

## NK7 – INNOVATION

*Provide one example, with supporting evidence, of an innovation implemented within the organization involving nursing.*

In March 2020, New York City became the epicenter of the COVID-19 pandemic. NewYork-Presbyterian/Columbia University Irving Medical Center (NYP/Columbia), located in New York City, quickly became overwhelmed with critically ill COVID-19 positive patients. In response to the surge of critically ill COVID-19 patients with acute respiratory failure, NYP/Columbia increased its intensive care unit (ICU) capacity by over 250 percent. ICUs were established in unconventional locations such as operating rooms, on medical-surgical floors and post-procedural observation units, and in the emergency department. Specialized ICUs, originally designated for neurologic, pediatric, post-surgical, and cardiac cases, were repurposed to predominantly treat adult patients with COVID-19-related acute respiratory failure and acute respiratory distress syndrome (ARDS) requiring mechanical ventilation.

### **Introducing an Innovative Prone Team**

Prone positioning was a well-established program in the MICU (4HN-605420) [MICU] for the management of moderate-to-severe ARDS. Prone positioning had historically been a nurse-led program. However, during COVID, clinical nurses beyond the MICU, especially those working in ICU converted areas, lacked familiarity and resources to perform prone positioning. While prone positioning was not a new treatment modality for patients with ARDS, the volume and acuity of COVID-19 patients was unprecedented and the NYP/Columbia clinical team required an innovative way to deliver evidence-based prone positioning care to patients throughout the organization regardless of the patient location.

With the support of Emily Jackson, MBOE, BSN, RN, NEA-BC, Director of Nursing (at the time) and Winsome “Max” West, MSN, MBA, RN, SCRNP, Patient Care Director (at the time), Patrick Ryan, MA, MS, RN, NP-C, CNS, CWOCN, CCRN, clinical nurse specialist (clinical nurse) (at the time), MICU, and Cynthia “Cyndy” Fine, MSN, RN, CRRN, Coordinator (clinical nurse) (at the time), Rehabilitation Clinical Program; approached Briana Short, MD, and Natalie Yip, MD, assistant attendings in the

NYP/Columbia ICUs, to exchange ideas for an innovative prone positioning practice. Mr. Ryan and Ms. Fine pioneered the idea of a mobile team comprised of nurses, that included the integration of occupational therapists (OT) and physical therapists (PT) as members of the team. The providers and nurses agreed that a COVID-19 Mobile Prone Team was an innovative approach to proning patients throughout NYP/Columbia. The PT and OT skill set of body mechanics and transfers, along with their involvement in a long-standing early mobilization program at NYP/Columbia, made them ideal team members for an interprofessional prone team. Since PT and OT consults had declined due to COVID, Mr. Ryan, Ms. Fine, Dr. Short, and Dr. Yip reached out to Rita Hamburg, PT, MA, Site Director, Rehabilitation Services, to gain support and recruit PTs and OTs from the NYP/Columbia Department of Rehabilitation Medicine.

Mr. Ryan and Ms. Fine identified Daphne Polynice, MSN, RN, ACNS-BC; Portia Adu Sarhene, DNP, AGACNP-BC, CCRN; and Ellie Jun, DNP, RN, CCRN, clinical nurses (at the time), MICU, as clinical RN leaders. Ms. Hamburg identified PTs and OTs willing to join the innovative interprofessional and mobile prone team to perform prone positioning on COVID-19 patients with ARDS requiring mechanical ventilation. Additionally, Ms. Hamburg, Dr. Short, and Dr. Yip assured the interprofessional COVID-19 Mobile Prone Team that the respiratory therapists and physicians working in the ICUs were aware of the plan to form this team and would be available to assist as needed. The response for help was overwhelming and a group of over 30 interprofessionals joined together to form the innovative interprofessional COVID-19 Mobile Prone Team.

On March 27, 2020, the PT/OT members of the interprofessional Mobile Prone Team required education on prone positioning. During leadership rounds on the ICU, Mr. Ryan and Ms. Fine requested Ms. Polynice, Dr. Adu Sarhene, and Dr. Jun to assist with the simulated training session. [NK7.1—Leadership Rounds Notes](#)

On March 30, 2020, the interprofessional Mobile Prone Team members received hands-on education with simulated experience using proning devices. They learned to use various techniques and equipment such as the Mölnlycke Tortoise® Turning and Positioning System. Mr. Ryan and Ms. Fine followed-up with the members of the interprofessional Mobile Prone Team to ensure they received proper training and felt comfortable with prone positioning. In addition, the COVID-19 Mobile Prone Team developed step-by-step guidelines for prone positioning to be used with each patient encounter, which were finalized on March 31, 2020. [NK7.2—COVID-19 Prone Team Guidelines](#)

On April 1, 2020, the NYP/Columbia interprofessional COVID-19 Mobile Prone Team started performing prone positioning on COVID-19 patients with ARDS in the ICU and pop-up ICUs. The team worked from 7:00 am to 7:30 pm, seven days a week, to cover the high volume of critically ill COVID-19 patients with ARDS. In April 2020, NYP/Columbia released “NYP/Columbia Prone Positioning for the COVID-19 Patient: Protocol for Clinical Practice” to guide the clinical ICU teams on prone positioning and the activation of the interprofessional COVID-19 Mobile Prone Team. [NK7.3—NYP Columbia Prone Positioning Protocol](#)

On April 6, 2020, at 10:40 am, the interprofessional COVID-19 Mobile Prone Team was called to perform prone positioning on Mrs. XX, a critically ill COVID-19 ICU patient. Prone team members, including Mr. Ryan and Amy Sommerville, MS, OTR/L (OT), safely placed the patient back in a supine position as documented on the supine-to-prone progress note in the EMR. On April 6, 2020, at 4:30 pm, the interprofessional Mobile Prone Team, Mr. Ryan and Ms. Sommerville, returned to place the patient in the prone position, as documented on the prone-to-supine progress note in the EMR. During the COVID-19 surge in April 2020, New York State Governor Andrew Cuomo waived documentation requirements for clinical RNs due to the overwhelming volume and acuity of critically ill patients. Instead, the nurses completed checkboxes on the progress note to indicate the presence of the clinical RN, Mr. Ryan, during the proning of the patient. [NK7.4—Prone Team Documentation](#)

### **Disseminating the Innovation**

The interprofessional and mobile approach in performing prone positioning interventions to critically ill COVID-19 patients with ARDS across 14 separate ICUs with a combined total of 240 COVID ICU beds, was an innovative solution. At the time, there had been no peer-reviewed literature outlining the implementation of an interprofessional and mobile team-approach for the purpose of safe prone positioning. Dr. Short; Madhavi Parekh, MD; Mr. Ryan; Maggie Chiu, PT, DPT, GCS; Ms. Fine; Peter Scala, MSPT; Shirah Moses, OTR/L; Ms. Jackson; Daniel Brodie, MD; and Dr. Yip collaborated on the manuscript, “Rapid implementation of a Mobile Prone Team during the COVID-19 pandemic,” which was published in the *Journal of Critical Care*, to disseminate this innovation. Additionally, Dr. Chiu; Adam Goldberg, PT, DPT; Ms. Moses; Mr. Scala; Ms. Fine; and Mr. Ryan wrote, “Developing and Implementing a Dedicated Prone Positioning Team for Mechanically Ventilated ARDS Patients During the COVID-19 Crisis,” which was published in *The Joint Commission Journal on Quality and Patient Safety* in June 2021. [NK7.5—Journal of Critical Care and TJC Publication](#)

NewYork-Presbyterian/Columbia University Irving Medical Center  
**ICU Leadership Round Minutes**  
**March 2020**

PRESENT: Emily Jackson, RN; Max West, RN; Patrick Ryan, RN; Cyndy Fine, RN  
 DATE: March 27, 2020

TOPIC	DISCUSSION	FOLLOW-UP
<p><b>Prone Education and Training</b></p>	<p>Emily and Max discussed the plan for the interprofessional COVID-19 Prone Team for critically ill patients in the ICUs (including pop-up ICU locations).</p> <p>Max noted Patrick and Cyndy will facilitate an education session to assure the PTs, OTs, MDs and RTs know how to use the Tortoise® Turning and Positioning System and safely prone patients.</p> <p>Patrick and Cyndy suggested Daphne Polynice, RN; Portia Adu Sarhene, RN; and, Ellie Jun, RN to assist with education session and serve as clinical RN leaders on the Prone Team as necessary.</p> <p>Education session scheduled for March 30. Will use simulation and hands-on training. Will offer additional session as necessary.</p>	<p>Patrick will also serve as primary RN on the Prone Team, as he can Prone all patients as needed with the interprofessional team. He will offer continuing education as needed for the Prone Team members.</p> <p>Patrick and Max will follow-up with Daphne, Portia and Ellie to confirm their role in the education and on the Prone Team.</p> <p>Patrick and Cyndy to follow-up with Rita regarding timing of education for PT/OT colleagues. Max will follow-up with Dr. Short and Dr. Yip regarding education session.</p>

