Improving Prone Positioning for Severe Acute Respiratory Distress Syndrome during the COVID-19 Pandemic

An Implementation-Mapping Approach

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Abstract

Rationale: Prone positioning reduces mortality in patients with severe acute respiratory distress syndrome (ARDS), a feature of severe coronavirus disease 2019 (COVID-19). Despite this, most patients with ARDS do not receive this lifesaving therapy.

Objectives: To identify determinants of prone-positioning use, to develop specific implementation strategies, and to incorporate strategies into an overarching response to the COVID-19 crisis.

Methods: We used an implementation-mapping approach guided by implementation-science frameworks. We conducted semistructured interviews with 30 intensive care unit (ICU) clinicians who staffed 12 ICUs within the Penn Medicine Health System and the University of Michigan Medical Center. We performed thematic analysis using the Consolidated Framework for Implementation Research. We then conducted three focus groups with a task force of ICU leaders to develop an implementation menu, using the Expert Recommendations for Implementing Change framework. The implementation strategies were adapted as part of the Penn Medicine COVID-19 pandemic response.

Results: We identified five broad themes of determinants of prone positioning, including knowledge, resources, alternative therapies, team culture, and patient factors, which collectively spanned all five Consolidated Framework for Implementation Research domains. The task force developed five specific implementation strategies, including educational outreach, learning collaborative, clinical protocol, prone-positioning team, and automated alerting, elements of which were rapidly implemented at Penn Medicine.

Conclusions: We identified five broad themes of determinants of evidence-based use of prone positioning for severe ARDS and several specific strategies to address these themes. These strategies may be feasible for rapid implementation to increase use of prone positioning for severe ARDS with COVID-19.

Keywords: respiratory distress syndrome; adult; critical care; artificial respiration

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An estimated 10–15% of patients admitted to intensive care units (ICUs) around the world suffer from acute respiratory distress syndrome (ARDS) (1–4) Mortality in ARDS is estimated to be as high as 40% (5, 6), and those who survive commonly experience long-term cognitive, emotional, and physical impairments (7, 8). Despite the large body of literature on interventions to treat ARDS, only three therapies have been proven in multicenter randomized trials to reduce mortality (6, 9, 10), one of which is prone positioning. In 2013, a multicenter randomized trial of patients with severe ARDS demonstrated that prone positioning early during the course of illness reduced mortality from 33% to 16% (10), and prone positioning for patients with severe ARDS is now included as a strong recommendation in a multisociety international practice guideline (11). Nonetheless, multiple international studies have recently demonstrated that up to 85% of patients with ARDS do not receive this lifesaving therapy (12–14).

The barriers to and facilitators of evidence-based use of prone positioning, and implementation strategies to address these determinants, are unclear. A few studies have described patient-level factors that influence the use of prone positioning, such as severity of hypoxemia, obesity, and hemodynamic instability (1, 12). However, these factors are largely unmodifiable, and may not explain the entirety of the gap between evidence and practice. Therefore, our primary objectives were to identify the determinants of prone-positioning use and to develop a menu of strategies to improve evidence-based use of prone positioning, using an implementation-mapping approach.

This work is particularly salient as clinicians face the challenges of responding to coronavirus disease 2019 (COVID-19), which is associated with high rates of severe ARDS. International societies and expert panels recommend prone positioning in patients with COVID-19 and severe ARDS (15, 16), and early experience has demonstrated that prone positioning may be a standard of care (17, 18).

Methods

In this qualitative study, we used an implementation-mapping approach, an evidence-based approach for developing strategies to improve evidence uptake (19). Implementation mapping involves five discrete, sequential tasks, as summarized in Table 1. For this project, we completed the first four of these tasks. Specifically, we first conducted a needs assessment and identified adopters of prone positioning through informal interviews of local ICU leaders. We then identified barriers and facilitators to implementation of prone positioning through qualitative interviews. Next, we convened a task force of ICU leaders to *1*) identify institutional change objectives to improve implementation on the basis of the identified barriers and facilitators and *2*) develop a menu of specific implementation strategies. Last, the task force members, in their roles as hospital and ICU leaders during the COVID-19 response, rapidly developed implementation materials and established implementation plans.

