

HARM PREVENTION: REDUCING UNPLANNED EXTUBATIONS IN INFANTS AND CHILDREN

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DISCLOSURE

- The presenter has no disclosures of conflicts of interest related to this material

OBJECTIVES

- Review pediatric patients at greatest risk of unplanned extubation
- Identify evidence-based strategies to reduce unplanned extubation
- Discuss the team approach to unplanned extubation harm prevention

DEFINING UNPLANNED EXTUBATION

- Defining Unplanned Extubation (UE)

“Any dislodgement of the ETT from the trachea that is not intentional.” <https://www.solutionsforpatientsafety.org>

- This may include:

- “Self-extubation” – patient exerts a force to remove ETT
- “Accidental extubation” – external force applied to the tube, causing it to dislodge
- “ETT malfunction” – ETT removed due to obstruction, patient decompensation – “unplanned today”

https://www.solutionsforpatientsafety.org/wp-content/uploads/sps-operating-definitions_November-2021-1.pdf

Patient Safety Movement Actionable Patient Safety Solutions (APSS) #8D:

Neonatal/pediatric unplanned extubation (UE). <https://www.airwaysafetymovement.org/sam>

DEFINING THE ISSUE

- Unplanned extubation may result in:
 - Respiratory complications
 - Desaturation
 - Stridor
 - Bronchospasm
 - Pneumothorax
 - Aspiration
 - Reintubation (14-65%)
 - Difficult intubation or vocal cord injury (up to 6%)

Da Silva, P. S.L, & de Carvalho, W. B. (2010). Unplanned extubation in pediatric critically ill patients: A systematic review and best practice recommendations. *Pediatric Critical Care Medicine* :
5 A Journal of the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies, 11, 287-294. doi:10.1097/PCC.ob013e3181b80951

DEFINING THE ISSUE

- Unplanned extubation may result in:
 - Cardiovascular complications
 - Bradycardia
 - Dysrhythmia
 - Cardiac arrest/CPR event
 - Death

R. Al-Abdwani et al, Incidence, outcomes and outcome prediction of unplanned extubation in critically ill children: An 11year experience, *Journal of Critical Care*, (44), 2018, 368-375, doi.org/10.1016/j.jcrc.2017.12.017.

Da Silva, P. S.L., & Fonseca, M. C. M. (2017). Incidence and risk factors for cardiovascular collapse after unplanned extubations in the pediatric ICU. *Respiratory Care*, 62, 896-903. doi:10.4187/respcare.05346

DEFINING THE ISSUE

- Unplanned extubation may result in:
 - Financial impact:
 - Increased hospital length of stay (16.5 d vs 10 d)
 - Longer ICU LOS (10 d vs 4.5 d)
 - Higher hospital cost (\$101,310 vs \$64,618)

HOW OFTEN SHOULD UNPLANNED EXTUBATION OCCUR?

- Ideally never
- Solutions for Patient Safety (SPS) current rate= 0.662 UE per 100 vent days
 - Trach/vent patients excluded

RISK FACTORS FOR UNPLANNED EXTUBATION

- Younger children (< 2 years)
- Inadequate sedation
- Agitation
- Weaning
- Inadequate ETT fixation
- Copious secretions
- ETT placement above the thoracic inlet on CXR
- Bedside procedures
- Transport
- Nurse experience
- Increased patient burden (nurse/patient ratio)

NEONATAL UNPLANNED EXTUBATION

- Risk of unplanned extubation in neonates greater in those with:
 - Lower birth weight
 - More preterm at birth
 - Older at time of NICU admission
 - Higher Clinical Risk Index for Babies score
 - Longer duration of mechanical ventilation
 - Restlessness/agitation
 - Poor ETT fixation
 - Tube manipulation
 - Bedside procedure

- **36%** of unplanned extubations occurred in neonates who had a prior unplanned extubation event (Hatch et al.)