## Prone position: step by step

- **Supine to Prone:**
- Assemble equipment-
  - Tortoise Prone (Lawson# 500602)
  - Extra set monitoring leads
  - Draw sheet & incontinence pad
- Assemble team:
  - Turn team- 4 staff, 2 on each side, includes team leader.
  - RT
  - Provider (to monitor, assist in emergency)
- Assess bed:
  - Flat, head and foot of bed locked in place
  - At appropriate height for all team members
- Assess patient:
  - Lines (CVC, PIV, A-line)- disconnect all unnecessary lines
  - Drains- If IUC &/or chest tube, run all drains to foot of bed.
  - ETT security
  - Place pulse oximeter on same side as radial A-line.
  - Disconnect SCDs if in use.
- Patient should be on draw sheet from shoulders to knees. Patient should not be in direct contact with Tortoise/ prone pads at any time.
- Tortoise pad (larger pad) goes underneath drawsheet, centered, top at patient shoulder level.
- Prone pad (smaller pad) goes on top of Tortoise & underneath drawsheet, centered with top at patient shoulder level & handles at sides.
- Team leader & RT constant communication to ensure ETT safety
- Two (2) staff pull patient **on prone pad** gently to side of bed (same side as A-line), other two (2) staff hold Tortoise.
- Two (2) staff pull Tortoise to other side of bed, exposing "spine", as patient and prone pad held in place. Place new draw sheet & incontinence pad on top of Tortoise.
- Tuck hand that will be under patient with palm to buttock. Using prone pad, turn patient (with A-line on top), hold patient at half-way point, release prone pad, apply new leads to back, remove old leads from chest. Place prone pad and old draw sheet aside.
- Pull Tortoise pad to assist in completing turn (patient should be facing toward side with A-line).
- Center patient and Tortoise.
- Insert large fluidized positioner (FP) underneath Tortoise on same side as A-line, from shoulder to hip. Tuck side and tail of Tortoise.
- Place smaller FP under head from back, molding to wedge shape, offloading pressure areas. Ensure patient neck not hyper extended, & bed locked in flat position. When stable, may place in reverse Trendelenburg.
- **Turn & reposition:**
- Assemble team:
  - Primary RN- additional staff member if needed.
  - RT
- Assess bed:
  - Flat, head and foot of bed locked in place

## Prone position: step by step

- At appropriate height for all team members
- Assess patient:
  - ETT security
- Remove FPs
- If neck supple and no risk, may turn head to face other side without lifting, otherwise may lift using Tortoise to safely turn head.
- Replace FPs on opposite sides.
- **Prone to supine:**
- Assemble equipment-
  - Extra set monitoring leads
  - Draw sheet & incontinence pad
- Assemble team:
  - Turn team- 4 staff, 2 on each side
  - RT
  - Provider (to monitor, assist in emergency)
- Assess bed:
  - Flat, head and foot of bed locked in place
  - At appropriate height for all team members
- Assess patient:
  - Lines (CVC, PIV, A-line)- disconnect all unnecessary lines
  - Drains- If IUC &/or chest tube, run all drains to foot of bed.
  - ETT security
  - Place pulse oximeter on same side as radial A-line.
  - Disconnect SCDs if in use.
- Patient should be on draw sheet from shoulders to knees, Tortoise at shoulder level. Patient should not be in direct contact with Tortoise/ prone pads at any time.
- Place prone pad (smaller pad) on top of Tortoise & underneath drawsheet, centered with top at patient shoulder level & handles at sides.
- Team leader & RT constant communication to ensure ETT safety
- Two (2) staff pull patient on prone pad gently to side of bed (same side as A-line), other two (2) staff hold Tortoise.
- Two (2) staff pull Tortoise to other side of bed, exposing "spine", as patient and prone pad held in place. Place new draw sheet & incontinence pad on top of Tortoise.
- Tuck hand that will be under patient with palm to buttock. Using prone pad, turn patient (with A-line on top), hold patient at half-way point, release prone pad, apply new leads to back, remove old leads from chest. Place prone pad and old draw sheet aside.
- Pull Tortoise pad to assist in completing turn.
- Center patient and Tortoise.
- Insert large fluidized positioner (FP) underneath Tortoise on same side as A-line, from shoulder to hip. Tuck side and tail of Tortoise.
- Place smaller FP under head, offloading pressure areas.

## **Prone positioning for the COVID-19 patient**

**Prone positioning should be done with only attending approval and after consulting pulmonary critical care.**

Discuss with Oversight attending if patient is in ICU. Consult Medical Critical Care if patient is in the OR-ICU

The prone team can be contacted by the PT Lead (332-218-3598)

### **Background**

1. Prone positioning improves outcomes in patients with moderate to severe acute respiratory distress syndrome (ARDS)

### **Indications**

1. Patient intubated with **ARDS and P:F <150** (FiO<sub>2</sub> ≥60% and PEEP ≥10) when RASS -5
2. Proning should ideally be initiated **within 12-24 hours of P:F<150**
3. Proning decision made **in consultation with medical critical care consulting team or oversight attending**
4. Proning performed in **conjunction with Prone team**

### **Potential contraindications**

- |  |  |
|--|--|
| 1. Significant hemodynamic instability                 | 11. Bronchopleural fistula                                     |
| 2. Severe acidemia                                     | 12. Unstable fracture  |
| 3. Cerebral perfusion pressure <30mmHg                 | 13. Serious burn (20% body surface area)                       |
| 4. Increased ICP >30                                   | 14. Spinal instability   |
| 5. Pregnancy   | 15. History of difficult intubation or nasotracheal intubation |
| 6. DVT treated for <2 days                             | 16. Inability to tolerate face down position                   |
| 7. Facial surgery or severe facial trauma              | 17. Recent sternotomy or major abdominal surgery               |
| 8. Massive hemoptysis                                  | 18. Recent tracheostomy  |
| 9. Pelvic fractures                                    | 19. Active intra-abdominal process                             |
| 10. Life-threatening cardiac arrhythmia within 24hours | 20. LVAD, BiVAD, IABP, ECMO                                    |

### **General approach**

1. Patients are placed in the prone position for a **minimum of 16 hours**. This time determination is made generally by staffing ability, minimize turning and use of PPE. Proning sessions can to **extend to 24 hours if needed**
2. Continue **repeat proning** sessions if **P:F <150** when supine and FiO<sub>2</sub> ≥60% and PEEP ≥10
3. **Stop proning** sessions when **maintaining P:F ≥150** with FIO<sub>2</sub> ≤60%, PEEP ≤10

### **Where can prone positioning take place**

1. Any ICU (including ORICU)

### **How many people are needed for re-positioning**

1. Between **2 and 4 people** are needed to turn patient depending on team and size of patient
2. Proning team will determine this
3. In addition, **respiratory therapy** and a **member of the primary team** (physician, NP or PA) are needed during re-positioning

### **Proning Team**

1. The Prone team should be consulted for any proning outside of the MICU or AICU
2. The Prone team will cover all major repositioning (supine/prone and prone/supine)
3. The Prone team is available Monday through Saturday from 7am-7pm
4. The Prone team will attempt to coordinate proning efforts during this time
5. The prone team can be contacted by the PT Lead (332-218-3598) or if unavailable, the OT Lead of the team (332-218-4666).

### ***Proning outside of the MICU or AICU should not take place without consultation of Medical Critical Care***

- Discuss with **Oversight attending** if patient is in **CCU, CTICU, NICU, SICU**.
- **Consult Medical Critical Care** if patient is in the **OR-ICU** (order can be placed in EPIC under Medical Critical Care Consult)
- The Medical Critical Care team and or oversight attending will coordinate with the Prone team timing of positioning.

