Neonatal Delivery Resuscitation Training Utilizing TeamSTEPPS to Implement a Pre-Delivery Checklist and Measurement of its Effects

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Abstract

Full neonatal cardiopulmonary resuscitation at delivery is infrequent and often unpredictable, which may lead tounpreparedness amongst the neonatal team, thereby having the potential to impact neonatal outcomes. Checklists can increase preparedness of the team; however, evidence supporting checklist content is lacking. The purpose of this project was to develop and implement pre-delivery checklists (PDCs)along with utilization of Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) briefing prior to all deliveries attended by the neonatal team. Perceptions of readiness and teamwork were measured with a readiness survey developed for this project and the TeamSTEPPS Team Perceptions Questionnaire (TTPQ). Participants took the surveys before and after implementation of PDCs and TeamSTEPPS briefing. The participants included a convenience sample of 78 members of the neonatal team. Neonatal outcomes were measured by the 5-minute APGAR scores before and after implementation. Surveys and 5-minute APGAR scores were analyzed using *t* tests and Pearson Correlation.

Implementation of PDCs with TeamSTEPPS briefing significantly improved the readiness scores (25.429, 22.895, p=<.000). The post-implementation TTPQ scores improved (66, 59.3, p=0.087); however, the results were not significant. In the pre-implementation neonatal group, 34.2% were delivered at 32 weeks gestation or younger compared to 50% of the post-implementation neonates who were delivered at 32 weeks or younger. The APGAR scores were lower post-implementation; however, Pearson's Correlation showed a significant positive relationship between gestational age and APGAR scores (r=.393, p=.047).

Implementation of PDCs and TeamSTEPPS briefing increased the team's perception of readiness and teamwork and may have the potential to improve neonatal outcomes. While there was not a neonatal improvement in this intervention, the clinical implications are consistent with the literature that checklists should be considered prior to delivery attendance.

Key words: newborns, neonates, infants, preterm, resuscitation, code, delivery room, TeamSTEPPS, checklists, and tools

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Neonatal Delivery Resuscitation Training Utilizing TeamSTEPPS to Implement a Pre-Delivery Checklist and Measurement of its Effects

Introduction

Neonatal resuscitation is an infrequent occurrence, and it is estimated that five neonates per every 10,000 deliveries require full cardiopulmonary resuscitation (CPR) with medication administration (Sawyer et al., 2018). Globally, the neonatal death rate at the time of delivery is estimated at 2.6 million, and many of these deaths are preventable with good prenatal care and appropriate delivery room interventions (World Health Organization, 2016).

There are several challenges associated with neonatal codes, including unpredictability, infrequency, the chaotic environment, and the decline in resuscitation skills over time (Skare et al., 2018). The unpredictability and infrequent occurrence have the potential to pose a safety error when the team is unprepared to resuscitate. Emergency deliveries in which the neonate is compromised are frequently chaotic and increase anxiety levels amongst the neonatal team. The guidelines established by the Neonatal Resuscitation Program (NRP) are often not followed due to errors and distractions during codes (Zehnder et al., 2019). To make matters worse, studies have indicated that there is a degradation of skills and knowledge of NRP, which begins approximately 3 months after training (Skare et al., 2018).

All of the aforementioned factors may significantly impact neonatal outcomes. Often neonatal outcomes are affected by the success of neonatal resuscitation, and alterations in communication and teamwork may have detrimental consequences (Zehnder et al., 2019). A Joint Commission Sentinel Review determined that communication issues during deliveries are one of the most common causes of neonatal death at birth (Sawyer et al., 2018). According to Lapcharoensap and Lee (2017), well-prepared teams contribute to the success of resuscitation.

There are important opportunities for improvement in neonatal resuscitation. Evidence has demonstrated that checklists in health care may reduce errors and adverse outcomes (World Health Organization, 2019). Poor communication has been identified as a leading root cause of sentinel events (Yamada et al., 2016). Neonatal delivery-resuscitation utilizing a pre-delivery checklist (PDC)may prevent the skill decay through application of standardized communication techniques prior to each delivery. Standardizing communication through a PDC may lead to a clearer understanding of roles and responsibilities, improve the team functioning through mutual support, and decrease provider variation while ensuring the recommended guidelines of NRP are followed. In turn, this may reduce errors and improve patient outcomes (Yamada et al., 2016). It is recommended that the team discuss pertinent facts prior to resuscitation. The addition of a PDC may lead to a shared mindset amongst team members, which may increase the perception of readiness (Edwards et al., 2015).Because of the intricate and simultaneous task management required by the team leader during resuscitations, a standardized approach to neonatal delivery attendance may "improve efficiency, coordination of care, and infant outcomes" (Balakrishnan et al., 2017, p. 886).

Needs Assessment

This project was implemented at Winchester Medical Center (WMC) in Winchester, Virginia. WMC is part of the Valley Health System, which is comprised of six hospitals. The mission of Valley Health is "serving our community by improving health" (About Valley, 2020, para. 2). This is a 495-bed hospital that includes a 30-bed neonatal intensive care unit (NICU; Winchester Medical, 2020). The NICU is staffed by 37 nurses (not including the float pool nurses), 33 nursery nurses, 23 respiratory therapists, six neonatal nurse practitioners (NNPs), and four neonatologists. The structure of the NICU includes 24-hour coverage by one neonatologist

and one NNP. The NNP provides 24-hour in-house hospital coverage. The neonatologist is on call during the overnight hours and is required to be at the hospital within 30 minutes if they are called in emergently.

Routine deliveries are attended by the "code pink team," which is comprised of a nursery nurse and a respiratory therapist. If there are unexpected neonatal issues during routine births, the code pink team calls the NICU team to the delivery. The neonatal team consists of the neonatologist, NNP, a NICU nurse, the NICU charge nurse, a nursery nurse, and the respiratory therapist. The NICU team attends all high-risk deliveries. High-risk deliveries consist of neonates delivered less than 35 weeks gestation and any delivery in which there is maternal or fetal compromise. The neonatologist is required to attend deliveries for neonates who are born at 32 weeks gestation and younger. WMC is a level III NICU that manages neonates from 22 weeks gestation and above. Any surgical cases are transferred to tertiary NICUs since WMC does not have a pediatric surgical team.

Currently, simulated training for neonatal resuscitation is conducted every 2 years in accordance with the NRP guideline renewal requirements. At WMC, NRP training is required for all healthcare professionals who may be involved with neonatal resuscitation, such as labor and delivery nurses, emergency room nurses, nursery nurses, NICU nurses, resident physicians, NNPs, and neonatologists. The training is a two-part process that includes self-learning and classroom learning. The self-learning module consists of textbook study, an online learning session with electronic resuscitation scenarios, and an exam regarding the resuscitation content (Neonatal Resuscitation, 2020). The classroom portion is team-oriented, and it focuses on skill application with the inter-disciplinary team members (Neonatal Resuscitation, 2020). At WMC, the team members (consisting of nurses, NNPs, neonatologists, respiratory therapists, and

resident physicians) each rotate through three stations. The three stations are (a) initial steps review,(b) intubation and airway review, and (c) medication and emergency line placement review. The purpose of the stations is to go over emergency procedures and to provide hands-on practice with the equipment. After all of the skills stations are completed, the team participates in a mock code scenario with a simulation mannequin. Following the mock code scenario, there is a debriefing facilitated by an NRP instructor, and all team members are expected to participate in the discussion. The debriefing discusses communication, leadership, successes, areas of improvement, and adherence to NRP guidelines (Neonatal Resuscitation, 2020).

As a supplement to the NRP education, the clinical team members in the NICU, nursery, and labor and delivery departments are required attend a mock code scenario during the "off year" between NRP training sessions. The mock code is set up exactly like the mock code in NRP instruction, and it is used as a refresher to NRP training.The needs assessment for this project was based on staff requests due to practice variation in delivery room preparation by the team leaders. The direct target population is the neonatal clinical team,which consists of the neonatologists, neonatal nurse practitioners, registered nurses, and respiratory therapists. The indirect target population is the neonate.

The implementation method best suited for this setting was through a quality improvement (QI) project. The improvement process was directed towards enhancing safety and communication with the intent to positively impact neonatal outcomes (Holly, 2014). The objective for this paper is to discuss the implementation of PDCs and Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) briefing for the neonatal team. The areas of discussion include the study purpose, framework, search strategies, literature review, implementation, and results.

Study Purpose

The goal of this project was to determine whether PDCs improve the perception of readiness and teamwork amongst the neonatal team and whether it improves neonatal outcomes through an evaluation of the 5-minute APGAR (Appearance, Pulse, Grimace, Activity, Respiration) score after implementation. The PICOT question guiding this project was: In the neonatal intensive care unit (NICU) team (P), how does the addition of a pre-delivery checklist based on gestational age (I) compared to solely utilizing the Neonatal Resuscitation Program (NRP) guidelines (C) impact the team's perception of readiness, teamwork, and neonatal outcomes (O) following a pretest posttest surveyand educational training session and evaluating APGAR scores before and after the intervention (T)?

Theoretical Framework

The framework used for this project wasTeam Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS). TeamSTEPPS training provides a focus on teamwork and patient safety, and it can be customized to specific areas in health care (AboutTeamSTEPPS, 2019).The focus of theTeamSTEPPS program is to highlight structure, leadership, situational monitoring, mutual support, and communication in teams (Sawyer et al., 2013). TeamSTEPPS training consists of three phases including the needs assessment phase, the planning-training-implementation phase, and the sustainment phase. The training modules can be modified to fit the practice area (About TeamSTEPPS, 2019).

The needs assessment phase determines whether the team needs an improvement in communication and teamwork techniques.The planning, training, and implementation phase is to define the TeamSTEPPS intervention, determine how the plan's success will be evaluated, plan how it will be executed, discuss the plan with leadership and gain approval, share the plan with

the team, organize the site of implementation, and begin the training process (About TeamSTEPPS, 2019).Lastly, in the sustain phase, TeamSTEPPS recommends continuing practice of the intervention, maintaining involvement of the leaders, allowing for constructive criticism, focusing on the positive aspects of the program, evaluating team satisfaction with the program, and providing revisions to the plan according to the individual needs of the institution (About TeamSTEPPS, 2019).

This framework suited the project because the needs assessment identified a need to standardize communication provided by the team leaders prior to neonatal delivery attendance. Because TeamSTEPPS allows flexibility and customization of training, the focus of the TeamSTEPPS intervention for this project was for the team leaders to utilize a briefing tool to define the plan for team members. The briefing tool took the form of a pre-delivery checklist that was developed by the author and reviewed by three experts in neonatology (two neonatologists and one NNP). The PDCs are located in Appendix F. The project implementation and the data outcomesare discussed below. This project received approval by management at WMC (refer to Appendix E). In order to sustain this intervention, the PDCs and TeamSTEPPS briefing interventions will be incorporated into future NRP and mock code training sessions at WMC.

Research Questions and Hypotheses

From the gaps in knowledge, the following research questions and hypotheses were proposed: What impact does a pre-delivery checklist have on the neonatal team’s perception of readiness and teamwork prior to delivery attendance of all gestational age groups? What impact does the implementation of a pre-delivery checklist have on neonatal outcomes related to APGAR scores?

Null Hypotheses

There is no relationship between utilization of a pre-delivery checklist and the team's perception of readiness and teamwork prior to delivery attendance.There is no impact on neonatal outcomes related to APGAR scores with implementation of a pre-delivery checklist.

Directional Hypotheses

The neonatal team will have an increased perception of readiness and teamwork with the implementation of a pre-delivery checklist for each gestational age group.The 5-minute APGAR scores will improve with the implementation of a pre-delivery checklist.

Definitions of Key Terms and Variables

For the purpose of this project, the variables of readiness and teamworkwere defined as they relate to neonatal resuscitation.

Readiness: Readiness is defined as the NICU team's mental preparation for any delivery scenario through mental readiness and knowledge, skills, and behavior. Mental readiness entails the shared mental model and knowledge of the plan with clearly defined roles and responsibilities, knowledge of equipment and its use and location, and knowledge of emergency medication dosage as communicated by the team leader. Readiness entails confidence in the participant's resuscitation skill set. Readiness also encompasses team behavior that is cohesive with clear and precise communication among team members.

Teamwork: Teamwork is defined as mutual support with effective and efficient completion of a duty while maintaining a respectful atmosphere to achieve the common goal of successful pre-delivery preparation. Teamwork includes the provision of clear and directive communication by the leader with discussion of the plan prior to delivery attendance. Teamwork also consists of team members exhibiting team functionality by performing the expected pre-delivery duties according to their roles.

Literature Reviews

Search Strategies

The key words used in this search were newborns, neonates, infants, preterm, resuscitation, code, delivery room, TeamSTEPPS, checklists, and tools. The databases searched were CINAHL, PUBMED, Medline, Embase, and Cochrane reviews. The date range was limited to 2015-2020. Inclusion criteria consisted of articles related to teamwork, checklist use, and simulation during neonatal resuscitation. One of the articles is not related to neonates; however, it is pertinent to the review since it discussed implementation of a checklist. A PRISMA diagram is located in Appendix A.A total of 13 articles regarding studies related to either neonatal resuscitation, teamwork, checklists, and simulation were identified and included for the final analysis in the literature reviews. The outcomes table is located in Appendix B. The synopsis table is located in Appendix I.

Current Practice Guidelines for Neonatal Delivery Practice with Resuscitation Preparedness

While any delivery has the potential for complications, high-risk scenarios including fetal distress, preterm deliveries, placental and uterine ruptures, and shoulder dystocia often require neonatal interventions at birth (Ten Common, 2020). High-risk scenarios may increase the likelihood of neonatal resuscitations; however, seemingly uncomplicated deliveries may also lead to neonatal emergencies. Because of the unpredictable nature of deliveries, the team should be prepared to resuscitate at every birth (Sawyer et al., 2018).

The most recent NRP guidelines recommend a pre-delivery briefing with the entire team to discuss four pertinent factors, including the gestational age of the fetus, whether or not the amniotic fluid is clear, the number of fetuses, and any additional risk factors (Weiner, 2016). The

team leader assigns roles during the briefing, and the equipment is checked (Summary, 2015). There are some differences in neonatal resuscitation requirements based on the gestational age of the infant (Weiner, 2016).

In term and late preterm infants with a gestational age of 35 weeks and above, delayed cord clamping is recommended for 30-60 seconds if the neonate does not need immediate resuscitation (Summary, 2015). Otherwise, the neonate is dried and stimulated under a radiant warmer. Within the first minute of life, the team assesses the heart rate, breathing, tone, activity, and response. If the heart rate is less than 100 and the infant has difficulty breathing or is not breathing, positive pressure ventilation (PPV) is started at 21% fraction of inspired oxygen (FiO2) and a pulse oximeter is placed on the right hand (Weiner, 2016). During PPV, chest rise should be detected and the heart rate should begin to rise within the first 15 seconds of initiating PPV. If not, then steps should be taken to ensure that the performance of PPV is correct. The leader should consider intubation if the heart rate remains below 100 (Weiner, 2016). If the heart rate is less than 60 in spite of effectual PPV, the neonate should be intubated and chest compressions initiated. Once chest compressions begin, electrocardiogram leads should be placed on the neonate's chest and the oxygen increased to 100% (Weiner, 2016). If the heart rate remains less than 60 after 60 seconds of chest compressions, an emergent umbilical line should be placed to administer epinephrine (which is dosed according to neonatal weight). In this situation, volume expanders should also be considered (Weiner, 2016). This cycle should continue until the heart rate rises above 60. Once the heart rate is greater than 60, chest compressions should stop, but PPV should continue. Once the heart rate is stable, the neonate should be transferred to the NICU for post-resuscitation management (Weiner, 2016).

