their patients with severe ARDS, compared with 96% of physicians and 70% of respiratory therapists ($P < .001$; Figure 3A). Less than half of nurses (35%) and physicians (27%) felt comfortable taking care of prone patients, compared with 70% of respiratory therapists ($P = .04$; Figure 3B). Less than 30% of providers across all disciplines were comfortable managing cardiac arrest in prone patients ($P = .43$; Figure 3C). Providers identified simulation and in-person demonstrations as the training methods that would be most helpful, with no significant differences found between the provider groups.

Table 1
Provider characteristics[a]

Characteristic	% of Providers Nurse (n = 37)	Physician (n = 18)	Respiratory therapist (n = 18)	All (N = 73)
Experience in intensive care units, y				
≤5	46	89	67	62
>5	54	11	33	38
Experience with prone position ventilation (No. of patients positioned prone)				
0	68	39	67	60
1-5	8	50	11	19
>5	24	11	22	21

[a] Data from posttraining surveys; no significant differences were found in provider type, experience in the intensive care unit, or experience with prone position ventilation from before to after training.

After Training

After training, the perceived benefit of PPV increased among all providers, with the largest increase (50 percentage points) occurring in nurses ($P < .001$ for before vs after training), compared with 30 percentage points for respiratory therapists ($P = .008$) and 4 percentage points for physicians