Study Setting and Participants

The study included bedside clinicians and leaders of nine ICUs within four hospitals of the Penn Medicine Health System (including two tertiary care academic hospitals and two affiliated community-based hospitals) and three ICUs of the University of Michigan Medical Center, a tertiary care and regional referral hospital. We selected a range of types of hospitals and ICUs to promote diversity of experience with and perspectives about prone positioning. All tasks described above were conducted at Penn Medicine. Qualitative interviews regarding barriers and facilitators (task 2) additionally included participants from the University of Michigan, as detailed below.

Interviews

We developed a semistructured interview script to elicit perspectives on use of prone positioning for patients with ARDS, including potential barriers and facilitators to implementation (*see* the online supplement). We used the Consolidated Framework for Implementation Research (CFIR) as a guide (20). The CFIR organizes 37 constructs relevant to implementation of evidence-based processes into 5 broad domains (*see* Table E1 in the online supplement) and has been used extensively in qualitative research related to implementation practices (21). We invited ICU leaders, bedside nurses, respiratory therapists, clinicians who place orders (including hospitalists, advanced-practice providers, and trainees), and critical care specialists (including fellow and attending physicians) to participate on a voluntary basis. We identified eligible participants through ICU leaders, approached them individually via e-mail, and compensated participants with a $50 gift card. We purposively sampled clinicians of different backgrounds from all study ICUs to facilitate representation of varied viewpoints (22). We first interviewed clinicians at Penn Medicine hospitals and continued interviews until we achieved thematic saturation and represented the key groups, as appropriate for the sampling methods we used. We then invited clinicians at University of Michigan hospitals to assess whether themes were consistent at a geographically and organizationally distinct hospital. We again used purposive sampling to ensure diversity of clinician groups and perspectives and continued interviews until all groups were represented and no new themes were identified.

We conducted three pilot interviews with ICU physicians, followed by further refinement of the interview script. All interviews, including pilot interviews, were conducted by one member of the research team (T.S.) trained in qualitative interviewing. Each interview lasted approximately 30 minutes and was recorded and professionally transcribed, and each transcript was deidentified before analysis. The study was deemed exempt from review by the institutional review board of the University of Pennsylvania.

Focus Groups

After analyzing qualitative interview data, we convened a task force of one ICU director, three critical care nursing leaders, and two respiratory therapists from two hospitals of Penn Medicine, with whom we conducted three 1-hour focus groups led by three members of the research team (T.K., M.B.L.-F., and M.P.K.). We presented the findings of the interviews by broad theme and provided preliminary objectives of an implementation program, which the research team developed on the basis of the CFIR constructs underlying each theme. The task force then refined these objectives through discussion.

Next, to facilitate the development of specific implementation strategies based on these themes and objectives, we provided the task force with a list of general strategies from the Expert Recommendations for

Table 1. Implementation mapping approach

Task	Description
1	Conduct a needs and assets assessment and identify adopters and implementers
2	Identify adoption and implementation outcomes, performance objectives, determinants, and change objectives
3	Select theoretical methods and design implementation strategies
4	Produce implementation protocols and materials
5	Evaluate implementation outcomes

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Implementing Change (ERIC) framework. In the ERIC project, an expert panel produced a list of 73 implementation strategies by using a modified Delphi process (23). These strategies were subsequently mapped to CFIR constructs by another expert panel, according to the likelihood that a given strategy could address an issue within a specific implementation construct (24). Using the CFIR–ERIC mapping tool, we selected those strategies that were mapped to the relevant CFIR constructs by at least 25% of experts (24). The task force then further developed and refined these general strategies into a list of specific strategies through discussion.

All focus-group conversations were documented by audio recording. Two study staff (J.A.S. and T.T.) additionally took notes during each of the focus-group sessions.

Implementation Planning

After development of the menu of specific implementation strategies, the Critical Care Alliance of Penn Medicine developed materials and plans for rapid implementation in the setting of the COVID-19 pandemic. Several members of the task force are members of the Critical Care Alliance, and in their health-system leadership roles, they guided implementation planning using the specific strategies as a foundation.

Analysis

We performed thematic analysis of qualitative interviews in two stages. We first coded all interview transcripts in NVivo 11 (QSR International) using CFIR as the codebook. Two research coordinators (T.S. and S.S.) coded the first three interviews by consensus and then coded the next three interviews independently and reviewed them together to ensure consensus. Thereafter, all interview transcripts were coded by research coordinators independently, with double-coding of 20% of interviews to ensure consistency. Outstanding coding questions and disagreements were resolved by consensus of four members of the team. Next, we identified broad themes of determinants and mapped them across CFIR domains. Three team members (T.T., J.A.S., and T.K.) developed a list of broad themes, which were then discussed and refined by the entire team. All coding and analysis were supervised by an experienced qualitative researcher (T.K.).

