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Unplanned Extubations Prevention Bundle 1.0

Table of Contents

I. Background & Team

A pediatric unplanned extubation (UE) is the inadvertent dislodgement of an endotracheal tube in a pediatric patient setting. Historically, many providers have considered unplanned extubations an expected consequence of care delivery in children's hospitals because of various difficult challenges, including sedation of a child, length of the neonatal/pediatric airway and inability to predict extubation readiness.

Multiple single-center studies have shown that quality improvement initiatives can reduce unplanned extubations. Summarized below are three studies that highlight quality improvement efforts that reduced unplanned extubation rates and showed that certain aspects of care, such as sedation practices, may impact unplanned extubation rates:

- "Unplanned extubation in a paediatric intensive care unit: impact of a quality improvement programme" (2008) – A five year quality improvement effort reduced unplanned extubations from 2.9/100 ventilator days to 0.6/100 ventilator days in the last year of the study[4].
- "An interdisciplinary initiative to reduce unplanned extubations in pediatric critical care units." (2012) – Coordinated inter-disciplinary efforts to standardize taping, sedation, hand-offs and review of unplanned extubations leads to reduction in events over time in pediatric and cardiac intensive care units [5].
- "Decreasing unplanned extubations: utilization of the Penn State Children's Hospital Sedation Algorithm." (2004) – Following the implementation of a standardized sedation algorithm and without altering any additional care delivery models or practice, unplanned extubations were reduced without increasing length of stay [6].

To further quantify prevention methods, the SPS UE Pioneer Cohort was launched in January, 2016. They have since achieved significant improvement and identified prevention bundle elements using data and analysis obtained from the UE Pioneer Cohort. The UE Pioneer Cohort has identified the initial bundle elements that are highly likely to result in decreased harm to hospitalized children when reliably implemented. The mechanism to spread this new knowledge is through the use of this bundle at individual SPS hospitals.

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Participating Cohort Hospitals
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Akron Children's Hospital
Arkansas Children's Hospital
Baystate Children's Hospital
Boston Children's Hospital
Children's Health Children's Medical Center Dallas
Children's Healthcare of Atlanta
Hasbro Children's Hospital at Rhode Island
Hassenfeld Children's Hospital at NYU Langone
Helen DeVos Children's Hospital
Kravis Children's Hospital at Mount Sinai
Lehigh Valley Children's Hospital
Mary Bridge Children's Hospital and Health Network
Memorial Health, an affiliate of University of Colorado Health

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Children's Hospital at Dartmouth Hitchcock
Children's Hospital New Orleans
Children's Hospital of Michigan
Children's Hospital of Pittsburgh of UPMC
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II. UE Pioneer Cohort Data Analysis 1.0 Summary

UE Pioneer Cohort Results

The UE Pioneer Cohort consisted of 53 network hospitals that tested various factors in an attempt to identify those most closely related to an UE rate reduction. Since the cohort began, the UE Pioneer Cohort had a reduction of 17%.

Data Collection and Preparation

The testing requires reliable house-wide implementation of factors and relating those factors to a change in outcomes. For our purposes, a 'factor' is a measured change to your hospital's system. The theory is that if the factor is effective, increasing the reliability of the factor will improve the outcomes measure.

- Each participating hospital has a start month in the cohort and time series for their baseline and post baseline. The total time for this period was 19 months.
- The baseline period was defined as March 2016 to October 2016
- The post baseline period was defined as November 2016 to September 2017
- Criteria to be included in the data required a hospital to have submitted outcomes data for at least 80% of the time in the baseline period (6 months or more). Once that was taken into account, there were 43 left from the cohort to be included in the data.

Factor Analysis

Analysis was completed using the ANCOVA model to statistically control for the initial rate of each group, and a p-value was determined. ANCOVA combines the feature of both regression and analysis of variance. ANCOVA is a generalized linear model that evaluates if the means of a DV (post baseline) are equal across levels of a categorical variable IV (buckets), while statistically controlling for the effects of other continuous variables know as a co-variate (baseline). This analysis placed hospitals into four groups: Reliable at baseline, Implementing and Measuring, Implementing but Not Reliable, and Not Implementing.

