Intubation Timeout Tool Implementation in a Level IV Neonatal Intensive Care Unit

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Abstract

Problem & Purpose: Endotracheal intubation is a common lifesaving, but technically challenging procedure performed in the neonatal intensive care unit (NICU). Based on a chart review of intubations performed in a Level IV NICU, use of a timeout protocol was reported 86% of the time, and 48% of intubations were associated with at least one adverse event. In this setting, adverse events occur more often when patients are acutely unstable and when providers demonstrate variable intubation proficiency. The purpose of this quality improvement project was to implement and evaluate an evidence-based pre-procedural intubation-specific timeout tool in a Level IV NICU in order to improve neonatal intubation process consistency and safety, leading to improved patient outcomes.

Methods: Project implementation occurred over a ten-week period in a 49-bed Level IV NICU. Implementation included collection of baseline data, identification of champions, staff education, and development of project resources and reminders. The intubation task-specific tool was initiated by the nursing staff for eligible intubation events and involved all intubation providers. A chart audit tool was used to extract demographic and intubation timeout tool data from the electronic health record (EHR).

Results: The pre-intubation timeout tool was used for nine intubation events (60%) over the ten-week period. With implementation of the tool, the incidence of intubation-associated adverse events decreased by 8% from baseline chart review.

Conclusion: Results suggest that the use of an evidence-based pre-procedural intubation-specific timeout tool improves intubation process, consistency, and safety across multiple intubating neonatal providers. Continuing education tactics are necessary to promote sustainability and accountability leading to improved patient outcomes.

Introduction

Neonatal endotracheal intubation is a common life-saving procedure performed in the neonatal intensive care unit (NICU) for critically ill neonates and can be associated with significant adverse events. Reports from the National Emergency Airway Registry for Children have shown that intubation-associated adverse events such as esophageal intubation, mainstem bronchial intubation, airway trauma, significant bradycardia, severe oxygen desaturation, and cardiac arrest occur in about 20% of neonatal tracheal intubations beyond the newborn period (Hatch et al., 2016). Factors associated with adverse events include proficiency of the intubating clinician, use of intubation pre-medication, intubation urgency, and the number of intubation attempts necessary to secure the airway (Hatch et al., 2016). Poor patient outcomes are associated with increased process variability, increased time to intubation, and increased number of intubation attempts. These outcomes include an increased incidence of intraventricular hemorrhage (IVH), poor neurodevelopmental outcomes, increased duration of mechanical ventilation, longer critical care unit stays, and increased morbidity and mortality (Davidson et al., 2018; Neubrand et al., 2019).

Based on a chart review of endotracheal intubations performed in an urban Level IV NICU, use of a timeout protocol was reported 86% of the time, and 48% of intubations were associated with at least one adverse event. In this setting, adverse events occurred more often when patients were acutely unstable and when providers demonstrated variable intubation proficiency. The purpose of this quality improvement project was to implement and evaluate an evidence-based pre-procedural intubation-specific timeout tool to be used prior to neonatal intubation in a Level IV NICU. It was anticipated that this practice change would improve intubation process consistency and safety, leading to improved patient outcomes.

Literature Review

The purpose of this literature review was to provide a synthesis of the evidence supporting the use of standardized, pre-procedural intubation checklists in the neonatal and pediatric population (Appendix A). The review aimed to address the use of intubation safety checklists and timeout tools, as compared to routine intubation practices, and their effect on intubation safety. The literature review focused on the efficacy of timeout tools and how they impact intubation safety, team performance, and improved neonatal patient care outcomes. Finally, the review summarized how implementing evidence-based strategies for endotracheal intubation improved health care outcomes in the neonatal population. The quality of evidence was determined using Melnyk & Fineout-Overholt's Hierarchy of Evidence (2015) and Newhouse Rating Scale for Quality of Evidence (2006) (Appendix B).

Endotracheal intubation is a lifesaving but technically challenging procedure which carries a meaningful risk of morbidity and mortality for critically ill infants. In order to minimize this inherent risk, decreasing practice variability and improving adherence to evidence-based interventions must be addressed (Hatch et al., 2016). The implementation of a standardized, pre-procedural intubation checklist prior to intubation has been shown to reduce the incidence of intubation-associated complications and severe adverse events when compared to routine intubation without the use of a checklist (Hatch et al., 2016; Kerrey et al., 2015; Neubrand et al., 2019; Smith et al., 2015). A reduction in the incidence of bradycardia and hypoxemia has been observed, along with a 50% decrease in the frequency of desaturation (Hatch et al., 2016; Kerrey et al., 2015; Neubrand et al., 2019; Smith et al., 2015). With the implementation of an intubation-specific checklist, there was an absolute risk reduction of 7.7-32% for intubation-associated

adverse events that was sustained past the post-implementation period (Hatch et al., 2016; Kerrey et al., 2015; Neubrand et al., 2019; Smith et al., 2015).

Provider and process variability in the use of evidence-based practices related to intubation, including effective communication and pre-procedural preparation contributed to poor patient outcomes (Hatch et al., 2016). Negative outcomes included a higher incidence of IVH, poor neurodevelopmental outcomes, increased duration of mechanical ventilation, longer critical care unit stays, and increased morbidity and mortality (Davidson et al., 2018; Neubrand et al., 2019). Davidson et al. (2018) found that the use of a neonatal intubation checklist improved team performance during simulated neonatal intubations, decreased the time required to successfully perform intubation, and improved the success of laryngoscopy attempts. Implementation of a standardized pre-procedural intubation checklist has also shown to decrease paralysis-to-intubation time, improve success of laryngoscopy attempts for intubation, and improve team adherence to recognized safety measures (Kerrey et al., 2015).

Checklists have been used in many arenas of the health care environment to enhance patient safety and minimize error (Davidson et al., 2018). Current low to moderate quality evidence (Level IV-VI, B/C quality) demonstrated that the use of a standardized, pre-procedural intubation-specific checklist can improve intubation process consistency, provider communication, equipment preparation, shorten the time to intubation, and reduce adverse intubation events leading to improved patient outcomes (Appendix A & B). In an urban Level IV NICU with a large census, high patient acuity, and multiple providers of varying training and experience levels, the implementation of an evidence based pre-procedural intubation-specific timeout tool has the potential to significantly improve outcomes.

Theoretical Framework

Lewin's Change Theory (1947) provided the framework for this quality improvement project. The theory is comprised of three stages through which change agents must proceed before change becomes part of a system. The model is based on the premise that behavior is a dynamic balance of forces working in opposition. There are driving forces that facilitate change by pushing individuals in a desired direction, resisting forces that hamper change by pushing individuals in the opposite direction, and an equilibrium where driving forces equal resisting forces, and no change occurs (Hendricks-Jackson & Hawkes, 2018). Once these driving and resisting forces are identified and understood, methods to strengthen the driving forces can be accomplished, making change successful (Lewin, 1947).

By applying Lewin's Change Theory, a framework was provided to implement, manage, and evaluate change during implementation (Figure 1). Stage 1 was the process of altering behavior to "unfreeze" or agitate the status quo. Presentation of baseline data regarding current intubation practices and evidence surrounding standardized intubation checklists was used to increase the driving forces for change by directing staff behavior away from existing intubation practices. Stage 2, "change," involved the movement of the health care team to a new equilibrium. Staff education, development of project resources, and the initiation of the pre-intubation timeout tool created the move toward a new equilibrium while allowing staff to process changes in thoughts, feelings, and behavior regarding intubation practices. Stage 3 was "refreezing," or attaining equilibrium with the newly desired behavior, so that it became integrated into the organizational culture. Promoting sustainability practices, celebrating project success, and ongoing educational training and support for unit staff was used to achieve this state. Without this final stage, it would be easy for members of the health care team to revert to previous behaviors.

Methods

Project Type, Setting, and Population

This quality improvement project occurred over a ten-week period from September 2020 – December 2020 in a 49-bed Level IV NICU of a large academic Children's Hospital, where more than 660 infants per year are admitted and treated. On average, the NICU daily census was about 40 neonates, and 2-3 intubations were performed each week. Infants intubated by the neonatology team were included in this project. Infants intubated outside of the NICU, infants with known difficult airways, congenital airway anomalies/malformations, and those intubated by a team other than neonatology were excluded.

Implementation Team, Strategies, & Tactics

The implementation team for this project included a project faculty advisor from the graduate neonatal nurse practitioner program, a clinical site representative from the targeted organization, an administrative sponsor, lead clinical nurse educator, and project champions. The practice intervention was an evidence-based intubation task-specific tool which was initiated by the NICU nursing staff for all eligible intubation events. Physicians, nurse practitioners, and respiratory therapists participated in the completion of the checklist process, including intubation. Preparation of project champions and staff education occurred during the first four weeks of implementation. A power point presentation (Appendix C) was used to educate all NICU staff based on an established set of learning objectives. Learning objectives included clinical significance of performing a timeout, project timeline/goals, inclusion/exclusion criteria, how to use the pre-intubation timeout tool, and provider-specific responsibilities (Appendix D). The pre-intubation timeout tool (Appendix E) was incorporated into each patient bedside reference binder and placed in each provider workroom to serve as a clinical reminder for use.

Additional clinical reminders utilized were memos and project updates in the monthly unit newsletter and staff meeting minutes. Educational tactics were modified after the first four weeks of initial education to include face-to-face communication and brief huddles for reinforcement which continued throughout implementation.

Structure, Process, and Outcome Measures

Structural change was reflected by improved knowledge regarding the use of the timeout tool, was achieved through staff education, and measured by the percent of staff educated. The main process change involved the use of an intubation-specific timeout process by NICU staff prior to each intubation procedure. When a collective decision was made to perform intubation, the registered nurse (RN) would initiate the process of using the timeout tool if the patient met inclusion criteria. The expectation was for the safety checks embedded in the tool to be performed and confirmed by the respective team member, and the timeout tool filled in by the RN prior to beginning intubation. The change in process was measured by the percent of intubations where the timeout tool was used. The percentage of patients who experienced an adverse event during the intubation procedure was collected as an outcome measure.

Data Collection and Analysis

During the implementation period, completed timeout tool forms were collected weekly, accompanied by chart audits to extrapolate, and collect data. The extraction of demographic and intubation timeout tool use data from the electronic health record (EHR) was performed using the Post Implementation Chart Audit Tool (Appendix F) for patients who were intubated and met inclusion criteria. Completion of staff education was recorded in the Implementation Education Check-Off (Appendix G). Run charts were created and updated each week with the data collected to follow the trends and patterns for structure, process, and outcome measures. The

main process and outcome measures of timeout tool use, and intubation-associated adverse events were analyzed using descriptive statistics to compare pre-implementation data vs. post-implementation data.

