Many Pediatric Intensive Care Unit (PICU) patients have respiratory failure and require invasive mechanical ventilation. In the PICU at Blank Children’s Hospital, ventilator weaning typically occurs no more than twice within a 24-hour period when pediatric intensivists are present in the PICU. In the PICU at Blank Children’s Hospital, practically, weaning occurs during hospital course due to physician consent.

Prolonged invasive mechanical ventilation is associated with complications (risk of pneumonia, dependence on opioids/benzos, muscle weakness, poor feeding). Patient outcomes and costs may improve with decreased ventilator hours.6

An opportunity was identified to standardize weaning practices amongst intensivists and use licensed staff to progress children through hospital course during all shifts.

A weaning protocol for use by nurses and respiratory therapists could lead to ventilator changes throughout a 24 hour period and reduce time to extubation.

**Current Practice**

Time to Extubation vs Time Spent Weaning
Respiratory Failure Patients aged 0-4 years

<table>
<thead>
<tr>
<th>Time to Extubation (Total Ventilation Time)</th>
<th>Time Spent Weaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>161 Hours</td>
<td>62 Hours</td>
</tr>
<tr>
<td>Mean Percentage of Total Ventilation Time Spent Weaning</td>
<td>52%</td>
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**Synthesis of Evidence**

- Pediatric ventilator weaning protocols are safe.2,4,6,7
- No one best method to wean pediatric patients from a ventilator; consistent weaning appears to be the best approach.3,5
- Pediatric studies demonstrate that consistency in weaning decreases time to extubation.2,5,7
- Leading pediatric institutions in the United States use protocolized ventilator weaning.1

**Theme and Aims**

- **Theme:** Large variety of patient population with a significant amount of respiratory patients; complex assessments and interventions; variability in experience of PICU RN, respiratory therapy, and resident physician staff; extensive sphere of experts and resources; family-centered care
- **Aim:** Safely reduce the time pediatric patients are invasively ventilated by >12 hours by targeting identification of readiness to wean and weaning time

**Background**

- Many Pediatric Intensive Care Unit (PICU) patients have respiratory failure and require invasive mechanical ventilation.
- In the PICU at Blank Children’s Hospital, ventilator weaning typically occurs no more than twice within a 24-hour period when pediatric intensivists are present in the PICU at Blank Children’s Hospital, thus prolonging time to extubation.
- Prolonged invasive mechanical ventilation is associated with complications (risk of pneumonia, dependence on opioids/benzos, muscle weakness, poor feeding). Patient outcomes and costs may improve with decreased ventilator hours.6
- An opportunity was identified to standardize weaning practices amongst intensivists and use licensed staff to progress children through hospital course during all shifts.
- A weaning protocol for use by nurses and respiratory therapists could lead to ventilator changes throughout a 24 hour period and reduce time to extubation.

**Implementation Plan**

- Create Awareness & Interest + Build Knowledge & Commitment8
  - Institutional Review Board Approval-Human Subjects Research (Chart Review)
  - Obtained one year of baseline data from chart review regarding ventilator hours, weaning time, and complications
  - Used a time series design for comparison between pre-implementation respiratory season and post-implementation respiratory season
  - Developed evidence-based patient weaning protocol for use by licensed PICU staff
  - Identified key stakeholders and champions
  - Provided education on weaning protocol to providers, nurses, and respiratory therapists in series of department and cohort meetings; provided written material
- Promote Action & Adoption2
  - Implemented protocol and provided support to staff with frequent pulse checks
- Pursue Integration & Sustained Use2
  - Obtained, compared, and analyzed post-implementation data
  - Modify protocol based on data analysis and provider/staff feedback, continue future PDSA cycles

**PDSA Cycles**

- **PDSA #1:** Implement protocol for PICU patients aged 0-4 years intubated for respiratory failure due to infectious process, excluding tracheostomy patients
  - Time to Extubation
  - Time Spent Weaning
  - Provider-Driven/Non-Protocol Weaning
  - Pre-Implementation Respiratory Failure Patients aged 0-4 years
    - Mean Time to Extubation
    - Total Ventilation Time
    - 161 Hours
    - Mean Time Spent Weaning
    - 62 Hours
    - Mean Percentage of Total Ventilation Time Spent Weaning
    - 52%

**Results**

**Time to Extubation vs Time Spent Weaning**

**Results**

**Time Spent Weaning**

- Protocol Weaning
- Non-Protocol Weaning

**Time to Extubation**

- Protocol Weaning
- Non-Protocol Weaning

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**Lessons Learned**

- **Barriers:**
  - Need to address age adjustments for babies 0-6 months - specifically minimal set respiratory rate and PS/CPAP trials (physiology of breathing and anatomy is different than with older infants and toddlers)
  - Education given via multiple modalities; however, many staff say they don’t know how to use protocol
  - Continue to reinforce ability to wean patients overnight

- **Successes:**
  - Think about weaning sooner
  - Patients being weaned overnight; need to continue to hardwire this process

- **Recommendations for Future Projects:**
  - PIC/CPAP trials length, frequency, amount
  - Sedation while intubated/sedation wean are patients too sedated?
  - Mobility while on ventilator
  - Extubation to non-invasive ventilation versus nasal cannula/room air
  - Implications for CNL Role:
    - Implementation of Best Practices Based on Data: protocol implemented, positive results seen, continue to use BIPAP to expand protocol
    - Quality Improvement/Outcomes measurement - monitor data through PDSA cycles and continue to grow to reach wider population while maintaining safe practices
    - Interprofessional Communication & Team Leadership - allows nursing and respiratory therapist to practice at full extent of licensure

**References**


**Acknowledgement**

The author would like to acknowledge the entire PICU staff of nurses, respiratory therapists, physicians, and leaders and Dr. Lindsey Joseph and Dr. Judy Verger for support and contributions to this project. Family, friends, and fellow CNL students have also been supportive and instrumental. There are no conflicts of interest.