Reducing Unplanned Extubation in the NICU: A Quality Improvement Project
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BACKGROUND: Unplanned extubation (UE) is the fourth most common adverse event in the NICU, with published rates ranging from 0.14 to 6.6 per 100 ventilator days. UE frequency has increased recently in our NICU. UE leads to acute respiratory and hemodynamic instability, plus the need for reintubation with consequent airway trauma; subsequent associated morbidities include intraventricular hemorrhage, pneumonia and chronic lung disease.

MECHANISMS: Major factors underlying UE events include failure of the endotracheal tube (ETT) holding device, patient agitation, secretions, procedure-related movement, and removal of the ETT by staff in response to acute cardiorespiratory instability.

AIM: Our objective was to capture all UE events occurring in NICU patients, identify factors that contributed to these events and to then implement changes to reduce the rate, with a target of <2/100 ventilator days by July 2015.

SETTING: This quality improvement work is being carried out at a 60 bed, private room, level IV NICU and associated patient care areas including delivery rooms and transport settings.

METHODS: Our multidisciplinary team used the Model for Improvement framework; to date, we have not involved families in this project. We developed an inclusive operational definition of UE, counting an UE as any ETT that was dislodged or removed by a provider at a time that was not planned. We sub-categorized event types into dislodged (more likely materials-related) versus removed tubes (more likely staff/care technique related). Dislodged ETTs were determined by objective criteria to be out of the trachea and removed ETTs were tubes that were removed from the trachea by a provider. A new commercial ETT holder was implemented during PDSA cycle 1 in the NICU in August 2014-January 2015, and then a month later in the delivery room. In March 2015-June 2015, PDSA cycle 2 was initiated and included standardized practices developed for all intubated patients; such as having at least two medical providers available (RN/RT) when transferring a baby to a parent for kangaroo care and using simulation-based education to aid the medical team develop a shared mental model on how to approach a patient with a possible UE event. In July 2015, PDSA cycle 3 was initiated and involves use of an “airway card” for all intubated patients. The data collection plan included a data form to capture standardized etiologic information on the events, as well as reviews of the events with the providers involved.

MEASURES: Our primary outcome measure was overall UE rates: number of ETTs dislodged or removed non-electively, per 100 ventilator days. We developed a data collection form that was completed by the providers involved at the time the UE occurred. These forms were reviewed and completed by members of the QI team, who categorized each event as either a dislodged or removed ETT.
RESULTS: Our overall average UE rate is 5.6 /100 ventilator days. In recent months our rates have been typically below this mean, and the proportion of ETTs classified as removed has decreased (Figure 2). We have also seen a decrease in the number of UE that occur during kangaroo care. We still find disagreements on whether some events should be counted as UEs, and on their sub-classification; interestingly, these issues are also noted at collaborating centers, despite standardized definitions.

CONCLUSIONS: Although we have not met our target rate of <2/100 ventilator days, the subtype of UE wherein the ETT is removed by staff has decreased over time. We attribute this to the shared mental model we developed for addressing desaturation events. Subsequent cycles need to focus on preventing dislodged ETTs. Standardized definitions and subtype classification will be essential for benchmarking across NICUs.


Keywords: Unplanned extubation, extubation, airway safety.

Figure 1: Run chart showing monthly UE rates/100 ventilator days.

This run chart shows UE rates declining after the PDSA cycle 2
**Figure 1b:** Number unplanned extubations (UE) and ventilator days per month

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**Figure 2:** Monthly UE rates /100 ventilator days, by UE subtype.

This graph chart shows our monthly UE rates and suggests that the number of ETTs removed by providers have declined.