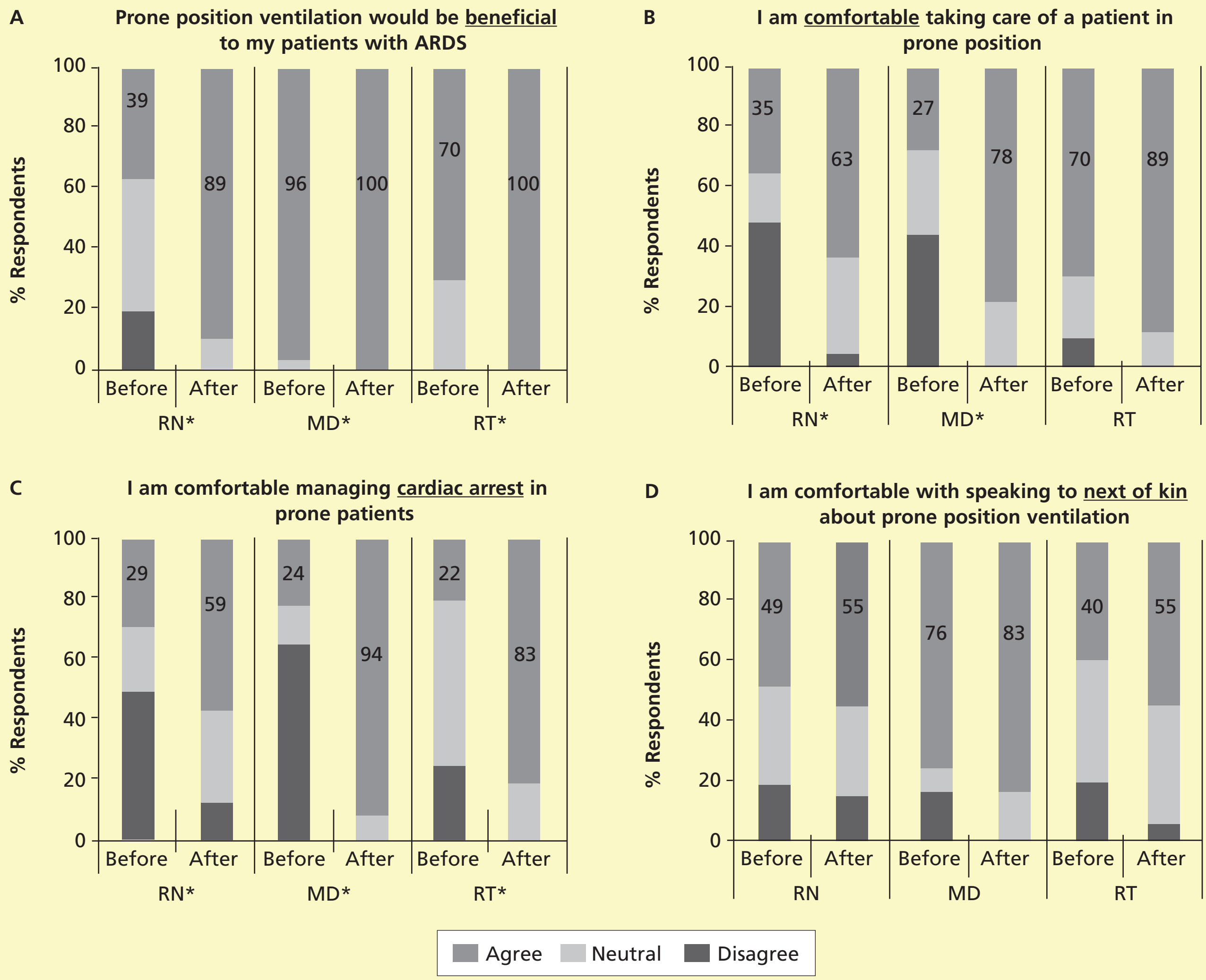

Figure 3 Interprofessional perception and comfort before and after simulation-based training. Asterisk indicates significant difference from before to after training.

Abbreviations: ARDS, acute respiratory distress syndrome; MD, physician; RN, registered nurse; RT, respiratory therapist.

($P=.046$; Figure 3A). The group with the greatest improvement in comfort with taking care of proned patients was physicians (increase of 51 percentage points from before to after training; $P=.005$), followed by nurses (28 percentage points; $P=.002$) and respiratory therapists (19 percentage points; $P=.48$; Figure 3B). In addition, physicians, who played the role of code leader, demonstrated the greatest improvement (increase of 70 percentage points from before to after training; $P<.001$) in comfort with managing cardiac arrest, followed by respiratory therapists (61 percentage points; $P=.01$) and nurses (30 percentage points; $P=.02$; Figure 3C). Nurses reported significantly increased comfort with routine nursing care, with increases of 27 percentage points for administering medications, 31 percentage points for feeding, and 17 percentage points for cleaning ($P<.05$ for each). Comfort with speaking to next of kin did not change significantly after training in any discipline (Figure 3D).

Identification of LSTs

Twenty novel LSTs were identified (mean of 1.67 per session, range 0-4). Of the total, 42% were related to equipment, 39% to procedure/protocol, 12% to personnel, and 7% to communication. Solutions included generation of new checklists, creation of bundles for equipment, and clarification of protocol (Table 2). Areas for training modification identified during debriefings included shortening the didactic component, using volunteers with different body types, and limiting the number of participants per session to 6 in order to maximize active participation. Coaching for physicians before running code simulations was also added to the training initiative, with corresponding checklists included in the

Table 2
Identified latent safety threats and corresponding protocol-driven changes

Category	Safety threat	Protocol-driven changes
Equipment	Bed too high for cardiopulmonary resuscitation	Purchased step stools, included in PPV bundle
	Reduced adhesiveness around endotracheal tube	Tried and obtained tape for moist surfaces
	Delay in cardiopulmonary resuscitation due to inability to locate backboard	Backboard included in PPV bundle; protocol updated to have backboard in PPV patient's room
Procedure/ protocol	Lack of role assignment, unclear order of maneuvers process in code; differences from codes in non-proned patients	Roles defined at start of shift, daily review of maneuvers, and checklist developed for physician to run code included in protocol
	Risk of hypotension with transition to prone position	Protocol adjusted to include higher goal mean arterial pressure (eg, 70 instead of 65) and pressor on standby before transition to prone position
	Patient manually turned in wrong direction when returning to supine	Creation of sign displaying correct prone/supine direction; protocol updated to include placement of sign at head of bed
Personnel	Inadequate nurse staffing	Protocol updated to notify charge nurse at time of decision to prone
	Lack of availability of respiratory therapist	Respiratory therapist contingency plan with signout and backup
Communication	Lack of standardized communication with family	Developed script for physicians and brochure for patients' families explaining what to expect with PPV, risks, benefits