For neonates born before 35 weeks gestation, there are several differences in delivery room management. Preterm neonates are at a greater risk for cold stress, insensible water loss, hypoglycemia, and intraventricular hemorrhage (Weiner, 2016). Because of the variable needs of a preterm infant, a dedicated NICU team should be present at these deliveries (Weiner, 2016).

Effective Interventions to Improve Neonatal Delivery-Resuscitation Practice

The analysis of the studies identified several interventions that improve teamwork during simulated neonatal resuscitation. The identified interventions encompass (a) simulation training, (b) team-based communication and teamwork-focused training, (c) utilization of a PDC, and (d) consistent delivery room practices.

Scenario-Based Simulation Training

Simulation training is frequently used in the health care setting to allow providers to practice and improve clinical skill performance in a safe environment without causing patient harm. In a pre- and post-intervention study by Palmer et al. (2019), participation in neonatal simulation increased confidence in resuscitation, although the results were not statistically significant. Cheng et al. (2017) measured cardiopulmonary resuscitation (CPR) quality in simulated pediatric cardiac arrest using a CPR coach in the intervention group. The study compared the outcomes of the intervention group with the control group. The study indicated that the use of a CPR coach resulted in a statistically significant improvement in the quality of CPR given by the intervention group. Additionally, there was a significant improvement in the depth of chest compressions in the intervention group (Cheng et al., 2017). This study implies that reminders and prompts may be beneficial in improving the required clinical skills and performances in resuscitations.

Team-Based Simulation Training

Simulation has also been used to improve team communication and function,which is critical for neonatal resuscitation. Malmstrom et al. (2017) found that simulation-based team training had a positive impact on the before and after self-assessed ability of the participants to perform neonatal resuscitation. After the simulation training, the overall team scores were higher in communication, leadership, and technical skills; however, these scores were not statistically significant. In less experienced team members, the scores were statistically significant in regards to communication, teamwork, and leadership skills (Malmstrom et al., 2017). This suggests that more exposure to simulated team training may improve the self-assessed ability and confidence in performing neonatal resuscitation. Similarly, Palmer et al. (2019) also observed that the team members who received simulation training had improved attitudes regarding simulation, and there was an improvement in team functioning, situation monitoring, and communication.

Simulation provides the opportunity to enhance the performance through a debriefing session. Salih and Draucker (2019) identified key facilitators and barriers to effective teamwork through simulated resuscitation scenarios. The identified facilitators to teamwork were communication, efficient task completion, and working as a team. In general, the teams found that clear role assignments and verbal feedback from the team leader gave the overall picture of the scenario,thereby providing opportunities for mutual support from all team members. The teams also identified closed loop communication with precise and exact instructions as beneficial to resuscitation success. The identified barriers to teamwork included unfocused team leaders, soft spoken directions, unclear roles and responsibilities, inexperienced team members, and the leader not listening to team suggestions (Salih & Draucker, 2019).

Utilization of Communication Tools/Checklists

A study by Brown et al. (2017) sent surveys out to 15 hospitals regarding their opinions on optimal criteria for delivery room checklists. In total, there were 299 responses from physicians, NNPs, RNs, and RTs. The survey asked questions about preferences on reference cards versus checklists at delivery attendance, whether there was time to use a checklist, and if there was a preference for one or multiple reminder tools during neonatal resuscitations. From the responses, 96% of the participants indicated preferences for delivery reminder tools although there was not an agreement on the reminder preferences (Brown et al., 2017). The participants recommended that the tool be concise, and the common desired content included equipment checks, pulse oximeter placement, and preparation of intubation equipment. While role assignments were not listed in the recommended checklist content, the team leaders and more experienced members of the team categorized role assignments as having greater magnitude than less experienced team members. Eighty-five percent of the participants stated that there was time for a briefing before delivery if a checklist was present. This study suggests the importance of a checklist and indicates that there is time to utilize it prior to deliveries a majority of the time (Brown et al., 2017).

The introduction of checklists in the surgical setting has increased communication and team safety awareness (Cabral et al., 2016). Use of checklists in neonatal care may also enhance safety and communication during neonatal resuscitation. Cabral et al. (2016) found that the introduction of a standardized surgical checklist had a significant impact in the pre- and posttest communication scores among the nursing staff. While the surgeons and surgical technicians also had an increase in the perception of communication, their scores were not statistically significant. Interestingly, there was an initial lack of compliance in using the checklist; however,

participant use of the checklists was voluntary, and there may have been resistance in its use. Of those using the checklist, there was an overall perception of improvement in teamwork following the implementation of the checklist (Cabral et al., 2016).The positive impact on the perception of communication suggests that checklists may improve overall teamwork (Cabral et al., 2016).

Pre-delivery checklists encourage precise communication and situational awareness of the team members. A quality improvement initiative project by Sauer et al. (2016) implemented a delivery bundle that included the use of pre-briefing and pre-delivery checklists. This initiative led to a significant improvement of neonatal temperatures on admission. There was also a decrease in the number of intubations and surfactant administration in the delivery room, although this was not significant (Sauer et al., 2016). This study supports the use of pre-briefing checklists as a means to improve communication, solidify team roles, and improve recognition of potential issues (Sauer et al., 2016).

Standardized communication may benefit team performance. Yamada et al. (2016) evaluated simulated resuscitation performance with standardized communication and non-standardized communication. This study did not find statistically significant improvement between the groups. However, there is a limitation in generalizing the results because the standardized scripts were only used by the nurses rather than used by the team leaders or by all team members (Yamada et al., 2016). Standardizing the script of the team leaders may have had more of an impact since the team leaders direct the resuscitations. Inclusion of the entire team in the standardized communication with a checklist may generate greater significance of the checklist's influence in practice.

An observational study by Yamada et al. (2015) found that errors of commission and omission were common in neonatal resuscitation, and there was an associated increase in errors

with an increase in resuscitation interventions. Errors of commission and admission were also correlated with the multiple distractions and high stress levels that occur during neonatal emergencies. From the observations of this study, the authors recommend that neonatal resuscitation teams use standardized communication as is utilized in other high-risk industries such as aviation and the military (Yamada et al., 2015). A limitation to this study was that the observations took place prior to the updated NRP guidelines. The updated NRP guidelines have an increased focus on teamwork and communication (Weiner, 2016). Another limitation is that this study did not observe neonatal resuscitations requiring emergent umbilical line access or epinephrine administration, likely due to the infrequency of occurrence. While the observational data is striking, it may bear more weight in practice had this been a before and after observational study in which standardized communication was evaluated.

The previous studies support that poor communication during delivery room resuscitation leads to poor performance and errors in adhering to NRP guidelines. The studies reinforce simulation-based training and recommend the use of pre-delivery checklists, though there is a lack of studies measuring the improvement in neonatal outcomes. Additionally, there is a gap in the evidence and a lack of guidelines as to what content should be included in the PDCs. However, the previous studies suggest inclusion of clear role assignments and responsibilities, equipment checks, pulse oximetry placement, and intubation equipment checks at a minimum. Use of standardized scripts for each team member based on their role may be helpful.

This project plans to address the gap in literature regarding the content of the pre-delivery checklists through the development and implementation of a pre-delivery checklist with clear role assignments and responsibilities of each team member.The long-term objectives are to continue utilization of this intervention with each delivery attendance by the neonatal team. By

preparing for each delivery as a potential emergency, the long-term goal is to prevent NRP skill degradation and improve teamwork during emergencies.

Consistent Delivery Room Practices

Edwards et al. (2015) performed a multi-hospital audit to evaluate ways to improve the quality and safety of neonatal care in the delivery room. The study evaluated the adherence to policies in the delivery room, briefing prior to deliveries, debriefing, and communicating with the neonate's family within 30 minutes following birth. The data collected from participating hospitals were measured using descriptive statistics. There were 609 deliveries audited, and only 14% of them met all four of the above criteria. The teams performed briefings 66% of the time, performed debriefing 19% of the time, and communicated with family members 92% of the time. This study suggests that consistent audits and policies would be helpful in improving the compliance of standardized practice recommendations. Consistent audits and policies regarding delivery room procedures and communication may also improve neonatal care at delivery (Edwards et al., 2015).

An evaluation of flow disruptions during neonatal resuscitation of neonates less than 32 weeks gestation found that a mean of 52.6 disruptions occurred per resuscitation (Herrick et al., 2020). A majority of these disruptions occurred during the first 3 minutes, and the most common flow disruptions were in the forms of extraneous interruptions, equipment-technology-layout, and coordination (Herrick et al., 2020). Interestingly, the facility where the observational study took place uses checklists per routine (Herrick et al., 2020). While it was not specifically stated in the study, consistent delivery room practices may help reduce the identified flow disruptions by increasing coordinated efforts during resuscitation.

Balakrishnan et al. (2017) introduced a delivery management plan for neonates less than 31 weeks gestation in a multi-hospital quality improvement collaborative. The study measured whether the delivery management plan impacted neonatal outcomes such as the 5-minute APGAR score, the need for chest compressions, temperature instability, and length of time from the delivery room to the NICU, delayed cord clamping, and target oxygen saturation levels. Through the use of the management plan, there were improvements in oxygen saturations, temperature, and compliance with delayed cord clamping; however, these results were not statistically significant. The authors also found that there was a higher likelihood for equipment checks, role assignments, and implementation of delayed cord clamping when pre-delivery briefing was utilized.The initiative recommended a toolkit to standardize delivery room management due to the positive findings (Balakrishnan et al., 2017).

Bennett et al. (2016) developed a quality improvement collaborative that included implementation of a delivery room checklist. The California Perinatal Quality Care Collaborative developed “standardized communication strategies and deployment of evidence-based best practices” in the form of a readiness bundle (Bennett et al., 2016, p. 370). The readiness bundle was put into practice in 24 NICUs throughout California. The requirements of the readiness bundle included a pre-delivery briefing, interprofessional communication between team members, and assignment of resuscitation tasks. Each NICU was able to modify the checklist as long as it contained the aforementioned components. Monthly compliance was evaluated for 1 year and again at 6 months. The NICUs in the study had a 71% compliance rate at the end of the year-long intervention, and 80% were compliant at the 6-month follow-up. At the end of the intervention period, the NICUs were surveyed regarding whether the readiness bundle changed their practice and whether or not they recommend the readiness bundle to other facilities. While

not all of the NICUs responded to the follow-up survey, 100% of those who responded recommended the readiness bundle, and 94% indicated that the bundle positively impacted their practice. While this was a promising study in for the recommendation of neonatal delivery room checklists, there is some concern regarding the accuracy of the data since only 17 out the 24 NICUs returned the survey. Additionally, the data was self-reported by each center and this may have led to bias in the accuracy of information (Bennett et al., 2016).

The data from these studies indicate that consistent delivery room practices (whether they are in the forms of standardized communication, delivery bundles, or checklists) positively impacts practice, communication, and teamwork.

Methodology

Study Design

The benefits of simulation training are well-documented in terms of improving team performance, confidence, and preparation. The quality of clinical skills, performance, and effective communication practices are essential during neonatal delivery codes. The neonatal team receives yearly resuscitation training at the study facility, and the training alternates between NRP renewal training and simulated mock codes. The simulation training is team-based. In spite of this training, many team members perceived the need for clearer role assignments, responsibilities, effective communication, and enhanced team functioning as a means to improve patient outcomes. The use of a PDC has been shown to positively impact communication.

The study design was in the form of a quality improvement project for neonatal team education and training. A quasi-experimental study with a pretest-posttest design was used to evaluate the effects of PDCs on the participant's perception of readiness, teamwork, and neonatal outcomes. TeamSTEPPS was used as the framework to guide this project. The TeamSTEPPS

intervention of implementing a checklist was based on the fundamental of leading teams through sharing the plan (TeamSTEPPS Fundamentals, 2018).

Study Sample/Study Setting

The study participants included the NICU clinical team, which consisted of the neonatologists, neonatal nurse practitioners, NICU nurses, NICU respiratory therapists, and nursery nurses at Winchester Medical Center.The sample encompassed all NICU staff members who attend high risk deliveries (37 nurses, 23 respiratory therapists, six NNPs, and four neonatologists) along with the nursery nurses who attend deliveries (33 in total).

Approvalwas obtained from WMC's research committee to implement this project. The research committee deemed this project exempt from Institutional Review Board (IRB) review since it was considered a performance improvement project. The performance improvement plan form was submitted to the research committee for review and was approved on July 7, 2020. The performance improvement plan form with signed approval is located in Appendix O. This project was approved by Radford University's IRB on August 31, 2020, and the approval form is found in Appendix M. All NICU clinical staff and nursery nurses were recruited to participate since this was an education-based quality improvement project. Participants had to take part in the training due to routine educational requirements by the hospital; however, participation in the pre- and posttest surveys was voluntary. Informed consent was obtained during the pre- and posttest surveys, and it contained the title, purpose, researchers involved, procedures, expectations of subjects, the use of the information, confidentiality, and the potential risks and benefits (Holly, 2014). The waiver for informed consent is found in Appendix J.

The participants voluntarily took the pretest surveys to measure perceptions of readiness and teamwork prior to deliveries. Following the closure of the pretest surveys, the participants

received online education on the PDCs and TeamSTEPPS briefing. The PDC was divided into two gestational age group categories: neonates less than 32 weeks gestation and neonates greater than 32 weeks gestation. The participants received education on both of the checklists. After the didactic education, the participantsparticipated in a pre-briefing simulation using role-play of the pre-delivery checklists. After the simulated role-play, the participants were asked to take posttest surveys measuring their perception of readiness and teamwork in addition to the demographic survey. A detailed description of the pretest surveys, online didactic education, and use of the pre-delivery checklists is discussed below.

Pretest surveys. Prior to the intervention, the participants were asked to complete a demographic survey (Appendix C), a Readiness Test (Appendix D), and the TeamSTEPPS Teamwork Perceptions Questionnaire (TTPQ) (Appendix G). The Readiness Test evaluated the participant's perception of readiness prior to delivery attendance. The Readiness Test consists of 12 questions based on a Likert Scale from 1-5 and measured the team's previous perceptions of readiness prior to delivery attendance. The Readiness Test was developed by the author and was reviewed by three experts in neonatology (two neonatologists and one NNP). The TTPQ is a 35-question survey based on team perceptions of teamwork. Permission to use this survey was not required since it is publicly available through the TeamSTEPPS website (About TeamSTEPPS, 2019).

SurveyMonkey was the site used to store the demographic and pretest surveys. The participants were sent an email to their hospital-based email accounts with a brief description of the project and the web links for the each of the surveys. The length of time to complete all three surveys was approximately 5 to 7 minutes, and the surveys were available for 2 weeks.