Prior to implementation, the DNP project was submitted to the Human Research Protection Office (HRPO) and the organization's Institutional Review Board (IRB) for approval and Non-Human Subjects Research (NHSR) determination. Due to the need to follow outcomes over time, patients and staff were both assigned a pseudo identifier for data collection and this information was recorded in the Patient and Staff Code Books (Appendix H and I respectively). The code books and all data collection tools using pseudo-identifiers were stored on a secure analytic framework environment (SAFE) desktop provided by the clinical site in which only the DNP student had access to.

Results

Based on a chart review of endotracheal intubations performed in an urban Level IV NICU, a timeout protocol was reported 86% of the time, and 48% of intubations were associated with at least one adverse event (Figure 2). This baseline data was collected over a twelve-week period prior to project implementation and demonstrated inconsistent use of a pre-procedural timeout protocol prior to endotracheal intubation, as well as associated adverse events.

Preparation of project champions and staff education occurred during the first four weeks of implementation. During the implementation period, 80.4% (n=201) of staff were educated on the clinical significance of performing an intubation-specific timeout process, project timeline/goals, inclusion/exclusion criteria, how to use the pre-intubation timeout tool, and provider-specific responsibilities (Figure 3). Barriers to education included the large number of staff that required education within a limited time period, competing unit projects and educational priorities, as well as high rate of staff turnover.

The pre-intubation timeout tool was used for nine intubation events (60%) over a ten-week period in the NICU, with an average of 1-2 intubations per week and a daily census of about 40 neonates (Figure 4). Instances in which the pre-intubation timeout tool was not utilized were identified as code events (n=3) and emergent intubations (n=3). The feasibility of utilizing the timeout tool during these events was identified as a barrier, as well as the inability to integrate the tool into the EHR due to organizational restraints.

With implementation of the pre-intubation timeout tool, the incidence of intubation-associated adverse events decreased by 8% (48% vs. 40%) from baseline chart review (Figure 5). While the overall incidence of intubation-associated events was reduced when compared to pre-implementation, high percentages of adverse events were seen at the end of the implementation

period. This can be attributed to the low number of endotracheal intubations performed (n=3), where the occurrence of a single adverse event can skew the overall adverse event rate. The adverse events recorded during implementation consisted of esophageal intubation (n=1) and non-severe desaturation events (n=6). Differences can be seen in the incidence and type of intubation-associated adverse events during pre-implementation vs. post-implementation (Figure 6). Although limited, results suggest that the use of an evidence-based pre-procedural intubation-specific timeout tool could improve intubation process consistency and safety.

Discussion

The results of this quality improvement project provide support for the use of a pre-procedural intubation-specific timeout tool prior to neonatal intubation within the NICU with the goal of improving intubation process consistency and safety, leading to improved patient outcomes. In alignment with the evidence, the implementation of the pre-procedural intubation timeout tool resulted in a decrease in the incidence of intubation-associated adverse events when compared to routine intubation without the use of a checklist. Similar results seen in the literature demonstrated a reduction of intubation-associated adverse events by 7.7-14% when a pre-procedural intubation timeout tool/safety checklist was used (Hatch et al., 2016; Kerrey et al., 2015; Neubrand et al., 2019; Smith et al., 2015).

Despite support from the literature that the implementation of an evidence based pre-procedural intubation-specific timeout tool can significantly improve patient outcomes, some endotracheal intubations were performed in the NICU without the use the pre-intubation timeout tool and were associated with adverse events. The feasibility of utilizing the timeout tool in a high-acuity NICU during code events and emergency intubations proved difficult without the ability to integrate the tool into the EHR. This resulted in decrease timeout tool use. Implementation of this practice change was further complicated by competing unit projects/initiatives, and organizational priorities coupled with the overwhelming stress and ongoing system changes related to the COVID-19 impact. Limitations to the project were the small number of neonates who were intubated during the ten-week implementation period. This small sample size can be attributed to low unit census at the time of implementation, as well as the increased use of non-invasive mechanical ventilation within the NICU.

Conclusions

Neonatal endotracheal intubation is a common lifesaving procedure performed in the NICU for critically ill neonates and can be associated with significant adverse events. Implementation of an evidence-based pre-procedural intubation-specific timeout tool may help improve intubation process consistency and safety across intubating providers, leading to improved patient outcomes. The movement toward the use of non-invasive mechanical ventilation in the NICU has resulted in a decreased need for intubation. Skills diminish over time when not performed frequently. The use of a pre-procedural intubation-specific timeout tool becomes even more imperative in order to ensure patient safety and avoidance of potential intubation-associated adverse events.

For practice implications in other NICU settings, an evidence-based pre-procedural timeout tool for intubation can be easily implemented after buy-in from staff is achieved. Incorporating timeout tool education into annual unit-based competencies and new hire orientation programs will aid in ongoing sustainability for nursing staff. The development of an endotracheal intubation policy/guideline which includes the pre-intubation timeout tool can promote accountability in practice, especially in a unit that is strongly policy driven. The ease of access of the pre-intubation timeout tool at the bedside during project implementation helped to promote its use, however in order to promote long-term sustainability, integration into the EHR will be important to help enhance usability and improve workflow. This quality improvement initiative was aimed at translating evidence into practice within this organization's NICU, therefore results are not generalizable beyond this specific population. While limited in its results, this project may be used as guidance for other NICUs who aim to improve intubation process consistency and safety among intubating providers and improve neonatal outcomes.

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Figure 1: *Lewin's Change Theory Framework for Implementation*

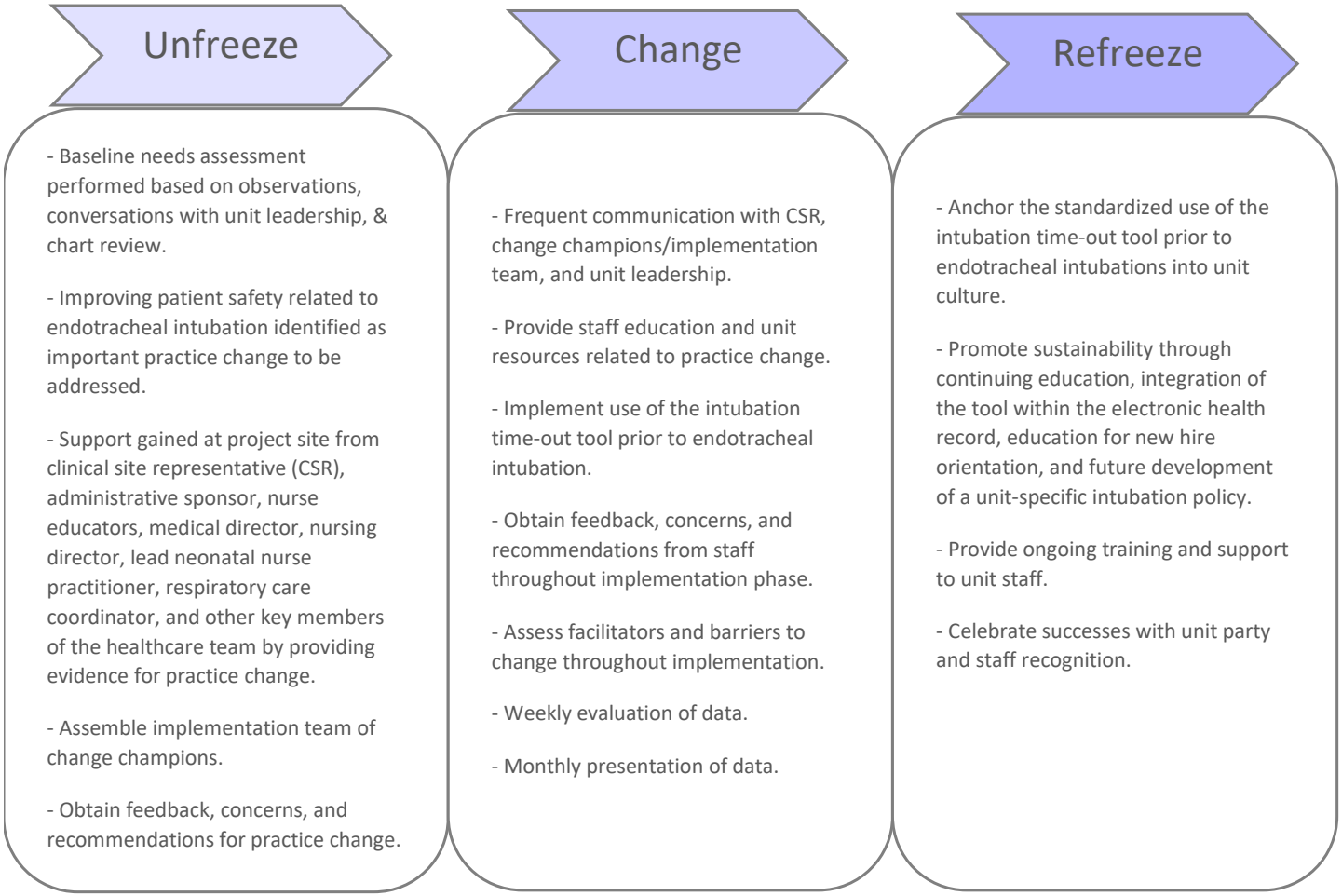


Figure 2: *Pre-Implementation Incidence of Intubation-Associated Adverse Events*

Date / Observation	Value	Median	Goal
1 | 2	0	50	0
3 | 4	50	50	0
5 | 6	100	50	0
7 | 8	50	50	0
9 | 10	33	50	0
11 | 12	71	50	0
13 | 14	50	50	0