Abbreviation: PPV, prone position ventilation.

protocol. Participants noted the following benefits of interdisciplinary training: increased interprofessional communication and team building and identification of patient-centered, discipline-specific LSTs by providers who volunteered to be proned (eg, identification of potential sites of pressure injury by a proned wound care nurse).

Discussion

In this study, a novel interprofessional simulation-based training program at a hospital with minimal previous PPV experience improved providers' perception of benefit and comfort levels with the procedure. The study highlights the importance of aligning providers' understanding of the utility of PPV in severe ARDS in order to achieve the interprofessional collaboration required. Perception of the benefit of PPV and comfort levels with both routine care and emergency scenarios improved for all 3 categories of providers. In addition, the training helped identify LSTs, allowing incorporation of solutions into the protocol to facilitate safe implementation.

Much like many other health care centers around the world, our hospital was initially hesitant to implement PPV. Michie et al[21] described a novel framework for behavior change interventions represented by a behavior change wheel. The hub of the wheel is a behavior system involving 3 essential conditions: motivation, capability, and opportunity. Our interprofessional simulation-based training fits into this framework by emphasizing motivation through improved perception of benefit of this lifesaving modality, capability through the didactic session and demonstration, and opportunity through real-time simulation.

The existing literature on education about and implementation of PPV reflects the traditional nursing-oriented approach to PPV.[18-20] In addition, many aspects of routine nursing care and quality metrics (eg, feeding) are directly affected by prone positioning. Our findings before training are consistent with previous studies that identified lack of perceived benefit and safety concerns as potential barriers to implementation of PPV.[9-11] Most nurses did not believe that PPV would be beneficial to patients with severe ARDS and were not comfortable with providing routine nursing care to patients in the prone position. Identifying and addressing discrepancies in perception of benefit with training before implementation may facilitate interprofessional buy-in and enhance collaboration among providers.

> Aligning providers' understanding of the utility of PPV in severe ARDS is key to achieving the interprofessional collaboration required.

An enhanced sense of teamwork may have contributed to the improved perception of and comfort with PPV after training, as reflected in debriefings across all 3 disciplines. Historically, providers from different disciplines have held discrepant attitudes about teamwork in the ICU, possibly affecting the quality of collaboration and delivery of care.[22] The significant improvements in comfort levels with PPV across all disciplines in our unit may reflect enhanced teamwork resulting from improved communication achieved during the simulations. The emphasis on read-back, which can improve information transfer during simulated crises,[23] provided an opportunity to practice the form of communication that would be essential during such scenarios. Furthermore, physician presence at simulated cardiac arrests may have facilitated cohesion and a sense of "shared leadership," which has been described as a promising method in simulation training for improving interprofessional collaboration.[12]

The ability to identify LSTs before implementation is probably another important factor in the improved comfort with PPV after training. Our center focused on the interprofessional nature of PPV from the start, with leadership representing nurses, physicians, and respiratory therapists working closely together in initial protocol development. Even so, our interprofessional debriefings elicited 20 additional LSTs from the 3 categories of providers. Proposed solutions to these unrecognized systems errors were incorporated into the protocol. We also applied an iterative learning process to our implementation, allowing staff members and trainers to continuously learn from the simulation training and subsequently improve the protocol.[24] Giving providers a voice during debriefings allowed all participants to develop a sense of ownership of the protocol that was being implemented. The open forum for voicing concerns may have provided reassurance, improving overall comfort with the procedure.