Individually wrapped bags with candy were placed in the charge nurse's office for the participants as a small token of appreciation for filling out the surveys.

Education part one: didactic online education. After the surveys closed, the participants received an email notification that they had an assignment to complete in the hospital's online education system, Halogen. The participants had to log into their Halogen account to receive the training on a PDC for neonates less than 32 weeks gestation, training on a PDC for neonates greater than 32 weeks gestation, and the TeamSTEPPS briefing plan. Part of the briefing plan requires the providers to pre-calculate code medications according to the neonate's weight for gestational age. A weight chart was developed for this project and was based on the Fenton Preterm Growth Chart. The Fenton Preterm Growth Chart measures preterm growth, and there are separate charts for males and females (Stavis, 2019). From the Fenton Preterm Growth Chart, male and female weights were collected at the 10^{th}, 50^{th}, and 90^{th} percentiles for each week between 22-42 weeks. To obtain an average weight for each gestational age category and percentile, the male and female weights were added together and averaged at the 10^{th}, 50^{th}, and 90^{th} percentiles for each week between 22-42 weeks. The weight chart is found in Appendix L,and the Weight Chart was reviewed by three experts in neonatology (two neonatologists and one NNP).

At the end of the online education, the participants took a five-question assessment and were required to pass with a minimum score of 80% before the education was marked complete. (Refer to Appendix H for the education outline, and the assessment is located in Appendix K.). After the Halogen education was released to the team, laminated copies of the PDCs and weight charts were placed in every delivery room and operating room within the labor and delivery unit.

Additionally, every provider was given a small, laminated copy of the weight chart to wear with their identification badge.

Pre-delivery checklists.The participants received training on two PDCs including a checklist for neonates greater than 32 weeks gestation and a checklist for neonates less than 32 weeks gestation. The checklists included pertinent inclusion activities to prepare the neonatal delivery team for resuscitation, and it was used in the briefing process prior to attending deliveries. The neonatal team was taught to utilize the components of the checklist based on the neonate's gestational age at the time of delivery.

The PDCs include a list of the neonatal team members and defines their roles and their expected responsibilities prior to and during deliveries (refer to Appendix F). While the focus of this project was on the perceptions of readiness and teamwork prior to deliveries, the author felt it was important for the PDCs to also clearly specify and standardize resuscitation responsibilities according to roles to further enhance the preparation of the clinical team. The participants received education on the entire checklist; however, the spotlight of this project was on the perceptions and briefing of the participants *prior* to delivery attendance.

The literature review supports the use of checklists; however, the content of what should be on the checklist is lacking. The checklists were drafted by the author and were reviewed by three experts in neonatology (two neonatologists and one NNP). The final version is in Appendix F.

Education plan. The online education component of the pre-delivery checklists and TeamSTEPPS briefing took participants approximately 20-30 minutes to complete. The participants received education on the benefits of checklists, how to use the PDCs, the TeamSTEPPS briefing, and communication techniques. The education plan was reviewed by the

Nurse Educator at WMC and is found in Appendix H. At the end of the education, the participants took a five-question assessment and were required to receive an 80% passing rate (Appendix K). The Halogen education was available for1 month prior to the initiation of onsite PDC simulation training. All participants received 1 hour of continuing education units for completing the Halogen education.

Education part two: pre-briefing simulation using role-play. One month after the Halogen education was implemented, the participants participated in pre-briefing simulation using role-play. The original plan was to implement the pre-briefing role-play simulations at staff meetings using a radiant warmer with delivery room supplies. However, the restrictions from COVID-19 prevented any in-person meetings, which required an adjustment to the education plan. The pre-briefing simulation using role-play occurred during staff huddles and NRP training, and for individuals during their scheduled shifts.

At the huddles and the NRP training, the participants were given a brief review of the PDCs and TeamSTEPPS briefing plan, and the PDCs and weight chart were available at the sessions. All sessions included a pre-delivery scenario for a neonate less than 32 weeks gestation and a pre-delivery scenario for a neonate greater than 32 weeks gestation so that both charts were utilized. The same scenarios were used for each training session to maintain consistency, and the scenarios are found in Appendix N.

During the sessions, each participant was assigned to a role in order to role play the functions of the team leader, respiratory therapist, nurse one (chest compression nurse), nurse two (medication nurse), and nurse three (documentation nurse). A facilitator was present at the training sessions and read the scenarios to the team. After the facilitator provided the scenarios and roles were assigned, the team leader initiated the pre-briefing process with the participants

according to the PDCs and TeamSTEPPS briefing plan. Each of the team members participated in a pre-brief simulation role-play session using the components of the pre-delivery checklist and the TeamSTEPPS briefing plan for both of the scenarios. Because the overall goal of the checklist is to complete it in less than 60 seconds, the pre-brief simulation role-play for both scenarios took approximately 3 to 5 minutes to complete. Following each session, the participants were given the opportunity to ask questions.

The members of the NICU clinical team and the nursery nurses completed pre-briefing simulation using role play training utilizing the TeamSTEPPS briefing and the pre-delivery checklists during the huddles and NRP training. Staff members who did not receive training during huddles received on-unit simulation training during their scheduled shifts.

Posttest surveys. After the team received training on the pre-briefing simulation role play, the participants were asked to complete the Demographic survey, the Readiness post-test, and the TTPQ. All three posttest surveys consisted of the same questions as the pretest surveys, and the voluntary consent form was available on the surveys. The participants received an email through their hospital-based email address with a link to SurveyMonkey to take the posttest surveys 1 month after the go-live date. The surveys were available for 1 month, and this time frame included an extension due to the poor response rate on the posttest surveys. Participants were provided with small bags of candy, which were stored in the charge nurse's office after they completed the posttest surveys, as a small gesture of appreciation for their time.

Study Instruments

Demographic survey (Appendix C). Demographic data was collected for the pre- and posttest surveys. The demographic survey included questions regarding age, job type, years of

experience in current position, years of NICU experience, and approximate number of resuscitations attended in the past year.

Readiness test (Appendix D). The participantstook a pretest survey prior to the didactic online education and completed a posttest survey after receiving the on-site pre-briefing simulation training using role-play to determine if perceptions of readiness changed after the introduction of the PDCs and TeamSTEPPS briefing. It includes 12 questions based on a 5-point Likert Scale. The Readiness questionnaire was developed for this project, and was reviewed by three experts involved in neonatal delivery resuscitation practices at WMC (one NNP and two neonatologists).

TeamSTEPPS Teamwork Perceptions Questionnaire (TTPQ) (Appendix G). The TTPQ was administered before the online didactic education and after the pre-briefing simulation training using role-play to determine if the participant's perception of teamwork changed after implementation of the PDCs and TeamSTEPPS briefing. The TTPQ is designed to measure the team's perceptions on overall teamwork (Teamwork Perception, 2017). The TTPQ contains 35 questions, and it measures team structure, leadership, situation monitoring, mutual support, and communication (Teamwork Perception, 2017). According to Keebler et al. (2014), the TTPQ has a Cronbach's alpha of 0.978, thereby indicating high reliability in measuring perceptions of teamwork.

Data Collection/Data Storage/Security

All of the study variable data obtained from the demographic surveys, Readiness pre- and posttests, and TTPQ pre- and posttests were collected through SurveyMonkey and stored in SurveyMonkey. The content was confidential and the data from SurveyMonkey was retrieved by the nursing research council specialist. After the data was retrieved from SurveyMonkey, the

project developer was given access to de-identified survey data. The data from each of the three surveys was matched to the participant by asking the participants to create a four-digit pin number consisting of the last digit of their phone number, last digit of their social security number, last digit of their birthday, and last number on their address. The participants were asked to enter this pin number on the pretest and posttest surveys, and a reminder of the pin prompt was available on both the pretest and posttest surveys.

The neonatal outcomes were evaluated using the 5-minute APGAR score that was collected by an information specialist (IS) through a retrospective chart review through data mining. In addition to collecting the 5-minute APGAR score, the neonate's gestational age was also included in the data. The IS was able to collect data for neonates born younger than 35 weeks gestation. For neonates born greater than 35 weeks gestation, the project developer performed a search of all neonates admitted to the NICU who had the full neonatal team present at the delivery. The gestational age and 5-minute APGAR scores were collected for 3 months prior to implementation and 3 months after implementation. This data was stored on a password protected computer located in a locked office.

Ethical Issues/Risk/Benefits

The ethical issues and risks to the participants were minimal. A potential risk was that the participants may have become more aware of their own teamwork abilities and those of their coworkers, which could have affected working relationships in either a positive or negative manner. Potential benefits identified were increased perception of readiness and teamwork and improved neonatal outcomes.

Budget

The budget plan was to conserve costs through the use of electronic surveys and online education through the hospital's educational system. The simulation training was incorporated during the participant's scheduled shifts. Other resources utilized for the project implementation included the research council, nursing administration, NICU nurse manager, the mother/baby manager, the nurse educator, the respiratory therapy manager, an information technology (IT) assistant, and several nurses and respiratory therapists employed by WMC. The nurse educator assigned the education to staff, and nursing administration uploaded the demographic survey, pretest surveys, and posttest surveys into SurveyMonkey. Nursing administration also emailed the raw data to the project developer. The IT assistant performed data mining for neonatal APGAR scores and gestational ages in the electronic medical record. Throughout implementation, the NICU nurse manager, a neonatologist, the respiratory therapy manager, nurses, and the nurse educator were consulted for their input regarding the project.

Study Evaluation Plan

Study variables. The *demographic data* measured included age, occupation, years of experience in current position, years of NICU experience, the number of resuscitations attended in the last year, and the gestational age of the infant. The variables of years of experience in current position and years of NICU experience were chosen to determine whether or not these variables had an impact on the pre- and posttest results. Occupation was evaluated to ascertain whether or not one particular group was impacted more than others following the execution of the PDC. The gestational age variable was evaluated to establish whether the checklist has an influence on either of the gestational age group's 5-minute APGAR scores.

The *independent variables* of this study are the education of a pre-delivery checklist and the TeamSTEPPS briefing intervention.

The *primary outcome variables*measured were the participant's (a) perception of readiness prior to deliveries, and (b) teamwork perceptions measured by TeamSTEPPS teamwork perceptions questionnaire.

The *secondary outcome variable* was the neonatal outcomes as measured by the 5-minute APGAR score for neonates meeting the inclusion criteria. The APGAR scores range from 0-10 and the goal was to have higher scores after implementation of the PDCs. The 5-minute APGAR score and gestational age of delivered neonates were evaluated for 3 months prior to implementation of the PDCs. Those scores were compared with the 5-minute APGAR score and gestational age for 3 months after implementation of the PDCs. The inclusion criteria for both pre- and post-intervention APGAR scores included all neonates who were admitted to the NICU and who had full NICU team attendance prior to the delivery.

Statistical analysis

The major study objective was to determine the impact of PDCs along with TeamSTEPPS briefing on the team's perception of readiness and teamwork. The outcome variables were the team's perception of readiness and teamwork for each gestational age category and the 5-minute APGAR score. The outcome variables of perception of readiness and teamwork were measured after an educational intervention. The 5-minute APGAR score for neonates was measured after participants began using the PDCs and TeamSTEPPS briefing as were learned in the educational intervention.

Descriptive statistics were used to measure demographic data, the readiness survey, TTPQ, and the neonate's 5-minute APGAR score. Frequency and percentage were used for

nominal/categorical variables, and mean and standard deviation were used for continuous variables.

The readiness survey, TTPQ survey, and 5-minute APGAR scores were analyzed using one-tailed *t*-tests and the means were compared to determine whether the intervention had a significant impact between the pretest and posttest groups regarding their perception of readiness, teamwork, and the neonate's 5-minute APGAR scores before and after implementation of the PDCs and TeamSTEPPS briefing procedure. Correlation Pearson *r* test was used to determine if there were any correlation between professions, years of NICU experience, and outcome variables at the baseline as well as at the post-intervention. Correlation Pearson *r* test was also used to evaluate the relationship between gestational age and 5-minute APGAR scores both before and after implementation of the PDCs and TeamSTEPPS briefing.

Results

The data for this project were analyzed using version 25 of the Statistical Package for the Social Sciences (SPSS). There were a total of 82 combined survey responses in the pre- and post-implementation groups; however, four of the survey results were unable to be used for analysis since those four participants did not fill out the demographic survey. In total, 78 surveys were analyzed yielding a post hoc power analysis of 0.7 (Soper, n.d.). Descriptive statistics were used to calculate frequency and percentages on the demographic surveys, and the pre-and post-implementation results of the years of NICU experience and job titles are found in figures 1and 2. The pre-implementation demographic survey consisted of 67.9% RNs, 19.6% RTs, 8.9% NNPs, and 3.6% neonatologists. The majority of the pre-implementation participants (55.4%) had between 0-10 years of NICU experience. The post-implementation participants consisted of

77.3% RNs, 13.6% RTs, 4.5% NNPs, and 4.5% neonatologists. Of the participants who participated in the posttest surveys, 63.6% had between 0-10 years of NICU experience.

