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Comparison of Neonates' Positions in SnuggleUp™ Wraps Prior to and Following Education

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Executive Summary

Problem

According to the Synactive Theory of Newborn Behavioral Organization and Development, the adaption of preterm infant to the NICU environment is determined by his/her ability to change their behavior in response to a stimulus, to achieve a self-regulated balance, and to maintain the energy required to sustain life (Als, 1986). When positioning is not done well, it can cause damage due to immaturity that can generate body alignment complications. Preterm infants do not have the muscle tone to move themselves out of an uncomfortable position. Therefore, the NICU team is responsible for the preterm infant's alignment, posture and movement (Santos et al., 2017).

Purpose

There has been a multitude of studies investigating and discussing the benefits of developmental positioning on infants' stability. The purpose of this study was to investigate if quality and consistency of infants' positions in SnuggleUp™ wraps improved following education.

Evidence-based practice is constantly evolving in the NICU and has become the foundation for patient-centered care; NNPs and RNs should be working together to improve patient outcomes, (Smith et al, 2009). At the end of the day, when providing patient care, it is not what was done or how it was done, but did we make a difference? (Assi, 2015).

Goals

The goal of this study is to improve the quality and consistency of developmental positioning in infants born 25 0/7 weeks to 34 6/7. This will be achieved by evaluating the use of the positioning aid, the SnuggleUp™ wrap, develop proper education, educate the staff and re-evaluate the use of the SnuggleUp™ wraps.

Objectives

The objective of this Quality Improvement Project (QI) was to improve the quality and consistency of developmental positioning utilizing the SnuggleUp™ wrap following education via the present form of education used in the unit, the Occupational Competency Index (OCI).

Plan

Pre-education and post-education were both collected in 4 week periods in a total of 7 data collection sessions; two of these data collection sessions occurred on weekend days. Observations were made up to 3 times per 12 hour shift on each baby. Education and training on both the use of this product and proper developmental positioning was provided to the nursing staff for one month via the Occupational Competency Index, the unit's current preferred mode of education. Staff was also provided with 4 baby dolls positioned in SnuggleUp™ wraps per manufacturer guidelines to facilitate tactile learning.

Outcomes

Though the data showed that there was not statistically significant change in position prior to and following education, there was data that showed that there was an improvement in positioning infants correctly, with the correct size of SnuggleUp™ with no extra blanket for infants who are 33 – 34 6/7 weeks gestation at birth. There were also correlations between the increased gestational age at collection and the decrease in use of extra blankets in the SnuggleUp™ Wraps.

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Table of Contents

List of Tables

List of Appendices

Problem Recognition and Definition

As a result of the demands on the body that are associated with prematurity, the preterm infant generally requires hospitalization; in many cases, for prolonged periods of time (Santos et al., 2017). According to the Synactive Theory of Newborn Behavioral Organization and Development, the adaption of preterm infant to the NICU environment is determined by his/her ability to change their behavior in response to a stimulus, to achieve a self-regulated balance, and to maintain the energy required to sustain life (Als, 1986). The NICU environment and infant's clinical condition can influence physiological and behavior response during hospitalization and following discharge. The muscular system of the newborn is responsible for the positioning during the hospitalization. The movements and postures contribute to the formation of the spine, joints and skull (Hunter, 2015).

During a preterm infant's hospitalization in a single shift, a NICU nurse will interact routinely with a patient roughly 4 times. This means that the nurse has at least 4 attempts each day to potentially misalign an infant. Normal procedure is to alternate positions throughout the day to prevent pressure sores and postural deformities (Santos et al., 2017). If the infant is misaligned, the infant could be stuck in that position for 3-4 hours; this could cause them not only pain, but a decreased quality of sleep (Jeanson, 2013). When positioning is not done well, it can cause damage due to immaturity that can generate body alignment complications. Preterm infants do not have the muscle tone to move themselves out of an uncomfortable position. Therefore, the NICU team is responsible for the preterm infant's alignment, posture and movement (Santos et al., 2017). During positioning, it is important to ensure that the posture is maintained and movements are easy in order to improve skeletal development and body alignment to keep newborn behavior comfortable and energy conserving. The maintenance of

proper positioning can provide control of sleep or wakefulness, improved cardiorespiratory function and promote energy conservation (Santos et al., 2017).

Many positioning aids are on the market to help NICU nurses properly position infants in a flexed position; however, there is limited research on the proper utilization of these products, despite their widespread use, (Sathish et al., 2017). The desire to investigate this research came from the observation that every unit this researcher has worked in utilizes the SnuggleUp™ wrap, but they are rarely used per recommendations of the manufacturer. Is this due to lack of education? Is it possible that the product just appeared one day without formal knowledge or training of how to use it?

Smith et al. (2009), completed a study which showed that Neonatal Nurse Practitioners (NNPs) found the ideal work environment would include open communication, a collaborative team, autonomy, identification with leadership, and support for professional development (Smith et al, 2009). Evidence-based practice is constantly evolving in the NICU and has become the foundation for patient-centered care; it only makes sense that NNPs and RNs should be working together to improve patient outcomes (Smith et al, 2009).

Population: Nurses in the Neonatal Intensive Care Unit of a Denver Metropolitan Hospital.

Intervention: Education on the proper use of the SnuggleUp™ wrap using the existing form of education in the unit, the Occupational Competency Index (OCI).

Comparison: Comparing the positioning of neonates in the SnuggleUp™ wrap prior to and following education.

Outcome: Increase in consistency of appropriate positioning of Neonates born between the ages of 25 0/7 weeks to 34 6/7 weeks.

Question: Will the rate of proper developmental positioning using the SnuggleUp™ Wrap in the Denver Metropolitan hospital increase following education using the Occupational Competency Index?

The basis for this project is to educate the staff on how to properly use this positioning device, as well as why it is important to properly position preterm infants 25 0/7 – 34 6/7 weeks at birth. The proposed outcome will be nurse-sensitive. According to the American Nurses Association, nursing sensitive indicators are measures and indicators that reflect the structure, processes and outcomes of nursing care. There are three types: clinical quality, patient satisfaction, and nurse satisfaction. By nature, nurses like to solve problems and when they know that a change can positively affect their patients, they are more likely to make the changes (Assi, 2015). Simply put, nursing sensitive measures are related to the structures and process that drive patient care. At the end of the day, when providing patient care, it is not what was done or how it was done, but did we make a difference? (Assi, 2015). Using the DNP education to explain how these changes to positioning will not only make a difference now, but also in the long-term, as well as hopefully aiding the nurses to want to improve their practices in infant positioning.

Literature Review

Throughout the past three decades, the care of preterm infants has been transformed. There have been several new advancements that have prolonged the life of preterm infants, which has begun to shift the focus to enhancing the life of preterm infants and their development (Valerie et al., 2011). Much of the current research focuses on how the neonatal intensive care unit (NICU) environment and medical care may impact the development of the preterm infant. This research has found that preterm birth interrupts infants' rapidly developing brains, which

subjects the growth of their nervous system to the extra-uterine environment for which they are ill-prepared (Valerie et al., 2011). It is during the third trimester of fetal development, and even in early infant development, that the brain is drastically changing with new brain cell production and migration, synaptic "pruning" of unused neurons and brain organization (Valerie et al., 2011).

A literature review regarding proper developmental positioning was performed via EBSCHOST and CINAHL. This review revealed that several of the articles focused on the infants' vital signs in different positions, with the most prevalent being oxygen saturations. It also revealed that there is limited research regarding the use of current positioning products, which play a key role in developmental positioning. There were a few research articles that discussed positioning outside of vital signs that did find that neonatal staff plays a major role in the musculoskeletal maturation process (Sweeney, 2002). A study completed by Valvre-Douret and Golse (2007) determined that infants' functional positioning was better in homemade blanket rolls vs. purchased cocoon. However, in the pre and post assessments, it showed that infants in the real cocoon group showed gains in postural development, they had fewer cranial deformities, improved arm relaxation and better orthopedic leg positioning (Valvre-Douret & Golse., 2007). The effects of postural support on neuromotor function in preterm infants has also been studied; Monterosso et al. (2003) found that use of postural roll while infants are in the prone position improves hip and shoulder posture. Another study that was conducted by Ferrari et al. determined that using a nest promotes the flexed posture of the limbs of pre-term neonates. It also aids in adduction of shoulders and helps facilitate proper wrist movements, as well as movements towards and across the midline (Ferrari et al., 2007).

Support Devices

For this research study, the focus is whether or not the SnuggleUp™ positioning aid is being utilized per manufacturer guidelines, followed by education of the staff that does the positioning of these infants. A study was conducted by Sathish et al. that discussed the clinical outcomes of 27-32 week infants who are compared to a group of infants in a SnuggleUp™ vs. a group not in a SnuggleUp™. Most of this particular research observed vital signs: respiratory rate, oxygen saturations, stability of cardiorespiratory system, weight gain, temperature, heart rate, and ventilator days (Sathish et al., 2017). The study found that the infants who were in the SnuggleUp™ had better respiratory rates, oxygen saturations, weight gain and overall cardiorespiratory stability (Sathish et al., 2017). It also showed that infants in the SnuggleUp™ group had a shorter length of stay. Therefore, use of the positioning aid is recommended to facilitate preterm infants' growth and to improve clinical outcomes.

Positioning

Most of the literature regards the prone position as the position of choice because preterm infants display fewer stress responses such as, startles, tremors, and twitches when in the prone position (Kihara & Nakamura, 2013). There is also a physiologic benefit of being prone since there is increased thoracoabdominal synchrony and rib cage motion. The pressure from the infant's weight against the supporting surface of the bed enhances the stability of the chest wall, allowing for greater excursion of the diaphragm and ultimately results in advanced breathing (Kihara & Nakamura, 2013). Kihara and Nakamura also found that there is an intense relationship between heart rate variability and sympathetic, as well as parasympathetic, nerve activity. The study found that for infants with very low birth weights, being prone enhances heart rate stability and leads to relaxation (Kihara & Nakamura, 2013). Infants who are

positioned supine or prone inevitably will lie with all four limbs flattened against the mattress in an external rotation as a result of gravity without any boundaries to aid them in maintaining flexion. In 1988, Grenier investigated infants who had brain damage and ways to prevent hip deformities. This research demonstrated that having excessive flexion of the legs in the prone position can cause flexor and adductor muscles to shorten within weeks. This shortening is completely reversible in infants with an intact brain. If there is any brain injury, the deformities are not reversible and will exacerbate any existing motor handicaps (Vaivre-Douret, et al, 2004). The findings of Greiner were confirmed in 1995 by Monterosso et al. who investigated the use of a postural support to reduce the frog-leg position in preterm infants born at less than 31 weeks. It was found that there was significantly less incidence of the frog leg position in the treated group who had a support when in prone position (Vaivre-Douret, et al, 2004). The studies of Georgieff et al. and Georgieff and Bernbaum examined infants who weighed less than 1750g at birth at ages 3, 6, 12 and 18 months and found that 46% had scapular retraction, and showed a delay in an ability to sit and handle objects (Vaivre-Douret, et al, 2004). Vaivre-Douret et al. found that properly supported position is a posture that ensures the functional support of all of the body parts, as well as ensuring physical safety. To be properly supported, the head should be in line with the main axis of the body and the body should be slightly curled when lying either on the side or back. The shoulders and knees must also be held forward when the baby is lying on its back. This position is similar to the fetal position. The shoulders should be rounded and the knees flexed with the hands up by the infant's mouth (Vaivre-Douret, et al, 2004).

Infant Positioning Assessment Tool (IPAT)

Spilker et al (2016) studied implementing a standardized positioning assessment tool to improve the proficiency of positioning in their NICU nurses. They found that there is a gap

between what is known in the evidence and what is practiced in some NICUs; it is clear that positioning is effective in improving outcomes, however, not much is known about how to improve the developmental positioning proficiency of the nurses who are providing care. This study used the Infant Positioning Assessment Tool (IPAT). This is a reliable, easy to use pictorial directory of appropriate positioning for preterm infants. Objective and measurable assessments of infant positioning is warranted to improve consistency in nursing practice, which affects neonatal developmental outcomes (Spilker et al, 2016). This study found that IPAT scores improved following education, but it was unclear if the education or the introduction of the IPAT improved the outcomes. Coughlin et al, 2010 also found that the IPAT tool provided consistent reference resource across clinicians in the NICU sites and that standardizing positioning practices as discussed by the IPAT tool has favorable results on consistency of optimal positioning (Coughlin et al, 2010). Most recently, Charafeddine et al (2018) used hands on education sessions to develop positioning practices and found that the mean IPAT scores went from 3.4 at baseline to 6.3 in the second cycle and the third cycle to 7.3. The targeted approach of in person education system improved nurses' clinical performance, but did take time as the most improvement was found at 18 months. This highlights the difficulty and complexity in changing behaviors (Charafeddine et al, 2018).

Theories

Levine's Conservation Model

Myra Levine wanted to provide individual and responsive patient care that wasn't all about the medical procedures, but was more individualized. The main focus of this midrange nursing theory is to promote physical, as well as the emotional, being of the patient by taking four areas of conservation into consideration (Mefford & Alligood, 2011). The major concepts

include: conservation of energy to make sure that the patient does not expend too much energy; conservation of self-integrity, by assisting the patient to maintain contact with their support system; conservation of personal integrity, by maintaining their uniqueness; and conservation of structural integrity to support their bodies physically.