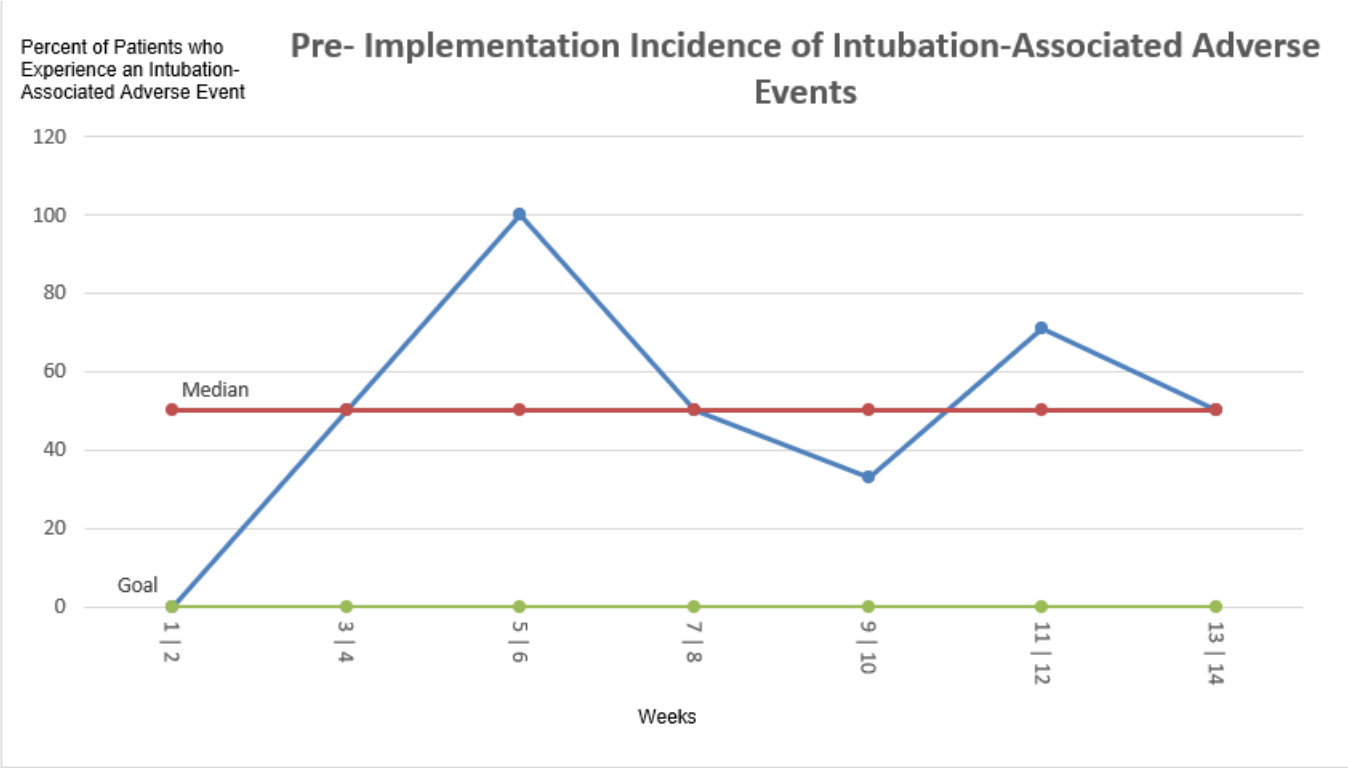


Figure 3: *Structure Measure – Staff Education on the Pre-Intubation Timeout Tool*

Date / Observation	Value	Median	Goal
1 | 2	2	46.4	100
3 | 4	24	46.4	100
5 | 6	28	46.4	100
7 | 8	46.4	46.4	100
9 | 10	54	46.4	100
11 | 12	70	46.4	100
13 | 14	80.4	46.4	100

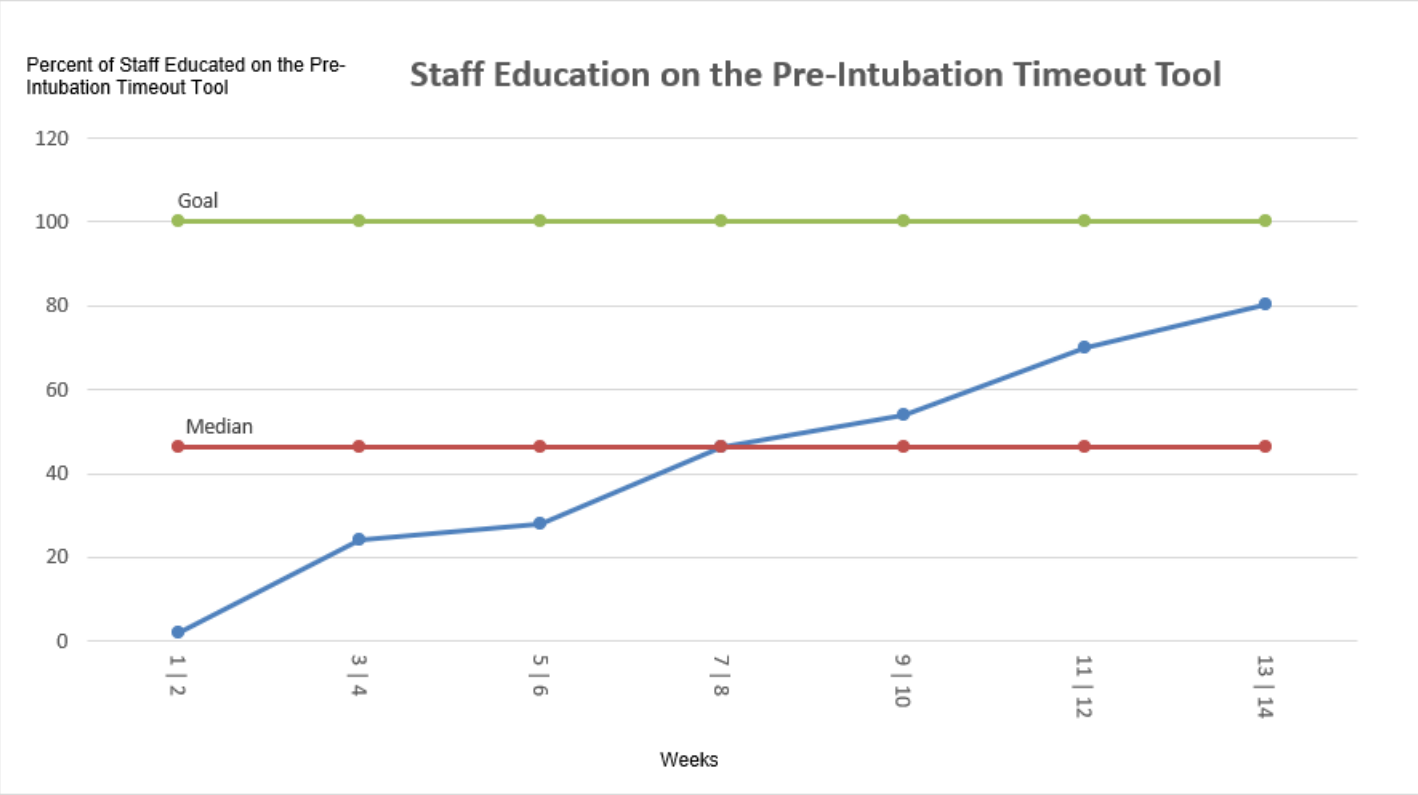


Figure 4: *Process Measure – Use of Pre-Intubation Timeout Tool in a Level IV NICU*

Date / Observation	Value	Median	Goal
5 | 6	100	60	100
7 | 8	60	60	100
9 | 10	25	60	100
11 | 12	50	60	100
13 | 14	100	60	100

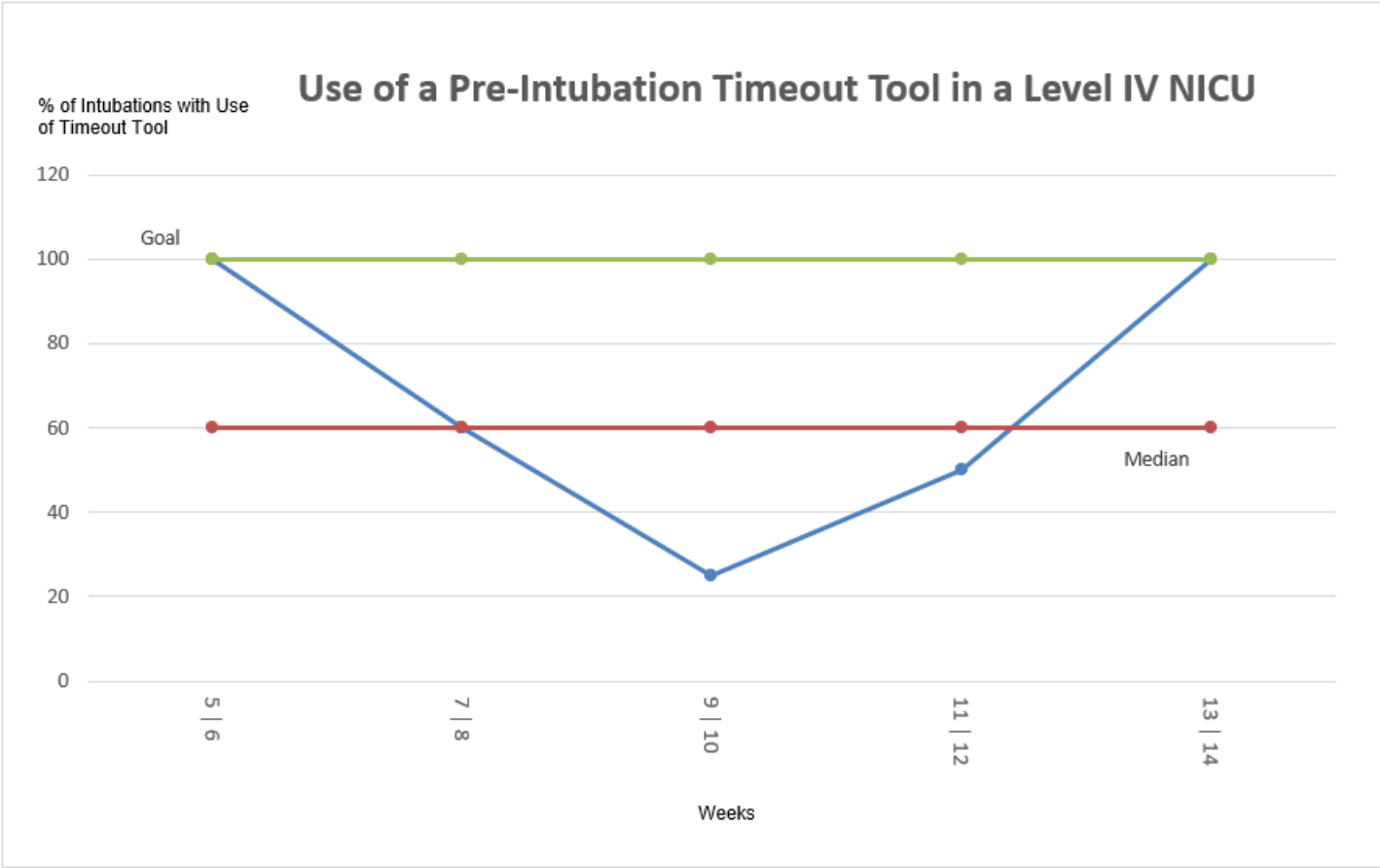


Figure 5: *Outcome Measure – Post-Implementation Incidence of Intubation-Associated Adverse Events*

Date / Observation	Value	Median	Goal
5 | 6	33	40	0
7 | 8	40	40	0
9 | 10	25	40	0
11 | 12	50	40	0
13 | 14	100	40	0