Figure 1

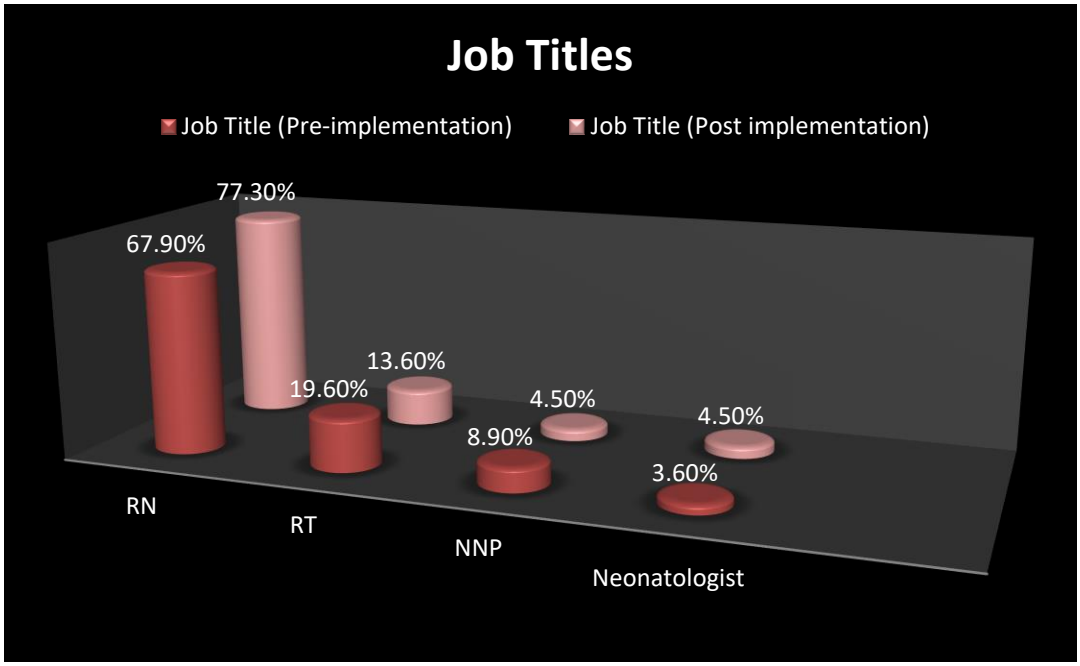
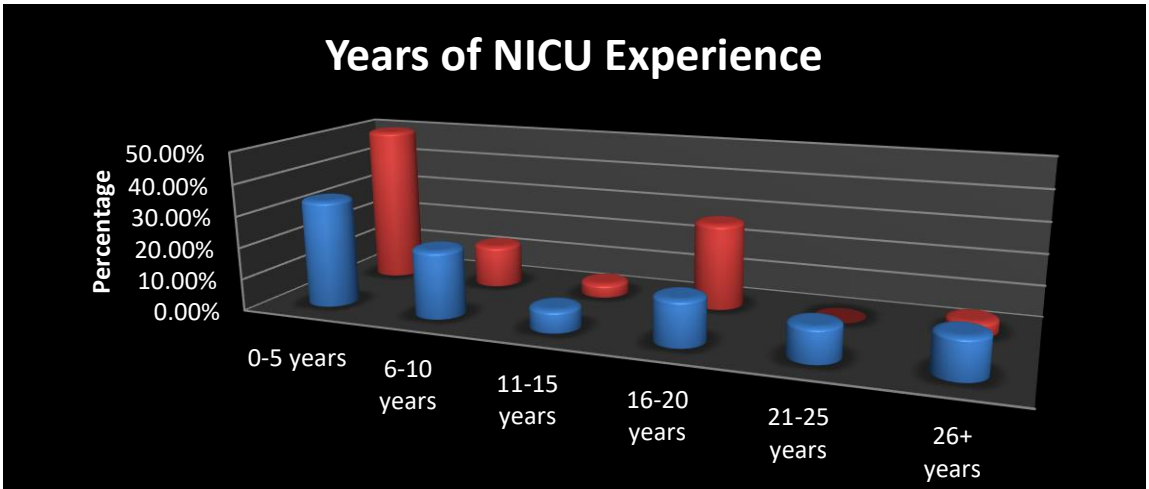


Figure 2



	0-5 years	6-10 years	11-15 years	16-20 years	21-25 years	26+ years
Years of NICU experience (pre-implementation)	33.90%	21.40%	7.10%	14.30%	10.70%	12.50%
Years of NICU experience (post-implementation)	50%	13.60%	4.50%	27.30%	0	4.50%

Between the pretest and posttest groups, there were only 12 matched pairs for the readiness survey and 15 matched pairs for the TTPQ survey. Because of the low number, the pre- and post-implementation readiness and TTPQ survey scores were measured as one sample *t*-tests and the means were compared. In order to assure that the pre- and posttest populations were similar, a one-sample *t*-test was performed on the pre- and post-implementation demographic for age, and the mean age range was the same for both tests and equal variances were assumed.

The readiness survey consisted of 12 questions based on a 5-point Likert scale. The total score has a range from 12-60 with the lower score indicating increased readiness. The pretest readiness survey had a mean score of 25.429 whereas the post-implementation readiness survey had a mean score of 22.895. The difference was statistically significant ($p < .000$) indicating that team's readiness scores significantly improved after implementation of the pre-delivery

checklists (Table 1). Pearson's *r* correlation was used to evaluate the relationship between the readiness score and years of NICU experience for both pre- and post-intervention data. The pre-intervention Pearson's *r* showed a statistically significant strong negative correlation between the two (Table 2). On the contrary, the Pearson's *r* correlation on the post-intervention readiness score and years of NICU experience had a weakly positive correlation that was not statistically significant (Table 3).

Table 1

Comparison of Pre- and Post-Implementation Readiness Scores

	N	Mean	Std. Deviation	Std. Error Mean
Total Readiness Score (pre-implementation)	56.000	25.429	.933	.125
Total Readiness Score (post-implementation)	21.000	22.895	1.749	.382

Independent Samples Test (Pre- and Post implementation Readiness Scores)

	Mean Difference	Std. Error Difference	t	df	Sig. (2-tailed)
Equal variances assumed	2.533	.309	8.211	75.000	.000
Equal variances not assumed	2.533	.402	6.309	24.391	.000

Hartley test for equal variance: F = 3.517, Sig. = 0.0001

Table 2

Pre-Implementation Correlations (Years of NICU Experience and Total Readiness Score)

		Years of NICU experience (pre)	Total readiness score pre-implementation
Years of NICU experience (pre)	Pearson Correlation	1	-.585**
	Sig. (2-tailed)		.000

	N	56	55
Total readiness score pre-implementation	Pearson Correlation	-.585**	1
	Sig. (2-tailed)	.000	
	N	55	56

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3

Post-Implementation Correlations (Years of NICU Experience and Total Readiness Score)

		Years of NICU experience (post)	Total readiness score post-implementation
Years of NICU experience (post)	Pearson Correlation	1	.367
	Sig. (2-tailed)		.371
	N	22	8
Total readiness score post-implementation	Pearson Correlation	.367	1
	Sig. (2-tailed)	.371	
	N	8	21

Teamwork perceptions were measured using the TTPQ, which encompasses five subcategories including team structure, leadership, situation monitoring, mutual support, and communication. Each category consists of seven questions using a 5-point Likert scale, and the total score for the TTPQ ranges from 35-175 with the lower score indicating positive perceptions of teamwork (About TeamSTEPPS, 2019). The overall scores of the pretest and posttest TTPQ were analyzed along with the total scores of each subcategory. Due to some missing answers, responses were not counted if the participant did not answer at least six out of the seven questions in each category, and the overall score was analyzed only if the participants answered a minimum of 30 out of 35 questions. The overall TTPQ pre-implementation mean score was 66

compared with the post-implementation mean score of 59.3. The lower score on the post-implementation TTPQ indicated that there were improved perceptions of teamwork; however, the difference was not statistically significant (Table 4). The subcategories of the pre- and post-implementation TTPQ all produced lower post-implementation scores indicating an improvement from the pre-implementation score; however, none of the subcategories showed a statistically significant change at the $p<.05$ level. A summary of each subcategory result is listed in Table 5.

Table 4

Comparison of Pre- and Post-Implementation Overall TTPQ Scores

	N	Mean	Std. Deviation	Std. Error Mean
Overall TTPQ Score (pre-implementation)	56.000	66.000	15.101	2.018
Overall TTPQ Score (post-implementation)	25.000	59.300	18.101	3.620

Independent Samples Test (Pre- and Post Implementation Overall TTPQ Scores)

	Mean Difference	Std. Error Difference	t	df	Sig. (2-tailed)
Equal variances assumed	6.700	3.866	1.733	79.000	.087
Equal variances not assumed	6.700	4.145	1.617	39.564	.114

Hartley test for equal variance: F = 1.437, Sig. = 0.1305

Table 5

TTPQ Subcategories	N	Mean	St. Deviation	Significance (2-tailed)
Total Team Structure Score (Pre)	56	12.571	3.697	.416
Total Team Structure Score (Post)	25	11.84	3.771	

Total Leadership Score (Pre)	56	14.679	4.76	.364
Total Leadership Score (post)	24	13.625	4.67	
Total Situation Monitoring Score (Pre)	56	13.232	3.516	.378
Total Situation Monitoring Score (Post)	23	12.478	3.217	
Total Mutual Support Score (Pre)	56	12.679	3.573	.937
Total Mutual Support Score (Post)	23	12.679	3.513	
Total Communication Score (Pre)	55	12.582	3.184	.745
Total Communication Score (Post)	23	12.304	3.948	

Pearson's *r* correlation was analyzed in order to determine whether there was an association between the overall TTPQ score and the years of NICU experience for the pre- and post-intervention data. The pre-intervention TTPQ score and years of NICU experience had a weakly positive correlation, which was not statistically significant (Table 6). The post-implementation TTPQ score and years of NICU experience had a very weak negative correlation, which did not have any statistical significance (Table 7).

Table 6

Pre-Implementation Correlations (Years of NICU Experience and Overall TTPQ Scores)

		Years of NICU experience (pre)	Overall TTPQ (pre-implementation)
Years of NICU experience (pre)	Pearson Correlation	1	.165

	Sig. (2-tailed)		.229
	N	56	55
Overall TTPQ (pre-implementation)	Pearson Correlation	.165	1
	Sig. (2-tailed)	.229	
	N	55	56

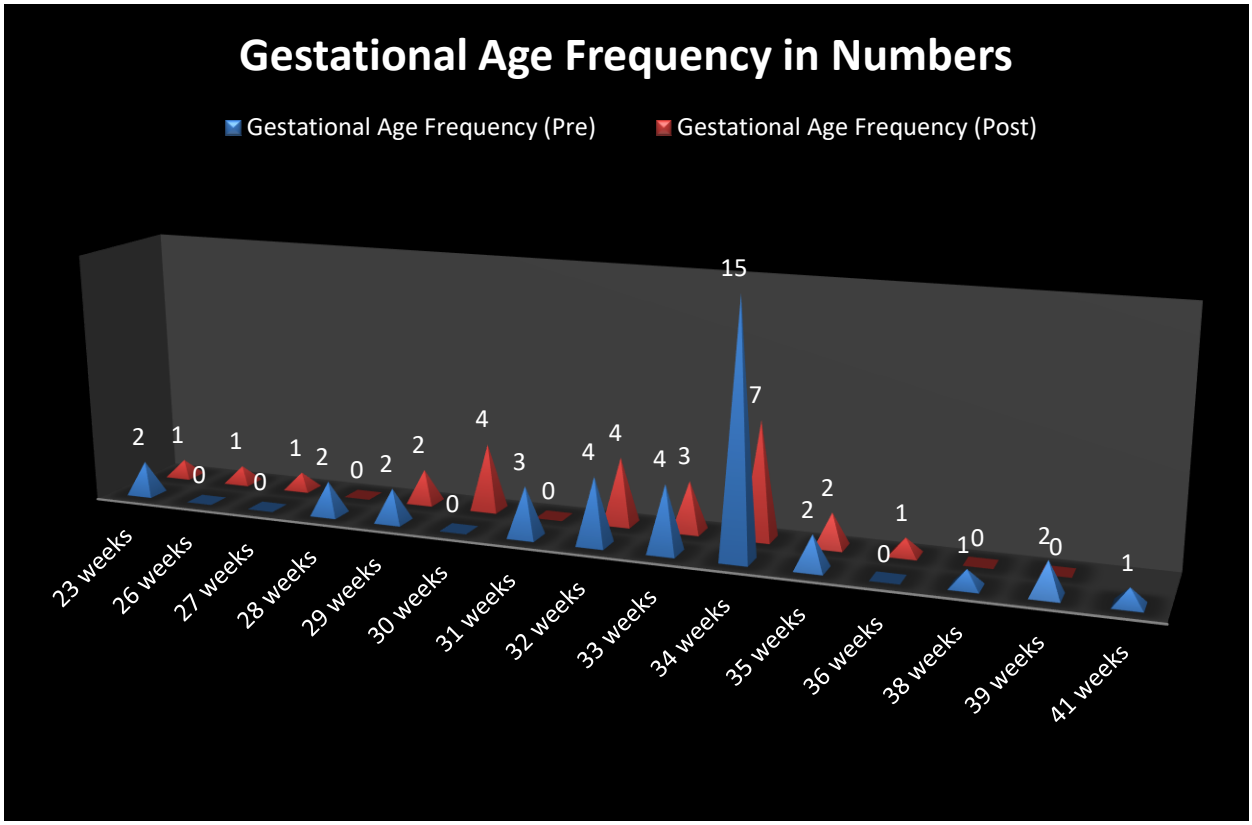
Table 7

Post-Implementation Correlations (Years of NICU Experience and Overall TTPQ Scores)

		Years of NICU experience (post)	Overall TTPQ (post-implementation)
Years of NICU experience (post)	Pearson Correlation	1	-.016
	Sig. (2-tailed)		.968
	N	22	9
Overall TTPQ (post-implementation)	Pearson Correlation	-.016	1
	Sig. (2-tailed)	.968	
	N	9	25

The 5-minute APGAR scores were analyzed for all neonates who had the full NICU team present prior to their delivery and who were admitted to the NICU following birth. The pre-implementation group yielded 38 neonatal APGAR scores at 5 minutes, and there were 26 neonatal APGAR scores at 5 minutes in the post-implementation group. Frequencies were evaluated on both pre- and post-implementation groups. In the pre-implementation group, 34.2% of the neonates were delivered at 32 weeks gestation or earlier, whereas the post-intervention group had 50% of the neonates born at 32 weeks gestation and younger. The gestational age range in the pre-implementation group was 23-41 weeks, and the gestational age range in the post-implementation group was 23-36 weeks (Figure 4).

Figure 3



The 5-minute APGAR scores in the before and after groups were analyzed using a one-sample *t*-test. The means of the one-sample *t*-test were compared with one another to determine whether or not the pre-delivery checklists had any effect on the neonatal outcomes. The mean 5-minute APGAR score in the pre-implementation group was 8.29, whereas the post-implementation group had a lower mean 5-minute APGAR score of 7.62, although this difference was not statistically significant (Table 8).

Table 8

Comparison of Pre and Post Implementation 5 minute APGAR Scores

	N	Mean	Std. Deviation	Std. Error Mean

Apgar before	38.000	8.290	1.063	.172
Apgar after	26.000	7.620	2.360	.463

	Mean Difference	Std. Error Difference	t	df	Sig. (2-tailed)
Equal variances assumed	.670	.435	1.540	62.000	.129
Equal variances not assumed	.670	.494	1.357	32.006	.184

The 5-minute APGAR scores had a positive correlation with gestational age that was statistically significant in both pre- and post-intervention groups (Tables 9 and 10). The post-intervention group had a lower mean gestational age of 31.73 weeks and consequently a lower mean 5-minute APGAR score in comparison with the pre-intervention group, which had a higher mean gestational age of 32.89 weeks and a higher mean 5-minute APGAR score.

Table 9

Pre-Implementation Correlations Between Gestational Age and 5-Minute APGAR Score

		Gestational age in weeks	5 minute APGAR (before)
Gestational age in weeks	Pearson Correlation	1	.544**
	Sig. (2-tailed)		.000
	N	64	38
5 minute APGAR (before)	Pearson Correlation	.544**	1
	Sig. (2-tailed)	.000	
	N	38	38

Table 10

Post-Implementation Correlations Between Gestational Age and 5-Minute APGAR Score

	Gestational age in weeks	5 minute APGAR (after)

Gestational age in weeks	Pearson Correlation	1	.393*
	Sig. (2-tailed)		.047
	N	64	26
5 minute APGAR (after)	Pearson Correlation	.393*	1
	Sig. (2-tailed)	.047	
	N	26	26

*. Correlation is significant at the 0.05 level (2-tailed).