NEONATAL UNPLANNED EXTUBATION

- Most common causes of UE in neonates:
 - Movement by patient (40%) Hatch et al.
 - Secondary to pain, agitation, poor sedation, developmental activity
 - Restlessness/agitation
 - More often larger, more gestationally mature, older infants
 - Accidental UE during retaping ETT (27%) Hatch et al.
 - ETT manipulation
 - Suctioning, retaping, vent circuit position/support
 - Poor fixation
 - Procedure
 - Kangaroo care

NEONATAL UNPLANNED EXTUBATION

- Harm associated with neonatal UE:
 - Respiratory support
 - 58% reintubated
 - 69% reintubated within 24 hours
 - 20% CPAP
 - 21% Low flow nasal cannula
 - 5% no support
 - Desaturation
 - 89% O₂ sats less than 89%
 - Median lowest sat 31%
 - Cardiovascular
 - 32% bradycardia
 - 6% chest compressions
 - 3% epinephrine with bradycardia
 - Intraventricular hemorrhage

UNPLANNED EXTUBATION IN THE CARDIAC ICU

Those patients who had UE were:

- Younger (0.09 vs 5.45 mo)
- Weighed less
 - UE group median weight of 3 kg vs control median weight of 6 kg
- Had longer duration of mechanical ventilation (8 vs 2 d)

Outcomes of those who had UE vs control:

- More likely to require CPR during their hospital stay (54% vs 18%)
- Had higher likelihood of in-hospital mortality (15% vs 7%)

RISK ASSESSMENT

- Unplanned extubation risk score
 - Tool to stratify risk of UE (RAS)
 - Low ≤ 2
 - Moderate 3-4
 - High 5
 - Extreme ≥ 6
 - Situational awareness
 - EMR “banners” or alerts
 - Color coded risk card at bedside

RISK ASSESSMENT (PEDIATRIC) COMPONENTS

| | |
|--|-------|
| Anatomical risk- difficult airway/facial deformity | 6 |
| Agitation/sedation holiday Mild/moderate/severe | 1/2/3 |
| Excessive oral secretions | 1 |
| Multiple procedures +/- transport | 1 |
| Planned extubation | 1 |
| Prone position | 1 |
| Frequent retaping | 1 |
| History of UE | 1 |

Vats, A., Hopkins. (2017). An airway risk assessment score for unplanned extubation in intensive care pediatric patients. *Pediatric Critical Care Medicine*, 18, 661-666. doi:10.1097/PCC.0000000000001189

RISK ASSESSMENT (NEONATAL) COMPONENTS

| | |
|---|-------|
| Anatomical risk- TEF, difficult airway/facial deformity | 6 |
| EGA <34 weeks | 3 |
| Weight <1500 grams | 2 |
| Agitation/sedation holiday Mild/moderate/severe | 1/2/3 |
| Excessive oral secretions | 1 |
| Multiple procedures +/- transport | 1 |
| Planned extubation | 1 |
| Prone position | 1 |
| Frequent retaping | 1 |
| History of UE | 1 |

Suzansky, D. T., Tierney, N. M. (2019, Sept 11-14). Reducing Unplanned Extubations in the NICU Using a Risk Assessment Scoring Tool.
Poster Presented at: National Neonatal/Mother Baby/Advanced Practice Nurses Conference, Orlando, FL.

How can we work together to reduce unplanned extubations in infants and children?