### **Timing of re-positioning**

1. Coordinate with Proning Team and Medical Critical care consultant/Oversight attending
2. In an effort to conserve PPE prone/supine repositioning should be scheduled during other patient care.
3. Coordinate with nursing and providers to minimize repeat entrance into patient's room
  - a. For example, time with physician examination, general nursing care, planned bathing

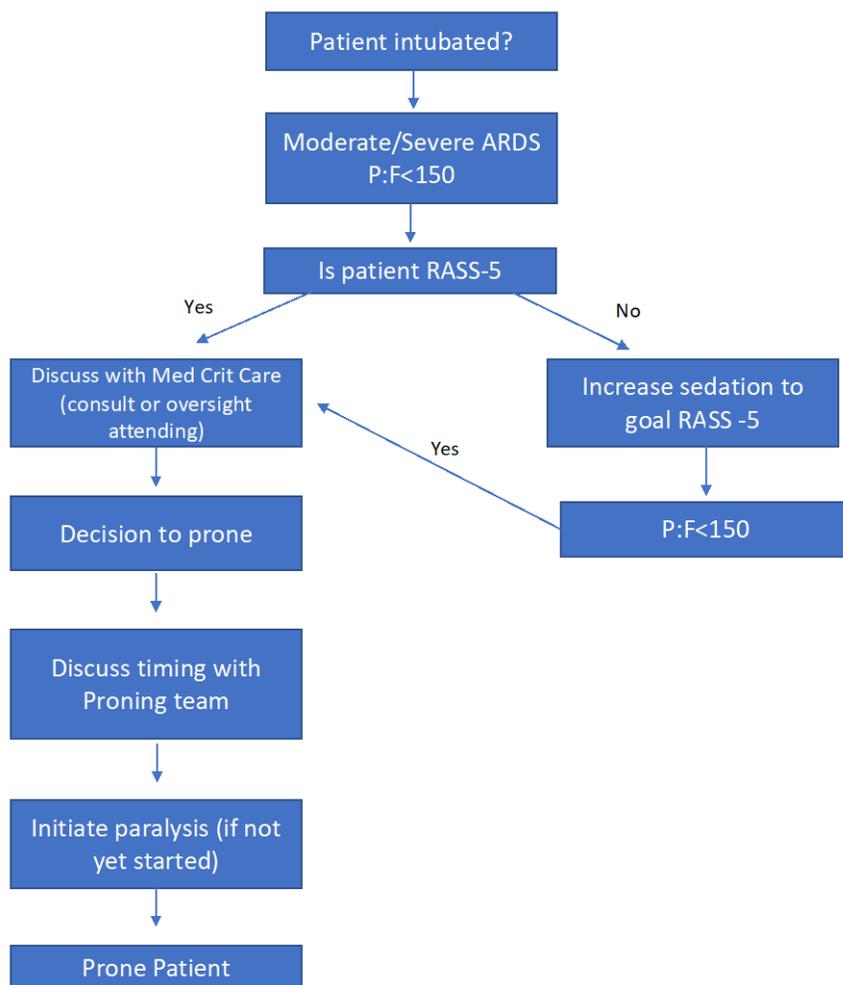
### **HCW safety/PPE**

1. All patients must be paralyzed during prone positioning and turning to ensure health care worker (HCW) safety given risk of extubation and circuit disconnect
2. HCW should wear N95s (in addition to other PPE recommended for COVID-19 patient) during changes in position due to risk of endotracheal extubation

### Checklist

- P:F<150 when FiO<sub>2</sub> ≥60% and PEEP ≥10 and RASS-5
- Medical Critical Care consulting/oversight attending aware
- Prone team aware
- Patient paralyzed
- Tortoise Prone™ secured from Prone team in coordination with MICU nursing
- Order placed in EPIC

### Flowchart



# NK7.4—Mrs. XX Prone Team Documentation

Chart Review History Allergies Problem List Immunizations Demographics Select Encounter Place Amb Orders Write Note Send Letter Call Patient Refill Med Create Encounter

Report Viewer

Report History View pane 1 View pane 2 Split Up/Down Split Left/Right Detach Window

04/06/2020 10:40 Progress Notes ED to Hosp-Admission (Discharged)

04/06/2020

Deceased

Female, Deceased (69 year old)

Needs Interpreter: SPANISH  
Code: Full, see Code Status History (no ACP docs)

Search

COVID-19 Vaccine: Unknown

Care Team: No PCP  
Coverage:

Allergies: No Known Allergies

ACD Status: No  
Pain Agreement: Not on File

None

Wt: 88.3 kg >30 days  
BP: 137/56 >1 day

LAST 3 YR

- ED to Hosp-Admission (Discharged)
- Anes (2), EMERGENCY ME, Gastro, OB/Gyn, Radiology (2)
- Lab (30+)
- Micro (15)
- Imaging (19)
- Other (14)

PROBLEM LIST (1)

Amv L Somerville, OT Occupational Therapist  
Progress Note Signed  
Date of Service: 4/6/2020 10:40 AM

**Patient Prone / Supine Position Note**

Safety Check Off	Yes/No
Primary Provider present in case of Emergency	Yes
RM present at bedside or doorside	Yes
RT present to stabilize ETT	Yes
• Pt positioned without extubation	Yes
• Pt positioned without lines removed	Yes
• Pt positioned in bed and not accidental falls occurred	Yes
• If supine -> Prone, HOB / foot of bed Locked	NA

\*\*Time: 10:40; Supined

Vent @ P102: 70 (0-70) / PEEP: 18  
pO2: 145 / P / F Ratio: 145/7=207  
ETT @ Up Pre: 22 Post: 22

Electronically signed by Amv L Somerville, OT at 4/6/2020 2:40 PM

ED to Hosp-Admission (Discharged) on 3/26/2020

Chart Review History Allergies Problem List Immunizations Demographics Select Encounter Place Amb Orders Write Note Send Letter Call Patient Refill Med Create Encounter

### Report Viewer

Report History View pane 1 View pane 2 Split Up/Down Split Left/Right Detach Window

04/06/2020 16:30 Progress Notes ED to Hosp-Admission (Discharged)

04/06/2020 04/06/2020

**Deceased**

Female, Deceased (69 year old)

Needs Interpreter: SPANISH  
Code: Full, see Code Status History (no ACP docs)

Search

COVID-19 Vaccine: Unknown

Care Team: No PCP  
Coverage:

Allergies: No Known Allergies

ACO Status: No  
Pain Agreement: Not on File

None

Wt: 88.3 kg >30 days  
BP: 137/56 >1 day

LAST 3YR

- ED to Hosp-Admission (Discharged)
- Anes (2), EMERGENCY ME, Gastro, OB/Gyn, Radiology (2)
- Lab (30+)
- Micro (15)
- Imaging (19)
- Other (14)

PROBLEM LIST (1)

Amy L Sommerville, OT Occupational Therapist  
Progress Notes Signed  
Date of Service: 4/6/2020 4:30 PM

#### Patient Prone / Supine Position Note

Safety Check Off	Yes/ No
Primary Provider Present in case of Emergency	Yes
RN present at bedside or doornside	Yes
RT present to stabilize ETT	Yes
• Pt positioned without extubation	Yes
• Pt positioned without lines removed	Yes
• Pt positioned in bed and not accidental falls occurred	Yes
• If Supine -> Prone, HOB / foot of bed Locked	Yes

\*\*Time: 16:30: Prone  
Vent @ FIO2: 70 (0.70) / PEEP: 18  
pO2: 126 / P / F Ratio: 126/.7=180  
ETT @ Lip Pre: 24 Post: 24

Electronically signed by Amy L Sommerville, OT at 4/6/2020 5:53 PM

ED to Hosp-Admission (Discharged) on 3/26/2020



## Rapid implementation of a mobile prone team during the COVID-19 pandemic



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### ABSTRACT

**Purpose:** The coronavirus disease 2019 (COVID-19) is associated with high rates of acute respiratory distress syndrome (ARDS). Prone positioning improves mortality in moderate-to-severe ARDS. Strategies to increase prone positioning under crisis conditions are needed.

**Material and methods:** We describe the development of a mobile prone team during the height of the crisis in New York City and describe characteristics and outcomes of mechanically ventilated patients who received prone positioning between April 2, 2020 and April 30, 2020.

**Results:** Ninety patients underwent prone positioning for moderate-to-severe ARDS. Sixty-six patients (73.3%) were men, with a median age of 64 years (IQR 53–71), and the median PaO<sub>2</sub>:FiO<sub>2</sub> ratio was 107 (IQR 85–140) prior to prone positioning. Patients required an average of 3 ± 2.2 prone sessions and the median time of each prone session was 19 h (IQR 17.5–20.75). By the end of the study period, proning was discontinued in sixty-seven (65.1%) cases due to clinical improvement, twenty (19.4%) cases due to lack of clinical improvement, six (5.8%) cases for clinical worsening, and ten (9.7%) cases due to a contraindication.

**Conclusion:** The rapid development of a mobile prone team safely provided prone positioning to a large number of COVID-19 patients with moderate-to-severe ARDS.

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### 1. Introduction

During the coronavirus disease 2019 (COVID-19) pandemic, an overwhelming majority of those requiring ICU level of care had acute hypoxemic respiratory failure requiring mechanical ventilation for acute respiratory distress syndrome (ARDS) [1]. ARDS is common. In one large observational study, 23.4% of patients requiring mechanical ventilation for acute respiratory failure met criteria for ARDS. Mortality from ARDS depends on severity, and ranges from 35 to 46% [2]. Prone positioning, when used in conjunction with low tidal volume ventilation, has been shown to significantly reduce mortality in moderate-to-severe ARDS [3–5]. Despite the evidence, the use of prone positioning in moderate-to-severe ARDS remains low [2,6]. Barriers to implementation of prone positioning

include lack of provider recognition of ARDS, uncertainty of evidence, and resource utilization [2,3].