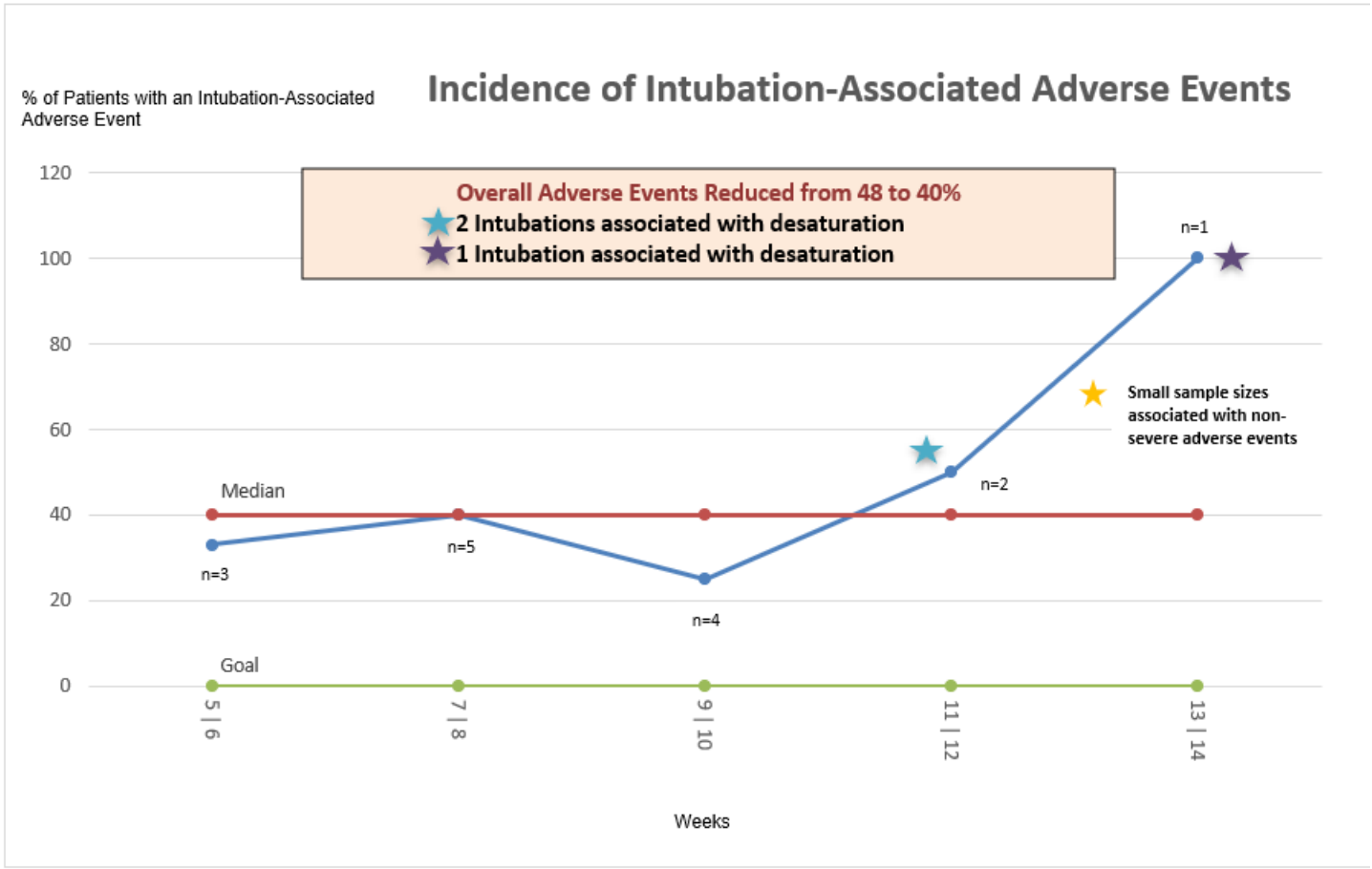
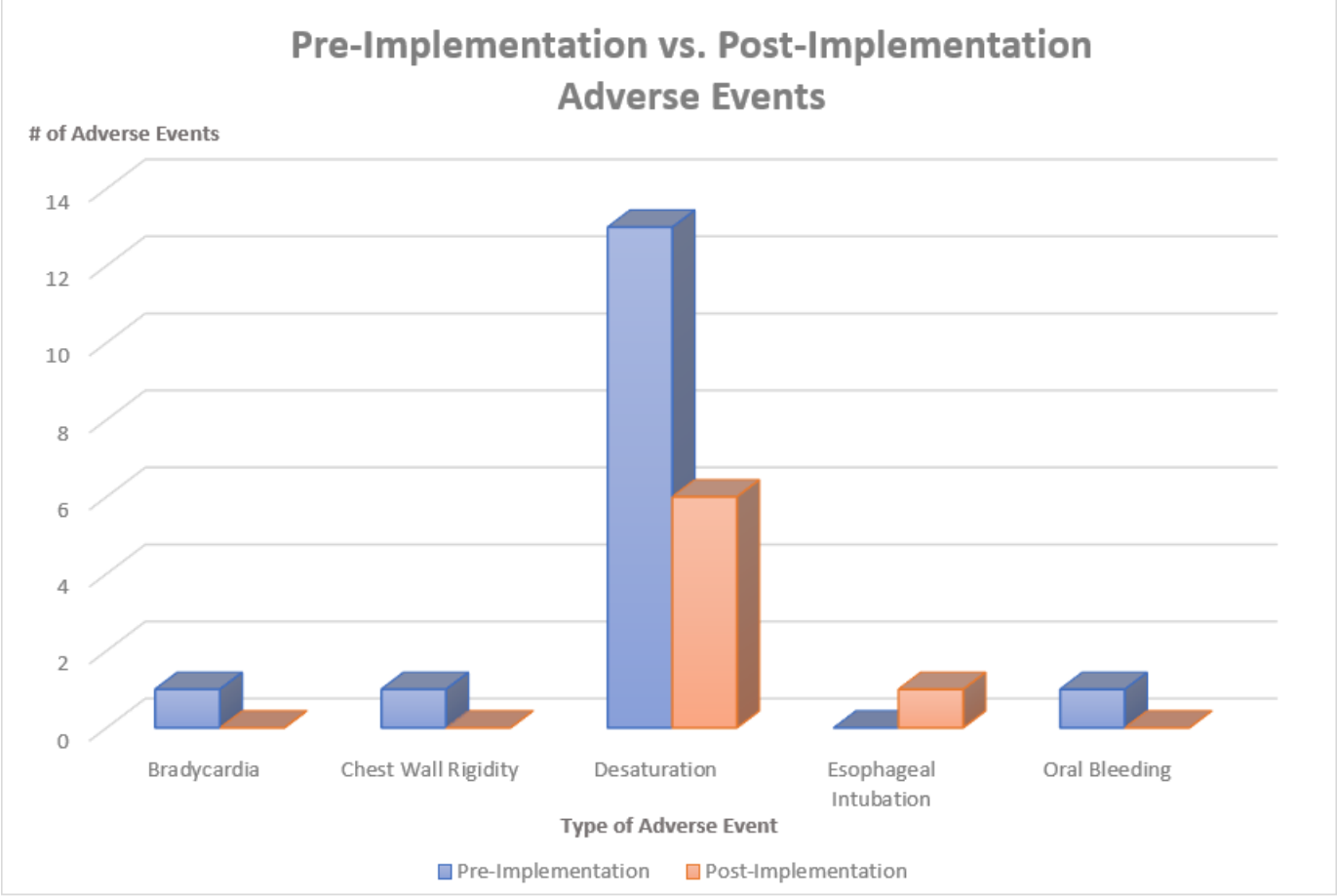


Figure 6: *Pre-Implementation vs. Post-Implementation Intubation-Associated Adverse Events*



Appendix A

Evidence Review Table

Citation: Davidson, L. A., Utarnachitt, R. B., Mason, A., & Sawyer, T. (2018). Development and testing of a neonatal intubation checklist for an air medical transport team. *Air Medical Journal*, 37(1), 41–45. https://doi.org/10.1016/j.amj.2017.09.010					Level: IV
Purpose/Aim/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
"To improve the preparation, technical proficiency, and safety of neonatal intubation without increasing the time required to perform the procedure, and to provide a means of standardizing training for neonatal intubation."	Time series design assessed at 3 time points— Baseline assessment, practice session, & final testing session.	Sampling Technique: Convenience Eligible Participants: Transport nurses employed by Airlift Northwest, an independent air medical transport service based in Seattle, WA (*N=18).* Excluded: Transport nurses not employed by Airlift Northwest. Accepted: 18 flight nurses employed by Airlift Northwest, paired into 9 two-person teams *(N=18).* Control: 18 flight nurses, paired into 9 two-person teams, same intervention group *(n=18).* Intervention: 18 flight nurses, paired into 9 two-person teams, same control group *(n=18).*	Control: Neonatal intubation during a simulation-based scenario according to standard practice, without the Neonatal Intubation Checklist as a cognitive guide. Intervention: Development and implementation of a Neonatal Intubation Checklist. Intervention Fidelity: The Neonatal Intubation Checklist was developed using a modified Delphi method, where a group of 24 subject matter experts provided feedback on the checklist content, structure, and format. Subject matter experts included experienced flight nurses & a board-certified neonatologist. The checklist included all the critical steps of neonatal intubation including equipment preparation, medication administration, intubation procedure, endotracheal tube placement check, & securing the endotracheal tube. Instruction in the use of the checklist included	Dependent Variable(s): (1) Intubation proficiency, and (2) time to successful intubation. Measurement: The dependent variable of intubation proficiency was measured through a developed Neonatal Intubation Proficiency Tool (NIPAT). Intubation time was defined as the period from the decision to intubate until the endotracheal tube was successfully placed and secured, which was included in a section of the NIPAT. The NIPAT was developed based on published neonatal intubation procedural guidelines & included 29 steps to safely intubate a neonate, each graded on a scale of 0-2 with 0 being "not done'; 1 being "done partially, done incorrectly, or done by wrong person"; and 2 being "done correctly and by correct person." The NIPAT was validated according to 5 sources of validity described by Downing: content validity,	Statistical Procedures(s) and Results: Changes in NIPAT scores & times to successful intubation were evaluated using a 1-way repeated measures analysis of variance. Statistical analysis was conducted using IBM SPSS Statistics 19. A P value <0.05 was considered statistically significant. Significant improvements in intubation proficiency & time to intubation were noted over the 3 sessions (NIPAT baseline 29 [7] vs. testing 57 [1.3], P <0.001; GRS baseline 2 [2, 2.5] vs. testing 5 [3, 5], P <0.001; intubation time baseline 626 [93] seconds vs. testing 479 [44] seconds; P<0.001). A high positive correlation was noted between NIPAT scores and GRS rating (r= 0.723, P <0.001). The use of the Neonatal Intubation Checklist improved transport team performance during simulated neonatal intubations