The team debriefed after each focus group to discuss identified interventions. Summaries were shared with participants to confirm agreement on the content.

Results

Determinants of Prone-Positioning Use

The qualitative interviews included 30 participants, as detailed in Table 2. The types of ICUs staffed by participants included both general and specialty ICUs (medical, surgical, cardiovascular, and neurological ICUs). Some participants worked in only one ICU, whereas others worked in more than one ICU.

When asked about the use of prone positioning, 8 respondents (27%) reported that their primary ICU used it frequently, 14 (46%) reported that it was sometimes used, and 8 (27%) reported that it was rarely or never used. Perceived determinants of prone-positioning use mapped to constructs from all five CFIR domains. We identified five broad themes, as summarized in Table E2: knowledge, resources, alternative therapies, team culture, and patient factors. Two domains were relevant across all themes: *1*) "intervention characteristics," which refers to characteristics of the evidence-based intervention, such as the quality evidence about the intervention, the relative advantage of the intervention over other treatments, the complexity of the intervention, and how easily it can be adapted locally and *2*) "inner setting," which refers to the setting immediately surrounding the intervention (in this case, the ICU environment) and includes constructs such as the structure of the setting, the culture within the setting, the climate for implementing new practices, and readiness for implementation (Figure E1).

Knowledge about prone positioning—including patient eligibility, its therapeutic value, and the procedure of actually putting a patient into a prone position—was consistently identified as integral to its uptake in the treatment of patients with ARDS. Many respondents were knowledgeable about the evidence that prone positioning is an effective intervention, particularly early in the course of ARDS; however, others perceived that prone positioning was often used as a rescue

Table 2. Participant characteristics

Characteristic	Participants (*N* = *30*)
Male, *n* (%)	13 (43)
Age, yr, mean (SD)	42 (9.4)
Race/ethnicity, *n* (%)	
White, non-Hispanic	22 (73)
Asian	7 (23)
White, Hispanic	1 (3)
Professional role, *n* (%)	
ICU director	4 (13)
ICU nurse manager	4 (13)
Physician, critical care attending or fellow	1 (3)
ICU hospitalist, nurse practitioner, or physician assistant	5 (17)
Nurse	9 (30)
Respiratory therapist	7 (23)

Definition of abbreviations: ICU = intensive care unit; SD = standard deviation.

Table 3. Program objectives to address themes of determinants of evidence-based use of prone positioning for severe ARDS

Theme	Program Objectives
Knowledge	Improve clinicians' knowledge about prone positioning—existing evidence, patient eligibility, timing, and process Provide training for new and inexperienced clinicians in prone-positioning processes Leverage experienced providers' expertise to provide education and leadership
Resources	Ensure adequate numbers of staff members Ensure availability of staff with expertise/experience Ensure availability of necessary supplies
Team culture	Facilitate and improve interdisciplinary communication Empower experienced staff to lead and educate Engage and educate ICU leadership
Patient factors	Educate providers on eligibility for (and contraindications to) prone positioning Educate providers on addressing clinical deterioration during prone positioning Provide education to family members regarding prone positioning
Alternative therapies	Provide education on timing of prone positioning Provide education about evidence regarding alternative therapies Standardize practices across providers Avoid improper use of prone positioning

Definition of abbreviations: ARDS = acute respiratory distress syndrome; ICU = intensive care unit.

therapy, or a "last ditch" effort, and expressed uncertainty about the right timing during the course of illness. Respondents also perceived that processes and protocols that describe indications for the intervention and outline staff roles and responsibilities could address lack of knowledge or variability in interpretation of the evidence for prone positioning. Respondents suggested that education and practice using simulations, videos, and photo cards could be useful. Furthermore, availability of ICU staff with knowledge of and experience with prone positioning—commonly nurses and nurse leaders—could facilitate administration of prone positioning to patients.