Our medical intensive care unit (MICU) instituted a prone positioning program in 2014 for the management of moderate-to-severe ARDS. The MICU Prone Program was a nursing-led initiative that trained MICU nurses in safe manual placement of patients with ARDS in the prone position. Indications for proning were based on prior evidence [4], including patients with moderate-to-severe ARDS with a ratio of partial pressure of arterial oxygen to fraction of inspired oxygen (PaO<sub>2</sub>:FiO<sub>2</sub>) of <150 despite standard-of-care management with low-volume, low-pressure ventilation and adequate ventilator synchrony. Between 2014 and 2019, our MICU successfully proned seventy-nine patients, with increasing experience over time.

New York City was an epicenter of the coronavirus disease 2019 (COVID-19) pandemic. In the face of this pandemic, our hospital increased our ICU capacity by over 250% in the setting of a surge of critically ill COVID-19 patients with acute respiratory failure. ICUs were created throughout the hospital in non-traditional areas including operating rooms, medical-surgical floors, post-procedural observation units

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and in the emergency department. Additionally, other subspecialty ICUs, including neurologic, pediatric, post-surgical and cardiac were repurposed to treat primarily adult patients with COVID-19-associated acute respiratory failure and ARDS requiring mechanical ventilation. Many of these patients met criteria for moderate-to-severe ARDS, but ICU staff outside of the MICU were not familiar with prone positioning. In an effort to increase our ability to meet this demand, we rapidly developed and trained a mobile prone team, capable of servicing ICUs throughout the hospital. Here we describe the series of patients with moderate-to-severe ARDS treated during the COVID-19 pandemic with prone positioning.

## 2. Methods

### 2.1. Prone team development

The COVID-19 Prone Team at NewYork-Presbyterian – Columbia University Irving Medical Center was developed as a dedicated mobile team comprised of a MICU clinical nurse specialist (CNS), occupational therapists (OTs), and physical therapists (PTs), who were redeployed to this role from their usual clinical jobs. Twelve OTs and twelve PTs were trained to be part of the team during the height of the pandemic. They all had cardiopulmonary rehabilitation experience, and most have worked with ICU patients as part of our early mobilization program. In addition to knowledge of body mechanics and positioning critically ill patients, they had experience in securing airways, lines, drains, and monitoring devices in an ICU setting.

These therapists underwent prone positioning training, developed by the MICU CNS, based on education materials that had been previously developed for the MICU Prone Program.

The MICU CNS led the development of the MICU Prone Program and had developed its protocol and nursing policy. In addition, the MICU CNS was certified in wound, continence and ostomy (CWOCN) with experience in pressure injury prevention and treatment. Training included education in basic principles of ARDS management and indications for prone positioning. It involved review of an instructional video [4], repetitive demonstration of equipment usage and positioning techniques, communication exercises to enhance overall teamwork during positioning, and proper donning and doffing of personal protective equipment (PPE).

To simulate a typical patient, a manikin equipped with an endotracheal tube, central venous catheter, arterial line, chest tube, foley catheter, cardiac monitor leads and a pulse oximeter lead was used for practice of positioning technique. The team performed multiple iterations of placement in prone and supine positions (Supplemental Image S1), including emergent positioning. Roles for team members included: team leader, airway manager (AM), turn team, line manager, recorder and vital signs monitor. Outside of the simulation environment, the role of AM was filled by a member of the ICU treating team or respiratory therapy. Training emphasized safety checks during positions to avoid loss of the airway, chest tubes, the central venous line or the arterial line. To avoid staff injury the training emphasized the importance of team members moving in sync.

Patients were manually positioned with the Tortoise Turning and Positioning System Prone (Mölnlycke Health Care, Gothenburg, Sweden) consisting of two low-pressure air-filled pads and two fluidized positioners to support and offload the patient. When this system was not available sheets were used to aid in the procedure. Due to the rapidly growing need for prone positioning beyond the MICUs, this training was completed in only two days prior to team launch.

The COVID-19 Prone Team covered 14 separate ICUs, a combined total of 240 COVID ICU beds. Their day-to-day availability increased based on demand, up to 7 days a week, from 7 am to 7 pm at the peak, for 22 days. If a patient needed to be emergently repositioned outside of the COVID-19 Prone Team hours, they were repositioned by

MICU nurses. In the event of cardiac arrest, if a patient could not be safely placed in the supine position, the protocol specified the prone position should be maintained for cardiopulmonary resuscitation in an effort to minimize risk of ventilator circuit disconnect with the associated risk of aerosolization of viral particles [7,8]. To date during this pandemic, our institution has not had a patient in cardiac arrest while in the prone position.

The daily COVID-19 Prone Team included the MICU CNS and five to six OTs and PTs. During proning, the MICU CNS and four therapists would enter the patient's room, and the remaining therapists acted as a scribe and runner and remained outside of the room. A note was placed in the electronic medical record indicating time, safety checklist, positioning of patient, and PaO<sub>2</sub>:FiO<sub>2</sub> ratio prior to repositioning. A member of the primary ICU treating team was required to be present during repositioning to manage emergencies. All patients who were prone were deeply sedated and receiving neuromuscular blockade during their proning session and during repositioning as previously described [4,9], and in an effort to minimize risk of virus exposure to the COVID-19 Prone Team via ventilator circuit disconnect or coughing by the patient [10].

### 2.2. Indications for proning

Patients who met criteria for prone positioning by the mobile prone team included those who were invasively mechanically ventilated with ARDS and a PaO<sub>2</sub>:FiO<sub>2</sub> < 150 despite standard-of-care management with low-volume, low-pressure ventilation and adequate ventilator synchrony, and required an FiO<sub>2</sub> ≥ 60% with positive end-expiratory pressure (PEEP) ≥ 10; the same indications established prior to the COVID-19 pandemic. Contraindications included clinical or physical conditions that precluded safe prone positioning (Table 3). Patients remained prone for 16–24 h per session. This length of time depended on the COVID-19 Prone Team availability. Proning was continued if the PaO<sub>2</sub>:FiO<sub>2</sub> remained < 150 when supine with FiO<sub>2</sub> ≥ 60% and PEEP ≥ 10. Proning was discontinued when the PaO<sub>2</sub>:FiO<sub>2</sub> was ≥ 150 with FiO<sub>2</sub> ≤ 60% and PEEP ≤ 10 while supine, if a patient did not tolerate positioning as determined by the treating team, or if the treating team declined.

### 2.3. Data collection and analysis

Baseline characteristics and clinical measures, including sex, age, height, weight, date of endotracheal intubation, date of prone position initiation, mechanical ventilator settings and Sequential Organ Failure Assessment (SOFA) score at time of prone position initiation were retrospectively collected for all patients treated by the COVID-19 Prone Team from April 2 through April 30, 2020. Further clinical measures and patient outcomes, including number of daily positionings completed, duration of proning, PaO<sub>2</sub>:FiO<sub>2</sub> during proning, adverse events during proning, patient tolerance of prone positioning, days on mechanical ventilation, tracheostomy, and mortality were collected through May 14, 2020. Continuous variables were expressed as means (+/– Standard Deviation) and medians (Interquartile range). Categorical variables were summarized as counts and percentages. This study was approved by Columbia University Irving Medical Center Institutional Review Board (study number AAAT0603).