Discussion

Interpretation of Study Findings

The results of the pre- and post-implementation readiness and TTPQ surveys rejected the null hypothesis,which states that there is no relationship between utilization of a pre-delivery checklist and the team's perception of readiness and teamwork prior to delivery attendance. The results of the readiness surveys and TTPQ indicated that the implementation of the PDCs had a positive effect on the team's perception of readiness and teamwork. There was a statistically significant improvement between the pretest and posttest readiness score. Prior to each delivery, the team leader was required to discuss roles with the team and provide a briefing to include pre-dosing code medications based on average weight for gestational age. This action is relevant to study findings, which indicate that briefings and checklists are beneficial (Brown et al., 2017). Additionally, initiating a briefing prior to deliveries was an expected responsibility of the team leaders, and the goal was to complete the briefing in less than 60 seconds. The briefing was designed to be concise, which is consistent with the literature findings that there is time to brief the team prior to deliveries a majority of the time (Brown et al., 2017). The overall improvement in the readiness scores relates to study findings such as Balakrishnan et al. (2017)

who noted that standardized pre-delivery communication increased preparatory behaviors such as checking the equipment and ensuring that roles are assigned.

The results of the pretest and posttest TTPQ surveys indicated a positive improvement in the overall score and each subcategory score; however, the results were not statistically significant in any category. The TTPQ addresses team structure, leadership, situation monitoring, mutual support, and communication. The goal of the PDCs was to standardize communication and enhance situational awareness through the utilization of pre-briefing prior to delivery attendance. The findings were consistent with previous studies in which teams felt a sense of improved teamwork when roles and responsibilities were clearly defined (Salih & Draucker, 2019). Additionally, the overall perception of improved teamwork relates to other studies in which checklists had a positive influence on the team's perception of communication and teamwork (Cabral et al., 2016). The score also supports the literature that briefing and checklists may help the team recognize potential situations before they become problematic (Sauer et al., 2016). The improvement in the both the readiness and TTPQ scores may stem from the team's knowledge of the plan ahead of time.

The difference in the pre- and post-implementation 5-five minute APGAR score was not statistically significant. In fact, the post implementation score was slightly lower than the pre-implementation score. However, the demographics of the pre-implementation neonates had a higher mean gestational age than the post-implementation group. Per the Pearson's *r* correlation, gestational age has a positive correlation with the 5-minute AGPAR score. The lower post-implementation -5 minute APGAR score was not entirely surprising since the overall gestational age of the post-implementation neonates were younger. There are an infrequent number of studies measuring neonatal outcomes using pre-delivery checklists and those that have did not

yield a statistically significant change. A possible explanation is that there may be a slight subjective component to the color measurement in the APGAR score. Another possible explanation is that the APGAR score does not take into account whether or not a neonate requires respiratory support. A neonate could still receive a full score for respiratory effort in spite of receiving an intervention such as blow by oxygen or continuous positive airway pressure.

An unexpected finding was the pre-implementation relationship between the readiness score and the years of NICU experience. The expected finding was that those with more NICU experience would have a higher readiness score, yet the opposite finding was true. There was a strong negative correlation indicating that the readiness score increased with fewer years of NICU experience. The post-implementation Pearson's *r* correlation had a weakly positive correlation between years of NICU experience and the readiness score, which was an expected finding. A potential explanation for the unexpected finding could be that the participants had other critical care job experiences leading them to feel an increased sense of readiness in high stress situations.

Limitations, Clinical Implication, Future Studies & Conclusions

While the project results seem promising, there are several limitations that indicate the need for cautious interpretation of the results. The sample size yielded a lower than desired statistical power of 0.7, which increases the risk of a type II error (Soper, n.d.). The pre-implementation surveys generated significantly more participants than the post-implementation surveys. The surveys were launched in the fall, which was during the same time frame that WMC collects survey data, and there may have been survey fatigue among the participants. The data collection method was a limitation since the participants had to log into their emails and

take three separate surveys on SurveyMonkey, which likely reduced participation. Future studies of this nature may consider having the survey materials readily available in a packet in order to increase participation.

The readiness survey was developed for this project and was evaluated by three experts in neonatology. A limitation is that the readiness survey has not been tested for internal validity and reliability, which may impact the accuracy of the results. Research has indicated that the TTPQ demonstrates reliability and validity (Castner, 2012). Although it meets criteria for reliability and validity, not all components of the TTPQ were pertinent to the aspects of teamwork required by the neonatal team prior to delivery attendance. The results indicated that there was an improvement in the TTPQ scores post implementation. However, the respondents may have been uncertain as to how to answer some of the questions, which may have skewed the results. Another limitation was the inability to perform consistent pre-briefing and simulation role-play as outlined in the education plan due to limitations set forth by the facility due to COVID-19 restrictions. The participants received the pre-briefing and simulation role-play during huddle, NRP training, and training the staff during working hours. The lack of consistency in this area may have impacted some of the responses. Another limitation stems from the fact that there were many staff members who had not yet attended any deliveries after the intervention, which may have impacted their responses or they may not have taken the posttest surveys as a result.

In spite of the limitations, the survey results were consistent with findings from the literature. The dynamic delivery room environment poses challenges to the neonatal team when unexpected emergencies occur. A future recommendation is to condense the PDCs into one form to alleviate confusion for the team. Another recommendation is to evaluate more neonatal data, such as admission temperature, blood glucose levels, oxygen requirement, and length of time to

close the isolette in addition to measuring the 5-minute APGAR scores. This project stemmed from a recognized need to enhance pre-delivery communication and decrease provider variation in pre-delivery communication with a goal of improving patient safety.The PDCs along with TeamSTEPPS briefing showed an improvement in the readiness and TTPQ scores and should be considered for implementation in centers where deliveries take place; however, more studies of this nature are needed to determine whether mentally preparing the team to resuscitate prior to each delivery has a positive impact on the team's perceptions of readiness, teamwork, and neonatal outcomes.

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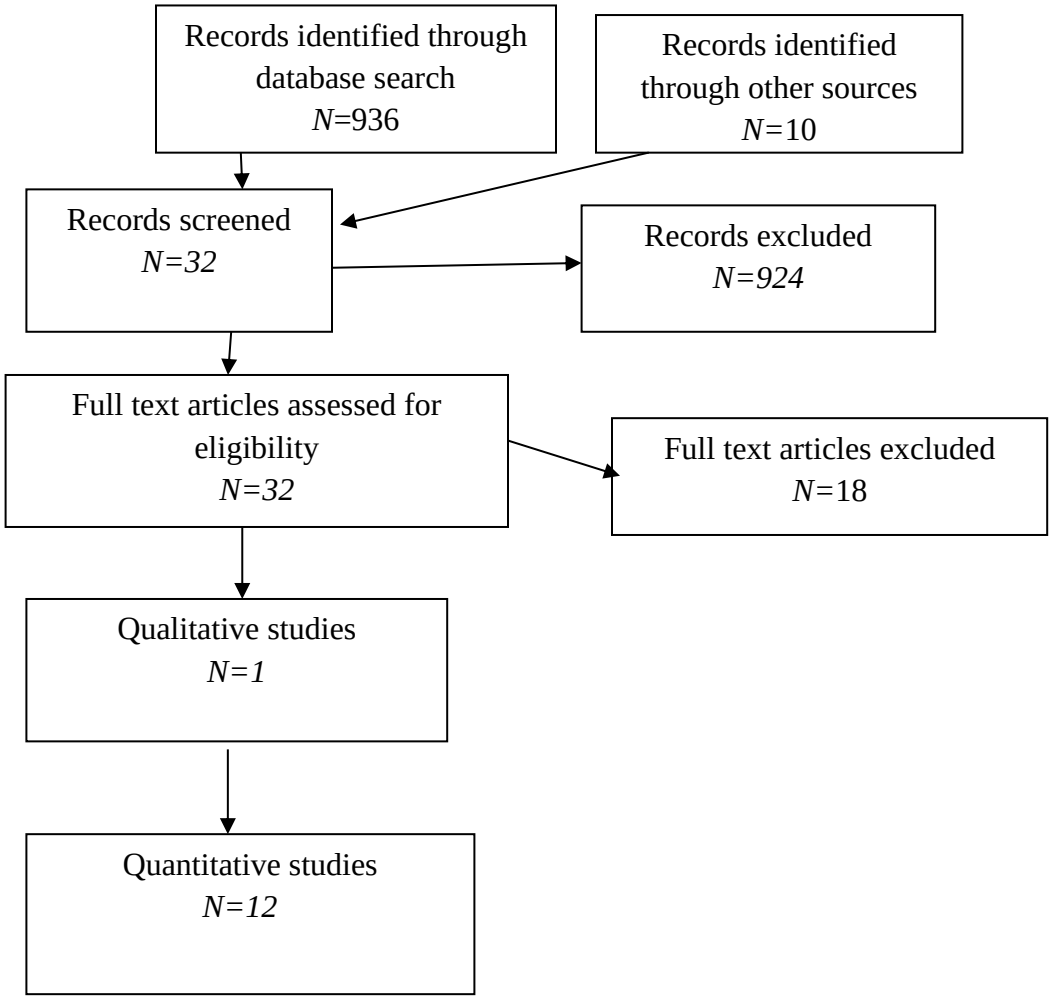
Appendix A

Prisma Diagram



Appendix B
Outcomes Table

	Use of simulation			Clear Team Communication (Team-Based training					Utilize Pre-Delivery Checklist				Sustainability Practice: Policy			
	Use of scenarios to apply knowledge	Team-Based Training	Utilize debriefing Session or Coach to Correct Errors in skills/team performances	Clear Role Assign-ment	Verbal Feed-Back	Closed Loop Commun-cation	Precise Instruction	Use of Scripted Commun-cation	Clear Role Assign-ments and Respon-sibilities	Equip-ment check	Pulse Oximeter Place-Ment	Prepare Intuba-tion Equip-ment	Follow Deliv-ery Policy	Brief Prior To Deliv-ery	Debrief	Commun-icate to neonate's family <30 minutes After Delivery
Balakrish-N=nan et al, 2016									X	X	X	X				
Bennett et al, 2016									X	X	X	X	X			
Brown et al, 2017										X	X	X	X			
Cabral et al, 2017							X		X	X	X	X				
Cheng et al, 2017	X		X													
Edwards et al, 2015													X	X	X	X
Herrick et al, 2020	X								X	X	X					

Malmstrom et al, 2017	X	X														
Palmer et al, 2019	X		X													
Salih & Draucker, 2019	X		X	X	X	X	X									
Sauer et al, 2016									X	X	X					
Yamada et al, 2016		X	X					X	X							
Yamada et al, 2015	X						X	X								

Appendix C

Demographic Survey

1. What is your age range?
    a. 20-29
    b. 30-39
    c. 40-49
    d. 50-59
    e. 60+
2. How many years experience do you have you in your current position?
    a. 0- 5 years
    b. 6-10 years
    c. 11-15 years
    d. 16-20 years
    e. 21-25 years
    f. 26+ years
3. How many years of NICU experience do you have?
    a. 0- 5 years
    b. 6-10 years
    c. 11-15 years
    d. 16-20 years
    e. 21-25 years
    f. 26+ years
4. What is your job title?
    a. Registered Nurse
    b. Respiratory Therapist
    c. Neonatal Nurse Practitioner
    d. Neonatologist
5. Approximately how many resuscitations have you attended in the past year?
    a. 1-2
    b. 3-5
    c. 6-8
    d. 9+

Appendix D

Readiness Questionnaire

Question	Always	Most of the time	Sometimes	Rarely	Never
1. I know my role assignment prior to deliveries					
2. I know what my responsibilities are prior to delivery attendance					
3. Briefing occurs before deliveries and I know what to expect if there is a resuscitation					
4. I have the NICU Epinephrine doses committed to memory.					
5. I am comfortable with doses of NICU volume expanders (normal saline and blood)					
6. I feel comfortable with my knowledge of the location of the resuscitation equipment					
7. I am confident in my skills during emergencies					
8. The equipment is checked prior to deliveries					
9. I am comfortable drawing up emergency medications during resuscitations					
10. I am comfortable preparing an emergency umbilical line					
11. I know the resuscitation plan in neonates less than 32 weeks before the delivery					
12. I know the resuscitation plan for neonates greater than 32 weeks before the delivery					

Appendix E

Approval Letter for Project Implementation

April 16, 2020

To Whom it May Concern:

Meredith Shaw has the approval to proceed with her project in the Neonatal Intensive Care Unit here at Winchester Medical Center. Winchester Medical Center is part of Valley Health System in Winchester, VA.

Please feel free to contact with me with any additional needs.

Respectfully,

Clarissa M. Barnes, MSN, RN

Clinical Manager NICU/Pediatrics

1840 Amherst Street

Winchester, VA 22601

540-536-5189

Appendix F- Pre-delivery Checklist

	Responsibilities According to Role				
Gestational Age Group	Team Leader (Neonatologist/NNP)	Respiratory Therapist	Nurse #1 (chest compressions)	Nurse #2 (Medication)	Nurse #3 (Recorder)
Less than or equal to 32 weeks gestation ***Less than or equal to 28 weeks gestation	1. Assign Roles (airway, medication nurse, chest compression nurse, and recorder) 2. Determine an estimated weight based on gestational age. 3. Pre-calculate intravenous and endotracheal tube Epinephrine doses based on average weight for gestational age. 4. Pre-calculate volume expander dose based on average weight for gestational age. 5. Determine appropriate endotracheal tube side and preferred laryngoscope blade size. 6. Call out times for each intervention 7. Pre-calculate surfactant dose based on average weight for gestational age. 8. Place umbilical line if indicated. 9. Evaluate and manage the code with minimal hands on when possible in order	1. Check T-piece resuscitator and ensure appropriate mask size. 2. Verify surfactant dose with leader 3. Set peak inspiratory pressure (PIP) to 20. 4. Set positive end expiratory pressure (PEEP) to 5. 5. Set oxygen to 30% 6. Prepare intubation equipment if anticipated. 7. Manage airway 8. Place pulse oximeter on infant's right hand. 9. Increase oxygen level to 100% if chest compressions are started	1. ***Place chemical mattress and wool hat on warmer 2. ***Prepare drape 3. ***Keep the head midline 4. Check to ensure stethoscope is at the bedside 5. Assess heart rate at 15 seconds and when prompted 6. Place electrocardiogram leads if indicated. 7. Perform chest compressions if indicated.	1. Verify estimated weight and doses with MD/NNP 2. Prepare medication doses if indicated. 3. Prepare the umbilical line with a stopcock and flush with normal saline. 4. Open the umbilical line tray if indicated	1. Record all events with closed loop communication 2. Notify team leader after 60 seconds of chest compressions for a heart rate check 3. Notify team leader when it has been 3 minutes from last epinephrine dose. 4. Time keep for golden hour.