		Power Analysis: No power analysis was performed. Group Homogeneity: Intervention & control group the same, homogeneity based on means of study subject's demographics including age & years of experience in air medical transport denoted in *Table 1*.	reviewing the checklist with an explanation of each of the sections & steps, as well as watching a demonstration video on its use.	response process, internal structure, relationship to other variables, & consequences.	& decreased the time required to successfully perform the procedure.
Citation: Hatch, L. D., Grubb, P. H., Lea, A. S., Walsh, W. F., Markham, M. H., Maynord, P. O., Whitney, G. M., Stark, A. R., & Ely, E. W. (2016). Interventions to improve patient safety during intubation in the neonatal intensive care unit. *Pediatrics*, 138(4), e1–e9. https://doi.org/10.1542/peds.2016-0069					Level: VI
Purpose/Aim/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
"To improve patient safety in our NICU by decreasing the incidence of intubation-associated adverse events (AEs). We hypothesized that decreasing practice variability and improving adherence to evidence-based interventions would decrease the incidence of intubation-related AEs."	Observational study/Quality improvement—Baseline data collected over 10 months (Period 1- September 2013 to June 2014) was compared with data collected over a 10-month intervention and sustainment period (Period 2- July 2014 to April 2015).	Sampling Technique: Convenience Eligible Participants: Any infant intubated in the Neonatal Intensive Care Unit (NICU) *(N=509)*. Excluded: Infants who were intubated in the delivery room, operating room, and during transport (unable to reliably collect data in these locations). Accepted: Infants intubated in the NICU *(N=509)*. Control: 273 infants intubated in the NICU during period 1 *(n=273)*.	Control: Standard intubation practice—No formal practice guidelines & medication choices for intubation at discretion of intubation clinician. Intervention: (1) Intubation Timeout Tool, (2) Premedication for Endotracheal Intubation Algorithm, (3) Intubation Computerized Provider Order Entry (CPOE) Set. Intervention Fidelity: Multidisciplinary team formed which included nurses, respiratory therapists, neonatal, and other subspecialty physicians, & NICU leaders. By using process flow diagrams, results from root cause analyses,	Dependent Variable(s): (1) Percentage of intubations containing any prospectively defined AE, and (2) intubations with bradycardia (defined as HR <60 bpm for >5 seconds) or hypoxemia (defined as oxygen saturation <60%). Measurement: The dependent variables were measured by using previously described data collection procedure to monitor for AEs. The intubating clinician and the bedside nurse completed 2 data collection instruments during and after intubation—these documents were used in conjunction with standardized medical record review and	Statistical Procedures(s) and Results: Clinical variables, outcomes, process, and balancing measures were compared during period 1 and period 2 via Student's t tests for continuous parametric data or Wilcoxon rank-sum tests for continuous nonparametric data, & X^2 tests or Fisher's exact tests for dichotomous data depending on the sample size. Risk ratios for primary and secondary outcomes were calculated between the 2 periods. Percentage of intubations with an AE, bradycardia, and severe hypoxemia were evaluated using p-charts.

		Intervention: 236 infants intubated in the NICU during period 2 *(n=236)*. Power Analysis: No power analysis was performed. Group Homogeneity: Intervention/control homogenous based on p values in *Table 1* for clinical variables of intubation by study period.	qualitative feedback, and baseline data, developed a 3-stage intervention to target modifiable key drivers of AEs. Interventions were sequentially implemented and refined according to the Institute for Healthcare Improvement's Model for Improvement in a series of plan-do-study-act cycles. Before & during each intervention period, the project team provided education about each intervention to all members of the health care team through presentation at staff meetings, e-mail reminders, & face-to-face instruction.	direction observation of intubations to record outcome, process, and balancing measures. Data was collected over a 10-month period for both period 1 and period 2. No reliability data available for described data collection tools.	One or more AEs occurred in 126/273 (46%) intubations during period 1 and 85/236 (36%) intubations during period 2 (RR= 0.78; 95% confidence interval, 0.63-0.97; p= 0.02). Significantly fewer intubations with bradycardia (24.2% vs. 9.3%, RR=0.39; 95% CI, 0.25-0.61, p<0.001) and hypoxemia (44.3% vs. 33.1%, RR=0.75, 95% CI, 0.6-0.93, p= 0.006) occurred during period 2. Using statistical process control methods, special cause variation was identified in the % of intubations with an AE corresponding to intervention 1, use of the Intubation Timeout Tool.
Citation: Kerrey, B. T., Mittiga, M. R., Rinderknecht, A. S., Varadarajan, K. R., Dyas, J. R., Geis, G. L., Luria, J. W., Frey, M. E., Jablonski, T. E., & Iyer, S. B. (2015). Reducing the incidence of oxyhaemoglobin desaturation during rapid sequence intubation in a paediatric emergency department. *BMJ Quality & Safety*, 24(11), 709–717. https://doi.org/10.1136/bmjqs-2014-003713					Level: VI
Purpose/Aim/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
"To reduce variation in the performance of rapid sequence intubation and, thereby, improving procedure-related safety. Specific aim is to increase the median number of patients between those with desaturation. We	Quality improvement—Historical, baseline data collected over 12 months (March 2009-April 2010) was compared with data collected from a 12-month testing period (July 2012-September 2013).	Sampling Technique: Convenience Eligible Participants: All patients undergoing rapid sequence intubation (RSI) in the pediatric emergency department (ED) *(N=189)*. Excluded: Patients undergoing RSI outside of pediatric ED.	Control: Standard institutional RSI practice Intervention: (1) RSI Checklist modeled after World Health Organization's surgical safety checklist, (2) Pilot-copilot model for checklist execution, (3) Restriction of laryngoscope attempts to specific providers, (4) Use of a videolaryngoscope.	Dependent Variable(s): Frequency of oxyhemoglobin desaturation during RSI, defined as verbalization of the pulse oximetry reading dropped to <90% during RSI. The RSI interval was defined as starting with the administration of the sedative and ending with securement of the endotracheal tube (ETT).	Statistical Procedures(s) and Results: Generation of statistical process control charts (G-charts) were used to measure change in the performance of six key processes, attempt failure, and the occurrence of oxyhemoglobin desaturation during RSI for both historical and testing periods. Adjunctive to the G-charts,

theorized that interventions designed to optimize patient preparation, minimize the duration of ineffective ventilation and facilitate early recognition of failing intubation attempts would markedly reduce the frequency of desaturation during RSI."		Accepted: Patients undergoing RSI in the pediatric ED (*N=189).* Control: 114 patients undergoing RSI in the pediatric ED during historical period *(n=114)*. Intervention: 75 patients undergoing RSI in the pediatric ED during the testing period *(n=75)*. Power Analysis: No power analysis was performed. Group Homogeneity: Intervention/control homogenous based on means represented in *Table 1* for patient characteristics by study period. The two groups were nearly identical for all characteristics, except gender.	Intervention Fidelity: A multidisciplinary improvement team was convened consisting of physicians, respiratory therapists, & nurses from the ED, a research coordinator & an analyst. The ED medical director served as project champion and contributed to regular communications with ED staff. Interventions were drafted and refined according to the Institute for Healthcare Improvement's Model for Improvement in a series of plan-do-study-act cycles, beginning with implementation on high-fidelity human patient simulators. Prior to testing and patient implementation, all ED providers were educated on the project's objectives and the four interventions. The modes of education were formal presentations, email updates, and improvement team meetings.	Measurement: The dependent variable was measured by the collection of data primarily through review of RSI video recordings during the 12-month testing period and the 12-month historical period. Videos were reviewed using a proprietary software program—prior to the testing period, the improvement team leader trained a research coordinator to collect data from these recordings. All data were collected on a standard form and then entered into a Microsoft Access database. Following the end of data collection, two team members compared all completed data collection forms with the database to identify and correct discrepancies. No reliability data available for described data collection tools.	direct comparison of key process performance, attempt success, and desaturation was done. As an additional measure of statistical significance, 95% confidence intervals were calculated to identify the absolute percentage differences between periods. The checklist was used for 69 of 75 cases (92%) during the testing period. Desaturation occurred for 16% (12/73) of patients, compared with 33% (38/114) during the historical period (absolute difference 17%, 95% CI 4% to 28%). For patients ages 24 months or younger, desaturation occurred for 27% (9/33) during the testing period, compared with 60% (32/53) during the historical period (absolute difference 33%, 95% CI 11% to 50%). Desaturation occurred for 6% (2/34) of these patients, compared with 24% (10/39) if one or more key processes were not performed (absolute difference 18%, 95% CI 2% to 34%).
Citation: Neubrand, T. L., Alletag, M., Woods, J., Mendenhall, M., Leonard, J., & Schmidt, S. K. (2019). Breathing Easier. *Pediatric Quality and Safety*, *4*(6), e230. https://doi.org/10.1097/pq9.0000000000000230					Level: VI
Purpose/Aim/ Hypothesis	Design	Sample	Intervention	Outcomes	Results