## 3. Results

Between April 2 and April 30, 2020, ninety patients were treated by the COVID-19 Prone Team. Of these ninety patients, thirteen required two unique proning episodes at separate time points during their hospitalization due to recurrent moderate-to-severe ARDS that met criteria for prone positioning. All patients requiring proning during this time were prone by this team, including within the MICUs. During this

**Table 1**  
Baseline characteristics.

Study Population	N = 90
Age, median (IQR)	64 (53–71)
Sex, n (%)	
Female	24 (26.7)
Male	66 (73.3)
Height, inches, mean $\pm$ SD	66.1 $\pm$ 3.62
BMI, median (IQR)	29.4 (26.1–33.9)
Comorbidities, n (%)	
Hypertension	50 (55.6)
Diabetes mellitus	42 (46.7)
SOFA score on day of first prone session, mean $\pm$ SD	10.3 $\pm$ 2.5
ICU location, n (%)	
Medical	15 (16.7)
Neurologic	12 (13.3)
Cardiac	13 (14.4)
Surgical	10 (11.1)
Operating Room	16 (17.8)
Medical/Surgical Floor Converted	9 (10)
Pediatric	6 (6.7)
Cardiothoracic	7 (7.8)
Post-procedural observation units	1 (1.1)
Emergency Department	1 (1.1)
Tidal Volume at time of first prone session, cc/kg of predicted body weight, median (IQR)	6.0 (5.5–6.26)
Median plateau pressure at time of first prone session, cm H <sub>2</sub> O, median (IQR)	30 (28–34)
PEEP prior to prone session, mean $\pm$ SD	14 $\pm$ 3.96
FiO <sub>2</sub> prior to prone sessions, median (IQR)	0.8 (0.7–1.0)
PaO <sub>2</sub> :FiO <sub>2</sub> prior to prone sessions, median (IQR)	107 (85–140)
Time from intubation to first prone session, days, median (IQR)	6 (IQR 2–11)

BMI = body mass index; SOFA = sequential organ failure assessment; ICU = intensive care unit; cc/kg = centimeters per kilogram; cm H<sub>2</sub>O = centimeters of water; PEEP = positive end expiratory pressure; FiO<sub>2</sub> = fraction of inspired oxygen; PaO<sub>2</sub> = partial pressure or arterial oxygen.

same period, 314 patients were admitted to our hospital with COVID-19 requiring invasive mechanical ventilation. Baseline characteristics of these patients are shown in Table 1. The majority of patients who required prone positioning were men (73.3%), with a median age of 64 years (range 53–71). There was a high prevalence of comorbid hypertension (55.6%) and diabetes (46.7%). All of the ICUs, including those newly created during the COVID-19 pandemic, had patients treated by the COVID-19 Prone Team.

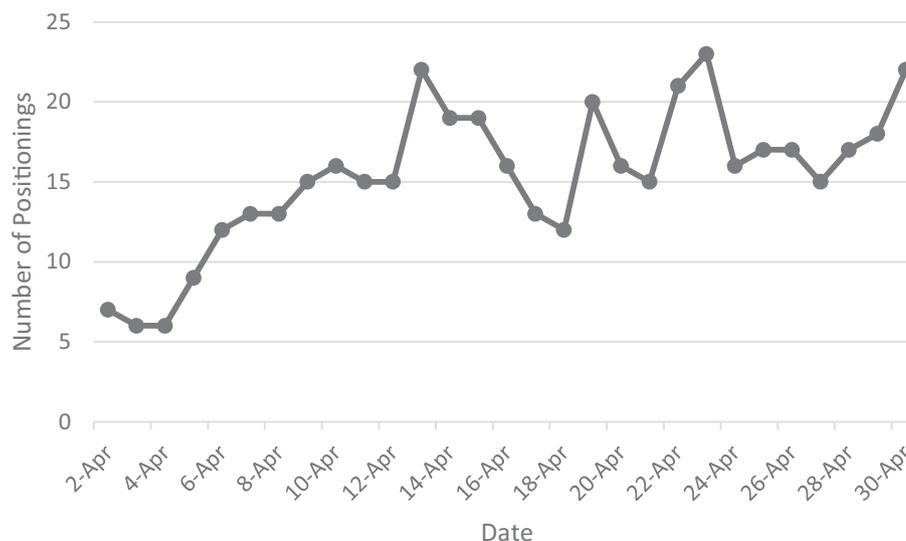
The median time between intubation and first prone session was 6 days (IQR 2–11). A total of 244 individual prone positionings were performed by the COVID-19 Prone Team during the study period. Patients were maintained in the prone position for a median of 19 h (IQR 17.5–20.75) per session. Patients required an average of  $3 \pm 2.2$  sessions. The COVID-19 Prone Team completed an average of  $15.3 \pm 4.5$  positionings per daily shift (Fig. 1).

By the end of the study period, proning was discontinued in sixty-seven (65.1%) cases due to improvement in gas exchange, in twenty (19.4%) cases due to lack of clinical improvement, in six (5.8%) cases for clinical worsening and in ten (9.7%) cases due to the development of a contraindication. Thirty-six patients died and 54 remained alive (Table 2). Recorded adverse events during prone sessions included peripheral intravenous line dislodgement in one patient, severe periorbital edema in one patient, brachial plexus injury in one patient, facial pressure injury in one patient, pressure injury to the ear in two patients and hypotension and hypoxemia in five patients requiring placement back into the supine position. No patients had a cardiac arrest while in the prone position.

#### 4. Discussion

The rapid implementation of the mobile COVID-19 Prone Team that travelled to multiple ICUs at our institution during the height of the COVID-19 pandemic, increased the ability to prone patients with moderate-to-severe ARDS. In a 28-day period, 90 patients were proned by this team with 244 individual proning sessions. After implementation of the COVID-19 Prone Team, more patients who met criteria for prone positioning were actually proned, as 12 patients intubated were proned between March 2, 2020 and March 31, 2020 [1] compared to 90 during the study period. By utilizing OTs and PTs who were familiar with critical illness and positioning patients, and by developing a careful but efficient training program, the COVID-19 Prone Team was able to safely provide an evidence-based intervention to critically ill patients with ARDS in a variety of ICU settings.

Prone positioning has been shown to have a mortality benefit in patients with moderate-to-severe ARDS, but has been underutilized due to provider under-recognition of ARDS, frequent misunderstanding of its indications, disbelief in quality of evidence, and resource utilization [11], which during times of crisis is more pronounced [2,12]. During the COVID-19 pandemic, the concentration of patients with moderate-to-severe ARDS increased considerably. This increase required rapid



**Fig. 1.** Number of interventions per day: Daily number of interventions completed by the prone team. Includes placing in both the supine and prone position. X axis represents dates in April 2020.

**Table 2**  
Outcomes.

Reason for Discontinuing Proning, n(%) <sup>a</sup>	N = 103 prone episodes
Improvement in gas exchange	67 (65.1)
Lack of clinical improvement	20 (19.4)
Clinical worsening	6 (5.8)
Developed a contraindication	10 (9.7)
Outcome at end of study period, n(%)	N = 90 unique patients
Dead	36 (40)
Alive	54 (60)
Extubated	11 (20.4)
Remains orally intubated at end of study period	17 (31.5)
Underwent Tracheostomy	26 (48.1)

<sup>a</sup> Thirteen patients required 2 unique proning episodes at separate time periods due to recurrent episodes of moderate-to-severe ARDS.

expansion of educational efforts on ARDS management. Additionally, as part of a clinical staffing strategy, critical care trained physicians provided clinical oversight across all ICU beds, allowing for relative consistency in the management of these patients with ARDS, as evidenced by the consistent use of a low tidal volume ventilation strategy, and identification of patients who met criteria for prone positioning. From a resource perspective, the staffing of a COVID-19 Prone Team with OTs and PTs available for redeployment during the crisis avoided additional strain on clinical nursing and other bedside clinicians who were already understaffed during this time. The ability to focus the training on a small group of individuals dedicated to proning appeared to enhance efficiency, expertise and safety.

This study has several limitations. While we are able to describe the characteristics of the patients treated, we have limited data to define the overall population of moderate-to-severe ARDS patients in our hospital during the study period. It is unclear what proportion of patients with moderate-to-severe ARDS received this therapy when indicated. Also, with limited data on the incidence of moderate-severe ARDS in our hospital prior to the COVID-19 pandemic, it is unclear if our proning rate changed with this implementation. However, prior to COVID-19, proning was only available to patients in the MICUs therefore limiting this treatment to the capacity of the MICU. Lastly, our outcomes data is limited by the study duration. At the end of the study, forty-five patients were still hospitalized, therefore the outcome of these treated patients is yet to be determined. However, of the fifty-four patients whose hospital

**Table 3**  
Potential contraindications to prone positioning.

Significant hemodynamic instability
Severe acidemia
Cerebral perfusion pressure < 30 mmHg
Increased ICP >30
Pregnancy
History of difficult intubation or nasotracheal intubation
DVT treated for <2 days
Facial surgery or severe facial trauma
Massive hemoptysis
Pelvic fractures
Active intra-abdominal process
LVAD, BiVAD, IABP, ECMO
Inability to tolerate face down position
Serious burn (20% body surface area)
Unstable fracture
Spinal instability
Recent sternotomy or major abdominal surgery
Recent tracheostomy
Life-threatening cardiac arrhythmia within 24 h
Bronchopleural fistula

ICP = intracranial pressure; DVT = deep vein thrombosis; LVAD = left ventricular assist device; BiVAD = biventricular assist device, IABP = intraaortic balloon pump; ECMO = extracorporeal membrane oxygenation.

survival is yet to be determined, thirty-six (80%) patients had prone therapy stopped due to clinical improvement.

The feasibility and success of the COVID-19 Prone Team has created the possibility of sustaining and even expanding prone positioning capabilities across our hospital network in case of a future crisis. Further education and training can be disseminated to nurses and clinicians working in non-medical ICUs, utilizing some of the training materials and personnel in the COVID-19 Prone Team.