Levine's Conservation Model explores the challenges related to the health of the preterm infant with concentration on conservation of the health of the patient as a whole, while fitting needs of the infants and their families. "The disruption of the normal path of intrauterine development by a preterm birth creates an environmental challenge for the infant and family," (Mefford & Alligood, 2011, p. 1000). The concepts are defined and logically organized and fit into the NICU setting well.

The role of neonatal nurses is to aid in supporting adaption of the infant and family through therapeutic and supportive nursing interventions that focus on the conservation of energy, structural integrity, personal integrity and social integrity, (Mefford & Alligood, 2011). The best way for an infant and family to adapt is for the nursing staff to help them successfully adapt. "Greater levels of consistency of nursing care in the NICU were predictive of short length of hospital stay and shorter duration of mechanical ventilation, oxygen therapy and parenteral nutrition," (Mefford & Alligood, 2011, p. 1009). A theory such as Levine's Conservation Model that is looking after the wholeness of patients to best guide the nursing care to have the highest impact on the outcome of the patient.

Conservation of energy is extremely important to premature infants. Proper positioning of an infant will aid them to conserve energy. If an infant is properly positioned, they will not only stay warmer, but they will also move around less, which will effectively conserve energy. It also helps to not allow for loss of heat through evaporation (Mefford & Alligood, 2011). By

carefully controlling the infant's environment, it maintains their personal integrity. This is best achieved through controlling the humidity and temperature in their isolette, as well as keeping the light and noise levels low. The developmental care aspect of premature infants, including proper positioning is going to become even more important as we are able to save infants at lower gestational ages.

Mefford's Health Promotion for Preterm Infants

The purpose of the mid-range nursing theory of Health Promotion for Preterm Infants is to aid the infant to better deal with the external environment that they were not ready for and to assist the family in being prepared for having a baby early. The theory was developed as an extension of Levine's Conservation Model, with the major concepts of adaption to having a sick infant for the families and for the infants to adapt to the outside world via nursing care to conserve structural integrity, personal integrity, social integrity and wholeness.

The theory has clear definitions, as well as set goals for each of its concepts; it is more focused with the conservation of structural integrity, personal integrity and social integrity, but also gets broader with wholeness as a major concept. The theory of health promotion for preterm infants has a framework to guide neonatal nursing practice to further research the importance of consistent nursing practice, as well as look into consistent caregivers to promote health in preterm infants (Mefford & Alligood, 2011).

The theory of health promotion for preterm infants is based on what nursing care can do for structural integrity, personal integrity, social integrity and wholeness. This theory is taking Levine's Conservation Model and making it more focused on developmental care and care of the whole infant. An initial test of the validity of this theory was done in 1995. The initial findings, as well as these findings, provide support for the use of this theory of health promotion for

preterm infants based on Levine's Conservation Model of nursing to guide the practice in the NICU. Placing theory into practice is an important part in the scientific base of the nursing discipline. "Neonatal nursing is a specialty in where the nurse must be highly attuned to the physiology changes, as they are critical, but also to the more subtle messages from the infant. The application of holistic nursing practice based on a sound nursing theory can help to improve the outcomes of the most fragile patients, as well as their families," (Mefford & Alligood, 2011).

For there to be successful family-centered and developmental care, it requires quick initial and continued engagement with the process of adaptive change. "A preterm infant is both physically small and structurally immature presenting the risk for injury with transition from intrauterine to extra uterine life (a threat to structural integrity)," (Mefford, 2004). Preterm physiologic systems are not fully developed. The role of the neonatal team is to support the adaptive efforts of both the infant and their family (Mefford & Alligood, 2011). One way to do this is by beginning supportive therapeutic nursing interventions that are directed towards conserving energy, as well as the structural integrity. This could be accomplished by doing proper developmental positioning with the ultimate goal of health or wholeness of the infant and family system.

Lewin's Change Theory

Lewin's theory has 3 stages through which change agents must proceed before change becomes part of a system; unfreezing (when change is needed), moving (when change is initiated), and refreezing (when equilibrium is established), (Smith, 2001). It is during the unfreezing stage that people realize that something is going to change and they are dealing with emotions related to the change. During the moving stage, it is of utmost importance that the change is implemented within a short time. The longer the process takes, the more inclined

people will be to relapse into old behaviors. The refreezing is what solidifies the change, also a time where people will try to revert into their old ways. Proper steps must be taken to ensure that there is no turning back (Smith, 2001).

It is essential for a business to fully disclose the state of affairs and to explain why a change process is put into effect. As a result of strong communication, employees are more willing to accept the new direction. The moving stage is often referred to as the ripple effect, but acting vigorously and implementing the change in a short time helps people to understand the importance better. Eventually, if all the correct steps are taken, the new situation will be accepted as the only situation (Mitchell, 2013). A change theory is important as most people don't like change and adjusting is difficult; having a process such as a change theory aids in the success of a change.

Lewin's theory is widely known for its success in making changes in business organizations (Smith, 2001). Most changes fail because an organization does not succeed in properly communicating the need and reason behind a change. Nursing staff will often be resistant to change unless they understand why it is better for the patient. The best way for management to have success is to convince the staff that the change is needed.

The unit in which this research took place is historically difficult to initiate change in, as with many units. However, often times change is initiated with little explanation. By utilizing the OCI, which the staff is used to for educating, they felt involved in the process and may be more likely to understand the need for the change, and will also be more aware of making the change. Utilizing a theory when making a change can help the employees to understand that change does not have to be a threat; that instead it can be a new challenge to motivate everyone.

It has been noted many times that theory is purposeful and, in the profession of nursing, it is of value. Theory supports nursing's desire to promote health through the application of practice that is continually developing in a changing body of nursing knowledge. Theory can influence practice in direct and indirect ways; the main issues identified are that it enhances professional autonomy and the power of nursing, that nursing action is deliberate and can both make challenges and respond to them (Ingram, 1991). When there is a change that needs to be made for the improvement of health in patients, nursing theory is important to consider, especially with initiation of the theory.

Nursing Educational Modalities

Since the other important aspect of this research is to educate in hopes of improving the positioning, it was important to also look at a study that was completed by Jeanson (2013) regarding one-on-one education of bedside nurses about positioning and if it improved consistency of positioning. In this study, they found that one-on-one education was the best way to get buy in from the staff; the bedside nurses are passionate about their care and that passion is contagious (Jeanson, 2013). Immediate feedback was also found to be helpful, with hands on correction so that they could see the improvement to further cement their desire to position infants well every time (Zarem et al., 2013). Zarem et al (2013) studied perceptions of Neonatal Nurses and Therapists, which showed that 99% of respondents agreed that positioning is important for the well-being of the infant. Nurses typically spend more time with the infants and can provide valuable information regarding the types of positioning devices; therefore, it is important to educate them to optimize their perceptions (Zarem et al., 2013).

Perkins et al. (2004) set out to determine the effects of different forms of education on the ability of nurses to position infants in a developmentally supportive way, as well as to determine

nurses' perceptions of effectiveness of educational methods. The study showed that formal education methods like in-services or workshops improved nurses' abilities to position neonates, however, the improvements declined in the absence of ongoing education. The nurses also felt that the workshops were more useful than independent reading (Perkins et al, 2004). These results suggest that nurses prefer in person education with ongoing education.

It also should be taken into consideration that the nurses are adult learners and bring their own professional knowledge and experience to the learning environment. Adult learners have independent self-concepts, they draw on their experiences, their needs are influenced by their social roles, they are problem-centered and want to apply new knowledge immediately. They also need to know why they have to learn something before participating, and they are normally motivated to learn by internal factors (Spies, Seale, & Botma, 2015). In teaching adult learners, it is also important to remember that they have not engaged in as many educational activities as present students have. This can cause them to have a lack of confidence in their ability to learn and demonstrate the new material. It is also possible that they have a high degree of dependency on the educator and cannot self-teach well. Adult learners should be part of the process in order to develop better learning experience and improve their learning, and it is important to remember that adult learners learn in different ways (Spies, Seale, & Botma, 2015).

Empowering nurses in their own education was proven to be very effective by Chaghari et al., (2015). They found that if the nursing staff participates in the design and implementation of the training programs, the content is more desirable. Empowering education refers to self-direction and practicality. Self-directed learning represents the nurses' own desire to learn and make a difference to their patients (Chaghari et al, 2015). This knowledge is important since the

education model for this project is self-directed, and on their own time while at work, which was initially a concern for the researcher.

In completing this literature review, there was a plethora of helpful information for moving forward with this research. To date, there remains no study or scientific evidence to support that using one positioning product over another is more beneficial; therefore, investigating positions and other interventions will help to optimize the care and outcome of neonates. The review also found that consistent, evidence-based therapeutic positioning can have beneficial outcomes for preterm neonates. It is known that the intrauterine environment aids in the neuromuscular development of the fetus. Preterm and sick infants miss out on the in-utero environment; therefore, by not providing boundaries, it is possible that there is a risk for compromise in the neuromuscular development of these infants (Sathish, 2017). By pre-auditing and educating with a post audit of the nursing staff in the metropolitan NICU, it is the goal of this researcher that the positioning of these infants will be improved following education. Educating this multigenerational and experienced staff to implement proper positioning during each set of cares could be difficult, but utilizing the knowledge that nurses are passionate about positively impacting their patients, and educating with that driver, may be the key to this research project's success (Jeanson, 2013).

Market Risk Analysis

Strengths, Weaknesses, Opportunities and Threats

A SWOT analysis was performed when determining the need for this project, which showed the strengths as: Having a nationally recognized developmental specialist in the unit to use for guidance and assistance with this project, as well as that the unit currently uses SnuggleUp™ wraps, causing no additional cost to the unit. The weaknesses of the proposed

project are: Potential limited available sample due to ever fluctuating unit census, inability to generalize findings, known resistance to change by RN's in Denver Metropolitan NICU. The DNP student researcher in this project has only worked in this unit since November 2017 and has already made several changes, as well as the new lack of a unit educator due to structure changes within the health system. Potential opportunities following the completion of this study were thought to include: Presentation at national professional meeting, presentation in Peru in March 2019 prior to graduation with Regis faculty, publication in professional journal, as well as potential role model regionally for units that utilize SunggleUp™ wraps. Threats to this study were found to include: Potential incorrect sizes of SnuggleUp™ in the unit, increased resistance to change related to many changes occurring at one time in the unit, potential limited stake-holder buy-in and potential limited administration buy-in.

Needs, Resources and Sustainability

The sustainability of this project is now ensured by the inclusion of its application as part of daily routine in nursing care. The element of proper developmental positioning can easily be integrated with importance in regular educational sessions for all nurses in the NICU.

Stakeholders and Project Team

Stakeholders in this project include the NNPs in the unit, the Clinical Nurse Specialists (CNCs), Nurses in the unit and the patients that will be evaluated. The Project team is made up of the DNP student researcher, the developmental therapist, the unit occupational therapist, the clinical mentor and the capstone chair. The project team will be instrumental with regard to aiding the student researcher; however, all evaluation of patient positioning will be completed by the student researcher, so as to not have to have reliability as a concern in this project.

Cost-Benefit Analysis

Cost versus benefit analysis shows that there is a potential cost to the unit if it is found that the incorrect sizing of SnuggleUp™ wraps is being utilized due to lack of smaller sizes. However, long-term for the patients, being positioned properly has the potential to decrease length of stay, and to decrease follow up appointments with Physical Therapy as outpatients. Presently, the March of Dimes estimates that annually, preterm births cost society $26.2 billion. Clements et al. (2007) reviewed early intervention costs and found that 14,033 of the 76,901 surviving infants in Massachusetts required early intervention at an average cost of $857 per patient per year. Mean cost per infant was highest for children who were 24 to 31 weeks' gestational age ($5,393) and higher for infants who were 32 to 36 weeks' gestational age ($1,578) compared with those who were born at term of $725 (Clements et al, 2007). This totals to $66 million per year. Recent studies also show that preterm infants cost 3 times as much in the first year as term infants do (Jacob, 2016). Utilizing the SnuggleUp™ wrap, which on contract costs the hospital roughly $6 per wrap and are laundered with hospital laundry, it is a cost-effective intervention and could save families and insurance companies hundreds of dollars per year in neurodevelopmental follow up costs.

The cost to duplicate this would include the hourly wage of the researcher to complete the observations; at roughly 16 hours of observation and data collection, at a NNP salary, the cost would be $880. The nursing staff is required to complete the OCI; if the hospital allows the staff to complete this outside of normal work hours, the cost for this unit would have been $1,845 for the 41 staff nurses at the time of this project. The SnuggleUps™ were available in this unit and did not have an additional cost. The other costs to replicate this would be the cost for the professional printing of the OCI, which was $25, and the baby dolls that were purchased at a local department store cost a total of $35 for the 4 dolls.

Earlier NICU discharge of children with special healthcare needs leads to families needing closer and more frequent healthcare follow-up. Some state agencies mandate NICUs to provide follow- up programs to coordinate care of these infants. These clinics are responsible for providing special medical, developmental, psychological and social assessments during the first 3 years of the baby's life (Jacob et al., 2016). Often times, these are not reimbursed well by insurance companies and the cost to run these programs is overwhelming to the clinics.