This study has several strengths. The novel simulation-based training for PPV, emphasizing an interprofessional approach to emergency scenarios such as cardiac arrest and bed malfunction, has not been previously described in the literature. In addition, the program allowed us to train nearly 90% of our MICU staff and practice placement of volunteers with different body types. Limitations include the single-center nature of the study and the lack of survey matching due to anonymity, which precluded measurement of the training initiative's intrapersonal impact and reduced the overall power for detecting differences. The simulations were not performed in the ICU but rather in a simulation center, which may not reflect the nuances of a real PPV experience. Not all providers who received training completed surveys, making respondent bias a possibility. In addition, providers were aware that they were being evaluated, giving rise to a possible Hawthorne effect. Nonetheless, no significant changes were found after training in comfort with speaking to next of kin about PPV, which was not addressed by our program; the comfort level not addressed by our training may serve as a control for the study. In addition, we did not use qualitative research methods when conducting debriefings and collecting qualitative data. We used automated beds in our training, which may limit generalizability. However, key principles of our design and implementation, including the interprofessional focus and emergency simulations, may extend to the implementation of a manual PPV program.

Although automated PPV is a popular option in many centers, future researchers will need to evaluate the impact of interprofessional simulation-based training on implementing a manual PPV program. Furthermore, in our study, we evaluated the initial training session before implementation. Further research is needed to assess the long-term effects of training on perception of and comfort with PPV, as well as the optimal timing of retraining to maximize knowledge retention and comfort.

Conclusion

Interprofessional simulation-based training can improve perception of benefit and comfort with providing PPV and is an effective method of identifying LSTs before implementing a PPV program for severe ARDS. By enhancing interprofessional collaboration, such simulation-based training may facilitate buy-in and implementation of this essential and underused intervention.

ACKNOWLEDGMENTS
Arjo Inc provided equipment and assistance with the didactic sessions and demonstration. The authors are grateful to the Mount Sinai Hospital MICU staff of nurses, respiratory therapists, physicians, and wound care experts, without whose enthusiasm, commitment, and collaboration this study and the implementation of PPV at our center would not have been possible.

FINANCIAL DISCLOSURES
None reported.

SEE ALSO
For more about prone position ventilation and acute respiratory distress syndrome, visit the *AACN Advanced Critical Care* website, **www.aacnacconline.org**, and read the article by Mitchell and Seckel, "Acute Respiratory Distress Syndrome and Prone Positioning" (Winter 2018).

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CE 1.0 Hour Category B

Notice to CE enrollees:

This article has been designated for CE contact hour(s). The evaluation demonstrates your knowledge of the following objectives:

1. Describe potential barriers to implementation of prone ventilation for severe acute respiratory distress syndrome.
2. Define "latent safety threats" and the significance of their identification before implementation.
3. Discuss the benefits of interprofessional simulation-based training before implementation of prone ventilation.

To complete the evaluation for CE contact hour(s) for this article #A2029033, visit www.ajcconline.org and click the "CE Articles" button. No CE evaluation fee for AACN members. This expires on May 1, 2023.

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Prone Position Ventilation in the Medical ICU Survey - #1

1. What is your position?
   RN RT MD (Fellow) MD (Attending)
2. How many years have you been practicing in critical care?
   <1 year 1-2 years 3-5 years 6-10 years >10 years
3. How many ARDS patients undergoing prone position ventilation have you taken care of?
   0 1-5 6-10 >10
4.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Prone position ventilation would be beneficial to my patients with ARDS					
I am comfortable taking care of a patient in prone position					
I am comfortable managing cardiac arrest in prone patients					
I am comfortable with speaking to next of kin about prone position ventilation					
I feel comfortable managing the following tasks in proned patients (*RN only*)					
Administering medications					
Feeding					
Cleaning					

5. What training methods can we provide to help you feel more comfortable in assisting with the placement and/or management of an ARDS patient in prone position: (circle all that apply)

   Didactic lecture Simulation RN expert speaker

   Video demonstration In-person demonstration Nothing will make me feel more comfortable

   Other: ______________________________

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY!