## 5. Conclusions

During the COVID-19 pandemic, the rapid development and implementation of a mobile prone team allowed for increased capacity to prone patients with moderate-to-severe ARDS in ICUs beyond the MICUs to meet the surge of critically ill patients during the height of the pandemic. This was done effectively and with tolerable adverse outcomes.

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## Declaration of Competing Interest

Dr. Brodie receives research support from ALung Technologies, he was previously on their medical advisory board. He has been on the medical advisory boards for Baxter, BRETHER, Xenios and Hemovent. Patrick Ryan reports honorarium from Mölnlycke Health Care. The other authors report no other conflicts of interest.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jcrc.2020.08.020>.

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# Developing and Implementing a Dedicated Prone Positioning Team for Mechanically Ventilated ARDS Patients During the COVID-19 Crisis

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**Background:** The spread of the COVID-19 pandemic in China demonstrated at an early stage the high rate of moderate to severe acute respiratory distress syndrome (ARDS) in the patient population. An intervention that has proved beneficial is the use of prone positioning (PP) for mechanically ventilated patients with ARDS. In one institution, PP was practiced in the medical ICU for this population. However, with the dramatically increasing patient load, staff anticipated that greater capacity to provide this treatment to all qualifying patients would be required.

**Methods:** A group of physical therapists and occupational therapists (PT/OTs) with ICU experience was redeployed from their regular roles to receive training in PP from an experienced medical ICU (MICU) RN. After intensive training, the team was ready to provide PP to patients. As the workload increased, additional PT/OTs were recruited to the team. A coordinating structure comprising attending pulmonologists screened and advised on appropriate patients. A communication and feedback structure was also implemented.

**Results:** Over a period of seven weeks, the team provided PP to more than 100 patients, with 577 individual interventions in a total of 14 ICUs and one emergency department. There were no major airway or central venous access complications, and only one anterior pressure injury was recorded.

**Conclusion:** The rapid implementation of an interdisciplinary PP team in a crisis situation is feasible. It can provide a safe and efficient alternative to adding to the workload of an overloaded nursing staff.

The coronavirus 2019 (COVID-19) outbreak resulted in more than 80,000 cases and 3,000 deaths in mainland China between December 2019 and March 2020.<sup>1</sup> The most severe complication in this population was acute hypoxemic respiratory failure or acute respiratory distress syndrome (ARDS), with more than 3% of total cases requiring intubation and mechanical ventilation.<sup>1</sup> Critically ill patients with ARDS present with acute hypoxemia, noncardiogenic pulmonary edema, reduced lung compliance, and increased work on breathing, and the need for positive-pressure ventilation can result in lung endothelial and epithelial injury.<sup>2</sup> In March and April of 2020, New York City was at the epicenter of the COVID-19 pandemic. At the peak in April, New York City reported more than 6,000 new cases with more than 1,500 hospitalizations and 400 deaths in a single day.<sup>3</sup> Based on case reports from China, it was anticipated that prone positioning (PP) would be widely used in the mechanically ventilated COVID-19 population.<sup>1,4</sup> PP has been shown to significantly decrease mortality in patients with moderate to severe ARDS.<sup>5</sup> This intervention consists of delivering

mechanical ventilation to a patient turned face-down.<sup>6</sup> PP sessions of 12 hours or more, in conjunction with low tidal volume ventilation and neuromuscular blockade agents, are associated with a survival benefit in patients with moderate to severe ARDS.<sup>4,6,7</sup> However, there are risks when performing PP. Adverse events, such as dislodgement or disruption of peripheral or central venous catheters, complications with the airway, and pressure injuries on the anterior surfaces of the patient occur with higher frequency compared to patients who are positioned in supine.<sup>8–10</sup>

At our institution, prior to the COVID-19 pandemic, PP was confined to two medical ICUs (MICUs) and performed exclusively by MICU staff. Manually positioning a patient to prone requires a minimum of four people for turning and line management, and one additional person for airway management.<sup>11,12</sup> The large influx of patients with COVID-19 and moderate to severe ARDS in our hospital prompted a need to develop a specialized interdisciplinary Prone Team to match the increased demand for PP interventions.

The goal in establishing the Prone Team, consisting of physical and occupational therapists (PT/OTs) and registered nurses (RNs), was to safely provide PP capability to all mechanically ventilated patients for whom the intervention was clinically indicated. Currently, the COVID-19 pandemic continues to spread and affect new regions of

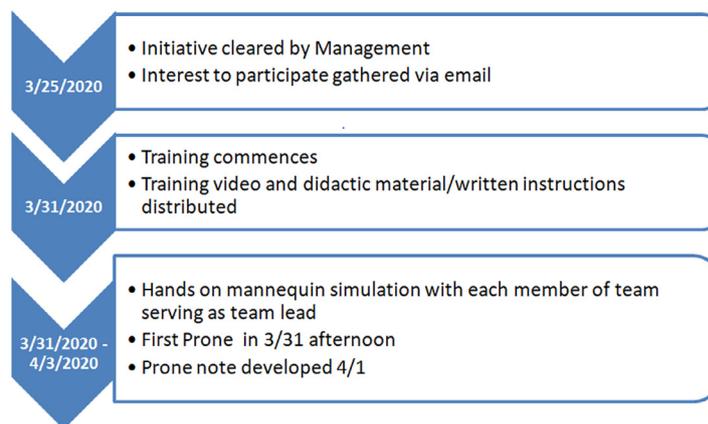
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## Dedicated Prone Positioning Team for Mechanically Ventilated ARDS Patients



**Figure 1:** This time line illustrates the time elapsed from conception of the Prone Team initiative to training and first intervention.

the United States. As a result, hospital systems will need to rapidly adapt to the demand of PP. The purpose of this article is to outline the development and implementation of an efficient interdisciplinary team dedicated to the critical need of PP interventions.

## METHODS

### Prone Team Assembly

Prior to the pandemic, our institution managed patients with moderate to severe ARDS or hypoxemic respiratory failure in two MICUs. In response to the immediate demand for additional critical care capacity, nonconventional spaces were converted to ICUs. In addition, operating rooms, cardiac catheterization labs, and step-down units were transformed into ICUs. During the COVID-19 pandemic, ICU capacity increased from approximately 100 ICU beds in 8 ICUs to 240 ICU beds in 14 ICUs.

Initially, several RNs from multiple ICUs were trained in PP. However, rapidly increasing RN workloads and the high acuity of patients made it clear that a separate dedicated team was required for PP interventions. PT/OTs in the ICU setting have the ability to mobilize critically ill patients safely and with low incidence of harmful adverse events.<sup>13,14</sup> Prior to the pandemic, PT/OT responsibility in the ICU included management of central and arterial lines, transfer training, rapid interpretation of vital signs, knowledge of basic ICU pharmacology, pulmonary toileting skills, and ventilator management. For these reasons, PT/OTs were ideal candidates to support PP. In addition, due to high critical acuity of the majority of patients in the hospital, PT/OTs had fewer therapy consults, allowing PT/OTs to be available to create the Prone Team. Consequently, senior leadership made the decision to redeploy a group of PT/OTs to meet the new demand for PP under the supervision of an ICU clinical nurse specialist (CNS).

Five days elapsed from initial communication to the first live-patient intervention (Figure 1). As demand for PP grew, additional therapists were added to the team. Ultimately, the Prone Team totaled 29 members (12 PTs, 13 OTs, and 4 RNs). The majority of the PT/OTs on the Prone Team had experience with cardiopulmonary rehabilitation and early mobilization in the ICU.

### Prone Team: Staffing and Training

Training of the PT/OT group was led by an experienced ICU CNS with eight years of PP experience. Prior to hands-on simulation, the PT/OT group was provided with education on ARDS and PP via a literature review, including the PROSEVA study,<sup>5,15</sup> that highlighted PP indications, rationale, and contraindications. An instructional video and handout with step-by-step directions for PP, supine positioning, and repositioning were used. Next, a mannequin with simulated lines (endotracheal tube [ETT], central line, radial arterial line, chest tube, and indwelling urinary catheter) was used for in-person repetitive practice of supining, proning, and head turning in accordance with our institution's nursing protocol. Each team member rotated and practiced all bedside positions to gain proficiency and understanding of tasks associated with each role. These roles and their responsibilities included the following:

- **Team Lead:** Communicated with airway manager to ensure airway security; ensured closed-loop communication and synchronized mobilization.
- **Airway Manager:** Secured ETT and ventilator management, supported head.
- **Positioners:** Performed proning or supinating maneuvers.
- **Recorder:** Documented safety measures, ETT depth, ventilator settings, and any adverse events in the electronic medical record (EMR).