	to process the entire scenario				
Gestational age	Team Leader (NNP/Neo)	Respiratory	Nurse #1 (chest compressions)	Nurse #2 (medications)	Nurse #3 (recorder)
Greater than 32 weeks gestation	1. Assign roles (airway, medication nurse, chest compression nurse, and recorder) 2. Determine an estimated weight based on gestational age. 3. Pre-calculate intravenous and endotracheal tube Epinephrine doses based on gestational age. 4. Pre-calculate volume expander dose based on gestational age. 5. Determine appropriate endotracheal tube side and preferred laryngoscope blade size. 6. Call out times for each intervention 7. Place umbilical line if indicated. 8. Evaluate and manage the code with minimal hands-on when possible in order to process the entire scenario.	1. Check T-piece resuscitator and ensure appropriate mask size. 2. Set peak inspiratory pressure (PIP) to 20. 3. Set positive end expiratory pressure (PEEP) to 5. 4. Set oxygen to 21% for neonates greater than or equal to 35 weeks. Set oxygen to 30% for neonates less than 35 weeks. 5. Prepare intubation equipment if anticipated. 6. Manage airway 7. Place pulse oximeter on infant's right hand. 8. Increase oxygen level to 100% if chest compressions are started.	1. Check to ensure stethoscope is at the bedside 2. Assess heart rate at 15 seconds and when prompted 3. Place electrocardiogram leads if indicated. 4. Perform chest compressions if indicated.	1. Verify estimated weight and doses with MD/NNP 2. Prepare medication doses if indicated. 3. Prepare the umbilical line with a stopcock and flush with normal saline. 4. Open the umbilical line tray if indicated.	1. Record all events with closed-loop communication 2. Notify team leader after 60 seconds of chest compressions for heart rate checks 3. Notify team leader when it has been 3 minutes from last epinephrine dose

Appendix G

TeamSTEPPS Team Perceptions Questionnaire

Team Structure	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
1. The skills of staff overlap sufficiently so that work can be shared when necessary.					
2. Staff is held accountable for their actions.					
3. Staff within my unit share information that enables timely decision making by the direct patient care team.					
4. My unit makes efficient use of resources (e.g., staff supplies, equipment, and information).					
5. Staff understands their roles and responsibilities.					
6. My unit has clearly articulated goals.					
7. My unit operates at a high level of efficiency.					
Leadership	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
8. My supervisor/manager considers staff input when making decisions about patient care.					
9. My supervisor/manager provides opportunities to discuss the unit's performance after an event.					
10. My supervisor/manager takes time to meet with staff to develop a plan for patient care.					
11. My supervisor/manager ensures that adequate resources (e.g., staff,					

supplies, equipment, and information) are available.					
12. My supervisor/manager resolves conflicts successfully.					
13. My supervisor/manager models appropriate team behavior.					
14. My supervisor/manager ensures that staff is aware of any situations or changes that may affect patient care.					
Situation Monitoring	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
15. Staff effectively anticipate each other's needs.					
16. Staff monitor each other's performance.					
17. Staff exchange relevant information as it becomes available.					
18. Staff continuously scan the environment for important information.					
19. Staff share information regarding potential complications (e.g., patient changes, bed availability).					
20. Staff meets to reevaluate patient care goals when aspects of the situation have changed.					
21. Staff correct each other's mistakes to ensure that procedures are followed properly.					
Mutual Support	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
22. Staff assist fellow staff during high workload.					
23. Staff request assistance from fellow staff when they feel overwhelmed.					

24. Staff caution each other about potentially dangerous situations.					
25. Feedback between staff is delivered in a way that promotes positive interactions and future change.					
26. Staff advocate for patients even when their opinion conflicts with that of a senior member of the unit.					
27. When staff have a concern about patient safety, they challenge others until they are sure the concern has been heard.					
28. Staff resolve their conflicts, even when the conflicts have become personal.					
Communication	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
29. Information regarding patient care is explained to patients and their families in lay terms.					
30. Staff relay relevant information in a timely manner.					
31. When communicating with patients, staff allow enough time for questions.					
32. Staff use common terminology when communicating with each other.					
33. Staff verbally verify information that they receive from one another.					
34. Staff follow a standardized method of sharing information when handing off patients.					
35. Staff seek information from all available sources.					

(Teamwork Perceptions, 2017).

Appendix H

Outline for Didactic Education

Utilizing TeamSTEPPS Briefing to Implement Pre-Delivery Checklists in the NICU

I. Pre-Delivery Checklists

a. Purpose and goals
   i. Purpose
      1. The purpose of checklist implementation and TeamSTEPPS briefing is to improve team communication and preparation prior to each delivery attended
      2. Another purpose is to treat each delivery attended by the neonatal team as a potential emergency so that the team is always prepared

   ii. Goals
      1. Improve the team's perceptions of readiness and teamwork prior to deliveries
      2. Improve neonatal outcomes by measuring the five minute APGAR Scores before and after checklist implementation

b. Background
   i. Infrequent occurrence of full cardiopulmonary resuscitation in neonates at delivery
      1. Approximately 5 neonates out of 10,000 deliveries require full CPR (Sawyer et al, 2018)
      2. Infrequent occurrence of full CPR may lead to laxities in resuscitation knowledge by the neonatal team
      3. Infrequency of full CPR may increase anxiety of the neonatal team
      4. Neonatal outcomes may be affected by the success of the resuscitation (Zehnder et al, 2019)

c. Significance
   i. Nature of codes are often chaotic
   ii. Can be unpredictable and catch the team by surprise
      1. Unprepared teams may be less efficient in resuscitation (Lapcharoensap and Lee, 2017)
      2. Potential safety error if the team is unprepared to resuscitate
      3. Potential inability to recall code medication dosing due to infrequency of use
      4. There may be provider inconsistencies in code management (Yamada et al, 2016)

d. Rationale for pre-delivery checklists and standardized communication practices
   i. Simulation training may improve confidence (Palmer et al, 2019)

ii. Reminders/prompts may be beneficial during resuscitation (Cheng et al, 2017)
iii. Team simulation may improve team function and communication (Malmstrom et al, 2017)
iv. Checklists may improve communication (Cabral et al, 2016)
v. There have been positive findings in standardized delivery room management (Yamada et al, 2016).
vi. Precise and accurate communication may be beneficial during resuscitations (Brown et al, 2017)
vii. Closed-loop communication and clear role assignments identified as a facilitator to teamwork (Salih & Drucker, 2019)
viii. Consistent delivery room practices may improve communication and teamwork (Edwards et al, 2015)

e. Pre-delivery Checklist Instructions
   i. Each role will have a standardized set of tasks/instructions
   ii. Implementation of pre-delivery checklists will be standard for every delivery attended by the full neonatal team
   iii. There are 2 pre-delivery checklists
      1. Greater than 32 weeks gestation
      2. Less than or equal to 32 weeks gestation
   iv. It is the team's responsibility to memorize the responsibilities of their roles
   v. The team leader will assign/discuss the roles prior to each delivery attended by the neonatal team(discussion can take place as we are walking to the delivery, in the anteroom of the OR, or at the delivery as we are waiting for the birth)
   vi. The roles and plan should be established by the team leader in fewer than 60 seconds
   vii. The pre-delivery checklists will be placed on all of the warmers in the OR and DR as a reference guide

f. Weight Chart
   i. A weight chart was developed for this project. (It is based on the Fenton Preterm Growth Charts for males and females). The weight chart will be placed on the warmer as a reference guide for the team leader to pre-calculate Epinephrine (both IV and ET doses), volume expander, and surfactant doses.
   ii. The weight chart was developed by averaging the male and female weights based on gestational age
   iii. The chart consists of estimated weights for the 10^{th}, 50^{th}, and 90^{th} percentiles for each gestational age in weeks from 22-42 weeks
   iv. The team leader will pre-calculate Epinephrine, volume expanders, and surfactant based on an estimated weight for gestational age.
   v. Surfactant to be pre-dosed for neonates less than or equal to 32 weeks gestation

vi. The estimated weight and medication doses will be communicated to the team **prior** to the delivery
vii. The med nurse (Nurse #2) will read back the doses to the team leader to close the loop of communication

g. Team Leader's Responsibilities (Neonatologists/NNPs)
    i. Assign Roles (airway, medication nurse, chest compression nurse, and recorder)
    ii. Determine an estimated weight based on gestational age.
    iii. Pre-calculate intravenous and endotracheal tube Epinephrine doses based on gestational age.
    iv. Pre-calculate volume expander dose based on gestational age.
    v. Pre-calculate surfactant dose (if applicable)
    vi. Determine appropriate endotracheal tube side and preferred laryngoscope blade size.
    vii. **Prior** to delivery, communicate the estimated weight, endotracheal tube size, and medication doses to the team. Receive verification of doses from medication nurse. Receive verification from RT regarding the ETT size and surfactant dose (if applicable).
    viii. This information may be communicated as soon as the team receives word that there is an impending delivery.
    ix. This may also be communicated when team is on the way to L&D, in the anteroom of the OR, or at the bedside.
    x. Call out times for each intervention performed during the resuscitation
    xi. Place umbilical line if indicated.
    xii. Evaluate and manage the code with minimal hands on when possible in order to process the entire scenario

h. Respiratory Therapist's Responsibilities
    i. Check T-piece resuscitator and ensure appropriate mask size.
    ii. Verify surfactant dose with leader (for deliveries less than or equal to 32 weeks)
    iii. Verify ETT size with leader
    iv. Set peak inspiratory pressure (PIP) to 20
    v. Set positive end expiratory pressure (PEEP) to 5
    vi. Set oxygen
        1. 21% for late preterm – term
        2. 30% for preterm less than 34 weeks
    vii. Prepare intubation equipment if anticipated.
    viii. Place pulse oximeter on infant's right hand and turn on
    ix. Increase oxygen level to 100% if chest compressions are started and communicate this intervention to the team.

i. Nurse One Responsibilities (Chest Compression Nurse)
    i. For less than or equal to 28 weeks

1. ***Place chemical mattress and wool hat on warmer
2. ***Prepare drape
3. ***Keep the head midline

ii. Check to ensure stethoscope is at the bedside
iii. Assess heart rate at 15 seconds and when prompted
iv. Place electrocardiogram leads if indicated.
v. Perform chest compressions if indicated

j. Nurse #2 Responsibilities (Medication Nurse)
   i. Verify/read back estimated weight and doses per gestational age with MD/NNP
   ii. Prepare medication doses if indicated.
   iii. Prepare the umbilical line with a stopcock and flush with normal saline.
   iv. Open the umbilical line tray if indicated

k. Nurse # 3 Responsibilities (Recorder)
   i. Record all events and read back interventions to close the loop.
   ii. Notify team after 60 seconds of chest compressions for a heart rate check
   iii. Notify team when it has been 3 minutes from last epinephrine dose.
   iv. Notify team of any pertinent events
   v. ***Time keep for golden hour (for neonates less than or equal to 28 weeks).

II. TeamSTEPPS
   a. Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS)
      i. Focuses on teamwork and patient safety
      ii. Customizable according to unit needs
   b. TeamSTEPPS briefing will be utilized as the framework for pre-delivery checklist implementation

III. TeamSTEPPS Briefing
   a. Share the Plan
      i. Team leaders
         1. Assign roles/responsibilities
         2. Establish the climate and goals
         3. Promote situational awareness
         4. Information-sharing
         5. Encourage team participation and input
         6. Provide feedback and accept feedback/suggestions

   b. Communication
      i. Call out and check back/closed loop communication
      ii. Open and clear communication
      iii. Supportive environment
         1. Team members should speak up if an error is discovered

2. Team leader should listen to team members
3. Team leader/team members provide corrective action/recommendations respectfully

IV. Implementation
   a. Implementation of pre-delivery checklists will begin after team training
   b. Team training will consist of role playing the pre-delivery checklists and TeamSTEPPS briefing
   c. Team members include: Neonatologists, NNPs, Respiratory Therapists, NICU Nurses, and Nursery Nurses
   d. Role play session should take less than 3 minutes per pre-delivery scenario
   e. Pre-delivery checklists will be placed on each warmer in the delivery rooms and operating rooms
   f. Weight chart based on gestational age will be placed on the warmer as a reference for the team leaders
   g. Pre-briefing should be discussed prior to each delivery and should take less than 60 seconds to complete.

V. Sustainment
   a. The plan to sustain this project is to continue pre-delivery checklist review
      i. During NRP training/renewal sessions
      ii. Mock-code training sessions

Appendix I

Synopsis Table

	Author, Year	Design/Level	Target Population (N=)	Study Setting	Findings/Results	Comments: Strengths/ Weakness
1	Balakrishnan et al, 2017	QI project, pretest/posttest Level IV	Preterm infants less than 31 weeks N=1113 deliveries	Multiple hospitals	Delivery management plan,	Improvement in cord clamping, temperature, oxygen saturations,
2	Bennett et al (2016)	Before and after design Level IV	NICU Delivery Staff N= 24 Hospitals	Multiple Hospitals delivery room setting	Readiness bundle recommended, improved admission temperatures, decreased need for intubation	70-80% compliance rate, all NICUs returning the survey recommended checklists. Weakness: not all NICUs responded to tool, monthly data reported by each NICU and compliance may have been biased
3	Brown et al (2015)	Survey Level IV	NICU Delivery Staff N= 299	15 Hospitals, Delivery Room setting	Results ranked according to most popular responses, majority prefer a delivery reminder tool	Large sample A weakness is the possibility for selection bias, (only surveyed hospitals in California)
4	Cabral et al(2017)	Pretest/Posttest Study Level IV	N= 93 Surgeons, Surgical Techs, and Nurses	Operating room setting	Use of a surgical checklist improved communication	Valid tools Use was voluntary in study, may have skewed results
5	Cheng et al (2017)	Randomized simulation based clinical trial	N= 210 participants Pediatric Intensive Care, Emergency	Multiple Hospitals/PICUs/ ERs	Use of a CPR coach during pediatric cardiac	Large sample, improvement in overall CPR quality, internal

		Level II	Department providers and bedside clinicians		arrestwith improvement in overall CPR quality	validity, may improve outcomes during cardiac arrest
6	Edwards et al, 2015	Survey/delivery audits, standard delivery protocols Level VI	N= 609 delivery audits in 84 different NICUs	Multiple hospital delivery room settings	Briefings, checklists, debriefings, video review not frequently used in audited NICUs. Recommend standardized communication to improve performance	Large sample. Limitation of only using descriptive statistics
7	Herrick et al, 2020	Observational study, level III	N=32 resuscitation videos of neonates less than 32 weeks gestation	Delivery room setting	Mean of 52.6 flow disruptions per delivery, most common were extraneous interruptions, equipment-technology-layout interruptions, and coordination	No studied interventions, no evaluation of emergent line placement or epinephrine administration
8	Malmstrom et al, 2017	Before and after study Level IV	N=110 Physicians, nurses, midwives	Delivery room setting	Simulation training and effects on teamwork, communication and leadership and there was improved confidence in less experienced team members,.	A control group was used to pretest questionnaire, good internal validity and large sample size were strengths Weakness is that respiratory therapists were not included
9	Palmer et al, 2019	Pre-post intervention scores Level IV	N=23 nurses and nurse anesthetists	Delivery room setting	Significant increase in attitudes after simulation training,	Strength: valid and reliable tools, weakness: other members including NNPs,

					supports simulation	Neonatologists, and Respiratory therapists were not involved
10	Salih & Draucker, 2019	Survey, qualitative Interprofessional simulation scenarios followed by debriefing Level VI	N=36 simulation sessions	Level IV NICU	Identified barriers and facilitators to communication	Small sample, realistic setting because simulation sessions occurred without prior training
11	Sauer et al, 2016	Before and after, Level IV	N=548 infants	NICU/delivery setting	Implement pulse oximetry by 2 minutes, delayed intubation, pre-brief, debrief, and delivery room checklist	Large sample size, decreased evidence of retinopathy of prematurity(though not confirmed with multivariate analysis), study included term deliveries (45%) and authors felt that this group did not indicate change in outcomes
12	Yamada et al, 2015	Observational study of errors made by the neonatal team during resuscitation Level III	N=23 complex resuscitations reviewed	NICU/Delivery setting	Analysis of errors (commission and omission). Average error rate 23%	Strength: identified errors, Weakness: small sample size, videos observed were from outdated NRP guidelines (data collected 2004-2004 and article was published in 2015), no resuscitations required epinephrine administration or Umbilical line placement
13	Yamada et al, 2016	Before and after simulation study with	N=15 physicians and nurses	NICU/delivery setting	Standardized communication with a smaller error but not	Small sample size, Standardized communication only taught to

		non-standardized and standardized communication, Level IV			statistically significant differences between the two	nurses, not team leaders

Appendix J

Consent Waiver

My voluntary completion of the demographic survey, readiness test, and TeamSTEPPS Team Perceptions Questionnaire indicates my consent to participate in the study. I understand that all answers are confidential and will be de-identified prior to release to the project team. I understand that my participation in these surveys is voluntary and I may choose to withdraw from the survey completion at any time without any consequence.