"To develop an airway safety intervention to decrease the severe tracheal intubation-associated adverse event (TIAE) rate from a baseline of 23% in the tertiary site and 25% in the community sites to <15% within 12 months and to sustain these outcomes for 6 months by decreasing process variation."	Quality improvement initiative—Baseline data (December 2015 to May 2016) and study data (June 2016-June 2017) were collected retrospectively and compared at all sites via a review of electronic medical records and resuscitation documents on a structured form.	Sampling Technique: Convenience Eligible Participants: Any patient intubated within the pediatric emergency department (ED) or any of the 5 satellite community pediatric EDs or pediatric urgent care centers within a single university-affiliated children's hospital regional care system (*N=181)* Excluded: Patients initially intubated by an anesthesiologist or by the critical care transport team. Accepted: Patients intubated within the pediatric ED or any of the 5 satellite community pediatric EDs or pediatric urgent care centers *(N=181)* Control: Patients intubated within the pediatric ED or any of the 5 satellite community pediatric Eds or pediatric urgent care centers during the baseline period *(n=43).* Intervention: Patients intubated within the pediatric ED or any of the 5 satellite community pediatric Eds or pediatric urgent care centers during	Control: Standard institutional intubation practice (no current airway safety bundle). Intervention: 4-part airway safety bundle that included: (1) color coded weight-based equipment chart, (2) visual schematic of airway equipment, (3) recommended medication dosing, and (4) safety checklist. Intervention Fidelity: After analyzing baseline data, a multidisciplinary team consisting of physicians, nurses, respiratory therapists, and pharmacists, used a mini-Delphi methodology to identify key drivers in which intervention was likely to result in decreased rates of severe tracheal intubation associated events (TIAE). After a literature review, 3 rounds of in-person meetings, and multiple plan-do-study-act cycles, the team reached a consensus for targets of interventions which included all 4 elements of the airway safety bundle. Before introduction of the bundle, all clinical staff members were educated on the problem of TIAE during in-person staff meetings and via emailed presentations. For the 2 weeks before the rollout of the bundle, the new process was discussed during daily safety huddles, during staff meetings, and during weekly pharmacy and	Dependent Variable(s): (1) Proportion of intubations that had an associated severe TIAE, as defined in concordance with the NEAR-KIDS database, and (2) Rate of compliance with the use of the standardized procedure documentation in the electronic health record (HER) (which included documentation of compliance with the airway safety bundle). Measurement: The dependent variables were measured by collecting retrospective data from all sites via review of electronic medical records and resuscitation documents on a structured form. Variables collected included: patient demographics, indications for intubation, time and dose of sedatives & paralytics administered, time to successful intubation, number of intubation attempts, intubating provider characteristics, and type and timing of adverse events. Data was managed using a REDCap (Research Electronic Data Capture) database. Video review became available at the tertiary site in December 2018, but video access was limited. The same structured data collection form was used whether video or	Statistical Procedure(s) and Results: Tracheal intubation adverse events in the tertiary site and the community sites were plotted over time using control charts (P-charts & G-charts) created with Excel macros. Statistical process control charts were reviewed for special cause variation, and the P-charts were restaged when 10 of 11 or 8 consecutive points were above or below the centerline. After the implementation of the airway safety bundle, a decrease in severe TIAE was noted in both the community sites (36.8% at baseline compared to 4.8% after intervention, 32% reduction) and the tertiary site (18.2% at baseline compared to 8.2% after intervention, 10% reduction) during the intervention period. The improvement in TIAE was sustained for the 6-month maintenance period at all clinical sites. Nonsevere TIAE did not significantly change after the implementation at either the tertiary site (50% vs. 33.6%, P= 0.14) or the community sites (50% vs. 38.5%, P= 0.43). The overall utilization rate of the airway safety bundle was 64% in both the

		the study and maintenance period *(n=138)*. Power Analysis: No power analysis was performed. Group Homogeneity: Intervention/control homogenous based on medians (interquartile range) represented in *Table 1* for patient characteristics (age, weight, gender). Baseline and study period characteristics for patients were similar between the groups.	respiratory therapy educational initiatives. The bundle was also presented to all newly hired employees during orientation, and an online video was developed and made available to all pediatricians at community sites.	chart review was being used for data collection.	tertiary and the community sites.
Citation: Smith, K. A., High, K., Collins, S. P., & Self, W. H. (2015). A preprocedural checklist improves the safety of emergency department intubation of trauma patients. *Academic Emergency Medicine*, 22(8), 989–992. https://doi.org/10.1111/acem.12717					Level: IV
Purpose/Aim/ Hypothesis	Design	Sample	Intervention	Outcomes	Results

"The hypothesis was that implementation of a standardized, preprocedural checklist would improve the safety of endotracheal intubation in trauma patients."	Prospective pre-/post interventional study—Data collected 6 months before intervention vs. 6 months after intervention were compared.	Sampling Technique: Purposive Eligible Participants: All adult trauma patients ≥16 years old who met American College of Surgeons criteria for tier 1 trauma activation and underwent endotracheal intubation while in the emergency department (ED) between November 2012 and October 2013. Excluded: Patients intubated in the ED who did not meet trauma or age requirement within study period. Accepted: All adult trauma patients ≥16 years old who met American College of Surgeons criteria for tier 1 trauma activation and underwent endotracheal intubation while in the ED between November 2012 and October 2013 (*N=141).* Control: 76 adult trauma patients ≥16 years old who met tier 1 trauma requirement and underwent endotracheal intubation while in the ED *(N=76)* Intervention: 65 adult trauma patients ≥16 years	Control: Intubation according to routine care without a standardized checklist Intervention: Intubation with pre-procedural checklist consisting of a "prearrival" portion of checklist & "preinduction" portion of checklist. Intervention Fidelity: A task force of emergency physicians, trauma surgeons, nurses, and paramedics reviewed available literature and practice guidelines to develop a preprocedural checklist of 15 essential safety elements. Checklist education occurred 1 month prior to final implementation into clinical practice.	Dependent Variable(s): (1) Percentage of intubation-related complications, which included any of the following events after induction: oxygen desaturation <90% by pulse oximetry, emesis, esophageal intubation, severe hypotension (systolic BP <70 mm Hg), or cardiac arrest, and (2) paralysis-to-intubation time defined as the time between administration of a paralytic medication and confirmation of correct endotracheal tube placement by capnography. Measurement: The dependent variables were measured by video recording of all tier 1 trauma resuscitations during the study period with a high-definition recording system. Data were collected by a single investigator by reviewing these recordings with a standardized data collection instrument. These data included time points for the decision to intubate, administration of RSI medications, confirmation of tube placement, execution of each item on the checklist, and intubation-related complications. Data unavailable from the video were obtained from the medical chart.	Statistical Procedures(s) and Results: Data were analyzed with comparisons between patients intubated during the 6-month pre-checklist period and those during the 6-month post-checklist period. The absolute change in intubation-related complications was calculated as the difference between the proportions of patients with a complication during the pre-checklist and post-checklist periods. Paralysis-to-intubation time and adherence to process measures were compared between groups using the Wilcoxon rank-sum test and chi-square test. An intubation-related complication was experienced by one (1.5%) patient in the post-checklist period, compared to seven (9.2%) patients during the pre-checklist period, representing a 7.7% (95% CI = 0.5% to 14.8%) absolute risk reduction. Median paralysis-to-intubation time during the post-checklist period was 82 seconds (IQR= 68 to 101 seconds), compared to 94 seconds (IQR= 78 to 115 seconds) during the pre-checklist period (p = 0.02). First-pass intubation success was similar in the post-

		old who met tier 1 trauma requirement and underwent endotracheal intubation while in the ED *(N=65).* Power Analysis: No power analysis was performed. Group Homogeneity: Intervention/control homogenous based on means represented in *Data Supplement 2* for patient and intubator characteristics by study period. Baseline characteristics for patients and intubators were similar between the groups.			checklist (86%) and pre-checklist periods (79%; p= 0.28). In the post-checklist period, the checklist was verbally stated for 54 (83.1%) patients and entirely executed for 45 (69.2%), as confirmed by video review.

Rating System for Hierarchy of Evidence

Level of Evidence	**Type of Evidence**
I (1)	Evidence from systematic review, meta-analysis of randomized controlled trails (RCTs), or practice-guidelines based on systematic review of RCTs.
II (2)	Evidence obtained from well-designed RCT and/or reports of expert committees.
III (3)	Evidence obtained from well-designed controlled trials without randomization.
IV (4)	Evidence from well-designed case-control and cohort studies
V (5)	Evidence from systematic reviews of descriptive and qualitative study
VI (6)	Evidence from a single descriptive or qualitative study
VII (7)	Evidence from the opinion of authorities

Appendix B

Synthesis of Evidence Table

Evidence Based Practice Question (PICO): In a 49-bed Level IV Neonatal Intensive Care Unit (NICU), does the implementation of an intubation timeout tool reduce the incidence of intubated-related adverse events in neonatal patients and improve the accuracy of documentation of intubation in the medical record?			
Level of Evidence	**# of Studies**	**Summary of Findings**	**Overall Quality**
IV	**1**	Smith et al. (2015) found that the implementation of a standardized, pre-procedural checklist prior to intubation reduced the incidence of intubation-associated complications and adverse events in their population of interest, compared to routine intubation without the use of a checklist. An absolute risk reduction of 7.7% was demonstrated for intubation-associated adverse events in this study. Smith et al. (2015) also found that the implementation of a standardized, pre-procedural checklist decreased paralysis-to-intubation time and improved adherence to recognized safety measures. Quality improvement (QI) initiative unable to distinguish which specific elements of the checklist led to improvement in patient outcomes, however specific safety measures showed substantial improvement with checklist implementation.	**B—** Smith et al. (2015) was able to reach reasonably consistent results with fairly definitive conclusions. Consistent recommendations and developed interventions based on review of available literature and practice guidelines. Evaluation of strengths and limitations were included. Generalizability and external validation may be limited due to the specific populations of interest in the study and by its single-center design.
VI	**4**	Davidson et al. (2018) found that the use of a Neonatal Intubation Checklist improved transport team performance during simulated neonatal intubations and decreased the time required to successfully perform the procedure. Likewise, Kerrey et al. (2015), also found that there was improved success of laryngoscopy attempts for intubation based on implementation of a rapid sequence intubation checklist within a pediatric emergency department. Kerrey et al. (2015) and Hatch et al. (2016) both demonstrated the use of a standardized pre-intubation checklist in decreasing the frequency of desaturation associated with intubation. Hatch et al. (2016) and Neubrand et al. (2019) also demonstrated that the implementation of a standardized, pre-procedural checklist/bundle prior to intubation reduced the overall incidence of intubation-associated complications & severe adverse events. Hatch et al. (2016) and Neubrand et al. (2019) reported that interventions resulted in a 10%-32% absolute reduction in adverse events that was sustained past the post-implementation period, while Kerrey et al. (2015)	**B—** Hatch et al. (2016) was able to reach reasonably consistent results with fairly definitive conclusions. Consistent recommendations and developed interventions based on review of available literature and practice guidelines. Evaluation of strengths and limitations were included in the study. Generalizability and external validation may be limited due to the specific population of interest in the study and by its single-center design. Validation of measure was attempted where possible, however self-report may contribute to bias and subsequent misclassification. **B—** Neubrand et al. (2019) was able to reach reasonably consistent results with fairly definitive conclusions, although sample size may be too small to indicate conclusive change. Consistent recommendations and developed interventions were based off of a comprehensive literature review. Evaluation of strengths and limitations were included in the study. Generalizability and external validation may be limited due to the specific populations of interest in the study and implementation in a setting with a strong culture of quality improvement.