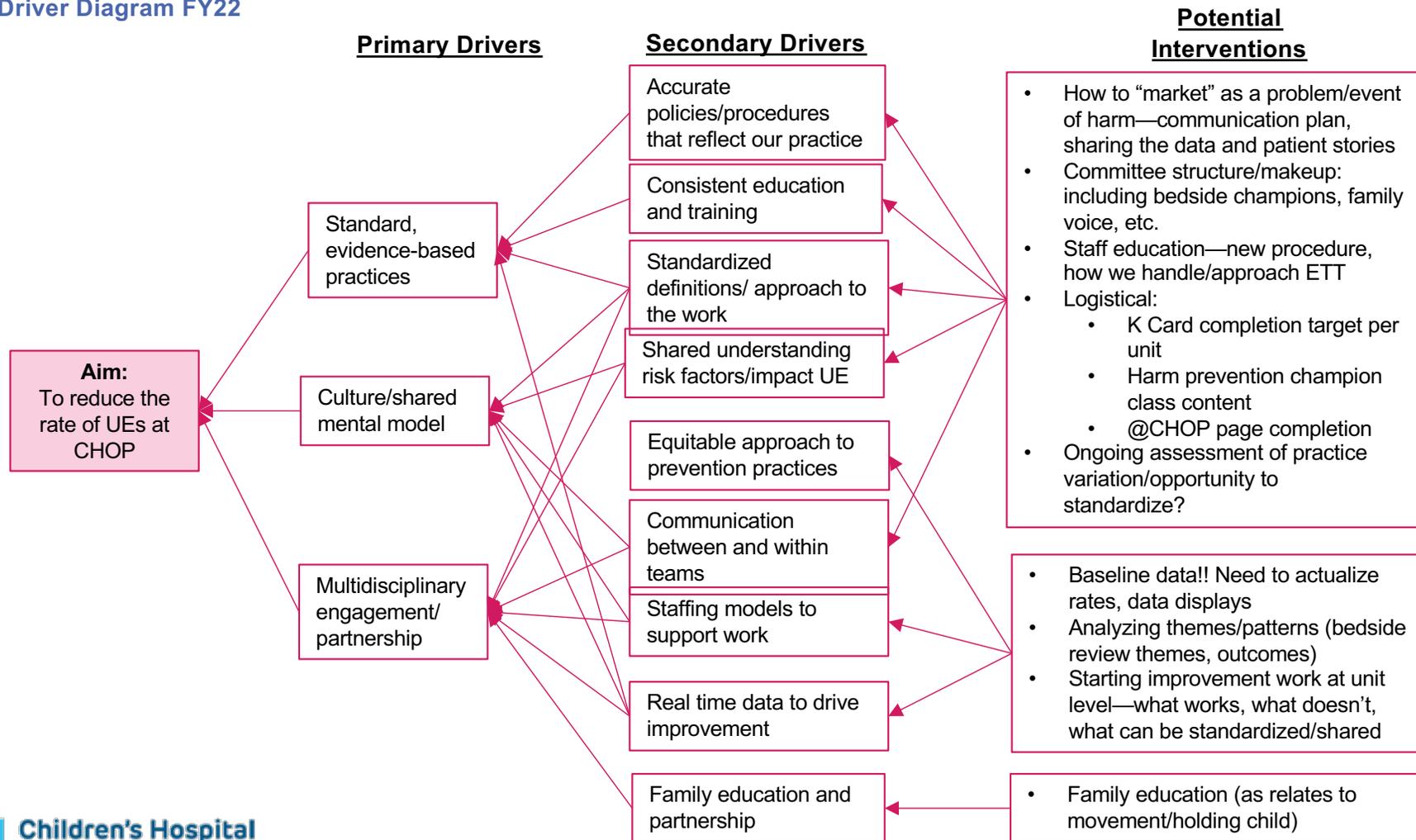
STRATEGIES TO REDUCE UNPLANNED EXTUBATION

- Identify key drivers of unplanned extubation at your institution
 - Safety culture
 - Evidence-based practices
 - Securement – ETT and vent circuit
 - High risk situations
 - Tube position/x-ray
 - Sedation
 - Restraint use/vigilance in observation
 - Weaning and extubation readiness
 - Interdisciplinary engagement

Kandil SB, et al Reducing Unplanned Extubations Across a Children's Hospital Using Quality Improvement Methods. *Pediatr Qual Saf* 2018;3:e114.

18 R. Al-Abdwani et al, Incidence, outcomes and outcome prediction of unplanned extubation in critically ill children: An 11 year experience, *Journal of Critical Care*, (44), 2018, 368-375, doi.org/10.1016/j.jcrc.2017.12.017.