Availability of appropriate resources was identified consistently as necessary for effective implementation of prone positioning. Prone positioning requires physical labor by a number of staff members, and lack of adequate staffing was commonly identified as a barrier, particular during nighttime hours. Availability of a dedicated team to provide supplemental staff members when needed was described as a facilitator. Several participants mentioned that the availability of clinical protocols could serve as a resource to delineate roles and procedures. A few participants also mentioned that equipment designed to help turn patients is available, but opinions regarding the need to have any special turning equipment was mixed. Some also described a need for supplies to support the patient once turned, such as eye shields and foam pillows to prevent decubitus ulcers.

The culture of the team was believed to contribute substantially, although in somewhat less-concrete ways, to use of prone positioning. ICU leadership was considered influential; for example, an ICU director or nursing leader with belief in, and experience with, prone positioning could facilitate changing culture among the ICU staff. Attending physicians were commonly considered the leaders in decisions of whether or not to put patients into the prone position; however, team discomfort or inexperience with prone positioning was described as a barrier that could overcome an attending physician's clinical decision. Team dynamics were also considered an important factor. Teams that communicated well and allowed all members to voice their opinions and concerns, that incorporated mentorship, and that integrated education into their work were believed to be more effective in using prone positioning. Those who had prior experience were champions of implementation. Although culture change implementing a new intervention was challenging, seeing the intervention successfully used increased uptake and buy-in from clinicians. On the other hand, prior negative experiences or adverse outcomes with prone positioning could be a significant barrier. As clinicians gained additional experience with prone positioning, organizational culture changed and became more supportive of the intervention.

Patient factors such as comorbidities and potential contraindications influenced use of prone positioning. For example, higher severity of hypoxia prompted clinicians to consider administering prone positioning. Commonly mentioned patient factors that served as barriers were obesity and hemodynamic instability. Some providers believed that exposure to a higher volume of eligible patients increased use of prone positioning.

Availability of alternative therapies for ARDS were generally considered to be barriers to prone-positioning use. Although many respondents acknowledged that available evidence suggests that prone positioning is efficacious as an early intervention for ARDS, it was often administered as a last resort, after other therapies had been tried. Many participants had uncertainty about the order in which to administer the different therapies and expressed variability in the practice of different attending physicians. Furthermore, when staff were uncomfortable with prone positioning, they defaulted to interventions that were more familiar and required less effort, even those that had not been proven effective. In some ICUs, extracorporeal membrane oxygenation was often an initial intervention implemented to treat ARDS, in part because of the immediate availability of a proactive extracorporeal membrane oxygenation team and an institutional culture supporting its use.

Development of Implementation Strategies

On the basis of the main points of each broad theme, the ICU leadership task force specified program objectives (Table 3). We mapped the general strategies based on the ERIC framework to the CFIR constructs relevant to each theme (Table E3). Prompted by these main points and frameworks, the task force first refined the program objectives for each theme and then generated a list of specific strategies to improve prone-positioning use. The final output of this project phase was a

Table 4. Menu of candidate implementation strategies to improve evidence-based use of prone positioning, mapped to determinants potentially addressed by each strategy

Implementation Strategy	General Description	Themes Addressed
Educational outreach program	• In-person presentations, online educational materials, educational videos, and simulation training • Developed and led by local experts • Outreach to ICU leaders for buy-in and bedside providers for training	Knowledge Resources Team culture Patient factors Alternative therapies
Learning collaborative	• Team of interprofessional ICU leaders across a hospital or multiple hospitals of the health system • Regularly scheduled meetings to share experiences with prone positioning, including success stories and challenges	Knowledge Resources Team culture Patient factors Alternative therapies
Written clinical protocol	• Written guidelines that include step-by-step instructions regarding procedure, including equipment required and staffing roles • Including a "thinking map" with patient eligibility and contraindications to facilitate patient selection • Including an algorithm regarding when and how to incorporate alternative therapies • Developed by interprofessional team of local experts	Knowledge Patient factors Alternative therapies
Prone-positioning team	• Interprofessional team trained to perform prone-positioning procedure • Led by a local expert who could provide consultation regarding patient eligibility • Team could provide staffing resources to perform procedure, or training, or supervision of ICU staff • Responsible for centralized quality monitoring and feedback	Knowledge Resources
EHR-based alerting system	• Automated system that uses EHR data to identify patients who meet criteria for severe ARDS and prompts clinicians with a text message or via a dashboard of potential eligibility for prone positioning • Developed by ICU leaders with information services support • Could facilitate feedback on adherence rates and quality monitoring	Knowledge