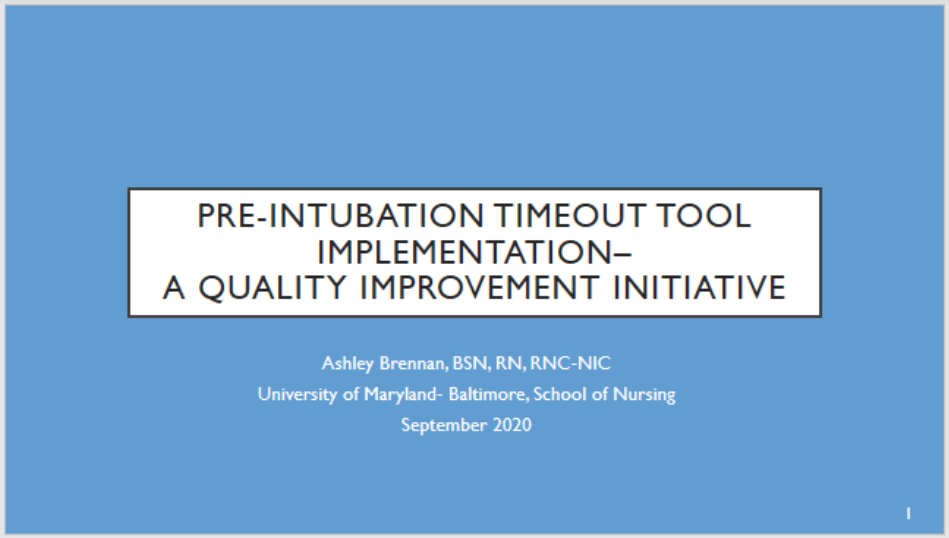
		showed a decrease in desaturation events by 50%, leading to more reliable, successful, and safer RSI. Kerrey et al. (2015) and Neubrand et al. (2019) acknowledge the inability to determine the equal contribution of individual interventions to the improvement in the primary outcomes given introduction of multiple interventions simultaneously.	**C—** Davidson et al. (2018) demonstrated little evidence, as well as an insufficient sample size to reach a definitive conclusion. 18 flight nurses of one specific air company were used to test a Neonatal Intubation Checklist which was limited to only neonatal simulation which reduces validity; no measures of adverse events were used in this study, and only nurses were responsible for intubation. Recommendations aimed at further research in reducing intubation-associated adverse events. **C—** Kerrey et al. (2015) demonstrated little evidence, as well as an insufficient sample size to reach a definitive conclusion. A two year gap existed between historical and intervention periods which may limit reliability, and study noted that there was "a notable reduction in the number of patients undergoing RSI in the intervention period." As the article also states, patients were not monitored by continuous pulse oximetry, so outcomes measured was relied upon verbalization by provider, introducing bias.

Rating Scale for Quality of Evidence (Newhouse)		
High (A)	Scientific	Consistent results with sufficient sample size, adequate control, and definitive conclusions; consistent recommendations based on extensive literature review that includes thoughtful reference to scientific evidence
	Summative Review	Well-defined, reproducible search strategies; consistent results with sufficient numbers of well-defined studies; criteria-based evaluation of overall scientific strength and quality of included studies; definitive conclusions
	Experiential	Expertise is clearly evident
Good (B)	Scientific	Reasonably consistent results, sufficient sample size, some control, with fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence
	Summative Review	Reasonably thorough and appropriate search; reasonably consistent results with sufficient numbers of well-defined studies; evaluation of strengths and limitations of included studies; fairly definitive conclusions.
	Experiential	Expertise seems to be credible.

Low Quality (C)	Scientific	Little evidence with inconsistent results, insufficient sample size, conclusions cannot be drawn
	Summative Review	Undefined, poorly defined, or limited search strategies; insufficient evidence with inconsistent results; conclusions cannot be drawn
	Experiential	Expertise is not discernable or is dubious
Newhouse, R. (2006). Examining the source for evidence based nursing practice. JONA.Volume 36, Number 7/8, pp 337-340		

Appendix C

Pre-Intubation Timeout Tool Power Point Presentation



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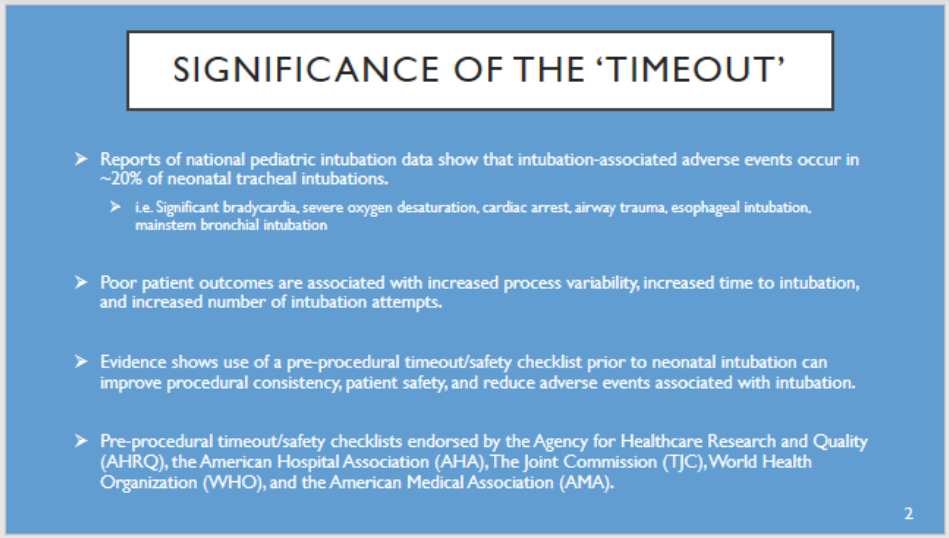

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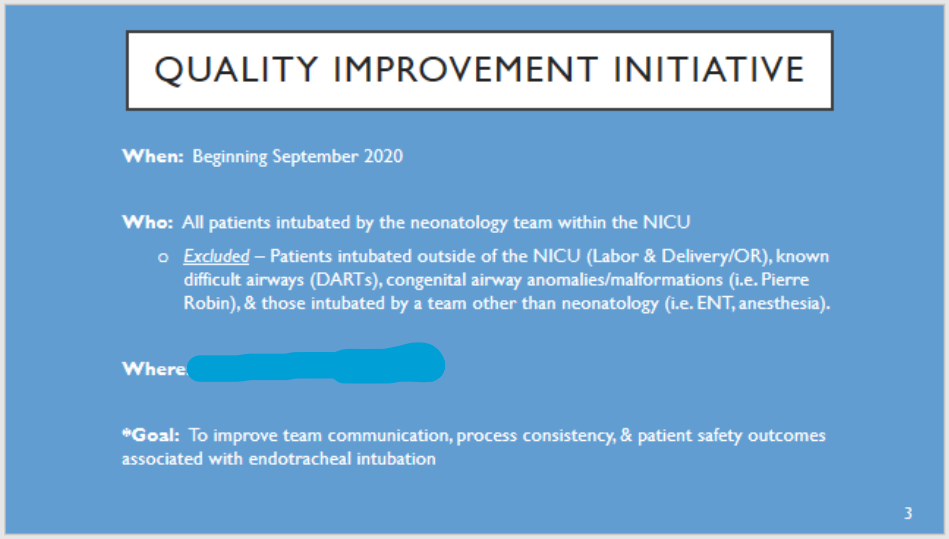

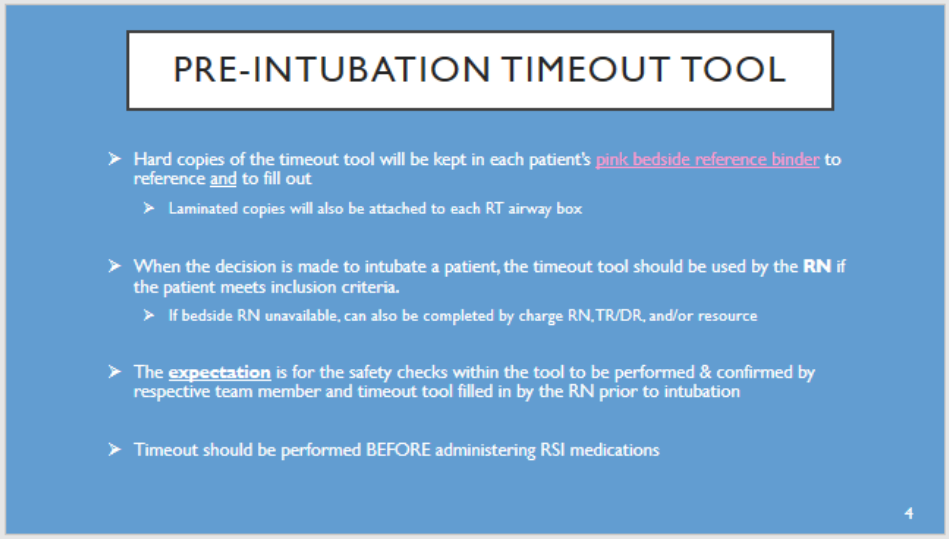

For emergent intubations/critically decompensating patients →

Prioritize completion of 'Equipment/Monitor Safety Checks' & 'Final Checks' sections

Pre-Intubation Timeout Tool

Initial Preparation ← Start here

- ☐ Bedside RN, Charge RN, Respiratory Therapy, & Attending notified of intubation
- ☐ Rapid sequence medications ordered & at bedside (if applicable)

Equipment/Monitor Safety Checks ← Safety checks by **RT & Nursing** while preparing for intubation

RN:

- ☐ EKG leads, pulse ox, & BP cuff on
- ☐ Alarms unsilenced and audible
- ☐ Emergency drug card up-to-date

RT:

- ☐ Bag-mask with appropriate pressures and set FiO_2
- ☐ Appropriate size face mask and oral airway/LMA
- ☐ Suction equipment prepared (Non-sterile, 8 & 10 fr suction catheters)
- ☐ Intubation equipment prepared (Laryngoscope blade, proper size ETT, CO_2 detector)

Assignment of Roles ← Roles are assigned when team at bedside preparing for intubation

- ☐ Primary intubating provider and back-up assigned (MD/NNP)
- ☐ Monitoring of patient & vital signs assigned

Patient Assessment ← Assessment by **RN**

- ☐ Patient accessible & positioned correctly, bed cleared for intubation
- ☐ IV access (if stable)
- ☐ Feeds turned off, stomach contents emptied
- ☐ Rapid sequence medications prepared

Final Checks ← **Final timeout before intubation, to be read aloud by provider & answered by team members.**

1) **Who is being intubated** (Name, DOB, MRN)?
2) **Are there any specific concerns for this patient to be aware of?**
3) **Are all team members ready to begin?**
4) **Administer RSI medications, preoxygenate (goal SpO_2 >95%), & prepare to intubate**

5

5

RESPONSIBILITIES OF **NURSING**

- Initiate use of the timeout tool if the decision is made to intubate the patient
- Completion of timeout tool as tasks and safety checks are performed by the team at the bedside
- Document that a timeout was completed in the patient's medical record ("Patient Observation" column in the NICU Vitals flowsheet)
- Documentation of any adverse events (if any) occurred during the procedure ("Patient Observation" column in the NICU Vitals flowsheet)
  - i.e. Bradycardia and desaturation per unit protocol, ETT dislodgement, direct airway trauma, chest compressions, emesis, etc.