- **Runner:** Supplied additional materials from outside of the room to minimize personal protective equipment (PPE) waste and improve efficiency.
- **ICU RN:** Performed overall supervision, managed lines and airway, monitored vitals.

In many cases, the above roles were fluid. Team members shared the tasks of placing electrocardiogram (ECG) electrodes, managing linens and fluidized positioning pillows (FPPs), maintaining line security, and ensuring closed-loop communication. Repetitive practice continued until the CNS deemed the PT/OT group competent prior to the first live-patient PP intervention. Initial competency was achieved within a few hours. Group simulation training allowed rapid visual and tactile skill acquisition in the shortest amount of time. Simultaneously it emphasized qualities that promoted success, such as open verbal communication, central team leader ensuring individual ownership of specific tasks, and pacing and sequencing of tasks.

During PP, the airway manager was at the head of the bed, with two therapists situated on each side of the bed. The airway manager was preferably a respiratory therapist, but the role could be assumed by a physician, nurse practitioner, physician assistant, or ICU RN with airway management skills. The ICU RN was positioned with line visualization and management to assist and supervise the intervention. In addition, the primary RN was present to manage intravenous pumps stationed outside the room (one of our institution's initiatives to minimize exposure and PPE usage), while a primary provider was available in case of emergencies.

Typically, the patient was moved laterally toward the side of the arterial line via a lateral transfer device. The patient was then transitioned to side-lying with the arterial line facing superiorly. In side-lying, the patient's anterior chest ECG electrodes were removed as a new set was simultaneously placed posteriorly. The two team members closest to the foot of the bed prepared the new set of linens, gown, and FPP. While maintaining in side-lying, the patient was transitioned laterally to ensure enough bed space to accept the patient's torso. When the airway manager was ready to turn the patient's head, the patient was then transitioned to prone or supine. When the patient was proned, a large FPP was placed underneath the patient lengthwise from shoulder to hip on one side, and a smaller FPP was placed underneath the head and molded to off-load vulnerable areas. During a handful of occasions in which FPPs were unavailable in the makeshift and popup ICUs, pillows and sheet rolls were used in replacement for pressure off-loading. In an effort to prevent pressure injuries, the patients were repositioned every two hours. Lubricant and transparent dressings were used for eye protection.

Increasing daily PP intervention highlighted the need for documentation to track PP duration, and thus the Recorder position was added. Often the Recorder also served as the

Runner to obtain any missing equipment needed for PP intervention. The addition of Recorder/Runner positions offered PT/OT members a short rest break between interventions amid long strenuous Prone Team shifts.

### Prone Process: Indications, Materials, and Accessibility

The Prone Team covered 14 separate ICUs across two hospital buildings within this institution. Although rare, the Prone Team also answered consults in the emergency department. The team worked a 12-hour shift from 7:00 A.M. to 7:00 P.M., seven days a week. Each shift, the Prone Team consisted of five to six PT/OTs and one experienced ICU RN.

When the request for PP is established, the pulmonary/critical care attending or fellow overseeing the ICUs (also known as the oversight attending) was then consulted to confirm appropriateness of PP. The oversight attending remained available to consult if repeated PP interventions were indicated and therapeutic. The Prone Team was contacted in person or via the dedicated mobile phone line, the Prone Phone. This phone was the primary method of contact for new and repeating consults, scheduling, emergencies, and cancellations. Orders for PP were placed in the EMR. Guidelines for PP describing indication, contraindication, general approach, personnel, timing, and safety were created for our institution using the PROSEVA study as guide.<sup>5,15</sup> For PP indications and contraindications see [Table 1](#).

Each morning a prone census list ([Figure 2](#)) was printed ([Figure 3](#)) from the EMR, noting patient location, the time the patient was positioned on the previous day, ventilator settings, partial pressure of arterial oxygen (PaO<sub>2</sub>), PaO<sub>2</sub>/fraction of inspired oxygen (FiO<sub>2</sub>) (P/F ratio), and ETT depth. The team lead was responsible for organization of daily triage and communication with the consulting team via use of the Prone Phone. Supination generally took place in the morning and proning in mid-morning/afternoon. Patients were placed in PP for 16–20 hours per session. Effort was made to minimize time spent in transit by grouping patients on the same floors and buildings of the hospital. In addition, communication between disciplines helped to ensure that patients were optimized for intervention prior to Prone Team arrival. If PP was required outside of Prone Team hours, the calls were answered by a core group of MICU nurses.

Initial PP interventions highlighted medical supplies that were often used but missing or stocked obscurely in various units. To answer this need, the Runner position and Prone Bag/Bundle was conceptualized. The Prone Bag and Bundles ([Table 2](#)) containing ECG electrodes/leads, central line lock plugs, and syringes allowed increased efficiency, minimized waste of PPE, and helped maintain strict isolation protocols. Equipment was carried via a wheeled cart to

**Table 1. PP Indications and Contraindications\***

1. PP is indicated when P/F ratio is < 150 and patient is RASS -5.
2. PP is indicated when P/F ratio < 150 despite ventilator support > 0.60 FiO<sub>2</sub> or PEEP > 10 cm H<sub>2</sub>O.
3. Potential contraindications must be assessed prior to intervening (for example, severe acidemia, hemodynamic instability).
4. Patient must be optimized prior to intervention:
  - a. Deep sedation and/or paralytics
  - b. Hemodynamically optimized (pressors)
  - c. Respiratory (pre-oxygenating, pulmonary toileting, ventilator management, ETT location, and cuff/harness security)

\* Guidelines for PP describing indication, contraindication, general approach, personnel, timing and safety were created for our institution using the PROSEVA study as guide<sup>5,15</sup>.

PP, prone positioning; P/F, partial pressure of oxygen / fraction of inspired oxygen; RASS, Richmond Agitation-Sedation Scale; FiO<sub>2</sub>, fraction of inspired oxygen; PEEP, positive end expiratory pressure; ETT, endotracheal tube.

References can be found at the end of this article.

IP Patient Weight	ABG - PO2	FiO2 (%)	PO2/FiO2	PEEP	Handoff Action List
65 kg	226, 226	100 %	226	5	5/21/2020: **Time: 11:15 from prone to SUPINE Vent @ FiO2: 70 / PEEP: 5 pO2: 108 / P / F Ratio: 154.3 ETT @ Lip Pre: 22 Post: 22

**Figure 2:** The prone census list, shown here as it appears in the electronic medical record, provides a preview of daily updated lab/vent settings and allows for communication and scheduling for the following shift.

\_NYP-CU - Prone Team Census - Last Refreshed: 04/03/20 0752

Unit/Room /Bed	Patient Name & MRN	Age/Gen der	Attending	IP Patient Weight	Specialty Comments
				105 kg	**Time: 9 :15 Supined Vent: Mode: VC/ PEEP: 20.0 / FiO2: 0.70 pO2: 108 / P / F Ratio: 108/0.70 = 154 **Time: 18:15 Proned Vent: Mode: VC / PEEP: 20 / FiO2: 0.80 pO2: 108 P / F Ratio: 108/0.8 = 135
				113 kg	**Time: 10:42 Supined Vent Mode: PRVC PEEP: 20.0 FiO2: 0.50  pO2: 106 / P / F Ratio: 106/0.5 = 212
				82 kg	**Time: 11:35 Supined Vent: Mode: AC / PEEP: 18 / FiO2: 0.60 pO2: 153 P / F Ratio: 153/0.60 = 255
				(l) 166 kg	**Time: 12:45 Proned Vent: Mode: VC / PEEP: 22.0 / FiO2: 1.0 pO2: 197 P / F Ratio: 197/100 = 197
				88 kg	**Time: 16:30 Proned Vent: Mode: AC PEEP: 14 FiO2: 1.0 pO2: 76 P / F Ratio: 76/1.0 = 76

**Figure 3:** Shown here is a sample prone census list printout, which serves as a daily scheduling list organized by time of previous intervention. This allows the Prone Team leader to schedule following interventions.

reduce the physical burden of having to carry the supplies throughout all units of the hospital.

**Documentation and Safety Checklist**

Prior-day interventions were organized by time of intervention in the EMR. Documentation was done by the Recorder during the PP procedure. Figure 4 shows a sample of the prone document template in the EMR. Documentation included a safety checklist, time of intervention, ventilator settings, and arterial blood gas. When

a note was completed, the information was copied into a handoff column within the EMR (Figure 2). This allowed the team leader of the following shift to sort the prone census list according to the time the patient was positioned (Figure 3).