Therefore, the benefits outweigh the costs. Furthermore, presently the SnuggleUp™ wraps are not an individual patient charged item; it is included in the room bundle pricing and this could be looked into see if it would benefit the hospital to make these individual patient charge items. (See Appendix A for Budget).

Project Objectives

Mission and Vision

To improve the quality and consistency of the proper use of SnuggleUp™ wraps on infants 25 0/7 weeks to 34 6/7 weeks gestation by utilizing current unit education method. The nursing staff was re-evaluated on quality and consistency of proper use of SnuggleUp™ Wraps following education.

Goals

The goal of this study is to evaluate the use of the positioning aid the SnuggleUp™ wrap, develop proper education, educate the staff and re-evaluate the use of the SnuggleUp™ wraps in order to improve the quality and consistency of developmental positioning in infants born 25 0/7 weeks to 34 6/7 weeks.

Outcomes Objectives

The objective of this Quality Improvement Project (QI) was to improve the quality and consistency of developmental positioning utilizing the SnuggleUp ™ wrap following education via the present form of education used in the unit, the Occupational Competency Index (OCI). (See Appendix B for Project Timeline).

Evaluation Plan

Logic Model

(See Appendix C.)

Study Population

The average daily census during pre-education evaluation was 10 infants, and the average census during post-education evaluation was 20 infants. Both during pre and post evaluation, 80% of the infants in the unit met criteria to be in the study and all infants whom qualified were entered into the study.

Setting

This Quality Improvement (QI) Project took place in a community hospital in the Denver Metro area. The NICU is a 24-bed level III unit with around 360 admissions per year and 31% are 34 6/7 weeks or under at birth. Minimal positioning aids are available overall, however the unit has a sufficient supply of SnuggleUp™ wraps in all available sizes. The education previously provided to the unit on developmental positioning has been minimal, with the most recent being an OCI completed 2 years ago. Staff hired after that OCI receive their developmental positioning knowledge informally from their preceptors during orientation with no official check-off as completed.

Sample

All infants were inborn at the maternity ward and were admitted directly to the Neonatal Unit. All infants who were in an incubator in the NICU and between the ages of 25 0/7 weeks and 34 6/7 weeks at birth, at the Denver Metro Community hospital were observed during the data collection period of this study. Data was collected on infants until they were no longer in SnuggleUp™ wraps if born prior to 34 6/7 weeks with the oldest infant being 35 6/7 weeks when data was collected. The infants are able to stay in the SnuggleUp™ wraps until they are in an open crib and able to maintain their own flexion when only swaddled. A power analysis was completed with Mu1 = 53, as that is the percent infants were properly positioned prior to education, and Mu2 = 62, as that is the percent of infants that were properly positioned following education.

Pre Education Audit Cycle 1:

The data collection prior to education occurred during a 4-week period and were collected in a total of 7 data collection sessions; two of these data collection sessions occurred on weekend days. Observations were made up to 3 times per 12 hour shift on each baby. The observations were made only on infants whom were in their bed at the time of the data collection. Although gestational age at birth, collection and days of life were recorded, no patient identifiers, nor protected health information, was collected at any time. A total of 105 assessments for the pre-education audit cycle were completed, (N=106).

Intervention

Although the SnuggleUp™ wrap is already widely preferred in the unit for boundaries, the system is not always used per the manufacturer's guidelines. The SnuggleUp™ is a soft and cozy support that provides proper positioning. The padded foot roll and soft adjustable straps allow movement while gently aiding in maintaining positioning and flexion. Phillips created a

brochure regarding proper use of the SnuggleUp™ (See Appendix D). Education and training on both the use of this particular product and the importance of proper developmental positioning was provided to the nursing staff for one month via the Occupational Competency Index during the month of January 2019, which is the unit's current preferred mode of education provided in Appendix E. Staff was also provided with 4 baby dolls positioned in SnuggleUp™ wraps per manufacturer guidelines to facilitate tactile learning. Dolls were properly repositioned up to 3 times per shift while DNP student was in the unit.

Post-Education Audit Cycle 2:

The data collection following education also occurred during a 4-week period and were collected in a total of 7 data collection sessions; two of these data collection sessions occurred on weekends. The observations were again made up to 3 times per 12 hour shift on each baby. A total of 144 assessments for the post-education audit were completed (N=144).

Instrument Reliability and Validity

The data collection tool consisted of 3 pictures that were taken from the manufacturer's brochure, 2 other subject lines regarding the use of extra blankets and the correct size based on infant's weight. When evaluating the infant's position with use of the picture, the evaluator looked at head position, arm position, trunk position, leg and feet position. The head position is normal if in line with the body axis with a deviation of no more than 45-degree inclination and abnormal if in lateral positions more than 45 degrees or hyperextended. Arm positions were normal if relaxed and close to the body or near the midline and were abnormal if abducted and elevated. Infants also should not have the 'W' position while supine. The trunk is normal if in the body axis and abnormal when hyperextended. Legs are normal if knees forward and flexed and abnormal when externally rotated with hip abduction or in the frog leg position, and feet

should be without deviation (Valvre-Douret & Golse, 2007). The examination was performed globally and was graded as either yes/no. If any part of the infant's position was not correct, the examiner said 'no' because any part of the position being incorrect can have a negative impact.

The data collection tool utilized in this study was created by the DNP student researcher. (Appendix F). The validity of the tool was determined by Dr. Erin Ross who is a Developmental Specialist and has been practicing for the last 29 years with a master's degree in Speech/Language Pathology and a Ph.D. in Clinical Sciences-Health Services Research. Dr. Ross is certified in Newborn Individualized Developmental Care and Assessment of Preterm Infant Behavior (See Appendix G).

All data was collected by the DNP student researcher to preserve the reliability of the data and remove inter-rater error. This team member assessed the position of infants independently and filled out the data collection tool at the time of observation while still at the bedside.

Unit Approval

The manager and director of the Neonatal Intensive Care Unit approved the project prior to ethical approval and IRB approval (See Appendix H.)

Ethical Approval

This project was approved by the Ethics Committee of the hospital where the intervention took place (See Appendix I).

Human Subjects Protection

This QI project was deemed exempt from the Institutional Review Board at Regis University in Denver, Colorado and also deemed IRB exempt from the hospital where the intervention took place. A letter/information sheet regarding this project was provided to all nursing staff in the unit where the intervention took place and was addressed during huddle at

morning and evening shift changes, (See Appendix J). The nurses were periodically reminded throughout the study that data was being collected on their patients and was for informational and educational purposes only. The information will not be shared with hospital administration and there will not be any punitive aspect associated with low achievement of goal. The data collection tool does not have any identifiable information about the nurse or about the infants, other than gestational age (See Appendix K, L, & M for IRB letters and Collaborative Institutional Training Initiative (CITI Training).

Statistical Analysis

The Statistical Package for Social Sciences (SPSS, version 23) was used for data analysis. Prior to utilizing SPSS for output of data, the data was coded in Excel, turning the words into numerical values. In the coding process, No = 0, Yes = 1, Pre-education = 2, Post-education = 3, softly supine incorrect = 40, softly supine correct = 41, properly prone incorrect = 50, properly prone correct = 51, side-lying support incorrect = 60, and side-lying support correct = 61.

In order to show a one-unit improvement in positioning after the intervention, a minimum of 80 observations were needed in each group in order to achieve a 90 percent power with an alpha of .05. A paired T-test was used to compare information pre/post education, whereas a nonparametric test, the Spearman's Rho was used to determine any correlation between variables.

Data Analysis

A level of significance was set prior to the study at 0.05. Means and standard deviations were calculated for infant demographics. Descriptive statistics (Mean, Standard Deviation, Median and Mode) were used to analyze the samples. Independent variable was the education,

and the dependent variables were position, use of extra blankets and correct size. Gestational age at birth, gestational age at collection, days of age, use of extra blankets, use of correct size and pre/post education were all considered rational, and position was considered nominal for level of data. The effect size was calculated and the Cohen's d = 0.162627.

Project Findings and Results

Pre-Education Audit Cycle 1 Results:

One hundred and five data points were evaluated in the pre-education audits. It was found that there was a minimum gestation of 27.2 weeks, a maximum gestation of 35.0 weeks and a mean of 30.839 weeks at birth. At time of collection, the minimum was 27.3 weeks, maximum was 35.5 weeks and the mean was 31.722 weeks. Infants were positioned supine roughly 45% of the time, prone 24% and 32% side-lying.

When positioned supine prior to education at the gestational ages of 25-29 6/9 weeks, infants were positioned correctly 38% of the time, prone correctly 90% of the time and side-lying 33% of the time. For gestational ages 30-32 6/7 weeks, infants were positioned correctly supine 38% of the time, prone 90% of the time and side-lying 50% of the time. Gestational ages of 33-35 6/7 weeks, infants were correctly positioned supine 50% of the time, prone 100% of the time and side-lying 57% of the time.

Prior to education, infants with gestational ages at birth between 25 and 29 6/7 weeks had extra blankets used 85% of the time, and the correct size was utilized 35% of the time. For gestational ages 30-32 6/7 weeks, extra blankets were used 60% of the time, and the correct size was chosen 77% of the time. For infants between 33 and 36 6/7 weeks, extra blankets were used 54% and the correct size was used 92% of the time.

Post-Education Audit Cycle 2 Results:

One hundred and forty-four data points were evaluated in the post-education audit. It was found that the minimum gestation was 27.0 weeks, the maximum was 34.2 weeks and the mean was 31.278 at birth, and at collection time, the minimum gestation at collection was 24.6, maximum was 35.6 and mean was 32.494. Following education, 33% of the time infants were positioned supine, 31% of the time prone and 33% of the time they were positioned side-lying.

When positioned supine post-education at the gestational ages of 25-29 6/7 weeks, infants were positioned correctly 48% of the time, prone correctly 79% of the time and side-lying 75% of the time. For gestational ages 30-32 6/7 weeks, infants were positioned correctly supine 50% of the time, prone 81% of the time and side-lying 50% of the time. Gestational ages of 33-35 6/7 weeks, infants were correctly positioned supine 43% of the time, prone 96% of the time and side-lying 64% of the time.

Following education, infants with gestational ages at birth between 25 and 29 6/7 weeks had extra blankets used 88% of the time, and the correct size was utilized 82% of the time. For gestational ages 30-32 6/7 weeks, extra blankets were used 73% of the time, and the correct size was chosen 100% of the time. And for infants between 33 and 36 6/7 weeks, extra blankets were used 45% and the correct size was used 99% of the time. Overall, following education, there was a 64.29% improvement in how often the infant was positioned correctly.

Pre-Education and Post-Education Data Comparisons

Initially, an independent sample's t-test was run on the data looking at position as there are 2 samples. Levene's test is part of the t-test and helps to guide if there is equal variance or not. Levene's test is performed in SPSS automatically prior to statistical analysis when you have an independent samples t-test. This test is used to identify homogeneity of variance between groups to aid in identifying significant difference in the variance. This particular Levenes test is

comparing position/correct size and use of extra blanket pre/post. As Levene's p value for position is .023 you use the equal variances not assumed and when looking at that p value, it shows that pre/post OCI the position does not have a statistically significant change. Next is correct size; the Levene's p value is .000, again use equal variances not assumed, that P value is .000, so there is a statistical difference before and after education related to correct size. Lastly, for extra blankets, Levene's test p value was .005, so again we look at equal variances not assumed, and that p value is .084, therefore there is no statistically difference pre/post OCI in relation to use of extra blankets (See Table I).

Spearman's Rho was utilized to determine correlation between the variables; it is utilized to assess how well the relationship between the two variables can be described using the monotonic function, (Polit, 2010, p. 205). Spearman's Rho found that, prior to education, as gestational age at birth and collection increased, there are less extra blankets used (CC: -0.300, p=.002, CC: -0.275, p=.005). It also found that, as gestational age and birth and at collection increased, the correct size was utilized more often (cc: 0.595, p=.000, cc: 0.600, p=.000). Following education, the same correlations were found, as gestational age at birth, and collection increased, correct size was used more often, (cc: 0.366, p.000, cc: 0.339, p=.000) and as gestational age at birth, and collection increased, there as less use of extra blankets, (CC: -0.246, p=.003, cc: -0.311, p=.000) (See Table II).

Prior to education, the correct size was chosen 50% of the time in supine when not positioned correctly, and 75% of the time when positioned correctly; prone, the correct size was chosen 0% of the time when the position was not correct, but 77% of the time when the position was correct; and, when in side-lying, the correct size was chosen 42% of the time when the

infant was not positioned correctly, but 93% of the time when the infant was positioned correctly, as seen in Table III.

Following education, the correct size was chosen 88% of the time when infants were not positioned correctly supine, but 100% of the time when infants were supine correctly; when incorrectly in the prone position, the correct size was chosen 77% of the time, and when positioned correctly 89% of the time; and in side-lying, when incorrectly positioned, the correct size was chosen 100% of the time, and when positioned correctly was chosen 87% of the time. (See Table XV). There was no large difference prior to and following education regarding the use of extra blankets in the SnuggleUp™ (See Table IV).