*** Place a patient label on the completed timeout tool and place it in the box labeled "Pre-Intubation Timeout Tool" in the charge nurse area ***

6

RESPONSIBILITIES OF **PROVIDERS (MD/NNP)**

- Complete tasks specific to provider role
  - Tasks include notifying team members, ordering premedication, and assignment of roles during intubation
- Complete a timeout prior to performing intubation in conjunction with the RN and RT (asking 'Final Check' questions & confirming tasks are done)
- Documentation of a timeout and any adverse events that occurred in the procedure note

RESPONSIBILITIES OF **RESPIRATORY THERAPY**

- Complete tasks specific to respiratory therapy
  - Tasks include respiratory-specific equipment checks
- Complete a timeout prior to performing intubation in conjunction with the provider (MD/NNP) and RN (responding to 'Final Check' questions & confirming tasks are done)

FUTURE PLANS

- Generation of monthly quality audits will be used to track tool use and desired outcomes of QI initiative which will be shared with staff
- Change Champions:
  - [redacted]
- Look out for staff recognition and incentives happening in the Fall for participation in this initiative! ☺
- Please let me know if you have any questions or feedback. I welcome any suggestions to make intubation safer for our patients.

ONE LAST THING!

Follow the link to complete a survey to acknowledge that you received this education.

Please submit by 9/25.

https://www.surveymonkey.com/r/GN65ZNF

Appendix D

Project Lesson Plan and Learning Objectives

Learning Objectives	Content Outline	Method of Instruction	Time Spent	Method of Evaluation
Objective 1: Describe the importance of performing a pre-procedural time-out prior to neonatal intubation	• Reports of national pediatric intubation data show that intubation-associated adverse events occur in ~20% of neonatal tracheal intubations. • Poor patient outcomes are associated with increased process variability, increased time to intubation, and increased number of intubation attempts. • Evidence shows use of a pre-procedural time-out/safety checklist prior to neonatal intubation can improve procedural consistency, patient safety, and reduce adverse events associated with intubation. • Professional organizations who endorse the use of a pre-procedural time-out/safety checklist include the Agency for Healthcare Research and Quality (AHRQ), the American Hospital Association (AHA), The Joint Commission (TJC), World Health Organization (WHO), and the American Medical Association (AMA).	Electronic (Power point)	5 min.	Survey eliciting feedback on specific objective - How well did you feel that the education met this objective? - How confident are you that you would be able describe the importance of performing a pre-procedural time-out?
Objective 2: Identify the task-specific components of the pre-intubation timeout tool	• There are five categories in the NICU Pre-Intubation Timeout Tool - Initial Preparation - Assignment of Roles - Equipment/Monitor Safety Checks - Patient Assessment - Final Checks	Electronic (Power point)	5 min.	Survey eliciting feedback on specific objective - How well did you feel that the education met this objective?

	*Will share the NICU Pre-Intubation Timeout Tool to show and explain what is included in each category			- How confident are you in describing the components of the timeout tool?
Objective 3: Define the inclusion and exclusion criteria for use of the pre-intubation timeout tool	• *Inclusion Criteria:* - Any intubation performed in the NICU by the neonatology team. • *Exclusion Criteria:* - Any intubation performed outside of the NICU (Delivery room, operating room, pediatric emergency department, labor and delivery, or on neonatal transport) - Known difficult airway (DART) - Congenital airway anomalies/malformations - Intubations in the NICU by a team other than neonatology (i.e. anesthesia)	Electronic (Power point)	2 min.	Survey eliciting feedback on specific objective - How well did you feel that the education met this objective? - How confident are you that you would be able define the inclusion and exclusion criteria for using the timeout tool?
Objective 4: Describe the steps for initiation and use of the pre-intubation timeout tool	At each patient's bedside in the pink reference binder, there will be hard copies of the Pre-Intubation Timeout Tool to serve as a guide and clinical reminder to fill out the form and perform a timeout. When a decision is made to intubate a patient, the timeout tool should be started by the RN if the patient meets inclusion criteria. • Fill out the "Initial Preparation" section FIRST as tasks are completed while preparing for intubation, time permitted - NOTE: This section may not be appropriate for emergent intubations - The RN may need to confirm with other providers that tasks are complete before checking off • When the team has arrived to the bedside for intubation, nursing will initiate the timeout beginning at the "Assignment of Roles" section	Electronic (Power point)	5 min.	Direct observation/Formative Assessment Survey eliciting feedback on specific objective - How well did you feel that the education met this objective? - How confident do you feel that you could use the Pre-Intubation Timeout Tool to lead a pre-procedural timeout?

	- Questions should be asked in sequential order to the team - If bedside RN unavailable, timeout can be initiated by charge RN, transport/delivery RN, or resource RN - The expectation is for the questions to be answered/confirmed by a respective team member and timeout tool filled in by the RN *Example:* RT would answer "Equipment Set-Up" questions, Nursing would answer "Patient Assessment" questions as it pertains to their role • Timeout should be performed BEFORE giving RSI medications for intubation • After the timeout is complete, DOCUMENT that it was done in the patient's medical record in the "Patient Observation" column of the NICU Vitals flowsheet • Please place a patient label on the completed NICU Pre-Intubation Timeout Tool and place it in the box labeled "Pre-Intubation Timeout Tool" in the charge nurse area for a treat ☺			
Objective 5: Identify specific roles and responsibilities with use of the pre-intubation timeout tool	• *Provider (MD/NNP)* - Responsible for completing tasks specific to provider role in the "Initial Preparation" section when indicated to prepare for intubation, time permitted (report back to RN when applicable) - NOTE: Some tasks may not be appropriate for an emergent intubation - Tasks include notifying team members, ordering premedication, and notifying parents when able - Expectation to complete a timeout prior to performing intubation in conjunction with the RN and RT (responding to questions & confirming steps are done) - DOCUMENTATION of a timeout and any adverse events* that	Electronic (Power point)	5 min.	Direct observation/Formative Assessment Survey eliciting feedback on specific objective - How well did you feel that the education met this objective? - How confident are you that you would be able describe your role/responsibility in the use of the timeout tool?

	occurred in the procedure note • *Nursing:* - Responsible for starting the timeout tool if a patient is being intubated - Responsible for filling out the "Initial Preparation" section, time permitted - Initiating the timeout when the team has arrived to the bedside to intubate - Completion of timeout tool as sequential steps are confirmed by the team - DOCUMENTATION in the patient's medical record that a timeout was completed ("Patient Observation" column in the NICU Vitals flowsheet) - DOCUMENTATION of any adverse events* that occurred during the procedure ("Patient Observation" column in the NICU Vitals flowsheet) • *Respiratory Therapy* - Expectation to complete a timeout prior to performing intubation in conjunction with the provider (MD/NNP) and RN (responding to questions & confirming steps are done) *Adverse events that warrant documentation include bradycardia and desaturation per unit protocol, ETT dislodgement, direct airway trauma, chest compressions, emesis, and chest wall rigidity.			

Appendix E

Pre-Intubation Timeout Tool

PRE-INTUBATION TIMEOUT TOOL

Pre-Intubation Timeout Tool

Initial Preparation

- ☐ Bedside RN, Charge RN, Respiratory Therapy, & Attending notified of intubation
- ☐ Rapid sequence medications ordered & at bedside (if applicable)

Equipment/Monitor Safety Checks

RN:

- ☐ EKG leads, pulse ox, & BP cuff on
- ☐ Alarms unsilenced and audible
- ☐ Emergency drug card up-to-date

RT:

- ☐ Bag-mask with appropriate pressures and set FiO_2
- ☐ Appropriate size face mask and oral airway/LMA
- ☐ Suction equipment prepared (Neo-suckers, 8 & 10 fr suction catheters)
- ☐ Intubation equipment prepared (Laryngoscope blade, proper size ETT, CO_2 detector)

Assignment of Roles

- ☐ Primary intubating provider and back-up assigned (MD/NNP)
- ☐ Monitoring of patient & vital signs assigned

Patient Assessment

- ☐ Patient accessible & positioned correctly, bed cleared for intubation
- ☐ IV access (if stable)
- ☐ Feeds turned off, stomach contents emptied
- ☐ Rapid sequence medications prepared

Final Checks

1) **Who is being intubated** (Name, DOB, MRN)**?**
2) **Are there any specific concerns for this patient to be aware of?**
3) **Are all team members ready to begin?**
4) **Administer RSI medications, preoxygenate (goal SpO_2 >95%), & prepare to intubate**

ET Tubes:

- <1000 g = 2.5
- 1000-2000 g = 3.0
- >2000 g = 3.5

Laryngoscope Blade:

- <1000 g = 00
- 1000-2000 g = 0
- >2500 g = 1

Completed by: _____

Questions/Feedback:

Patient Label

Appendix F

Post Implementation Chart Audit Tool

Patient Code #	Gender	Gestational Age (Weeks)	Post-Menstrual Age (Weeks)	Birth Weight (g)	Current Weight (g)	Indication for Intubation	Date & Time of Intubation

Method of Intubation (Direct or Video)	# of Intubation Attempts	Time-Out Documented (Yes or No)	Adverse Event (Yes or No)	Type of Adverse Event	Adverse Event Documented By (Type of Provider)

Appendix G

Implementation Education Check-Off

Staff Education

Registered Nurses

Staff Code #	Complete (Yes or No)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

Respiratory Therapists

Staff Code #	Complete (Yes or No)
1000	
1001	
1002	
1003	
1004	
1005	
1006	
1007	
1008	
1009	
1010	
1011	
1012	
1013	
1014	
1015	
1016	
1017	
1018	
1019	

Nurse Practitioners

Staff Code #	Complete (Yes or No)
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	
2016	

Physicians

Staff Code #	Complete (Yes or No)
3000	
3001	
3002	
3003	
3004	
3005	
3006	
3007	
3008	
3009	
3010	
3011	
3012	
3013	
3014	
3015	
3016	
3017	
3018	
3019	

Appendix H

Patient Code Book

Code #		Patient MRN					
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Appendix I

Staff Code Book

Registered Nurses				Respiratory Therapists				Nurse Practitioners				Physicians		
Code #	Last Name	First Initial		Code #	Last Name	First Initial		Code #	Last Name	First Initial		Code #	Last Name	First Initial
1				1000				2000				3000		
2				1001				2001				3001		
3				1002				2002				3002		
4				1003				2003				3003		
5				1004				2004				3004		
6				1005				2005				3005		
7				1006				2006				3006		
8				1007				2007				3007		
9				1008				2008				3008		
10				1009				2009				3009		
11				1010				2010				3010		
12				1011				2011				3011		
13				1012				2012				3012		
14				1013				2013				3013		
15				1014				2014				3014		
16				1015				2015				3015		
17				1016				2016				3016		
18				1017								3017		
19				1018								3018		
20				1019								3019		