Definition of abbreviations: ARDS = acute respiratory distress syndrome; EHR = electronic health record; ICU = intensive care unit.

multifaceted implementation menu of strategies that individually and collectively could address all the perceived determinants and achieve the program objectives (Table 4). For example, an interprofessional educational outreach program could improve knowledge of individual clinicians and ICUs, and it could also promote change in team culture through educating and obtaining buy-in from ICU leadership. Learning collaboratives could facilitate changes in team culture and belief in the value of prone positioning. Written clinical protocols and automated electronic health record–based alert systems could enhance knowledge about patient eligibility for prone positioning and provide prompts to clinicians to consider prone positioning. Hospital-wide prone-positioning teams could support inexperienced ICUs in patient identification, education, and staffing resources.

Development of Implementation Plan and Materials

In response to the COVID-19 pandemic, in anticipation of high rates of severe ARDS, the Penn Medicine Health System rapidly produced implementation plans and materials for all of these strategies (Table 5). The Critical Care Alliance, composed of a team of interprofessional ICU leaders across all health-system hospitals, which includes members of the task force that developed the implementation strategies, led the implementation planning and efforts. The alliance serves as a learning collaborative, in which ICU leaders meet monthly and share experiences and implementation plans of practices common to multiple ICUs. Experienced clinical nursing specialists serve as consultants for ICUs without prior experience with prone positioning. Leaders from the medical and surgical ICUs across the health system collaborated to create educational materials for widespread just-in-time training, including *1*) an educational video about procedures for placing patients into the prone position, *2*) a one-page clinical infographic card summarizing patient eligibility and procedures (*see* online supplement), and *3*) written guidelines for skin care, developed in conjunction with the Wound, Ostomy, and Continence Nursing team. The committee approved and disseminated a clinical protocol that had been developed previously in one medical ICU with historically high adherence to evidence-based prone positioning, thereby leveraging institutional experience and success and promoting leadership buy-in. An existing information technology program, the ARDS Finder (University of Pennsylvania), leverages the electronic health-system record to continuously screen patients for ARDS and display relevant ventilator data on an electronic dashboard. This system was enhanced to identify and alert clinicians when patients with ARDS meet criteria for prone positioning (*see* Figure E2). This alert also prompts ICU nursing leaders and ICU telemedicine staff, who can then provide validation and expertise regarding patient eligibility and procedures for prone positioning. Finally, four of the six hospitals have created prone-positioning teams, whose

Table 5. Specific implementation plans and materials for COVID-19 pandemic response

Implementation Strategy	Implementation Plan
Educational outreach program	• Development of educational video to demonstrate procedure for placing a patient into the prone position • Creation of a single-page infographic outlining patient eligibility, contraindications, and procedures for prone positioning • Availability of all educational materials on health-system website for COVID-19 learning resources
Learning collaborative	• Monthly meetings of interprofessional ICU leaders through the health-system Critical Care Committee to share experiences with prone-positioning use, among other clinical issues specific to critical illness with COVID-19 • Availability of clinical nurse specialists experienced in prone positioning for consultation across all health-system ICUs
Written clinical protocol	• Dissemination across all hospitals of written clinical protocol for prone positioning developed before the pandemic by one hospital's medical ICU
Prone-positioning team	• Development of a template for a prone-positioning team, including staffing and roles, equipment needed, and consultation parameters • Implementation of teams in four of six hospitals
EHR-based alerting system	• Enhancement of previously developed EHR-based screening system to identify patients with ARDS who are potentially eligible for prone positioning • Developed alerting system to prompt bedside clinicians, nursing leaders, and staff of ICU telemedicine program when a patient meets eligibility criteria • Increased interaction between ICU telemedicine staff and bedside staff to support decision-making regarding prone positioning and support and supervise procedures for turning patients safely

Definition of abbreviations: ARDS = acute respiratory distress syndrome; COVID-19 = coronavirus disease 2019; EHR = electronic health record; ICU = intensive care unit.

members provide consultation regarding eligibility for prone positioning, as well as staffing and expertise to safely implement prone positioning in sites with little prior experience and/or inadequate staffing. The committee has developed a template for the prone-positioning team, describing the staffing, the equipment needed, and the roles and responsibilities, to support the other hospitals as they build local prone-positioning teams.

