C11: Reducing Unplanned Extubations in the Intensive Care Nursery

Improvement Advisor Project, Wave 23
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Our Project Aim Statement

• To reduce the incidence of unplanned extubations in ventilated infants in the Intensive Care Nursery from 47.1 to less than 10 per 1000 ventilator days by the end of December 2012.

• Project Goals:
  • To decrease unplanned extubations for ventilated infants.
  • To decrease length of stay for our ventilated infants.
  • To decrease cost associated with care for these infants.
What are Unplanned Extubations?

- Accidental or unintended removal of an endotracheal tube (ETT) in a ventilated infant.

- It carries with it an increased risk for airway-related morbidity and mortality, as well as:
  - Increased time on the ventilator
  - Increased length of stay
  - Potential for increased resource utilization associated with the re-intubation process.

- This project is aligned with the organizational Blueprint for Quality imperative to reduce variations in care.

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**Driver Diagram**

**Project Structure**

**Outcomes**
- Reduce Unplanned extubations (UE) to below 10 per 1000 ventilator days by December 2012

**Primary drivers**
- The position of the ETT
- Securing the ETT
- Adjusting the ETT (and interpretation of x-rays)
- Understanding the impact to the patient of UE and subsequent reintubation

**Ideas for change**
- Order in SCM regarding position of ETT with corresponding bedside card.
- Two-person check (RT and RN) at each shift change to verify ETT position.
- Visual check every three hours to verify the integrity of the tape.
- Establish standard taping technique to secure ETT and document the technique.
- Use NeoBar as alternative fixation device.
- Add a care giver of the ETT during patient movement and procedures.
- Standard positioning of infants during x-rays
- Multi-disciplinary review of x-rays to determine the need to adjust an ETT.
- Running “ticker” in unit publicizing days since last UE event.
- Re-education regarding importance of preventing unplanned extubations.
- Debriefing each UE event to identify factors and future ideas for change.

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*Penn Medicine*
Key Project Measures

**Outcome:**
- Unplanned extubation (UE) rate – events per 1000 ventilator days
- Ventilator days between UE events
- Number of ventilator days
- Avg. length of stay for ventilated infants
- Expenses associated with re-intubation process

**Process:**
- Percentage of infants with an order in SCM and a bedside card documenting the centimeter mark at which the ETT should be taped.
- Percentage of infants whose ETT tape and location was checked per nursing shift.
- Percentage of infants who are positioned appropriately during x-ray procedures.
- Percentage of infants with a morning x-ray in which the entire multidisciplinary team viewed the images together.

**Balancing:**
- Increase in UE during tube re-taping
- Increased use of x-rays or sedation medications

Review of 38 extubations from 7/11 to 2/12

**Causes of Unplanned Extubations**

- Tape loose or during retaping: 13 events (34.2%)
- With procedure or patient care: 10 events (26.3%)
- Suspected dislodgement: 7 events (18.4%)
- Self / patient motion: 4 events (10.5%)
- Suspected plug: 4 events (10.5%)
Updated Causes of 20 UE – 2/12 to 7/13

Factors Associated with Unplanned Extubations

<table>
<thead>
<tr>
<th>Causes</th>
<th>Number of Events</th>
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<td>Procedure related movement</td>
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<tr>
<td>Tube disengaged during time</td>
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<tr>
<td>Eclampsia</td>
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<tr>
<td>Seizures</td>
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<tr>
<td>Activity/agitation</td>
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<tr>
<td>BPD intubated</td>
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Ideas for Change

- **Planned change ideas (P):**
  - Investigate new types of tape.

- **Testing change ideas (T):**
  - Verification of tube in airway by visualization with laryngoscope.
  - Second person to secure ETT for all procedures.
  - Elevation of bed 30 degrees.
  - Run feedings over 1 hour.
  - *Use of NeoBar as an alternative fixation device*

- **Implemented change ideas (I):**
  - Documentation of position of ETT in SCM and on bedside card.
  - Tape integrity check every three hours by bedside nurse.
  - Two person check of ETT location at change of shift.
  - Multidisciplinary review of x-rays on rounds.
  - Debriefing of events – SWAT team.
  - Quality “ticker” in the unit raising awareness
Raising Awareness

Using a PDSA ramp to test change – the NeoBar

Evidence & Data

Breakthrough Results

Wide-scale tests of change

Test new conditions

Follow-up tests

Very small scale test

Try on bigger babies.

Try the NeoBar on one patient.

Expand to more than one patient.

Test use of NeoBar on all ventilated infants.

Test education about NeoBar use.
Process Measures

- SCM order
- Bedside Card
- X-ray Review at Bedside
- Shift Change Tube Check

These have been imbedded in our culture.

Unplanned Extubation Rate

- Decrease from 49.6 to 25.5 per 1000 ventilator days
Days between Unplanned Extubations

Ventilator Days between Unplanned Extubations (UE) – G chart

- Began process measure audits
- NeoBar trial
- Second person for procedures; Elevate head of the bed

Increase from 8.8 to 30.1 ventilator days between unplanned extubations

Keys to Success, Barriers, Lessons Learned

- Initial success with interventions reflected in our process measures led to improvements in our outcome measures.

- By increasing awareness of the staff that UE is a problem probably contributed to an overall increased attention to ETT care in general. This was achieved by:
  - Posting data in the unit.
  - Discussing each UE in a timely fashion with involved staff in a non-accusatory way.
  - Asking for feedback from the bedside staff regarding ideas for change.

- The new ideas are currently being tested and hopefully will drive our outcomes towards increased improvement and sustainability.
  - Second person available during procedures and patient movement.
  - Investigating new types of tape that will be more resistant to secretions and losing its stickiness.
  - Revisit the use of the NeoBar as an alternative to tape.

- The importance of consistent team members and replacing those who leave the project or institution.
The Business Case – preliminary analysis

- On average, infants who have had unplanned extubations were:
  - Gestational age: 26 4/7 weeks
  - Birth weight: 858 grams
  - Number of UE per baby: 1.85
  - Ventilator Days: 59
  - Length of stay (excluding mortality): 136
  - Mortality: 2 deaths (unrelated to UE)

- Average length of stay for < 1000g babies in 2011: 116 days

- For each baby with an unplanned extubation that we prevented, we could reduce length of stay by approximately 20 days.
  - Direct cost attributable for each hospital day (exclusive of indirect or fixed costs) is $844.75 per day.

- By reducing unplanned extubations from 49.6 to 25.5 per 1000 ventilator days, we would prevent approximately 29 unplanned extubations based on our current number of ventilator days per year.

- On average, a baby who has an unplanned extubation has 1.85 of them.

- So we could potentially reduce the length of stay of 16 babies by 20 days each.

- Possible cost savings associated with reduced length of stay per year is:
  - 16 babies x 20 days x $844.75 = $270,320

- Each reintubation costs approximately $175 ($45 for x-ray and $130 for medications and equipment)
  - Two-thirds of our infants require reintubation after an extubation
  - 19 unnecessary reintubations cost: $175 x 19 = $3325.

- Cost savings from LOS reduction and materials utilization = $273,645
Decreasing MRSA Colonization

Decreased rate from 3.9 to 1.5 per 1000 patient days.

Improving Delivery Room Care

Decreased ventilator days and length of stay.