Although not found to be vastly different, there was a difference between prior to education and following education regarding the amount of time that infants were positioned correctly when the size of the SnuggleUp™ was correct, as well as there being no extra blankets. See Tables V and VI. Prior to education, when the correct wrap was utilized and there are no extra blankets, 30% of time infants were correctly softly supine, 18% were properly prone, and 43% were correctly in side-lying (See Table VII).

Following education, when the size of the SnuggleUp™ was correct, as well as there being no extra blankets, the percentages of time infants were positioned correctly was improved when softly supine and properly prone. 33% of time infants were correctly softly supine, 45% were properly prone, and 32% were correctly in side-lying (See Table VIII). There is an overall improvement of 10% when positioned softly supine, and 150% when positioned properly prone.

A more in-depth t-test was SPSS to determine if any of the above data had statistical significance. In able to properly run this data via SPSS, the correct size of the wrap and the extra blankets were made the Independent Variables to compare the mean pre/post (See Table IX).

This table showed that when infants were incorrectly positioned softly supine, it was significantly worse when the correct size was not chosen, meaning if infants were not in the correct size, more infants were positioned incorrectly. When infants were positioned incorrectly in the properly prone position, it correlated with the incorrect size of the SnuggleUp™ wrap, as well; prior to education, there were no infants incorrectly positioned prone that were in the incorrect size; however, following education, all infants who were positioned incorrectly prone were also in the correct size of SnuggleUp™ wrap. When infants were correctly in the properly prone position, it was significantly improved following education when there were no extra blankets utilized. When infants were not correctly positioned side-lying prior to education, 42% of infants were in the correct size of SnuggleUp™, but following education, 100% of infants positioned incorrectly were in the right size of SnuggleUp™ wrap. These results make it seem as though having the correct size does not impact if they are positioned incorrectly.

Lastly, this comparison is regarding gestational ages at birth in relation to the use of correct size with no extra blankets. The results showed that prior to education the ages of 25-29 6/7 weeks, only 4 infants were positioned correctly. Infants between 30 weeks and 32 6/7 weeks prior to education were positioned correctly 6 times, and infants between 33 and 34 6/7 weeks at birth were correctly positioned 6 times (See Table X).

Following education, the ages of 25-29 6/7 weeks, only 3 infants were positioned correctly. Infants between 30 weeks and 32 6/7 weeks prior to education were positioned correctly 3 times, and infants between 33 and 34 6/7 weeks at birth were correctly positioned 28 times. This shows that even though not statistically significant, there was an improvement in positioning infants correctly with the correct size of SnuggleUp™ with no extra blanket for

infants who are 33 – 34 6/7 weeks gestation at birth, showing that there was a 24.7% improvement following education (See Table XI).

Discussion

Proper developmental positioning in the NICU provides the foundation for motor skill development through postural support utilizing the SnuggleUp™ wrap. Attention to optimal positioning of the body in a flexed manner is consistently inconsistent in every day practice. Since the application of developmentally supportive care has been shown to improve neurodevelopmental outcomes and reduce long term costs, this is an important practice to focus on going forward.

A study conducted by Sathish et al. (2017) discussed using a SnuggleUp ™ when positioning compared to the routine and found a significant difference between the two groups in terms of cardiorespiratory and documented SCRIP scores, as well as reduced hospital stays and a significant improvement in weight gain in comparison to the control group. Another study completed by Kihara & Nakamura (2013) found that a position with nested and swaddled positioning support might facilitate sleep and heart rate stability compared to prone positioning alone in very low birth weight infants. Another study done by Zarem et al. (2013) aimed to determine the perceptions about positioning and the differences between nurses and therapists in regards to the ideal method. This study found that the Dandle-Roo™ by Dandle Lion was the easiest positioning method when put up against the SnuggleUp™ wrap by Phillips, Sleep Sack™ by Halo, Bendy Bumper™ by Phillips or Dandle-Wrap™ by Dandle Lion. Lastly, a study completed by Vaivre-Douret and Golse (2007) compared homemade cocoon made out of soft rolled up sheets and the comparison is a designed support with a flexible material inside the pad to adjust positioning boundaries. This study found a significant and beneficial difference that

favored the cocoon in maintaining appropriate physiologic orthopedic and postural positioning.

The present study was conducted to establish knowledge about the use of the SnuggleUp™ following education utilizing the unit's current mode of education, the Occupational Competency Index. Though the data showed that there was not statistically significant change in position prior to and following education, there was data that showed that there was an improvement in positioning infants correctly with the correct size of SnuggleUp™ with no extra blanket for infants who are 33 – 34 6/7 weeks gestation at birth. There were also correlations between the increased gestational age at collection and the decrease in use of extra blankets in the SnuggleUp™ Wraps. The key findings of this study are that neonatal positioning of the preterm infant can have important developmental effects. Preterm infants who are positioned properly flexed will have improved long term outcomes. To our knowledge, this is the first quality improvement to target proper use of the SnuggleUp™ wrap with the guidelines from the manufacturer.

The results of this research also suggest that nurses might be insufficiently reflective of their positioning practices. It seems that most nurses are highly satisfied with their positioning abilities and report so verbally during interactions. They feel that they have gained knowledge that they integrate into their positioning practices from the Occupational Competency Index, however, there was not statistically significant data to support this.

Nurses require the appropriate tools and necessary education to provide patient care that is evidence-based and improves outcomes. This research indicates that the education with the Occupational Competency Index may not have been a sufficient amount of education since there was no statistical improvement made in infants' quality and consistency of positioning following the education.

Limitations, Recommendations, Implications for Practice

Limitations

The first limitation to the current research study is the subjective nature of the data collection tool utilized during the data collection. Given that each infant has unique health conditions, some subjective consideration of each infant's medical situation contributed to the final assessment of the positioning of the infant. This limitation was minimized due to only one individual collecting data.

Secondly, it was noted that even following education, there was limited nurse 'buy-in', as evidence by multiple conversations with bedside nurses, as well as based on history. Historically speaking, bedside nurses are passionate about patient care. Their passion is contagious, and if one nurse passes on their positive experience about proper positioning, the desire will be shared to all. Few nurses were unwilling to apply the recommended positioning at first; this was expected as some people are more resistant to change than others. It was also noted by the collector that, during the high census times with the increased acuity, it was more noticeably neglected to consider the positioning as a priority.

Third, the short-term design of this study limited determining any long-term outcomes. Future research could be done to result any long-term developmental outcomes related to this topic.

The fourth limitation relates to nurse staffing, as frequently nurses have two infants in their assignment with the same care time. This has the potential to leave nurses feeling rushed to get to their next room. Developmental positioning is one of the last things a nurse does prior to leaving an infant's room. The possibility exists that nurses are not spending adequate time positioning infants.

The final limitation concerned the actual SnuggleUp™ wrap itself for two reasons. First of all, no infants were positioned in a brand new wrap; all were previously used and had been washed. Due to the washing and being used previously, the bolstering was noted to be slightly worn down. Due to frequent movements of the infants themselves, these supporting elements did not always provide the boundaries as expected, therefore not always maintaining the physiologically correct position as desired.

Recommendations

One recommendation is to use hands-on education in utilizing the present nursing education tool. Nurses learn best in person as Charafeddine et al. (2018) documented. It would also be potentially helpful to have a pre and post-test given to nursing staff. This way it would be documented if their understanding of the importance of developmental positioning is improved following the in-person education. It would also be helpful to consider utilizing the IPAT tool in conjunction with if the SnuggleUp™ is being utilized correctly. The IPAT tool gives a score which could be helpful for nurses to recognize improvement. The other option is to utilize the NICU Network Neurobehavioral Scale (Madlinger-Lewis et al, 2014). Another potential recommendation or consideration is changing the developmental positioning tool; other options to consider include the DandleRoo, the Zacky, or the Z-Flow mattress.

To further the progress made in this QI project in developmental positioning in this unit, as well as potentially other units, it is suggested that in person, hands on education should be provided to all staff as the initial form of education. There should also be regularly scheduled continued formal in-services to aid in catching new hire nurses. Bedside consultation sessions with nursing staff to provide live feedback, as well as encourage the staff to reflect on their positioning practices with guidance at the bedside, would be helpful between the researcher and

or the developmental team. Nursing staff should also be educated on discussing the positioning of the infants during their bedside report to one another in their care plans. It is felt by the researcher that the more in-person time with the nurses, the more potential buy in and the higher potential for continued improvement.

There is potential for further research into this subject, as research samples were relatively small due to it being in an individual unit. Collaborative, larger-scale research between neonatal units is needed to increase the validity of data and help to improve preterm infants' outcomes.

Implications for Practice

The study results encourage further education regarding not only the use of SnuggleUp™ wraps, but the overall importance of developmental positioning in a hands-on and continued matter. It is speculated that proper infant positioning can translate into less positional deformities and better developmental outcomes.

Conclusion

Using the quality improvement approach, this project demonstrated that the use of the Occupational Competency Index, along with the hands-on practice, was not enough to show a statistical improvement in the practice. The use of a structured knowledge assessment test after the Occupational Competency Index could be helpful to improve the outcomes. This project did not require significant funding in order to achieve a small change in practice. Developmental positioning continues to be inconsistently applied and effective ways to improve proficiency of NICU staff is still needed.

Though there was not a drastic improvement in quality and consistency of infants' positioning, this project did improve patient care with no additional cost to the unit. The strength

of this project lies in the rigor of its methodology, the reliability of the outcomes measured by the data collection tool and the high inter-rater reliability of the one researcher. It is felt that this quality improvement project has enhanced the culture in the unit; there is markedly greater discussion related to positioning with continuous open feedback from nurse to nurse, as well as NNP to bedside nurses, that is crucial to further improvement in this area in the unit. The engagement and support of stakeholders and the involvement of the team will continue to improve the outcomes in this unit; this will contribute to the overall buy in of all staff involved and ultimately to change the behavior.

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The author received no sources for funding of this project to declare.

Conflict of Interest

As stated above, there was no outside funding for this research. The primary researcher is employed at the facility where the research took place. The facility covered no outside costs for the needs of this research.

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List of Tables

Table I) Independent Samples t-test/Levene's Test for Equality of Variances

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
position	Equal variances assumed	5.204	.023	-1.405	248	.161	-1.516	1.079	-3.641	.609
	Equal variances not assumed			-1.390	215.161	.166	-1.516	1.091	-3.666	.634
correctsize	Equal variances assumed	138.399	.000	-5.714	248	.000	-.284	.050	-.382	-.186
	Equal variances not assumed			-5.306	158.802	.000	-.284	.054	-.390	-.179
extrablanket	Equal variances assumed	8.001	.005	1.381	248	.169	.084	.061	-.036	.204
	Equal variances not assumed			1.394	231.685	.165	.084	.060	-.035	.203

Table II) Spearman's Rho Correlations Split Data Pre/Post OCI

Correlations

prepostOCI				position	extrablanket	correctsize	gaab	gaac	daysold	prepostOCI
Spearman's rho	2	position	Correlation Coefficient	1.000	−.044	.146	.064	.063	.067	.
			Sig. (2-tailed)	.	.653	.137	.515	.524	.500	.
			N	105	105	105	105	104	105	105
		extrablanket	Correlation Coefficient	−.044	1.000	−.078	−.300**	−.275**	.328**	.
			Sig. (2-tailed)	.653	.	.430	.002	.005	.001	.
			N	105	105	105	105	104	105	105
		correctsize	Correlation Coefficient	.146	−.078	1.000	.595**	.600**	−.235*	.
			Sig. (2-tailed)	.137	.430	.	.000	.000	.016	.
			N	105	105	105	105	104	105	105
		gaab	Correlation Coefficient	.064	−.300**	.595**	1.000	.928**	−.526**	.
			Sig. (2-tailed)	.515	.002	.000	.	.000	.000	.
			N	105	105	105	105	104	105	105
		gaac	Correlation Coefficient	.063	−.275**	.600**	.928**	1.000	−.294**	.
			Sig. (2-tailed)	.524	.005	.000	.000	.	.002	.
			N	104	104	104	104	104	104	104
		daysold	Correlation Coefficient	.067	.328**	−.235*	−.526**	−.294**	1.000	.
			Sig. (2-tailed)	.500	.001	.016	.000	.002	.	.
			N	105	105	105	105	104	105	105
		prepostOCI	Correlation Coefficient	.	.	.	.	.	.	.
			Sig. (2-tailed)	.	.	.	.	.	.	.
			N	105	105	105	105	104	105	105
	3	position	Correlation Coefficient	1.000	−.021	−.011	.043	.115	.105	.
			Sig. (2-tailed)	.	.801	.900	.611	.168	.208	.
			N	145	145	145	145	145	145	145
		extrablanket	Correlation Coefficient	−.021	1.000	−.111	−.246**	−.311**	−.181*	.
			Sig. (2-tailed)	.801	.	.183	.003	.000	.029	.
			N	145	145	145	145	145	145	145
		correctsize	Correlation Coefficient	−.011	−.111	1.000	.366**	.339**	−.068	.
			Sig. (2-tailed)	.900	.183	.	.000	.000	.415	.
			N	145	145	145	145	145	145	145
		gaab	Correlation Coefficient	.043	−.246**	.366**	1.000	.843**	−.134	.
			Sig. (2-tailed)	.611	.003	.000	.	.000	.109	.
			N	145	145	145	145	145	145	145
		gaac	Correlation Coefficient	.115	−.311**	.339**	.843**	1.000	.281**	.
			Sig. (2-tailed)	.168	.000	.000	.000	.	.001	.
			N	145	145	145	145	145	145	145
		daysold	Correlation Coefficient	.105	−.181*	−.068	−.134	.281**	1.000	.
			Sig. (2-tailed)	.208	.029	.415	.109	.001	.	.
			N	145	145	145	145	145	145	145
		prepostOCI	Correlation Coefficient	.	.	.	.	.	.	.
			Sig. (2-tailed)	.	.	.	.	.	.	.
			N	145	145	145	145	145	145	145