**RESULTS**

Between March 30, 2020, and May, 22, 2020, the Prone Team safely performed 577 interventions (prone to supine

Physical Therapist      Signed  
Occupational Therapy

**Patient Prone / Supine Position Note**

Safety Check Off	Yes/ No
Primary Provider Present in case of Emergency	Yes
RN present at bedside or doorside	Yes
RT present to stabilize ETT	Yes
• Pt positioned without extubation	Yes
• Pt positioned without lines removed	Yes
• Pt positioned in bed and not accidental falls occurred	Yes
• If Supine -> Prone, HOB / foot of bed Locked	NA

5/21/2020:  
**\*\*Time: 11:15 from prone to SUPINE**  
**Vent @ FIO2: 70 / PEEP: 5**  
**pO2: 108 / P / F Ratio: 154.3**  
**ETT @ Lip Pre: 22 Post: 22**

**Figure 4:** The note template serves as a safety checklist and documentation of prone intervention to aid scheduling and quality improvement

Item	Count
Alcohol swab	10
ECG leads set and trunk cable	5+
ECG electrode set	5+
ETT cuff flush	1-2
Rigid oral suction catheter	1-2
Saline flushes 2.5/10 mL	5+
Sterile Luer lock plugs	10
SpO <sub>2</sub> sensors	5+
Tape	5
Transparent film dressing—small	5
Transparent film dressing—large	5
Prone bundles (per intervention):	
■ Repositioning device	
■ Extra set of linen + incontinence pad	
■ Extra set of ECG lead/dots	
PPE (per staff)	
■ N95 mask	
■ Cover mask	
■ Eye protection/face shield	
■ Gown and gloves	
ECG, electrocardiogram; ETT, endotracheal tube; SpO <sub>2</sub> , oxygen saturation; PPE, personal protective equipment.	

**DISCUSSION**

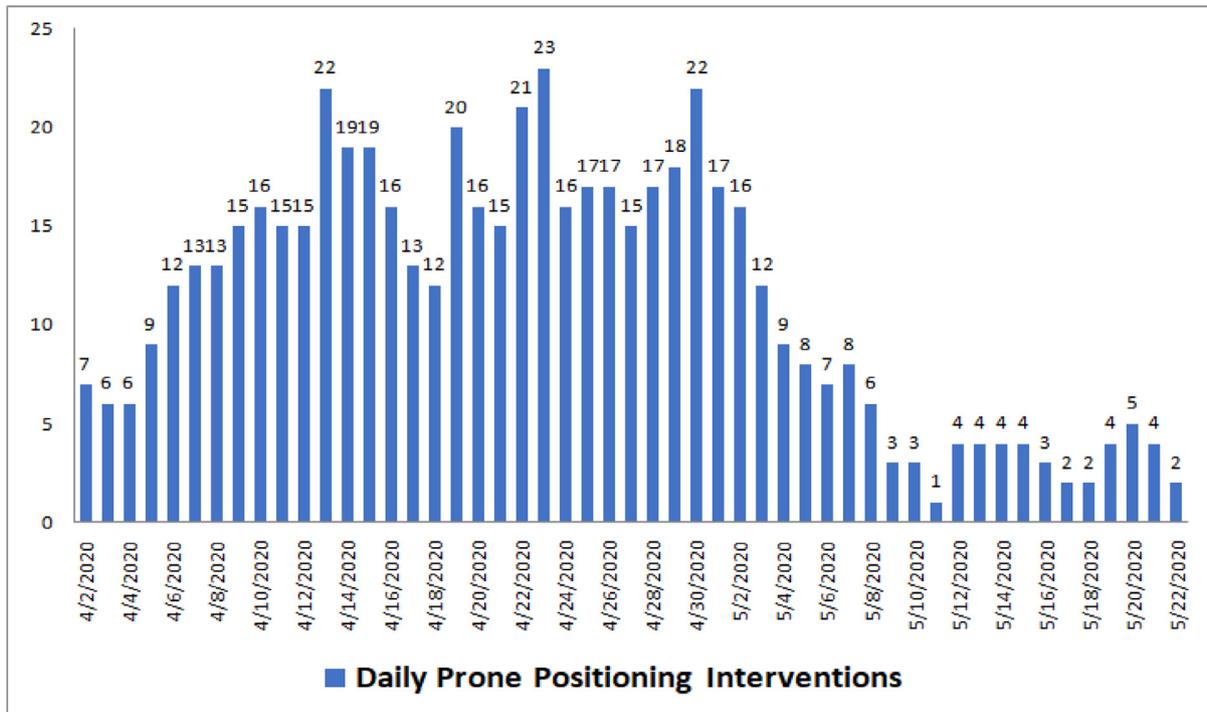
During the COVID-19 pandemic, the Prone Team was developed to respond to the rapidly growing number of patients with respiratory distress, and for whom PP was indicated. Overall, the interdisciplinary expertise, training, and collaboration of the Prone Team members allowed for quick deployment and helped to enhance safety and efficiency of proning interventions.

PP remains underutilized as a treatment modality for ARDS.<sup>4</sup> Barriers to PP include inexperience in managing pressure areas, suctioning, accidental injuries, and management of emergencies.<sup>4,5,16,17</sup> Infrequent use of PP has been identified as a barrier to maintaining PP competency in ICU staff.<sup>16</sup> Nurses have noted patients were heavy to maneuver manually and were stressed by the lack of clear coordination during interventions.<sup>16</sup> Other issues include difficulty performing tracheal suctioning, obtaining intravenous access, regurgitation of enteral feed, and the lack of manpower to address emergencies during night shift.<sup>16</sup> At this institution, fears of overburdening an already exhausted nursing staff with additional PP demand was prevalent. The Prone Team used standardized training protocol based on the PROSEVA study<sup>5,15</sup> led by an experienced ICU RN to address these barriers. Enhanced individual and team competence helped the team to become an autonomous, mobile unit. This mobile format combined with a high level of self-sufficiency allowed increased capacity with minimal disruption to unit activity.

To our knowledge, there has been no peer-reviewed literature outlining the implementation of an interdisciplinary team for the purpose of safe PP. Some articles noted how the rapid deployment of specialized teams can improve safety and efficiency.<sup>18,19</sup> Safe PP requires proficiency with body mechanics and transfers, a specialization of PT/OTs. This

or supine to prone) on 101 unique patients. The majority of patients required multiple PP interventions (Figure 5). The patients remained prone for a median of 19 hours per session, with interquartile range (IQR) duration of 17.5 to 20.75 hours.

There were no incidents of central venous catheter or airway loss. Recorded adverse events included loss of two peripheral intravenous lines and one facial pressure injury. No staff members were injured (Table 3).



**Figure 5:** The graph illustrates the number of daily interventions provided by the Prone Team between April 2 and May 22, 2020.

Adverse Events	Occurrence	
	During Proning	Noted Postproning
Unplanned patient extubation	0	0
Unplanned patient central line removal	0	0
Unplanned patient peripheral line removal	2	0
Patient falling out of bed	0	0
Other patient injury	0	1 facial DTI Unable to specify cause of injury—PP + ETT bracket vs. adhesive sensitivity
Staff and team member physical injury	0	0
PPE failure leading to COVID exposure	0	0

DTI, deep tissue injury; PP, prone positioning; ETT, endotracheal tube; PPE, personal protective equipment.

baseline skill set along with involvement in a long-standing early mobilization program at our institution allowed for a more than capable Prone Team.

Loss of venous access and displacement of ETT or thoracotomy tube are among the reported complications of PP.<sup>20,21</sup> Complications were prevented through adherence to protocol, clearly defined roles, and closed-loop communication. Hemodynamic stability was closely monitored by the Prone Team and communicated to the primary providers during PP interventions. In the case of adverse responses, such as desaturation or dysrhythmia, the onus is on the medical team to provide necessary intervention via modification of ventilator settings or pharmacologic support. Requiring oversight attending approval prior to any intervention helped to ensure appropriate referrals. During adverse events, the oversight attending can be consulted to

suggest if PP intervention should be reversed. The use of the Prone Phone allowed timely intervention for all referrals placed during Prone Team hours. In addition, documentation enhanced efficient scheduling. As a token of appreciation, the Prone Team was awarded the “2020 Friend of Nursing Award” by senior management.

There are distinct limitations to this study. The Prone Team was possible in this institution because of the availability of ICU-experienced PT/OTs, who could be redeployed. The staffing and procedures may not be replicable at other institutions due to limited resources. Although there was a considerably low number of adverse events, there were no comparators to assess the relative effectiveness of the team. Data collected reflect incidents recorded by the Prone Team and do not capture any intervention or adverse events provided by ICU staffing outside

of Prone Team hours. Finally, the long-term effects of an interdisciplinary Prone Team were not assessed and should be considered for future research.

## CONCLUSION

The Prone Team successfully provided skilled and safe PP to all ICUs throughout our institution. The extent of the success of the Prone Team required an interdisciplinary approach including experienced clinicians with support from hospital leadership. The rapid creation of an interdisciplinary team during a crisis is feasible, safe, and efficient.

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