Abbreviations: ARDS, acute respiratory distress syndrome; ICU, intensive care unit; MD, physician; RN, registered nurse; RT, respiratory therapist.

Prone Position Ventilation in the Medical ICU Survey - #2

1. What is your position?
   RN RT MD (Fellow) MD (Attending)
2. How many years have you been practicing in critical care?
   <1 year 1-2 years 3-5 years 6-10 years >10 years
3. How many ARDS patients undergoing prone position ventilation have you taken care of?
   0 1-5 6-10 >10
4.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Prone position ventilation would be beneficial to my patients with ARDS					
I am comfortable taking care of a patient in prone position					
I am comfortable managing cardiac arrest in prone patients					
I am comfortable with speaking to next of kin about prone position ventilation					
I feel comfortable managing the following tasks in proned patients (*RN only*)					
Administering medications					
Feeding					
Cleaning					

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY!

Abbreviations: ARDS, acute respiratory distress syndrome; ICU, intensive care unit; MD, physician; RN, registered nurse; RT, respiratory therapist.

Continued

Prone Position Ventilation - Simulation Guide

- Many of you have said that simulations would be a helpful training method.
- The purpose of the simulations is to help you practice the act of proning, to run through a few emergency scenarios to make you feel more comfortable should they ever arise, and to help answer any questions you may have

- **Expectations:**

While you are not in the ICU, we'd like you to treat this as realistically as possible so 1) you can get the most out of the experience and 2) we can make sure that our systems are in place in the real world.

A. Please talk through your reasoning and actions ("think out loud") because:
  - o it helps us and those around you understand what you are thinking
  - o helps reinforce actions
  - o good habit anyway

B. We will be observing to make sure you meet certain training milestones (please see checklist)

C. Debrief: We will have 15 minutes after the simulations to discuss what issues you think may arise; your input will be valuable for identifying potential issues for going live with proning

<u>**Case 1** – Cardiac Arrest and Extubation – *Automated*</u>

A 35-year-old man is proned for severe ARDS due to influenza A. He is in septic shock and requiring vasopressors. During rounds, his blood pressure suddenly drops to 50/30s, and his heart rate drops to 35. When you approach the patient, his cardiac monitor indicates asystole.

Actions:

1. Verbalize patient is in asystole and will return to supine
2. MD verbalizes he/she will be code leader, assigns roles to surrounding providers
   a. Monitoring ETT
   b. Monitoring lines
3. Place CPR board over back; close hatches
4. Demonstrate automated maneuver to return patient to supine position
   a. Press and hold CPR button until message "CPR operation is complete"
   b. Push lock pin
5. Initiate chest compressions

<u>**Case 2** – Cardiac Arrest and Extubation – *Manual*</u>

A 49-year-old woman presents with respiratory failure due to pneumonia, complicated by severe ARDS. The patient is placed in the prone position. Her lung mechanics are improved, but she goes into asystole.

Actions:

1. Verbalize patient is in asystole and will return to supine
2. MD verbalizes he/she will be code leader
3. Nurse goes to press CPR button
   RN Verbalize: Screen is blank and automated bed is unresponsive
4. Confirm that the bed is plugged into one of the red-emergency outlets (verbalize)
   RN Verbalize: Power to bed is out and will need to use manual maneuver
5. Verbalize return to supine using manual maneuver
6. Demonstrate manual maneuver to return patient to prone position
   Tell team: Patient noted to be extubated upon return to prone
7. Initiate chest compressions

Abbreviations: ARDS, acute respiratory distress syndrome; CPR, cardiopulmonary resuscitation; ETT, endotracheal tube; ICU, intensive care unit; MD, physician; RN, registered nurse.