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

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

Table III) Pre-Education Correct Size by Position

Pre-Education Correct Size by Position %	%
Softly Supine No	14/28 = 50%
Softly Supine Yes	15/20 = 75%
Properly Prone No	0/2 = 0%
Properly Prone Yes	17/22 = 77%
Side-Lying No	8/19 = 42%
Side-Lying Yes	14/14 = 93%

Table IV) Post-Education Correct Size by Position

Post-Education Correct Size by Position %	%
Softly Supine No	23/26 = 88%
Softly Supine Yes	21/21 = 100%
Properly Prone No	10/13 = 77%
Properly Prone Yes	34/38 = 89%
Side-Lying No	16/16 = 100%
Side-Lying Yes	27/31 = 87%

Table V) Pre-Education No Blankets

Pre-Education No Blankets	%
Softly Supine No	11/28 = 18%
Softly Supine Yes	8/20 = 40%
Properly Prone No	1/2 = 50%
Properly Prone Yes	4/22 = 18 %
Side-Lying No	5/19 = 26 %
Side-Lying Yes	6/14 = 43%

Table VI) Post-Education No Blankets

Post-Education No Blankets	%
Softly Supine No	7/26 = 27 %
Softly Supine Yes	7/21 = 33 %
Properly Prone No	8/13 = 62 %
Properly Prone Yes	17/38 = 45%
Side-Lying No	6/16 = 38 %
Side-Lying Yes	10/31 = 32%

Table VII) Pre-Education Correct Size No Blankets

Pre-Education Correct Size No Blankets %	%
Softly Supine No	4/28 = 14%
Softly Supine Yes	6/20 = 30%
Properly Prone No	0
Properly Prone Yes	4/22 = 18%
Side-Lying No	1/19 = .05%
Side-Lying Yes	6/14 = 43%

Table VIII) Post-Education Correct Size No Blankets

Post-Education Correct Size No Blankets %	%
Softly Supine No	7/26 = 27%
Softly Supine Yes	7/21 = 33%
Properly Prone No	4/13 = 31%
Properly Prone Yes	17/38 = 45%
Side-Lying No	6/16 = 38%
Side-Lying Yes	10/31 = 32%

Table IX) Independent t-test Split by Position

Independent Samples Test

position			Levene's Test for Equality of Variances		t-test for Equality of Means						
										95% Confidence Interval of the Difference	
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
40	correctsize	Equal variances assumed	37.556	.000	-3.589	52	.001	-.420	.117	-.655	-.185
		Equal variances not assumed			-3.645	46.394	.001	-.420	.115	-.652	-.188
	extrablanket	Equal variances assumed	.100	.753	.158	52	.875	.019	.122	-.225	.263
		Equal variances not assumed			.158	51.475	.875	.019	.122	-.225	.264
41	correctsize	Equal variances assumed	59.927	.000	-2.580	39	.014	-.250	.097	-.446	-.054
		Equal variances not assumed			-2.517	19.000	.021	-.250	.099	-.458	-.042
	extrablanket	Equal variances assumed	.711	.404	-.433	39	.667	-.067	.154	-.378	.245
		Equal variances not assumed			-.433	38.689	.668	-.067	.154	-.378	.245
50	correctsize	Equal variances assumed	4.245	.060	-2.404	13	.032	-.769	.320	-1.461	-.078
		Equal variances not assumed			-6.325	12.000	.000	-.769	.122	-1.034	-.504
	extrablanket	Equal variances assumed	.098	.760	.290	13	.777	.115	.398	-.745	.976
		Equal variances not assumed			.222	1.163	.857	.115	.519	-4.650	4.881
51	correctsize	Equal variances assumed	6.342	.015	-1.271	58	.209	-.122	.096	-.314	.070
		Equal variances not assumed			-1.168	33.945	.251	-.122	.104	-.334	.090
	extrablanket	Equal variances assumed	21.927	.000	2.121	58	.038	.266	.125	.015	.516
		Equal variances not assumed			2.263	52.692	.028	.266	.117	.030	.501
60	correctsize	Equal variances assumed	202.752	.000	-5.085	33	.000	-.632	.124	-.884	-.379
		Equal variances not assumed			-5.555	18.000	.000	-.632	.114	-.870	-.393
	extrablanket	Equal variances assumed	1.770	.193	.694	33	.492	.112	.161	-.216	.439
		Equal variances not assumed			.688	30.666	.496	.112	.162	-.220	.443
61	correctsize	Equal variances assumed	1.353	.251	.558	43	.579	.058	.103	-.150	.266
		Equal variances not assumed			.612	31.694	.545	.058	.094	-.134	.249
	extrablanket	Equal variances assumed	1.250	.270	-.676	43	.503	-.106	.157	-.422	.210
		Equal variances not assumed			-.656	23.476	.518	-.106	.162	-.440	.228

Table X) Pre-Education Correct size with No Blankets by Gestation

Pre-Education Correct Size with No Blankets 25 -29 6/7 Weeks Gestation @ Birth	
Softly Supine No	0
Softly Supine Yes	3
Properly Prone No	0
Properly Prone Yes	1
Side-Lying No	0
Side-Lying Yes	0

Pre-Education Correct Size with No Blankets 30-32 6/7 Weeks Gestation @ Birth	
Softly Supine No	0
Softly Supine Yes	1
Properly Prone No	0
Properly Prone Yes	2
Side-Lying No	0
Side-Lying Yes	3

Pre-Education Correct Size with No Blankets 33-34 6/7 Weeks Gestation @ Birth	
Softly Supine No	4
Softly Supine Yes	2
Properly Prone No	0
Properly Prone Yes	1
Side-Lying No	1
Side-Lying Yes	3

Table XI) Post-Education Correct Size with No Blankets by Gestation

Post-Education Correct Size with No Blankets Gestation 25-29 6/7 Weeks	
Softly Supine No	1
Softly Supine Yes	1
Properly Prone No	2
Properly Prone Yes	1
Side-Lying No	0
Side-Lying Yes	1

Post-Education Correct Size with No Blankets Gestation 30-32 6/7 Weeks	
Softly Supine No	0
Softly Supine Yes	1
Properly Prone No	1
Properly Prone Yes	1
Side-Lying No	1
Side-Lying Yes	1

Post-Education Correct Size with No Blankets Gestation 33-34 6/7 Weeks	
Softly Supine No	6
Softly Supine Yes	5
Properly Prone No	2
Properly Prone Yes	15
Side-Lying No	5
Side-Lying Yes	8

Appendices

A. Budget

B. Timeline

C. Logic Model

D. Phillips Brochure

E. OCI Education

F. Data Collection Tool

G. Letter from Dr. Ross

H. Letter from Unit Director

I. Letter from Ethics Director

J. Information Sheet for Participation in a Research Study

K. IRB Exempt Letter – Regis

L. IRB Exempt Letter – HealthOne

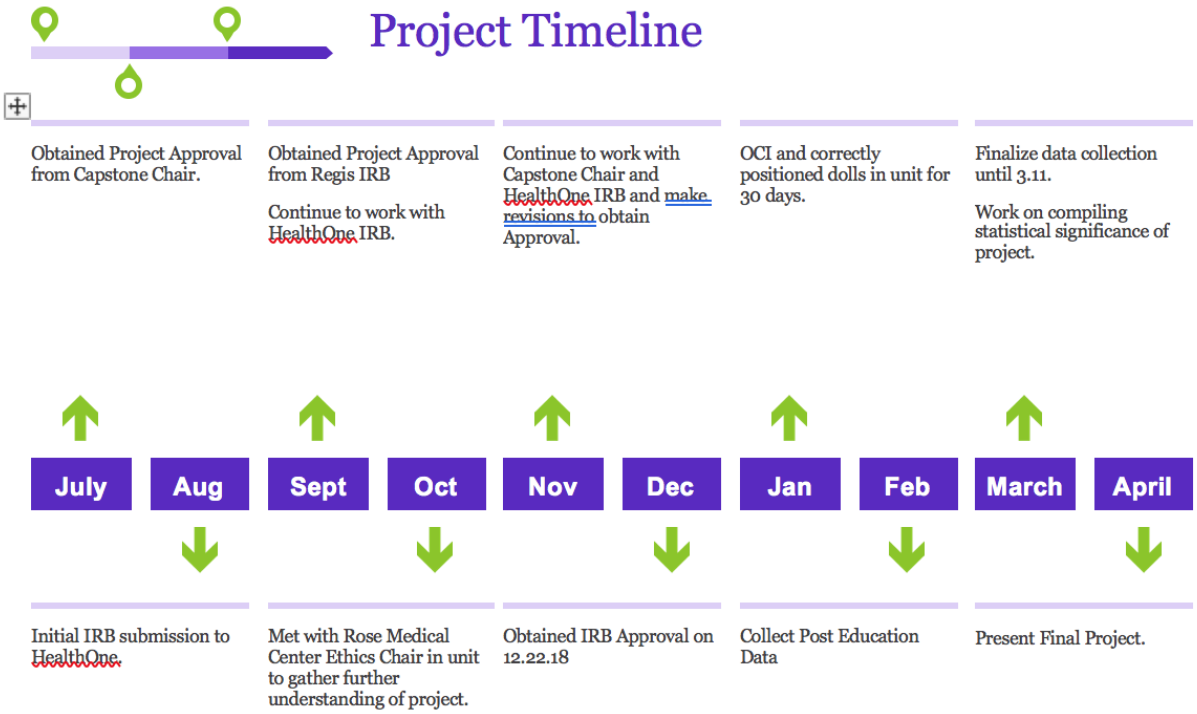
M. Citi Training

N. Literature Review Table

Appendix A – Budget

Evaluation	Itemized Cost	Total Annual Cost
DNP Students time evaluating	Average NNP hourly wage of $55 x 16 hours total evaluating	$880
OCI	Average RN hourly wage of $30 x 1.5 hours each x 41 nurses	$1845 (However not additional expense as not done outside of normal work hours)
SuggleUp wraps	Not additional cost to our unit, already in use.	$0
Professional Printing of OCI	One Copy of OCI printed at Local Print shop for $25	
4 Baby dolls for students to practice on	2 Dolls at $4 each 1 Doll for $12 1 Doll for $15	Total of $35

Appendix B- Timeline



Appendix C) Logic Model

RESOURCES	ACTIVITIES	OUTPUTS	SHORT & LONG-TERM OUTCOMES	IMPACT
In order to accomplish our set of activities we will need the following:	In order to address our problem or asset we will accomplish the following activities:	We expect that once accomplished these activities will produce the following evidence of service delivery:	We expect that if accomplished these activities will lead to the following changes in 1-3 then 4-6 years:	We expect that if accomplished these activities will lead to the following changes in 7-10 years:
- Support from unit educator. - Knowledge and support from developmental specialist of the unit. - Buy in from the staff - IRB Approval unless determined to be exempt as a QI. - Appropriate pre audits of infants 25 0/7 weeks to 34 6/7 weeks. - Appropriate education utilizing the Occupational Competency Index (OCI). - Ability to interpret pre audit, educate and interpret post audit.	-Develop support from unit educator and unit developmental therapist so everyone can be on the same page. -Develop assessment tool to be utilized for pre and post audits, which will include positioning poster from SnuggleUp website, as well as yes/no questions assessing appropriate size, additional blankets, and flexion of upper and lower body. -Appropriate education based on supplies/equipment that unit already has via the OCI, and hands on doll in SnuggleUp.	-Assessment tool will be validated by the developmental therapist of the Metropolitan unit, as well as the occupational therapist, and the developmental therapist of the larger sister hospital. -Ability to complete the pre and post audits of a pre-determined sample size. -Successfully get the OCI education to all of the nurses on the unit.	-Successfully complete the OCI, and educate the entire nursing staff about proper use of the SnuggleUp, including correct size, positioning, and flexion of upper/lower body. -In doing the education notice an improvement in positioning of infants in the follow up audits. -If there is not a significant/notable difference in positioning following education consider doing a follow up study regarding nursing perceptions, or look into if positioning is improved when nurses have only 2 patients vs. 3.	-Improved continuing education of present staff as well as an understood importance of passing this knowledge on to both new employees of our hospital, as well as new graduate nurses who start in our unit. -Improved knowledge of the positioning aids we have to work with, instead of the economical burden of wanting to purchase new equipment. -Improved long term muscular and neurodevelopmental outcomes of sick and preterm infants.