Level of SPS Evidence Scenario Key:

- **Scenario 1:** Hospitals that reliably implement an element show improvement
- **Scenario 2:** Hospitals that do not implement an element fail to improve when the system improves
- **Scenario 3:** When all hospitals implement an element, hospitals that implement an element without measuring reliability fail to improve when the system improves
- **Scenario 4:** Hospitals that reliably implement an element do not show improvement; however, relevant research literature supports adoption
- **Scenario 5:** Implementing an element is associated with improvement; however, the impact of reliability cannot be determined due to data or design factors

****CDC Modified Recommendation Category**

- **IA** - A strong recommendation supported by high to moderate quality evidence suggesting net clinical benefits or harms
- **IB** - A strong recommendation supported by low quality evidence suggesting net clinical benefits or harms or an accepted practice (e.g., aseptic technique) supported by low to very low quality evidence
- **IC** - A strong recommendation required by state or federal regulation
- **II** - A weak recommendation supported by any quality evidence suggesting a tradeoff between clinical benefits and harms

III. Prevention Bundle Elements – Evidence Reviewed

SPS stratified bundle elements based on their level of evidence to assist hospitals in prioritizing their efforts at designing and implementing evidence-based bundles for Unplanned Extubations and the other aviator HACs:

- *Standard Element:* Strong evidence suggests that implementation of this element is associated with significant decrease in patient harm; **all SPS hospitals should implement and measure reliability of this element.**
- *Recommended Element:* Preliminary data and clinical expert opinion support the implementation of this element; **SPS hospitals should strongly consider implementing this element.**

Prevention Bundle Element	Description	Level of Evidence SPS Pioneer Analysis	Level of Evidence: Medical Literature, CDC **	Evidence Cited
Standard Elements				
Standardized anatomic reference points and securement methods	• Two licensed clinicians are present for securing, repositioning, and/or manipulating endotracheal tubes • Hospitals will select one of the following as an anatomic landmark: gums, teeth, or nare. When unable, use lips (reference NRP guidelines) • Each unit selects one standard securement method (or one house-wide standard securement method)	Scenario 1		1, 5

Prevention Bundle Element	Description	Level of Evidence SPS Pioneer Analysis	Level of Evidence: Medical Literature, CDC **	Evidence Cited
Protocol for high risk situations	Repositioning *occurs* with 2 licensed clinicians (having 1 dedicated to hold the tube during movement and repositioning) during high risk situations **High Risk Situations include at least (use local ACA data to append list):** a. Bedside imaging procedures b. Bedside invasive procedures c. Kangaroo care/parent holding d. Routine repositioning e. Switching beds f. Early mobility	Scenario 1		4, 7
Recommended Elements				
Multidisciplinary Apparent Cause Analysis	• A multidisciplinary ACA event form should be completed for each event on the current shift by all clinical witnesses • ACA should be used to pareto institutional-specific causes of UE to identify areas for improvement	Scenario 5		
Active Discussion on Extubation Readiness	Conduct a multidisciplinary active discussion to evaluate for planned extubation • Conduct on all individual patients weaning toward extubation • Discussion to include: o Necessity for the ET tube o Discuss target extubation time ▪ Post-extubation respiratory support plan ▪ Pre-extubation sedation/analgesic/restraints plan ▪ Post-extubation analgesic plan o Scheduled re-evaluation time • Attended by at least: RN, RT, MD or NP, PA • Conduct discussion a minimum of once a day	Scenario 5		

IV. Measurement- Prevention Bundle Reliability

Measurement	Formula	Number of observations	Reporting Period
UE Prevention Bundle Standard Bundle Elements: • Standardized anatomic reference points and securement methods • Protocol for high risk situations	Number of audits totally compliant with SPS Prevention Bundle Elements/Number of audits completed x 100	• Your bundle reliability data should include all the SPS Prevention Bundle Standard Bundle Elements • Minimum of 20 house-wide audits per month	Monthly

V. References

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VI. Revision History

I. Version	Primary Author(s)	Description of Version	Date Completed
Version 1	Klugman D., Maynord P., Melton, K.	Bundle 1.0	03/07/18
Version 2	Klugman D., Maynord P., Melton, K., Mustin, L.	Updated section IV (Measurement – Prevention Bundle Reliability) to reflect measurement of the 2 standard aviator bundle elements "all or none" compliance	3/13/19
Version 3	Klugman D., Maynord P., Melton, K., Gupta, V.	Added recommended bundle element "Active discussion on Extubation Readiness" in section III	10/14/20

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