I understand that the risk of my participation is minimal. I understand that the purpose of the surveys is for a Doctor of Nursing Practice Project by Meredith Shaw which will evaluate the impact of pre-delivery room checklists on readiness, teamwork, team function, and neonatal APGAR scores.

Appendix K

Online Education Assessment

1. Standardized delivery room management and checklist use may improve communication and neonatal outcomes.
   - True
   - False

2. For all deliveries, the team leader (MD or NNP) will pre-calculate doses of Epinephrine and volume expanders based on the neonate's estimated weight for gestational age. The doses will be verbalized to the team during the briefing prior to the delivery. The medication nurse will repeat these doses back to the team leader for closed-loop communication.
   - True
   - False

3. The pre-delivery briefing should occur _____ delivery, and it should take less than _____ to complete.
   a. before: five minutes
   b. before: 60 seconds
   c. during: two minutes
   d. after: 10 minutes

4. If I see something performed incorrectly during a resuscitation, I should:
   a. Keep it to myself; the team knows what they are doing.
   b. Roll my eyes, breathe heavily, and gossip about the incompetence I saw.
   c. Respectfully tell my team members what I see and offer a suggestion.
   d. Keep my mouth closed, but then tell the manager my concerns after the resuscitation.

5. The purpose of the TeamSTEPPS briefing is to:
   a. Annoy me with another task to complete.
   b. Share the plan while fostering a supportive environment with open and clear communication.
   c. Place the responsibility of the task solely on the team leader.
   d. Teach the team to remain quiet and avoid offering suggestions.

Appendix L

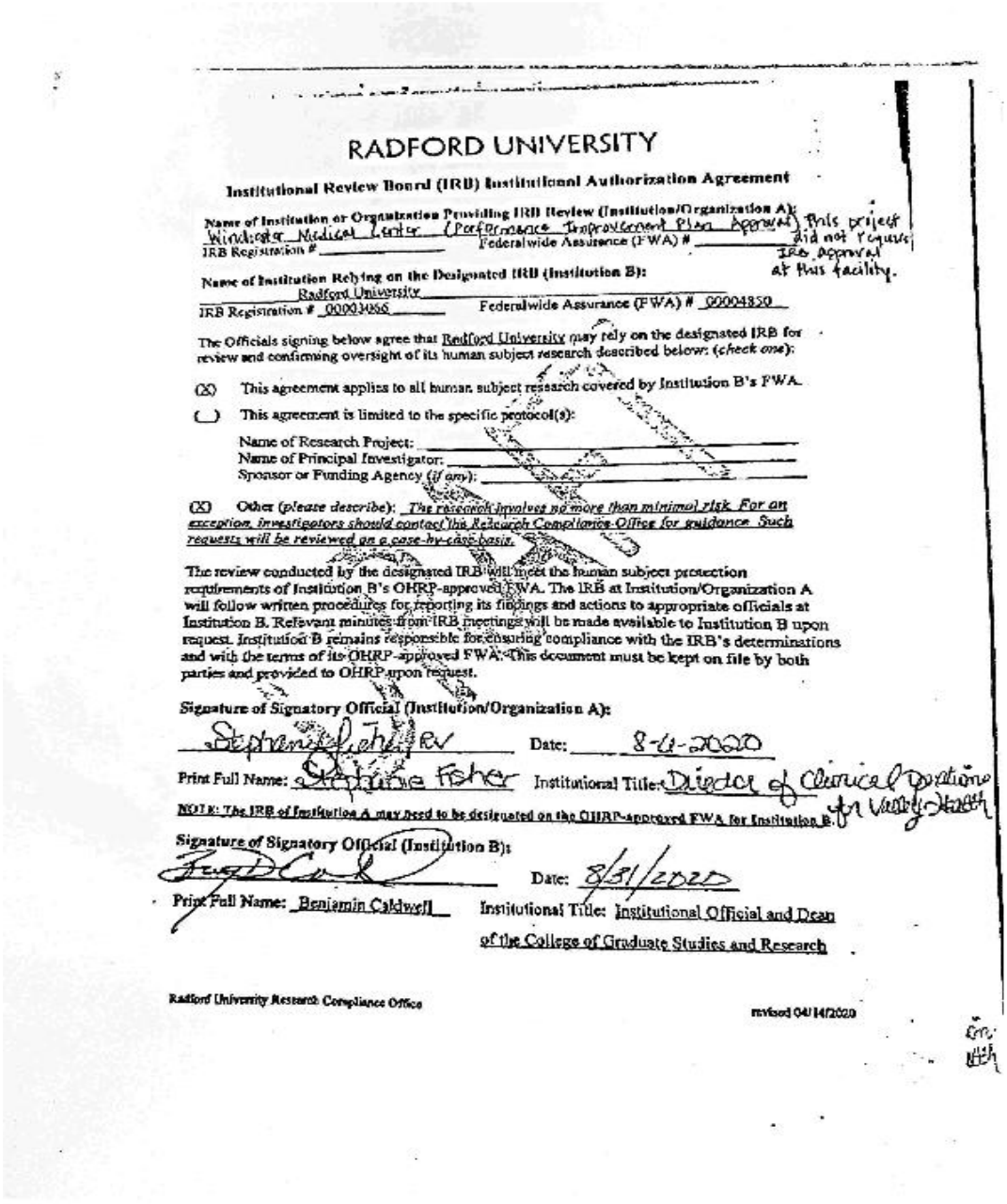
Weight Chart Guide

Gestational Age in Weeks	Weight for 10th percentile	Weight for 50th percentile	Weight for 90th percentile
22	0.4 kg	0.5 kg	0.6 kg
23	0.45 kg	0.55 kg	0.7 kg
24	0.5 kg	0.6 kg	0.75 kg
25	0.55kg	0.7 kg	0.85 kg
26	0.6 kg	0.8 kg	1 kg
27	0.65 kg	0.9 kg	1.2 kg
28	0.7 kg	1 kg	1.3 kg
29	0.8 kg	1.2 kg	1.45 kg
30	0.9 kg	1.3 kg	1.65 kg
31	1.1 kg	1.5 kg	1.8 kg
32	1.3 kg	1.7 kg	2.1 kg
33	1.4 kg	1.9 kg	2.4 kg
34	1.6 kg	2.1 kg	2.6 kg
35	1.9 kg	2.4 kg	2.9 kg
36	2.1 kg	2.6 kg	3.2 kg
37	2.3 kg	2.9 kg	3.4 kg
38	2.5 kg	3.1 kg	3.7 kg
39	2.7 kg	3.3 kg	3.9 kg
40	2.9 kg	3.5 kg	4.1 kg
41	3 kg	3.6 kg	4.3 kg
42	3.1 kg	3.8 kg	4.5 kg

Information modified from Fenton Growth Chart (both male and female) (Stavis, 2019).

Appendix M

Radford University Institutional Review Board Approval



RADFORD UNIVERSITY

Institutional Review Board (IRB) Institutional Authorization Agreement

Name of Institution or Organization Providing IRB Review (Institution/Organization A): Winchester Medical Center (Performance Improvement Plan Approval) This project did not require IRB approval at this facility.
IRB Registration # _____ Federalwide Assurance (FWA) # _____

Name of Institution Relying on the Designated IRB (Institution B): Radford University
IRB Registration # 00003068 Federalwide Assurance (FWA) # 00004850

The Officials signing below agree that Radford University may rely on the designated IRB for review and continuing oversight of its human subject research described below: (*check one*):

(X) This agreement applies to all human subject research covered by Institution B's FWA.

( ) This agreement is limited to the specific protocol(s):

Name of Research Project: _____
Name of Principal Investigator: _____
Sponsor or Funding Agency (*if any*): _____

(X) Other (*please describe*): *The research involves no more than minimal risk. For an exception, investigators should contact the Research Compliance Office for guidance. Such requests will be reviewed on a case-by-case basis.*

The review conducted by the designated IRB will meet the human subject protection requirements of Institution B's OHRP-approved FWA. The IRB at Institution/Organization A will follow written procedures for reporting its findings and actions to appropriate officials at Institution B. Relevant minutes from IRB meetings will be made available to Institution B upon request. Institution B remains responsible for ensuring compliance with the IRB's determinations and with the terms of its OHRP-approved FWA. This document must be kept on file by both parties and provided to OHRP upon request.

Signature of Signatory Official (Institution/Organization A):

Stephanie Fisher Date: 8-4-2020

Print Full Name: Stephanie Fisher Institutional Title: Director of Clinical Operations for Valley Health

NOTE: The IRB of Institution A may need to be designated on the OHRP-approved FWA for Institution B.

Signature of Signatory Official (Institution B):

Date: 8/31/2020

Print Full Name: Benjamin Caldwell Institutional Title: Institutional Official and Dean of the College of Graduate Studies and Research

Radford University Research Compliance Office revised 04/14/2020

Appendix N

Scenarios

Scenario I

Term, 39 weeks, uncomplicated prenatal history, admitted in labor but required a priority one cesarean section (c/s) for prolonged decelerations and suspected abruption.

Scenario II

28 weeks gestation, severe IUGR with maternal history of insulin dependent diabetes. History of prolonged rupture of membranes and uncontrolled preterm labor prompting a c/s delivery

Appendix O

WMC Project Approval

Before beginning a project:

1. Identify issue/opportunity: clinical or patient issue; organization, state or national initiative; data/new evidence; accrediting agency requirements or regulations; philosophy of care
2. Determine if this topic is a priority by consulting with your Clinical Manager and/or UBC. If not a priority at this time, consider another issue/opportunity
3. Consult with your unit Educator and/or Nurse Researcher (Joanne Duffy at jduffy@valleyhealthlink.com) to develop your PICOT question
4. Review the literature to see if there is evidence to support your intervention, practice change, etc.
5. Complete all sections of this form as applicable, including the Action Plan
6. Obtain permission and signature from your Manager, Director
7. Submit/email completed form with the completed action plan/timeline to the WMC Nursing Research, EBP & Innovations Council (c/o Candice McNelly cmcnelly@valleyhealthlink.com.)

***For assistance with completion of this form or for questions about your project, please consult the WMC Research, EBP& Innovations Council**

Project Title:	Neonatal Delivery Resuscitation Training Utilizing TeamSTEPPS to Implement a Pre-Delivery Checklist and Measurement of its Effects
PICOT Question **P=problem, issue of interest; I=intervention, what you want to do; C=comparison intervention; O=outcome; T= time (this is optional and only needed if it applies to your project)**	
In the neonatal intensive care unit (NICU) team (P), how does the addition of a pre-delivery checklist based on gestational age (I) compared to solely utilizing the Neonatal Resuscitation Program (NRP) guidelines (C) impact the team's perception of readiness, teamwork, and neonatal outcomes (O) following a pretest posttest survey and educational training session and evaluating APGAR scores before and after the intervention (T)?	
Team Leader name, unit and email contact:	Meredith Shaw, NNP-BC, Neonatal Intensive Care Unit, mshaw@valleyhealthlink.com
Mentor name and email contact:	

Team Members			
Name	**Unit**	**Name**	**Unit**
Meredith Shaw, MSN, NNP-BC	**NICU**		

1. Background and Significance:
    a. State the current problem or opportunity for improvement.

The needs assessment for this project was based on staff requests due to practice variation in delivery room preparation by the NICU team leaders. A proposed opportunity for improvement is to implement pre-delivery checklists (based on gestational age of the neonate) and utilizing the TeamSTEPPS briefing plan. The proposed pre-delivery checklists will standardize preparation tasks for each role in the neonatal team as a means to improve readiness, teamwork, team function, and neonatal APGAR (appearance, pulse, grimace, activity, respiration) scores.

I am working towards obtaining my doctor of nursing practice (DNP) through Radford University, and the implementation of pre-delivery checklists and TeamSTEPPS briefing is part of my final project.

    b. Why is this a priority for our organization/department? Provide specific information, data, evidence to support

The proposed pre-delivery checklists are a priority for Winchester Medical Center because it will increase patient safety by providing the highest level of care in our patient population. Neonatal resuscitation is an infrequent occurrence, and it is estimated that five neonates per every 10,000 deliveries require full cardiopulmonary resuscitation (CPR) with medication administration (Sawyer et al, 2018). Globally, the neonatal death rate at the time of delivery is estimated at 2.6 million, and many of these deaths are preventable with good prenatal care and appropriate delivery room interventions (World Health Organization, 2016).

There are several challenges associated with neonatal codes, including: unpredictability, infrequency, the chaotic environment, and the decline in resuscitation skills over time (Skare et al, 2018). The unpredictability and infrequent occurrence have the potential to pose a safety error when the team is unprepared to resuscitate. Emergency deliveries in which the neonate is compromised are frequently chaotic and increase anxiety levels amongst the neonatal team. The guidelines established by the Neonatal Resuscitation Program (NRP) are often not followed due to errors and distractions during codes (Zehnder et al, 2019). To make matters worse, studies have indicated that there is a degradation of skills and knowledge of NRP which begins approximately three months after training (Skare et al, 2018).

All of the aforementioned factors may significantly impact neonatal outcomes. Often, neonatal outcomes are affected by the success of neonatal resuscitation, and alterations in communication and teamwork may have detrimental consequences (Zehnder et al, 2019). A Joint Commission Sentinel Review determined that communication issues during deliveries are one of the most common causes of neonatal death at birth (Sawyer et al, 2015). According to Lapcharoensap and Lee (2017), well-prepared teams contribute to the success of resuscitation.