Appendix D) Phillips Brochure

Appendix E) OCI Education

Neonatal Positioning Education

Dalacy Jesina, DNPc, NNP-BC

Background

- In the United States Preterm birth impacts about 500,000 infants every year. And it is the leading cause of long term neurodevelopmental disability with an estimated cost of $26 billion dollars per year.
- Babies born before 37 weeks lack muscle strength to control movements.
- Immature babies are prone to muscle imbalance
- Preterm infants do not have the typical fetal position because of their decreased amount of time in utero – a lack of physiologic flexion

Fetal Position in the Womb

- In Utero the Infant has:
  - Flexed arms and legs
  - Knees and elbows tucked to Midline
  - A curved Spine
  - The head is tucked Forward
  - Hands midline and to mouth
  - Posterior Pelvic Tilt
  - Foot bracing

Preemies miss out on the Womb

- Muted Sensory input from lights and sounds
- Maternal Rhythms help to develop levels of consciousness
  - Heartbeat
  - Breath sounds
  - Circulatory system
  - Movement
- Physiologic Flexion – basis for all functional activity which increases with gestational age.

Importance of Positioning

- Provides the building blocks to promote physical development
- Curled up position helps baby control his/her behavior to feel safe and secure.
- Help protect fragile skin and joints
- Improve sleep quality
- Encourage relaxation
- Help conserve body heat and reduce energy
- Help baby understand midline coordination
- Optimize respiratory function
- Develops visual skills

What Do We Know?

- Developmental Positioning:
  - Promotes normal postural & musculoskeletal development
  - Maintains a patent airway
  - Promotes thermal regulation
- Infants who are developmentally positioned:
  - Cry less, have less flailing of their extremities and fewer behavioral indicators of pain
  - Have improved physiologic outcomes and sleep states

Common Positioning Problems

- No prone Support
- No posterior pelvic tilt
- No foot support or opportunity for foot bracing
- Hands not near mouth/face
- Not enough space given in swaddle for movement of lower extremeties
- Neck Hyperextension

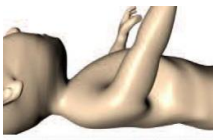
Poor Positioning: Negatively Impacts:

- Cerebral Blood Flow
- Blood Pressure
- FiO2 Needs
- Pain Scores
- Sleep & Rest
- Need for PT
- Motor Development
- Parental anxiety and satisfaction
- Nursing Satisfaction

Possible Musculoskeletal Issues

- Shoulder Girdle alignment affects
  - Midline activities
  - Weight-bearing on elbows
  - Reaching
  - Sitting
  - Shoulder rounding
  - Rolling
  - Arm/shoulder instability in prone position
  - Weight-bearing on hands – handwriting and fine motor coordination.

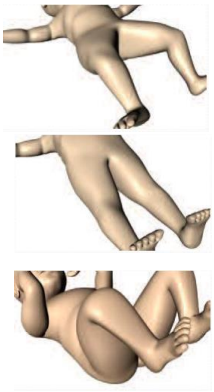
Shoulders: Do/Don't



- Don't – Keep Shoulder Retracted
- Ok to keep shoulders flat/neutral
- Do- Keep shoulders softly rounded

- Pelvic tilt and hip alignment affect:
  - Biomechanical interface with skilled movement
  - Weight-bearing
  - Sitting
  - Crawling
  - Rolling
  - Gait
  - Balance

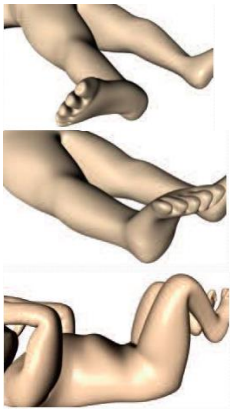
Hips: Do's & Don't



- Don't – Keep hips abducted, or externally rotated
- Don't – Keep Hips extended
- Do – Keep hips aligned and softly flexed

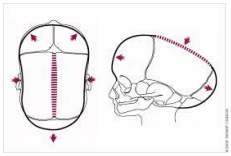
- Foot Alignment/Bracing affects;
  - Occurrence of tibial torsion, ankle eversion, foot pronation
  - Proper weight-bearing
  - Gross motor activities

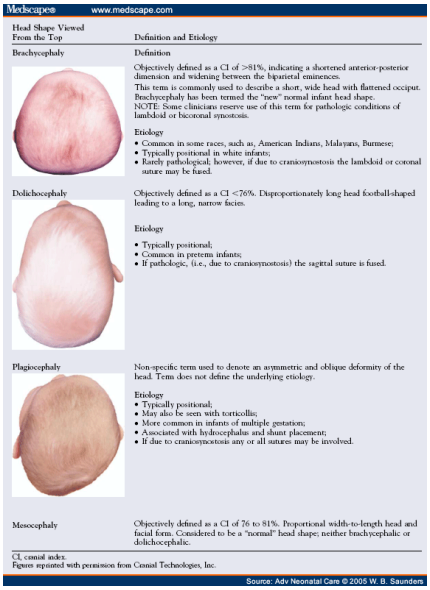
Knees, Ankles, & Feet: Do/Don't



- Don't – Knees extended and ankles/feet externally rotated
- Don't – Knees, ankles & feet extended
- Do: Keep Knees, ankles and feet aligned and softly flexed.

- Head/Neck alignment affects:
  - Head Centering/midline activities
  - Head control in prone and sitting
  - Limited downward visual gaze
  - Long term developmental implications
  - Head shaping
    - Brachcephaly (posterior head flattening)
      - Rolling
      - Weight-bearing on elbows
    - Plagiocephaly (Bulge in posterior quadrant with bulge in opposite anterior quadrant)
      - Head turning preference
      - Torticollis
    - Scaphocephaly (side to side flattening
      - Eye/Vision Problems





Medscape www.medscape.com

Head Shape Viewed From the Top	Definition and Etiology
Brachycephaly	Definition Objectively defined as a CI of >81%, indicating a shortened anterior-posterior dimension and widening between the biparietal eminences. This term is commonly used to describe a short, wide head with flattened occiput. Brachycephaly has been termed the "new" normal infant head shape. NOTE: Some clinicians reserve use of this term for pathologic conditions of lambdoid or bicoronal synostosis. Etiology • Common in some races, such as, American Indians, Malayans, Burmese; • Typically positional in white infants; • Rarely pathological; however, if due to craniosynostosis the lambdoid or coronal suture may be fused.
Dolichocephaly	Objectively defined as a CI <76%. Disproportionately long head football-shaped leading to a long, narrow facies. Etiology • Typically positional; • Common in preterm infants; • If pathologic, (i.e., due to craniosynostosis) the sagittal suture is fused.
Plagiocephaly	Non-specific term used to denote an asymmetric and oblique deformity of the head. Term does not define the underlying etiology. Etiology • Typically positional; • May also be seen with torticollis; • More common in infants of multiple gestation; • Associated with hydrocephalus and shunt placement; • If due to craniosynostosis any or all sutures may be involved.
Mesocephaly	Objectively defined as a CI of 76 to 81%. Proportional width-to-length head and facial form. Considered to be a "normal" head shape; neither brachycephalic or dolichocephalic.

CI, cranial index.
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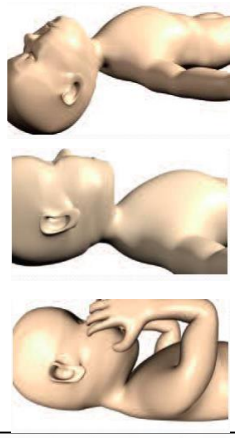
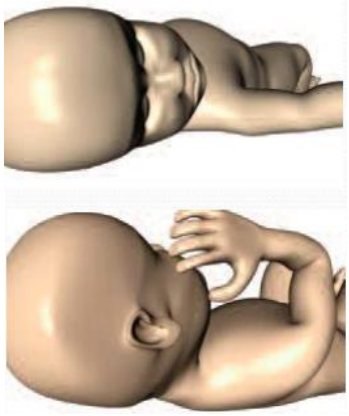
Source: Adv Neonatal Care © 2005 W. B. Saunders

Head/Neck: Do's & Don't



- Don't – Hyperextend the Neck
- Ok to keep Neck Neutral
- Best to keep Neck neutral, head slightly flexed forward 10 degrees.

Head: Do/Don't Continued



- Don't – Rotate head laterally greater than 45 degrees from midline.
- Do – Position infant midline or less than 45 degrees from midline.

Hands: Do's/Don't

- Don't – Keep hands away from the Body, avoid 'W'
- Ok to have hands touching torso
- Do – have hands touching face

- Overall Extensor Pattern
  - Toe Walkers
  - Restricted mobility at pelvis, scapulae, hips, feet and elbows
  - Insufficient play in prone

- Potential Deformities Related to Positioning
  - Frog Leg – Gravity causes weak arms and legs to flop out to sides, leading to muscle imbalance
    - Ability to transition in/out of prone and sitting
    - Hip stability in 4-point crawl
    - Prolonged weight-based gait
    - Excessive out-toe gait
    - Tendency for babies to feel unsafe and stressed

  - Everted feet (turned out)
  - Hyperextended neck and retracted shoulders
  - Abnormal head shaping

- Pelvic tilt and hip alignment affect:
  - Biomechanical interface with skilled movement
  - Weight-bearing
  - Sitting
  - Crawling
  - Rolling
  - Gait
  - Balance

Benefits of Supportive Positioning

- Promotes physiologic stability (joint stability, muscular development and tone, and alignment).
- Increases O2 sats and decreased RR and HR
- Promotes deep sleep
- Facilitates different levels of consciousness/ arousal
- Promotes neurobehavioral development/stability
- Promotes self-regulation
- Reduces stress
- May decrease need for analgesics/sedatives

Ideal Supported Positioning

-Recall the Womb-

- Flexed
- Head in midline, neutral neck
- Shoulder protraction
- Hands to midline/mouth
- Posterior pelvic tilt
- Neutral hips and feet
- Boundaries with some freedom of movment
- Tactile input
- Varied positions (while maintaining/supporting flexed posture)

Positional Support

- In the Womb:
  - Tight abdominal muscles
  - Bony pelvis and spine
  - Diaphragm
- Incubator:
  - Nest (SnuggleUp)
  - Gel pillow
  - Freddy Frog

Things to Consider with SnuggleUp

- Positioning aids can help facilitate thermo-regulation – should be taken into consideration when adjusting temps
- Infants should be repositioned at each scheduled care time, alternating positions between supine, side-lying and prone. This decreases joint compression and decreases risk for skeletal deformities, muscle shortening, and promotes ossification and bone density.
- Infants whom are fragile or on life support need special consideration to ensure varied positions are still achieved.

Nesting

- Nesting is one key factor in maintaining a beneficial position for neonates
- Use a SnuggleUp wrap to provide a safe and supportive nest.
- Be sure to choose the size based on infants current weight.
- Do not put extra blanket rolls inside the SnuggleUp
- Avoid restraining the lower extremities and not attending to the body head and arms.

Nesting in SnuggleUp: Supine/Side Lying

- Position baby deep in the bunting pocket with the hips and knees flexed
- Position the infant with the shoulders supported against the back part of the SnuggleUp
- In Side-lying place small roll between infants knees to maintain hip flexions
- Strap the baby in

Nesting in SunggleUp: Prone

- Make the appropriate sized surfboard to support the infants trunk
- Place the linen support at the infants collarbone
- Place the infant deep in the pocket of the SnuggleUp
- Allow the shoulders to fall forward and the arms to ‘hang’
- Place the strap around the infants back

Supine

- Gravity causes limbs to flop outwards, therefore it is important to provide appropriate support to prevent this.
- It reduces narrow head shape
- Having head midline will aid in development
- Supine position is not optimal for oxygenation/ energy expenditure
- Clear Visual monitoring
- Avoid the ‘W’ shape – it contributes to scapular retractions.

Side-lying

- Gravity is useful in this position!
- Limbs brought together to midline
- Helps develop hand to mouth coordination
- Ventilation/perfusion best in upper lungs
- Shoulders should be rounded
- Arms and head should be midline
- Avoid knees and feet from going horizontal

Prone

- Use a surfboard under the snuggleup to allow the truck to round downward toward the mattress – it should be below the neck, starting at the collarbone.
- Supports sternum and rib cage
- Optimal for oxygenation
- Increases time in quiet sleep
- Lowers energy expenditure
- Baby must be monitored

Proper Use of SnuggleUp

Supine

Side Lying

Proper Use of SnuggleUp: Prone

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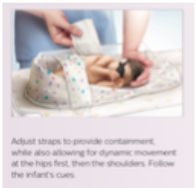
Appendix F) Data Collection Tool

DATA COLLECTION TOOL

SOFTLY SUPINE

PROPERLY PRONE



SIDE-LYING SUPPORT

CORRECT SIZE

EXTRA BLANKETS

PRE OCI POST OCI

COMPARISON OF NEONATES POSITIONS IN SNUGGLEUP WRAPS PRIOR TO AND FOLLOWING EDUCATION

Gestational Age @ Birth _____Days Old _____ Date_____
Gestational Age @ Collection_____

YES	NO

Appendix G) Letter from Dr. Ross

Feeding FUNdamentals, LLC
1602 Atwood St, Longmont, CO, USA 80501
1-720-320-5757
www.feedingfundamentals.com

March 21. 2019

RE: Dalacy Iesina Capstone Project

Dear Committee Member,

This letter is in support of the research completed by Dalacy Iesina. I am the Developmental Specialist in the Neonatal Intensive Care Unit at Rose Medical Center. I have been at Rose for 30 years, 29 of which in the NICU. I have a Master's Degree in Speech/Language Pathology, and a Ph.D. in Clinical Sciences-Health Services Research from the University of Colorado Health Sciences Center. In addition, I am certified in both the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) and the Assessment of Preterm Infant Behavior (APIB). Both of the certification programs certify me to work with preterm infants and their parents in the NICU, and add to my expertise specifically in the area of motor development.