Unplanned Extubations Key Driver Diagram FY22



REDUCING UNPLANNED EXTUBATION

- Gather data->identify current state
 - Identify current number of unplanned extubations/vent days
 - Capturing data
 - EMR
 - Incident reporting
 - Other – charge report, shift huddles, etc
 - Set a goal for unplanned extubations (ex: less than 1 UE/100 vent days)
- Recruit a team
 - Multidisciplinary
 - Buy-in

REDUCING UNPLANNED EXTUBATION

- Develop a process to debrief after events
 - Include all providers involved in care and those witnessing event
 - Understand contributing factors
 - Identify potential mitigating factors
- Track the outcomes of UE, such as
 - Re-intubation rates, NIPPV
 - Significant hypoxia, need for assisted ventilation
 - CPR events
 - Aspiration

UNPLANNED EXTUBATION DEBRIEF FORM

| | |
|---|-----------------|
| Date of Event: | Time of Event: |
| Age: | Weight: kg |
| Reintubated <input type="checkbox"/> Yes <input type="checkbox"/> No | |
| Non Invasive Ventilation <input type="checkbox"/> Yes <input type="checkbox"/> No | |

Patient Label Here

| Reason for Event | | Event Occurred During | |
|------------------|--|-----------------------|-------------------------|
| | Coughing/ gagging | | ETT Retaping |
| | Excessive oral secretions | | ETT Suctioning |
| | Plug <input type="checkbox"/> Suspected <input type="checkbox"/> Confirmed | | Routine care |
| | Planned Extubation | | Bedside procedure |
| | Agitation/ Inadequate sedation | | Bedside imaging (state) |
| | Movement of head/ excessive movement | | Transport |
| | Not seen | | Being held |
| | Other (state) _____ | | Other (state) _____ |
| | | | |
| Assessment | | Outcome | |
| | UE Risk Assessment Score _____ | | Desaturation |
| | Last SBS Time | | Bradycardia |
| | Last CAPD Time | | Compressions |
| | Oral Intubation | | Nasal Intubation |
| | Difficult Airway | | Facial deformity |
| | Restraints Present | | Other: _____ |
| | | | |

Persons at bedside when event occurred:

RN RT MD X-Ray Technician Family/ Caregiver
 Other

List Responding Personnel:

| |
|--|
| |
| |
| |
| |

Form Completed by: _____

REDUCING UNPLANNED EXTUBATION

- Create a database to track event details and monitor for the emergence of patterns
- Use data to guide education, policy development, system changes, and to secure buy-in
 - Consider a risk assessment tool
 - Develop a system to extubate when the **child** is ready
 - Consider an educational “campaign” about UE
 - Consider the use of check lists
 - Include patient family advisors

REDUCING UNPLANNED EXTUBATION - OTHER INTERVENTIONS

- Utilize a policy to guide care of the patient with an ETT (retaping, movement, verifying tube placement by markings, x-ray, ETCO₂ use, etc)
- Develop a policy to standardize ETT securement
- Standardize ETT positioning and vent circuit support, ETT position for x-rays
- Require waveform capnography to quickly detect ETT position changes
- Identify an “airway guardian” when repositioning the patient
- Control movement with developmental positioning whenever possible, mitts as needed, and restraints when absolutely necessary
- Utilize sedation pathways
- Consider a ventilator weaning pathway with criteria for extubation readiness

<https://www.airwaysafetymovement.org/sam>

<https://static1.squarespace.com/static/5a98e2f4620b85a7c5613e2a/t/5e6c4b94fd82d42cb232e5d4/1584155542111/APSS-8D%5B2%5D.pdf>

REDUCING UNPLANNED EXTUBATION

- Consider small tests of change and monitor for improvement

OR

- Implement a bundle

UNPLANNED EXTUBATION BUNDLES

- Implementation of a UE bundle in a consortium of 43 children's hospitals from 2016-2018
- Included intubated patients in NICU, CICU, PICU
- Resulted in:
 - 24% reduction in UE
 - 36.6% reduction in cardiovascular collapse

UNPLANNED EXTUBATION BUNDLE ELEMENTS

- Standardized anatomic reference points and securement method
 - 2 licensed clinicians for securing, repositioning, and/or manipulating ETT
 - Selection of 1 anatomic reference point
 - Gum, teeth, or nare (lip if unsure)
 - Standard securement method
 - H, Y, tube holder, etc
- Daily discussion of extubation readiness