Discussion

Using qualitative research methods and implementation-research frameworks, this study identified five broad themes of determinants of evidence-based use of prone positioning for patients with ARDS, including knowledge, resources, team culture, patient factors, and availability of alternative therapies, thus adding to an existing literature limited to an understanding of patient factors as determinants (1, 12). Determinants of implementation most consistently mapped to constructs within the two domains of intervention characteristics and inner setting. Therefore, strategies to improve use of these complex, team-based interventions for critically ill patients may be similarly complex and multifaceted to address multiple domains of implementation. Indeed, several of the specific strategies developed by the task force address several determinants. Knowledgeable and experienced clinicians can serve as educators and champions to improve awareness and change culture in their local environments. Educational programs, including simulation training and informational brochures, can also help inexperienced clinicians to acquire knowledge and comfort with a complex and unfamiliar intervention. Establishing clinical protocols or guidelines can serve a similar educational purpose, and they can also support the necessary team coordination. Finally, a culture of collaboration and teamwork, in which all clinician groups believe their concerns and suggestions are valued, can help to promote this team-based intervention. These findings are similar to studies of barriers and facilitators of other complex, team-based practices in critical care, such as low tidal volume ventilation for ARDS (25–29) and implementation of evidence-based mechanical-ventilation bundles (30). Lack of or erroneous knowledge about the interventions and team culture have been identified as important determinants, and clinical protocols can be important facilitators (31).

Although this study was initiated before the COVID-19 pandemic, the lessons learned are directly relevant to prone-positioning implementation in response to the current emergency. In fact, physicians in Wuhan found that prone positioning of patients with COVID-19 was widely used for critically ill patients (32) and appeared to improve hypoxia, protect organ function (33), and increase lung recruitability (34). We anticipate prone positioning will and should be implemented more broadly throughout the course of the pandemic. Our health system has taken a multifaceted approach to rapidly adapt and implement strategies to facilitate increased use of prone positioning in inexperienced and novel ICUs, selecting those developed by the task force that were perceived to be most readily implemented (e.g., the existing clinical protocol and an automated alert from one ICU were refined and disseminated broadly) and that would be most effective (e.g., the development of hospital prone-positioning teams that could bring knowledge, experience, and resources to multiple ICUs).

Strengths and Limitations

Our study has several strengths. To our knowledge, it is the first study to identify ICU- and clinician-level determinants of evidence-based use of prone positioning, expanding the existing literature on patient-level determinants. We included broad groups of clinicians, and we conducted interviews in hospitals of various sizes and organizational models and focus groups with a diverse set of clinicians. We used implementation frameworks to code the data from interviews and to develop specific strategies to ensure that we considered evidence-based domains of implementation. Our study also had a few notable limitations. First, all the interviews were conducted

among clinicians of two large academic hospital systems; therefore, they may not be representative of all possible perspectives. We did, however, include several different hospitals and ICU types to elicit perspectives from clinicians who care for a broad array of patients under different organizational models and have variable exposure to prone positioning, with some clinicians practicing in settings where prone positioning was not performed at all. Second, we also used a convenience sample of those who agreed to participate, so the sample may be subject to self-selection bias; however, we heard a variety of perspectives from people who represent varied positions, and we believe we reached thematic saturation on this topic. Third, our needs assessment was performed before the COVID-19 pandemic began, so we could not capture factors that may be particularly relevant to immediate practice, such as concerns over personal-protective-equipment conservation with a staff-intensive intervention. However, the lessons learned were immediately relevant to our local practice during the pandemic and may remain relevant beyond this crisis. Lastly, the final task of implementation mapping involves evaluation of implementation outcomes, which we have not yet performed; therefore, we cannot report on the success of these strategies. Importantly, we did not attempt to estimate the costs or resources required to develop and implement the strategies as described. This implementation outcome may be of particular importance in the context of a pandemic, when both hospital finances and the time ICU and hospital leaders have to dedicate to implementation efforts may be strained. Future work should assess how these strategies impact implementation outcomes in the different contexts in which they will be applied.

Conclusions

In summary, our study identified several broad themes of barriers to and facilitators of evidence-based implementation of prone positioning for severe ARDS, a lifesaving, proven-effective treatment that is administered to a minority of eligible patients. We identified specific methods for implementation in the areas of infrastructure, personnel, guidelines/protocols, and leadership buy-in. We have developed implementation plans for some of these strategies in our own institution and believe they can inform the increased uptake of prone positioning in response to the COVID-19 crisis. ■

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