I reviewed Dalacy's data collection tool and offered her advice regarding the items she was assessing. I am in full support of her efforts to improve the correct use of positioning aids in our NICU.

Sincerely,

Erin Sundseth Ross, Ph.D., CCC-SLP
President, Feeding FUNdamentals, LLC
Developmental Specialist, Rose Medical Center

Appendix H) Letter from Director

Dalacy,

I would like to thank you for your quality improvement project proposal regarding developmental positioning in the NICU. After a careful analysis, I have decided to grant you permission to begin work on your project following approval from the IRB.

I believe that this is a valuable endeavor that will significantly improve the use of SnuggleUp wraps in our unit and our understanding of the importance of proper positioning. Thanks again for the project proposal and I looking forward to working with you. Please let me know if you have any needs going forward.

Sincerely,

Tracy Anderson

Tracy Anderson BSN, RNC-NIC
NICU Director
Rose Medical Center
4567 E. 9Th Ave
Denver, CO 80220
Desk Phone: 303-320-2914
Cell Phone: 303-564-8270
Tracy.Anderson@HealthOneCares.com

Appendix I) Letter from Ethics Director

Health ONE Rose Medical Center

Administration
4567 E. 9th Avenue
Denver, Colorado 80220
303.320.2121 Phone
303.320.2200 Fax

Dear Dalacy,

I am writing to you on behalf of the Rose Ethics Committee, in response to your submission of an application for ethical approval for your study "Comparison of Neonates Positions in SnuggleUp Wraps Prior to and Following Education."

Having considered the information that you have provided in your correspondence the Committee as well as the 2 in person meetings I would like to notify you that your study has been approved and may move forward to the IRB.

Please let us know should there be are any significant changes to the proposal which raise any further ethical issues.

Yours sincerely,

Mandi Henry
Director of Ethics & Compliance

Appendix J) Information Sheet for Participation in a Research Study

INFORMATION SHEET FOR PARTICIPATION IN A RESEARCH STUDY

Title: COMPARISON OF NEONTATES POSITIONS IN SNUGGLEUP™ WRAPS PRIOR TO AND FOLLOWING EDUCATION
Principal Investigator: Dalacy Jesina
Site: Rose NICU
Study Sponsor: Cathy Witt – Dean of LHSN at Regis University

Purpose: You are being asked to participate in the study because you are staff in the Neonatal Intensive Care Unit (NICU). The purpose of this study is to improve the proper use of the SnuggleUp wraps on infants through education with the Occupational Competency Index (OCI) and infant doll.

Procedures: If you volunteer to participate in the study, we would ask you to complete the education via the OCI and practice on the dolls provided. You may be observed and education may be provided by the principal investigator. In addition, data will be collected regarding the positioning of the infants at random time points.

Voluntary Participation:
Your participation in this research is VOLUNTARY. If you choose not to participate, that will not affect your employment with Rose Medical Center. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time.

Risks and Benefits: You may feel uncomfortable being observed by the Principal Investigator. A possible benefit is it may increase your competency skills in positioning the infants with the use of the SnuggleUp wraps.

Confidentiality Protections: There will be no documentation of what nurses positioned what infant. This a quality improvement project that is aimed to improve the staffs' positioning of the infants in the SnuggleUp wraps as a whole. This is not meant to single any one out. The data collected for this project will be stored in a locked area only accessible to the principal investigator.

Compensation: You will not be paid for your involvement in this project.

Contact Information: Please contact Dalacy Jesina, MSN, APRN, NNP-BC with questions at 319-430-8700.

If you have questions regarding your rights as a research subject, you may contact the HCA-HealthONE Institutional Review Board (IRB) Administrative Office at 303-584-2300.

Appendix K) IRB Exempt – Regis

REGIS UNIVERSITY

REGIS.EDU

Institutional Review Board

DATE:	September 12, 2018
TO:	Dalacy Jesina
FROM:	Regis University Human Subjects IRB
PROJECT TITLE:	[1302490-1] COMPARISON OF NEONATES POSITIONS IN SNUGGLEUP WRAPS PRIOR TO AND FOLLOWING EDUCATION
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	September 12, 2018
REVIEW CATEGORY:	Exemption category # *(2)*

Thank you for your submission of New Project materials for this project. The Regis University Human Subjects IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations 45.CFR46.101(b).

This is a simple and useful plan to improve nurses' education and use of SnuggleUp wraps.

The evaluation document does not include a way to identify which nurse positioned each infant. How will you determine which nurses have improved post-training if you don't know which nurse is connected to which infant? Or are you only interested in group differences in improvement?

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the Institutional Review Board at irb@regis.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Regis University Human Subjects IRB's records.

Appendix L) IRB Exempt – HealthOne

The Medical Center of Aurora
North Suburban Medical Center
Presbyterian/St. Luke's Medical Center &
Rocky Mountain Hospital for Children
Spaulding Rehabilitation Hospital
Rose Medical Center
Sky Ridge Medical Center
Swedish Medical Center
LEADING HOSPITALS. TRUSTED CARE.

HCA - HealthONE
Institutional Review Board
4900 South Monaco Street
Suite 220
Denver, Colorado 80237
303.584.2300 Phone
303.584.2305 Fax
www.HealthONEcares.com

DATE: December 21, 2018

TO: Dalacy Jesina
FROM: HCA-HealthONE IRB

PROJECT TITLE: [1327559-1] COMPARISON OF NEONATES POSITIONS IN SNUGGLEUP WRAPS PRIOR TO AND FOLLOWING EDUCATION

SUBMISSION TYPE: New Project
REVIEW TYPE: Exempt Review
EXEMPT CATEGORY: Category 1

Exemption 1: Normal Educational Practices and Settings

"Research conducted in established or commonly accepted educational setting, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods."

ACTION: **EXEMPT**

Thank you for your submission of New Project materials for this project. The HCA-HealthONE IRB has reviewed and granted an **EXEMPTION FROM IRB APPROVAL** for your submission for the above-referenced project. This exemption was granted based on the associated risk of the project, very little risk if any, and it falls within one or more of the six exempt categories outlined in the federal regulations 45 CFR 46.101.

This submission has received Exempt Review based on applicable federal regulations.

The purpose of this project is to evaluate the effectiveness of the Occupational Competency Index (OCI) as an education tool for nurses regarding the proper use of the SnuggleUp wraps on infants.

A Waiver of Documentation of Informed Consent has been granted based on the criteria outlined in **45 CFR 46.117(c)** *(the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality **OR** the research activity presents no more than minimal risk and involves no procedures for which consent is normally required).*

This project has been determined to be an Exempt project. Based on the exempt status, this project does not require continuing review by this committee. However, should any procedures change that could affect the exempt status of this project, please contact the HCA-HealthONE IRB office immediately.

The Ethics and Compliance Officer (ECO) at the facility where research is performed must be contacted to obtain facility approval for your research and ensure compliance with HCA's External Data Release policy.

This letter has been electronically signed in accordance with all applicable regulations and a copy is retained within the HCA-HealthONE IRB's records.

Appendix M) CITI Training

CITI PROGRAM

Completion Date 05-Nov-2018
Expiration Date 04-Nov-2021
Record ID 29359926

This is to certify that:

Dalacy Jesina

Has completed the following CITI Program course:

Basic/Refresher Course - Human Subjects Research (Curriculum Group)
Social/Behavioral Research Course (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

HCA-HealthONE

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wa14713c8-a260-4339-80e9-46192291bd4c-29359926

Appendix N) Literature Review Table

Article/Journal	A Synactive Model of Neonatal Behavioral Organization: Framework For the Assessment of Neurobehavioral Development in the Premature Infant and for Support of Infants and Parents in the Neonatal Intensive Care Environment. Physical & Occupational Therapy in Peds	Empowering Education: A new model for In-Service Training for Nursing Staff. Journal of Advances in Medical Education and Professionalism
Author/Year	Als, H. 1986	Chaghari M; Saffari M; Ebadi A; Ameryoun A 2017
Database/Keywords	CINAHL NICU + Developmental	Medline Nursing + Education
Research Design	Qualitative	Qualitative
Level of Evidence	V	V
Study Aim/Purpose	The quality of survival of the PTI is emphasized, and the **synactive** framework of development (SFD) is proposed as a way of understanding the PTI and attending to the individual infant's **behavioral** cues	This study attempted to design **a new** optimal **model** for **in-service training** of nurses.
Population/Sample Size Criteria/Power	N/A	35 nurses Data was collected through interview, observation and field notes.
Methods/Study Appraisal Synthesis Methods	N/A	**In** the first stage, the Grounded Theory was adopted to explore the process of **training** participating nurses. **In** the second stage, the findings were employed through 'Walker and Avants strategy for theory construction so as to design an optimal **model** for **in-service training** of **nursing staff.**
Study Tool/Instrument validity/Reliability	Brazelton **Neonatal Behavioral** Assessment Scale	Corbin and Strauss method (2008) involving coding for concepts, analysis for contexts and processes, analysis for consequences, and finally integration of categories to build theoretical framework
Primary Outcome Measure/Results	N/A	**Empowering education** is **a new model** for **in-service training** of nurses, which matches the **training** programs with andragogical needs and desirability of learning among the **staff.**
Conclusions/Implications	The SFD also advocates the understanding, support, and involvement of parents since normalization and humanization of the hospital environment; integration of the infant's care by the parents; and affording space, privacy, and the ongoing opportunity for increasing developmental differentiation are primary aims	The **empowering education** can facilitate occupational tasks and achieving greater mastery of professional skills among the nurses.
Strengths/Limitations	Some Opinion	Training the participants' confidence and real answers to the questions were limitations of the study.
Funding Source		N/A

Article/Journal	Targeted Educational Program Improves Infant Positioning Practice in the NICU. International Journal for Quality in Health Care.	Preterm Birth-Associated Cost of Early Intervention Services; An Analysis by Gestational Age. Pediatrics
Author/Year	Charafeddine L; Masri S; Ibrahim P; Badin D; Cheayto S; Tamim H 2018	Clements KM; Barfield WD; Ayadi MF; Wilber N 2007
Database/Keywords	Medline Nursing + Education	MEDLINE Cost Analysis + Preterm
Research Design	Quality Improvement Quantitative	Retrospective study Quantitative
Level of Evidence	IV	IV
Study Aim/Purpose	To improve IPAT scores	Characterizing the cost of preterm birth is important in assessing the impact of increasing prematurity rates and evaluating the cost-effectiveness of therapies to prevent preterm delivery.
Population/Sample Size Criteria/Power	33 nurse, five residents, 3 fellows and 3 therapists.	14033 of 76901 surviving infants received early intervention services.
Methods/Study Appraisal Synthesis Methods	Pre-evaluate IPAT scores, Educate then post evaluate IPAT scores	Using the Pregnancy to Early Life Longitudinal Data Set, birth certificates for infants who were born in Massachusetts between July 1999 and June 2000 were linked to early intervention claims through 2003.
Study Tool/Instrument validity/Reliability	IPAT Tool	Database
Primary Outcome Measure/Results	Mean IPAT scores increased from 3.4 to 6.3 following intervention.	24 to 31 weeks had the higher cost of intervention services.
Conclusions/Implications	Hands on practice proved to be successful.	Mean cost per infant was highest for children who were 24 to 31 weeks' gestational age ($5393) and higher for infants who were 32 to 36 weeks' gestational age ($1578) compared with those who were born at term ($725).
Strengths/Limitations	Strength lied in the rigor of the methodology and reliability of the IPAT	Only 1 state.
Funding Source	None	Not disclosed
Comments		