Continued

Prone Ventilation Competency Checklist[a]

Performance criteria	Met	Not met	Comments
Patient placement			
Opening/closing of hoop system			
Transfer of patient to Rotoprone support surface			
Proper placement of lines and tubes at head/foot of bed	*Verbalize each line, tube, slack*		
Place patient in head support properly	*Ears lined up with ear holes*		
Insert leg abductor pack and adjust between legs			
Install side support packs	*Post and position for wide and narrow bodies*		
Install abdominal sling on top of patient	*Straps through slots on side pack, fold, fasten*		
Install face mask (verbalize face mask install)	*Foam across forehead*		
Adjust and install prone packs	*Upper packs across abdomen, pelvic across hips, lower across shins*		
Control panel			
Prone direction	*Prone toward ventilator*		
Pull lock pin			
Verbalize “check lines and tubing” with repeat back	*Line at head and foot of bed have slack*		
Verbalize “check airway”	*RT at head of bed, monitoring ETT*		
Verbalize “check head support” with repeat back	*Ears lined up and head support tightened*		
Verbalize “check arm slings” with repeat back	*Arms positioned outside side pack, sling secured*		
Verbalize “check abdomen support” with repeat back	*Support firmly fastened with Velcro*		
Verbalize “reconfirm face pack in place, secure” with repeat back	*Secured, but foam not compressed*		
Initiate prone therapy (verbalize “starting rotation”)			
Demonstrate reverse Trendelenberg			
Demonstrate return to supine rotation	*Verbalize direction is away from ventilator (ie, reverse of prone direction)*		
Emergency procedures			
Verbalize patient in asystole, return to supine			
Verbalize role assignment – (a) ETT and (b) lines			
Verbalize CPR board placed over back			
Demonstrate automated option to perform CPR			
Verbalize patient in asystole, return to supine			
Verbalize role assignment – (a) ETT and (b) lines			
Verbalize CPR board placed over back			
Verbalize screen is blank, check power			
Verbalize power is off, initiate manual option			
Demonstrate manual option to prone patient			

Abbreviations: CPR, cardiopulmonary resuscitation; ETT, endotracheal tube; RT, respiratory therapist.
[a] Modified with permission from Arjo Inc.

Continued

Simulation Observation Tool[a] – latent safety threats

Type	Knowledge gap	Specific threat
Equipment		
Procedure/protocol		
Personnel		
Communication		
Others		

[a] Adapted from Wetzel EA, Lang TR, Pendergrass TL, Taylor RG, Geis GL. Identification of latent safety threats using high-fidelity simulation-based training with multidisciplinary neonatology teams. *Jt Comm J Qual Patient Saf*. 2013;39(6):268-273 with permission from Elsevier. ©2013. https://www.sciencedirect.com/journal/the-joint-commission-journal-on-quality-and-patient-safety

Continued

Debriefing Template[a]

Debriefing checklist	Information shared	Source of info (RN RT MD)
What were your gut feelings about this exercise? How did it make you feel?		
What issues do you imagine arising if this was a real-world situation?		
What do you think went well with the simulation?		
What do you think could have been done better with the simulation?		
How can we improve the course (longer vs shorter? realistic? enough cases?)		
Teamwork concepts discussed (ie, role assignment, leadership communication, staffing numbers)		
Additional notes:		

Identified threats	Information shared	Source of info (RN RT MD)	Suggested solutions
Were there any issues with equipment (eg, missing, placement)?			
Are there any other resources we would need to improve this process?			
Do you foresee any issues regarding medications in this process?			
Other:			

Abbreviations: MD, physician; RN, registered nurse; RT, respiratory therapist.

[a] Adapted by permission from BMJ Publishing Group Limited from Wheeler DS, Geis G, Mack EH, Lemaster T, Patterson MD. High-reliability emergency response teams in the hospital: improving quality and safety using in situ simulation training. *BMJ Qual Saf.* 2013;22(6):507-514. ©2013.

Supplement *Continued*