

Accidentally dislodged breathing tube is fourth-most common adverse event in the nation's NICUs

Children's NICU slashes unintended extubation rates by 60% over 10 years

WASHINGTON, USA-(April 26, 2019) - A quality-improvement project at the neonatal intensive care unit (NICU) at Children's National that included standardized taping methods, bedside review of events within 72 hours and reducing how often newborns received chest X-rays reduced unintended extubations by 60% over 10 years and saved an estimated \$1.5 million per year, according to research published online April 26, 2019 in Pediatrics.

Each year more than 800 medically fragile newborns are transferred to Children's 60-bed NICU from dozens of regional hospitals, often within hours of birth. Many of these infants are born so premature their lungs have not had time to fully develop, requiring mechanical ventilation via an endotracheal tube to keep them alive. Unintended extubations (UE) - when such breathing tubes accidentally become dislodged - are the fourth-most common adverse event in the nation's NICUs and can lead to airway trauma, bleeding and cardiovascular collapse.

Children's NICU leaders launched the quality-improvement project in December 2010 with the goal of lowering UE rates below 1 per 100 ventilator days, the suggested benchmark.

"These babies have complex care needs, however lowering the rates of these life-threatening events came down to instituting a series of simple changes to standardize what we do, including how we tape the endotracheal tube to the child's mouth, how we position infants during X-rays and who we include on daily rounds when the medical team discusses intubated patients' care plans," says Lamia Soghier, M.D., MEd, Children's NICU medical director and the study's senior author. "In addition to reducing UEs at Children's National, our quality-improvement techniques are being adopted by other institutions to safeguard their newborns' health."

Among other improvements, Children's NICU team:

- Enhanced the accuracy of Apparent Cause Analysis (ACA) reports by also recording complications like cardiac instability as well as resuscitation medications given to children experiencing a

code event.

- Conducted bedside huddles within 72 hours of a UE to determine contributing factors, such as wet or loose tape.
- Reviewed ACA reports weekly and monthly to look for additional opportunities to improve methods.
- Assembled an Airway Safety Protection Team of respiratory therapists, nurses and physicians to develop innovative solutions. As the project evolved, this group became the SUN (Stop Unintended Extubation) Team.
- Mandated that respiratory therapists be included in daily rounds for any intubated patient.
- Standardized taping practices, using a double Y taping method that was taught to all staff.
- Ensured uniform insertion depth by using a weight-based formula and X-ray confirmation after placement.
- Positioned ventilator tubing so it emerged from the head of the bed, placing tubing across the child's face and supporting infants with rolls to prevent sliding within the isolette. The team used photos to remind nurses of optimal endotracheal tube position: on the opposite side of the ventilator tubing, with the infant's cheek acting as a stabilizer to make it more difficult for them to push out the medical device with their tongue.
- Confirmed that infants undergoing morning X-rays were uniformly in a vertical neutral position to avert the need to remove and reapply tape.
- Required that two staff members were present any time an infant would be moved for an X-ray.

Overall, 249 UEs with detailed information about the 184 affected patients occurred from May 2011 to December 2017. These infants had a median gestational age of 25 weeks at birth and a mean weight of 2,108 grams when the event occurred. They spent a mean 35 days on mechanical ventilation. Twenty-nine percent had had a prior UE. Sixty-four percent were boys.

During the first phase of the quality-improvement project, UEs decreased by 43% to 0.99 events per 100 ventilator days, a reduction that was sustained over three years during the project's next phase.

When UE rates again spiked in mid-2015, the team refocused their energies on achieving even greater reductions. By reducing the frequency of chest X-rays for neonates whose conditions were stable, reeducating staff about proper positioning and introducing a tool to identify patients at high-risk for accidental extubations, UEs dropped

to 0.68 per 100 ventilator days.

"By the second phase of this project, the number of days between UE events lengthened from six days to nine days. Equally important, our NICU went 75 days with no UE at all, a testament to our strong safety culture and the commitment of our staff to best practices," Dr. Soghier adds. "By trimming the number of daily X-rays not only did we reduce potential harm to newborns, we lowered overall health care spending."

The team's future research will compare infants who experience UEs with newborns who do not, will measure how much sedation these infants are given, will revise nurse-to-patient ratios as well as examine how long these newborns' parents participate in skin-to-skin kangaroo care.

In addition to Dr. Soghier, Children's study co-authors include Lead Author John P. Galiote, M.D., a neonatologist at Children's National -Virginia Hospital Center NICU; Michelande Ridoré, MS, NICU quality improvement lead; Jessica Carman, R.N., BSN; Lisa Zell, R.N., BSN; Karen Brant, RRT, NRP, NPS; Cheyenne Gayle, RRT; Billie L. Short, M.D., chief, Division of Neonatology; and Darren Klugman, M.D., medical director, cardiac intensive care unit.

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