There are important opportunities for improvement in neonatal resuscitation. Evidence has demonstrated that checklists in health care may reduce errors and adverse outcomes (World Health Organization, 2019). Poor communication has been identified as a leading root cause of sentinel events (Yamada et al, 2016). Neonatal delivery-resuscitation utilizing a pre-delivery checklist may prevent the skill decay through application of standardized communication techniques prior to each delivery. Standardizing communication through a checklist may lead to a clearer understanding of roles and responsibilities, improve the team functioning through mutual support, and decrease provider variation while ensuring the recommended guidelines of NRP are followed. In turn, this will reduce errors and improve patient outcomes (Yamada et al, 2016). It is recommended that the team discuss pertinent facts prior to resuscitation. The addition of a checklist may lead to a shared mindset among team members which may increase the perception of readiness (Edwards et al, 2015). Because of the intricate and simultaneous task management required by the team leader during

resuscitations, a standardized approach to neonatal delivery attendance may “improve efficiency, coordination of care, and infant outcomes” (Balakrishnan et al, 2017, p. 886).

References:

Balakrishnan, M., Falk-Smith, N., Detman, L. A., Miladinovic, B., Sappenfield, W. M., Curran, J. S., &Ashmeade, T. L. (2017). Promoting teamwork may improve infant care processes during delivery room management: Florida perinatal quality collaborative's approach. *Journal of Perinatology*, *37*(7), 886-892. doi:10.1038/jp.2017.27

Edwards, E. M., Soll, R. F., Ferrelli, K., Morrow, K. A., Suresh, G., Celenza, J., &Horbar, J. D. (2015). Identifying improvements for delivery room resuscitation management: results from a multicenter safety audit. *Maternal Health, Neonatology and Perinatology, 1*(1), 2. doi:10.1186/s40748-014-0006-x

Lapcharoensap, W., & Lee, H. C. (2017). Tackling Quality Improvement in the Delivery Room. *Clinics in Perinatology*, *44*(3), 663-681. doi:https://doi.org/10.1016/j.clp.2017.05.003

Sawyer, T., Lee, H. C., & Aziz, K. (2018). Anticipation and preparation for every delivery room resuscitation. *Semin Fetal Neonatal Med*, *23*(5), 312-320. doi:10.1016/j.siny.2018.06.004

Skare, C., Boldingh, A. M., Kramer-Johansen, J., Calisch, T., Nakstad, B., Nadkarni, V., . . . Niles, D. (2018). Video performance-debriefings and ventilation-refreshers improve quality of neonatal resuscitation. *Resuscitation, 132*, 140-146. doi:10.1016/j.resuscitation.2018.07.013

World Health Organization. (2016). True magnitude of stillbirths and maternal and neonatal deaths unreported.Retrieved from https://www.who.int/news-room/detail/16-08-2016-true-magnitude-of-stillbirths-and-maternal-and-neonatal-deaths-underreported

WHO surgical safety checklist. (2019). Patient safety. Retrieved from https://www.who.int/patientsafety/safesurgery/checklist/en/

Yamada, N. K., Fuerch, J. H., &Halamek, L. P. (2016). Impact of Standardized Communication Techniques on Errors during Simulated Neonatal Resuscitation. *Am J Perinatol, 33*(4), 385-392. doi:10.1055/s-0035-1565997

Zehnder, E. C., Law, B. H. Y., &Schmölzer, G. M. (2019). An opportunity for cognitive task analysis in neonatal resuscitation. *Frontiers in Pediatrics, 7*(AUG). doi:10.3389/fped.2019.00356

- Does it align with one of below? If yes, please circle which one (s) and briefly describe why.
  - Core Values: 1) Compassion; 2) Integrity; 3) Collaboration; 4) Courage; 5) Innovation; 6) Excellence
  - Strategic Plan: 1) Achieve Excellence in Quality, Safety, and Preventable Harm; 2) Create a High Reliability Organization Driven by a Culture of Engagement, Alignment, and Excellence; 3) Deliver Exceptional Consumer Experience; 4) Enhance Access and Expand Availability of Services, Capabilities, and Sites of Care; 5) Build and Advance Destination Services; 6) Achieve Operational and Financial Excellence
  - Quality-Caring Professional Practice Model: 1) Mutual Problem Solving; 2) Attentive Reassurance; 3) Human Respect; 4) Encouraging Manner; 5) Appreciation of Unique Meanings; 6) Healing Environment; 7) Basic Human Needs; and 8)Affiliation Needs

Team preparation allows for collaboration amongst the interdisciplinary professionals through discussion of the plan prior to each delivery and it fosters the atmosphere of teamwork. The checklists will contribute to excellence in quality, safety, and preventable harm through standardization of team roles and preparation for each delivery as a potential emergency. Studies have shown that unprepared teams pose a risk to patient safety. With the proposed checklists, the participants will experience a shared mental model with the goal of improving patient outcomes and decreasing the potential for harm in the delivery room.

Are there any financial issues to be considered? Yes / No. If yes, describe whether the manager/director has been consulted &/or how the financial implications will be dealt with?

c. Do you know of previous efforts to resolve this problem, or data to support this project at WMC? YES NO

If YES: please describe:

d. Please provide evidence and research found to resolve issue.

A study by Brown et al (2017) sent surveys out to 15 hospitals regarding their opinions on optimal criteria for delivery room checklists. In total, there were 299 responses from physicians, NNPs, RNs, and RTs. From the responses, 96% of the participants indicated preferences for delivery reminder tools (Brown et al, 2017). The participants recommended that the tool be concise, and the common desired content included: equipment checks, pulse oximeter placement, and preparation of intubation equipment. While role assignments were not listed in the recommended checklist content, the team leaders and more experienced members of the team categorized role assignments as having greater magnitude than less experienced team members. Eighty-five percent of the participants stated that there was time for a briefing before delivery if a checklist was present. This study suggests the importance of a checklist and indicates that there is time to utilize it prior to deliveries a majority of the time (Brown et al, 2017).

The introduction of checklists in the surgical setting has increased communication and team safety awareness (Cabral et al, 2016). Use of checklists in neonatal care may also enhance safety and communication during neonatal resuscitation. Cabral et al (2016) found that the introduction of a standardized surgical checklist had a significant impact in the pre- and posttest communication scores among the nursing staff. Of those using the checklist, there was an overall perception of improvement in teamwork following the implementation of the checklist (Cabral et al, 2016). The positive impact on the perception of communication suggests that checklists can improve overall teamwork (Cabral et al, 2016).

Pre-delivery checklists encourage precise communication and situational awareness of the team members. A quality improvement initiative project by Sauer et al, 2016 implemented a delivery bundle which included the use of pre-briefing and pre-delivery checklists. This initiative led to a

significant improvement of neonatal temperatures on admission. There was also a decrease in the number of intubations and surfactant administration in the delivery room, although this was not significant (Sauer et al, 2016). This study supports the use of pre-briefing checklists as a means to improve communication, solidify team roles, and improve recognition of potential issues (Sauer et al, 2016).

Standardized communication may benefit team performance. Yamada et al (2016) evaluated simulated resuscitation performance with standardized communication and non-standardized communication. This study did not find statistically significant improvement between the groups. However, there is a limitation in generalizing the results because the standardized scripts were only used by the nurses rather than used by the team leaders or by all team members (Yamada et al, 2016). Standardizing the script of the team leaders may have had more of an impact since the team leaders direct the resuscitations. Inclusion of the entire team in the standardized communication with a checklist may generate greater significance of the checklist's influence in practice.

While the literature supports the use of pre-delivery checklists, a gap in the literature is what items should be on the pre-delivery checklists. Pre-delivery checklists were developed for this project and reviewed by three experts in the neonatal field (Dr. Teresa Clawson, Dr. Edward Lee, and Eileen Brumbaugh, NNP).

References:

Brown, T., Tu, J., Profit, J., Gupta, A., & Lee, H. C. (2015). Optimal Criteria Survey for Preresuscitation Delivery Room Checklists. *American Journal of Perinatology, 33*(2), 203-207. doi:10.1055/s-0035-1564064

Cabral, R. A., Eggenberger, T., Keller, K., Gallison, B. S., & Newman, D. (2016). Use of a Surgical Safety Checklist to Improve Team Communication. *AORN Journal, 104*(3), 206-216. doi:10.1016/j.aorn.2016.06.019

Sauer, C.W., Boutin, M.A., Fatayerji, A., Proudfoot, J., Fatayerji, N., &Golembeski, D. (2016). Delivery room quality improvement project improved compliance with best practices for a community NICU. *Scientific Reports*, 6, 37397; doi: 10.1038/srep37397 (2016).

Yamada, N. K., Fuerch, J. H., &Halamek, L. P. (2016). Impact of Standardized Communication Techniques on Errors during Simulated Neonatal Resuscitation. *Am J Perinatol, 33*(4), 385-392. doi:10.1055/s-0035-1565997

Please provide the level of evidence supporting this project

Brown et al (2015) – Level IV (survey)

Cabral et al (2017) – Level IV (pretest/posttest study design)

Sauer et al (2016) – Level IV (before and after study design)

Yamada et al (2016) – Level IV (before and after simulation study)

If None found: Consider further consultation with Educator, Manager, or Nurse Researcher to determine if PICOT question can be revised or if a research project should be considered.

2. How will you measure the effectiveness of your intervention? Is this data currently being collected or will you be collecting it? Provide details. (If you don't know if this is being collected, please contact the Research council to help answer this question)

The major study objective is to determine the impact of pre-delivery checklists along with TeamSTEPPS briefing. The outcome variables are the team's perception of readiness, teamwork, and team function for each gestational age category and the five minute APGAR score. The outcome variables will be measured after an educational intervention using a pretest/posttest design. The five minute APGAR score for neonates will be measured after participants begin using the checklist and TeamSTEPPS briefing.

Descriptive statistics will be used for demographic data, the readiness tool, TeamSTEPPS Team Perceptions Questionnaire (T-TPQ), and the neonate's APGAR score. Frequency and percentage will be used for nominal/categorical variables and mean and standard deviation will be used for continuous variables.

The data will be collected through survey monkey. The team will receive an email with the survey monkey link which will contain a demographic survey, a readiness test, and the TeamSTEPPS Team Perceptions Questionnaire (T-TPQ). The surveys are voluntary. Before submitting the surveys, The team will be asked to create a four digit PIN number prior to taking the survey so that the pre- and posttest information may be linked. The team will receive online education regarding the checklists through Halogen followed by a pre-briefing simulation role play session on the checklists. After the education training session, the team will receive another email link to Survey Monkey to voluntarily take the readiness post-test and the TeamSTEPPS Team Perceptions Questionnaire. The participants will enter the four digit PIN that they created before submitting the surveys. Additionally, the five minute APGAR scores of the neonates will be collected for two months before and two months after the checklists and TeamSTEPPS briefing is implemented. Inclusion criteria is all neonates admitted to the NICU who had full NICU team attendance prior to the delivery. The goal is to evaluate 25 APGAR scores prior to the checklist and 25 APGAR scores after the checklist is implemented.

The data will be analyzed using two-tailed *t*-tests to test whether the intervention had a significant impact between the pre- and posttest groups regarding their perception of readiness, teamwork, and team function, and the neonate's five minute APGAR scores before and after implementation of the checklists and TeamSTEPPS briefing procedure.

Correlation Pearson *r* test or logistic regression will be used to determine if there is any correlation between professions, years of experience in current position, years of NICU experience and outcome variables at the baseline as well as at the post-intervention.

3. What is your baseline data? (Number or Percentage, beginning state - If applicable)

4. What is your improvement goal? (Number or Percentage of improvement you hope to achieve – should be attainable & measurable)

The goal is to determine if the checklist implementation and TeamSTEPPS briefing significantly improves the neonatal APGAR scores, readiness scores, and T-TPQ scores. The pre-delivery checklists and TeamSTEPPS briefing will occur prior to each delivery. The briefing on the pre-delivery checklists should take less than 60 seconds to complete.

5. List the Departments and/or Disciplines this process involves/effects:

NICU Nurses	NICU Respiratory Therapists	NICU NNPs	Nursery Nurses	Neonatologists	

Submitted by: Meredith Shaw, MSN, NNP-BC Date: July 1, 2020

YES

Discussed and Approved

by Nursing Director

Manager

Director/Manager Name: Clarissa Barnes

Director/Manager Signature:

Approved by Nursing RQEBP Chair: Stephanie Fisher, MSN, RN, HCS-D, COS-C

Date: July 7th, 2020

ACTION PLAN		
Action- How will results be accomplished, what specific steps will be taken? Tasks to be completed	Person Responsible	Completion Date
Obtain approval for the project by the Winchester Medical Center's Research Council and Radford University	Research Council for WMC and Radford University's IRB	July – August, 2020
Formulate education plan (to include the Halogen session and in person training sessions)	Meredith Shaw	July 20, 2020
Form interprofessional committee to assist with input and planning on project implementation.	Meredith Shaw to coordinate.	Early August, 2020

Upload surveys (demographic survey readiness test, and TeamSTEPPS Team Perceptions Questionnaire) to survey monkey.	Meredith Shaw to submit surveys to Candice McNelly	Early August, 2020
Send out email to interprofessional staff involved in neonatal resuscitations at deliveries (NICU nurses, respiratory therapists, neonatal nurse practitioners, neonatologists, and nursery nurses) with survey monkey link with a request that staff take the surveys in survey monkey.	Meredith Shaw	Mid-August, 2020
Upload the education plan regarding pre-delivery checklists and TeamSTEPPS briefing to Halogen and notify staff of new education to be completed. Staff will have one month to complete education.	Meredith Shaw to submit education to Jane Hisey-Smith to upload to Halogen	Mid-August, 2020
Begin in-person training on the pre-delivery checklists and TeamSTEPPS briefing at staff meetings (provided COVID-19 restrictions allow for in-person meetings). If COVID-19 restrictions are still in place, the in-person training sessions will occur during staff huddles and during working hours. (Estimated time to practice the in-person training role-play is approximately 3 minutes per groups of five people). Estimated time frame for staff completion of the in-person training sessions is three weeks.	Meredith Shaw to coordinate with NICU, Nursery, and Respiratory therapy managers to either schedule	Mid-September through early October, 2020

	training sessions during NICU and Nursery Staff Meetings or to begin training sessions during staff huddles at shift change (based on COVID-19 restrictions in this time frame).Meredith Shaw to coordinate with committee members to assist with this process.	

After in-person training has been completed, staff will receive an email with a link to survey monkey requesting that they take the posttest readiness and TeamSTEPPS Team Perceptions Questionnaire. They will be asked to enter their 4 digit pin that was created during the first survey so that the answers will be matched.	Meredith Shaw to coordinate with Candice McNelly.	Early October, 2020
Data collection on survey responses	Meredith Shaw to coordinate with Candice McNelly	Early November, 2020
Data collection on neonatal APGAR scores (before and after implementation).	Meredith Shaw to coordinate with information technology support to obtain neonatal data (5 minute APGAR score and gestational age of neonate).	Mid-December, 2020

Compile data and complete final write up of project.	Meredith Shaw	January – May, 2021

PROJECTION COMPLETION

Once the Project is completed, the Team Leader will need to complete the information below:			
Actual date project started:		Project end date:	
Briefly Describe what changes were made			
Outcome measurement results			
Were improvement goals achieved?			
If no, what are the next steps?			
If yes, how do you plan to maintain improvement?			
Team Leader Signature:		Date:	

This completed form MUST be submitted to the Research, EBP & Innovations Council to allow for continued tracking and monitoring of all EBP/PI at WMC

send to Candice McNelly cmcnelly@valleyhealthlink.com