UNPLANNED EXTUBATION BUNDLE ELEMENTS

- Protocol for high-risk situations
 - Patient repositioning occurs with 2 clinicians
 - One licensed clinician dedicated to holding ETT during movement, repositioning, and high-risk situations
 - Bedside imaging
 - Bedside invasive procedures
 - Kangaroo care/parent holding
 - Routine position change
 - Changing beds
 - Changing linens
 - Early mobility

UNPLANNED EXTUBATION BUNDLES

- Recommend a review of all events
 - Multi-disciplinary review completed after each event on the current shift, by those who witnessed the event
 - Obtain real time data and feedback
 - Include clinicians, parent/family member
 - Use the event review data to create a chart to trend specific causes of UE and identify areas of improvement
- These reviews may be helpful to identify other patients at potential risk

UNPLANNED EXTUBATION BUNDLES

- Monitor intervention or bundle compliance
 - Are the staff doing the work aware of the change(s) implemented, and are those changes happening at the bedside?
 - *“Work as done, not work as imagined”*
 - Consider Kamishibai Card (“K card”) rounding

UNPLANNED EXTUBATION K-CARD

| | Bundle in Action? (Y, N, N/A) |
|--|----------------------------------|
| Bundle components starred (*) below. Version: 9/2021 | |
| <p>*Standardized Anatomic Reference Points and Securement Methods:</p> <p>Tell me who should be present for adjustment/securement of endotracheal tubes.</p> <ul style="list-style-type: none"> • RN, RT, FLOC, MD/DO, Paramedic | |
| <p>Is an appropriate anatomic reference point documented for this patient? Show me the documentation.</p> <ul style="list-style-type: none"> • Gums/teeth, naris, or lips | |
| <p>Show me how the tube is secured. Is it consistent with hospital policy and/or patient condition (i.e., sutures)?</p> <ul style="list-style-type: none"> • Tape, Neobar, or Anchorfast. Sutures may be used based on patient condition (i.e., skin integrity issues) | |
| <p>*Protocol for Repositioning and High-Risk Patient Populations:</p> <p>Tell me what roles should be present during repositioning and what are their responsibilities?</p> <ul style="list-style-type: none"> • When moving any patient: <ul style="list-style-type: none"> • Bedside imaging procedures (i.e., CXR) • Bedside invasive procedures • Patient transport • Routine repositioning and turning • Early mobility • Switching beds • Kangaroo care/parent holding • Potential higher risk patient populations: <ul style="list-style-type: none"> • Critical or difficult airways • Advanced modes of ventilation (HFJV, HFOV, VDR) • Weaning sedation • Weaning towards extubation • Endotracheal tube size < 3.5 mmID • Non-standard airway fixation (e.g., sutured airways, altered skin integrity) | |
| <p>*Daily Discussion of Extubation Readiness:</p> <p>Was ventilator management discussed in rounds? Show me documentation of the discussion. If discussion did not occur, what was the reason?</p> <ul style="list-style-type: none"> • Team discussion around escalating, weaning, or maintaining current ventilation • Documented as part of the Attending Physician's daily note | |

REDUCING UNPLANNED EXTUBATION

- An unplanned extubation harm reduction initiative will be an ongoing process.
- Utilize the strategies discussed and Plan, Do, Study, Act cycles to monitor the impact of interventions/process or system change and respond accordingly.
- Expect ups and downs!

SUMMARY

- Unplanned extubations are associated with identifiable risk factors and may lead to patient harm.
- A multi-disciplinary approach using evidence-based interventions may reduce unplanned extubations and improve patient outcomes.
- You all can make a difference in the care of pediatric patients – work as a team!

RESOURCES

- Airway Safety Movement
 - Actionable Patient Safety Solutions (APSS) #8D: Neonatal/pediatric unplanned extubation (UE)
 - <https://www.airwaysafetymovement.org/sam>
- Solutions for Patient Safety
 - <https://www.solutionsforpatientsafety.org>
 - <https://www.youtube.com/watch?v=NoyH3CD1pLQ>
- Children's Hospital of Philadelphia Clinical Pathways
 - <https://www.chop.edu/pathways>

THANK YOU FOR THE WORK THAT YOU DO!



QUESTIONS?



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