Article/Journal	Reliability and Effectiveness of Infant Positioning Assessment Tool to Standardize Developmentally Supportive Positioning Practices in the NICU Newborn and Infant Nursing Reviews	Posture and Movement in Healthy Preterm Infants in Supine Position In and Outside the Nest. Arch Dis Child Fetal Neonatal Ed.
Author/Year	Coughlin M; Lohman M.B; Gibbins S 2010	Ferrari F; Bertoncelli N; Gallo C; Roversi M; Guerra M; Ranzi A; Hadders-Algra M 2007
Database/Keywords	CINAHL Neonate + Developmental Positioning	MEDLINE Neonate + Developmental Positioning
Research Design	Quantitative	Quantitative
Level of Evidence	II	IV
Study Aim/Purpose	The aim of this study was twofold: (1) to develop an infant position assessment tool to standardize best practices in neonatal positioning and (2) evaluate its effectiveness in teaching consistent positioning practice. The Infant Position Assessment Tool (IPAT)	To evaluate whether lying in a nest affects the posture and spontaneous movements of healthy preterm infants.
Population/Sample Size Criteria/Power	55 infants	10 infants
Methods/Study Appraisal Synthesis Methods	Observed when not receiving direct care.	serial video recording in the supine position, when lying in a nest and outside it, at three ages: 30–33 weeks postmenstrual age (PMA) (early preterm), 34–36 weeks PMA (late preterm) and 37–40 weeks PMA (term)
Study Tool/Instrument validity/Reliability	IPAT & Educational Program	The video recordings were assessed by three observers. One observer (MC) scored the postural items in eight infants and another observer (CG) scored the items relating to spontaneous movements in the same eight infants. A third observer (QB) evaluated posture and motility data of the remaining two infants.
Primary Outcome Measure/Results	Statistically higher IPAT scores after education.	When lying in the nest, the infants more often displayed a flexed posture with shoulder adduction and elbow, and hip and knee flexion, and the head was frequently in the midline.
Conclusions/Implications	Utilization of a process improvement education program combined with defined and standardized developmentally supportive care positioning practices results in consistency in developmentally supportive positioning practices as measured by the IPAT	A nest promotes a flexed posture of the limbs with adduction of shoulders, facilitates elegant wrist movements and movements towards and across the midline and reduces abrupt movements and frozen postures of the arms and legs.
Strengths/Limitations	Small sample size	First, the infants, for the rest of their stay in hospital, were placed in the nest. Second, the observers, unavoidably, were not blinded to the nesting condition and might have had a bias favoring the nest, and a team of observers evaluated different aspects of motor behavior.
Funding Source		
Comments		

Article/Journal	The Use of Clinical Audit in Successfully Implementing a Change of Clinical Practice in Developmental Positioning Clinical Practice	Why Does Nursing Need a Theory? Journal of Advanced Nursing
Author/Year	Hunter, A. 2015	Ingram, R., 1991
Database/Keywords	CINAHL Neonate + Developmental Positioning	Medline Nursing Theory
Research Design	Descriptive study Quantitative	Opinion Qualitative
Level of Evidence	II	VII
Study Aim/Purpose	The purpose of this study was to audit current practice in developmental positioning in the NICU in relation to local developmental care guidelines.	Seeks to explore importance of nursing theory
Population/Sample Size Criteria/Power	34	
Methods/Study Appraisal Synthesis Methods	Infants were audited for 12 weeks, in different positioning aids, educated then re-evaluated.	
Study Tool/Instrument validity/Reliability	An audit tool was developed to audit positioning of preterm infants using a scoring scale.	
Primary Outcome Measure/Results	Positive shift in infant positioning	
Conclusions/Implications	Highlighted the importance of formally auditing.	
Strengths/Limitations	Not a randomized control study.	
Funding Source	Positioning systems were provided by Sundance.	
Comments		

Article/Journal	Cost Effects of Preterm Birth: A Comparison of Healthcare Costs Associated with Early Preterm, Late Preterm and Full Term Birth in the First 3 Years After Birth. The European Journal of Health Economics	One-to-One Bedside Nurse Education as a Means to Improve Positioning Consistency Newborn and Infant Nursing Reviews
Author/Year	Jacob J; Lehne M; Mischker A; Klinger N; Zickermann C; Walker J 2016	E. Jeanson, 2013
Database/Keywords	Medline	Positioning, IPAT, Nurse Education
Research Design	Retrospective Observational Quantitative	Qualitative
Level of Evidence	III	V
Study Aim/Purpose	Cost for 3 years after birth of early preterm, late preterm, and full-term births	Explain how to use the infant positioning tool along with how it improves consistency across shifts and experience
Population/Sample Size Criteria/Power	5947 births were included in the final study group	Nurses at a Level IIIB NICU in the Midwest
Methods/Study Appraisal Synthesis Methods	To evaluate mean cost differences associated with different gestational ages, infants were assigned to one of the three following groups depending on the ICD-10-GM	Prior to intervention survey and monitor position of infants
Study Tool/Instrument validity/Reliability	Costs were calculated separately for the first 3 years.	Educating
Primary Outcome Measure/Results	Total health costs differed considerably between gestational ages. Average health costs of early preterm infants during the first year after birth were 74,009 EUR, whereas they were much lower for late preterm infants with an average of 8565 EUR and full-term infants with an average of 1590 EUR	Using the infant positioning tool with the one on one education improved positioning consistency.
Conclusions/Implications	The present study shows that health care expenses associated with childbirth generally increase with decreasing gestational age at the time of birth	Infant positioning tool and education together works to improve outcomes
Strengths/Limitations	Good sample size.	Infant positioning assessment tool already exists.
Funding Source	N/A	
Comments		Learn more about the infant positioning assessment tool, and use it with my education.

Article/Journal	The Evolving Practice of Developmental Care in the Neonatal Unit: A Systematic Review Physical & Occupational Therapy in Pediatrics	The Effects of Alternative Positioning on Preterm Infants in the Neonatal Intensive Care Unit: A randomized clinical trial Research and Developmental Disabilities
Author/Year	Legendre V; Burtner P; Martinez K; Crowe T 2011	Madlinger-Lewis L; Reynolds L; Zarem C; Carapnell T; Inder T; Pineda R 2014
Database/Keywords	Medline Developmental Positioning + Neonatal	Preterm Positioning
Research Design	Systematic Review Qualitative	Quantitative
Level of Evidence	VI	II
Study Aim/Purpose	The aim of this systematic review is to research current literature documenting the short-term effects of developmental care and the Newborn Individualized Developmental Care and Assessment Program (NIDCAP).	Investigate the effects of a new alternative positioning device compared to traditional positioning methods used with preterm infants.
Population/Sample Size Criteria/Power	15 articles were assessed	100 preterm infants born <32 weeks
Methods/Study Appraisal Synthesis Methods	Meeting study criteria for levels of evidence, sample population, intervention method, outcome measures, intervention results, and study limitations (see Table 1 for rating criteria).	Randomized to be positioned in the alternative positioning device or to traditional positioning methods for their length of stay in the NICU.
Study Tool/Instrument validity/Reliability	N/A	Assessed using the NICU Network Neurobehavioral scale between 35 and 40 weeks.
Primary Outcome Measure/Results	Many studies claim that developmental strategies, including NIDCAP, have a positive impact on the medical outcomes of the preterm infant.	Infants who were placed in the alternative position showed less asymmetry of reflex and motor responses.
Conclusions/Implications	Our findings suggest evidence supporting developmental care and NIDCAP, however, further research documenting outcomes for preterm infants receiving developmental care and/or NIDCAP is needed.	Alternative positioning shows that there is less asymmetry of reflexes and motor responses
Strengths/Limitations	Owing to the complex nature of the NICU environment and the fragile nature of the infants, many studies are unable to blind staff effectively or to control for confounding variables.	The NICU Network Neurobehavioral scale and that the study was done in the United States
Funding Source	NA	N/A
Comments		Important to follow this sample of preterm infants to determine the effects of early positioning on neurodevelopmental outcome in childhood.

Article/Journal	Testing a Theory of Health Promotion for Preterm Infants based on Levine's Conservation Model of Nursing The Jouranl of Theory Construction & Testing	Evaluating Nurse Staffing Patterns and Neonatal Intensive Care Unit Outcomes Using Levine's Conservation Model of Nursing Journal of nursing management
Author/Year	Mefford, L; Alligood, M 2011	Mefford L; Alligood M 2011
Database/Keywords	CINAHL Levine's Conservation Model + NICU	CINAHL Levine's Conservation Model + NICU
Research Design	Qualitative	Qualitative
Level of Evidence	V	V
Study Aim/Purpose	Test a middle range Theory of Health Promotion for Preterm Infants based on Levine's Conservation Model of Nursing,	Explore the influence on intensity of nursing car and consistency of nursing caregivers of health outcomes using Levine's Conservation Model.
Population/Sample Size Criteria/Power	The sample was a convenience sample of 235 infants with a gestational age at birth of less than 37 weeks who were treated in the study Neonatal Intensive Care Unit	235 born before 37 weeks gestation.
Methods/Study Appraisal Synthesis Methods	Descriptive correlational *ex postfacto* study design with data collected from existing data bases of a Level III Neo-natal Intensive Care Unit	A structured equation modelling approach tested the influence of intensity of nursing care and consistency of nursing care givers on morbidity and resource utilization in the NICU.
Study Tool/Instrument validity/Reliability	Clinical measures were selected based upon two criteria: (1) their theoretical congruence with the Theory of Health Promotion for Preterm Infants based on Levine's Conservation Model of Nursing.	Structured equation modelling statistical causes.
Primary Outcome Measure/Results	The study supported utility of the mid-range **Theory** of **Health Promotion** for **Preterm Infants** as a framework to guide neonatal **nursing** practice and research and highlighted the importance of consistent **nursing** caregivers to promote **health** in **preterm infants.**	Consistency of nursing caregivers served as a powerful mediator of length of stay and the duration of mechanical ventilation, supplemental oxygen therapy and parenteral nutrition. Analysis of nursing intensity indicators revealed that a mix of professional nurses and assistive personnel was effective.
Conclusions/Implications	**Testing** and refinement of a path diagram produced a complete mediation **model** in which consistency of **nursing** caregivers during the hospital stay completely mediated the effects of physiologic immaturity at birth on the age at which initial **health** was attained.	Providing consistency of nursing caregivers may significantly improve both health and economic outcomes. New evidence was found to support the efficacy of the primary nursing model in the NICU.
Strengths/Limitations		
Funding Source		
Comments		Designing nursing care delivery systems in acute inpatient settings with an emphasis on consistency of nursing caregivers could improve health outcomes, increase organizational effectiveness, and enhance satisfaction of nursing staff, patients, and families.

Article/Journal	A Theory of Health Promotion for Preterm Infants based on Levine's Conservation Model of Nursing. Nursing Science Quarterly	Selecting the Best Theory to Implement Planned Change, Nursing Management
Author/Year	Mefford LC 2004	Mitchell G 2013
Database/Keywords	CINAHL Levine's Conservation + NICU	Theory of Change
Research Design	Qualitative	Qualitative
Level of Evidence	V	VI
Study Aim/Purpose	Review previous study.	This article considers three change theories and discusses how one in particular can be used in practice.
Population/Sample Size Criteria/Power	235	
Methods/Study Appraisal Synthesis Methods		
Study Tool/Instrument validity/Reliability		
Primary Outcome Measure/Results		Discussing comparing three change theories.
Conclusions/Implications		Attempts to implement planned change face numerous barriers, but using a framework, such as Lippitt's, proactively rather than retrospectively can help eliminate some of the potential problems, and address and act on others.
Strengths/Limitations		
Funding Source		
Comments		

Article/Journal	Neuromotor Development and the Physiologic Effects of Positioning in Very Low Birth Weight Infants. Journal of Obstetrics, Gynecology and Neonatology	Nested and swaddled positioning support in the prone position facilitates sleep and heart rate stability in very low birth weight infants Research and Reports in Neonatology
Author/Year	Monterosso L; Kristjanson L; Cole J 2002	Kihara H; Nakamura T 2013
Database/Keywords	CINAHL Neurodevelopmental + NICU	CINAHL Nested + NICU
Research Design	Quantitative	Quantitative
Level of Evidence	II	II
Study Aim/Purpose	To provide a comprehensive lit. review of neuromotor development related to physiologic effects of positioning infants who are very low birth weight.	The purpose of this study was to observe in very low birth weight infants (VLBWI) the effect of nested and swaddled positioning support in the prone position on heart rate, sleep distribution, and behavior state.
Population/Sample Size Criteria/Power	180 studies/clinical papers related to neuromotor development of preterm infants	20 VLBWI born 26.5 +/- 4 weeks with a birth weight of 709g +/- 207g.
Methods/Study Appraisal Synthesis Methods	Data Extraction	A prospective and crossover design was used.
Study Tool/Instrument validity/Reliability	Comparisons were made to determine the most reliable, valid and consistent findings.	HR data was recorded by a body living information control system
Primary Outcome Measure/Results	The development of posture and mobility in newborn infants requires optimal balance between passive muscle tone	HR in prone infants with positioning support (153.7 ± _15.9/bpm) was lower than without positioning support (157.7 ± _17.1/bpm).
Conclusions/Implications	Use of empirically tested postural interventions appropriate for infants gestational ages and heath status is recommended based on findings of this meta analysis.	The percent of quiet sleep and behavior state 1 in prone infants with positioning support were higher compared to prone infants without positioning support. In conclusion, the present study demonstrated that a prone position with nested and swaddled positioning support might facilitate sleep and heart rate stability compared to prone positioning alone in VLBWI
Strengths/Limitations		
Funding Source	None	No conflicts of interest
Comments		

Article/Journal	Effect of Nursing Education on Positioning of Infants in the Neonatal Intensive Care Unit. Pediatric Physical Therapy	Clinical Outcomes of Snuggle up Positioning Using Positioning Aids for Preterm (27-32 Week) Infants Iranian Journal of Neonatology
Author/Year	Perkins E; Fanning JK; Bartlett DJ 2004	Sathish Y; Lewis L; Noronha J; George A; Snayak B; Pai M; Bhat R; Purkayastha J 2017
Database/Keywords	CINAHL Developmental + Neonatal	Snuggle up/Preterm Infants
Research Design	Quantitative	Quantitative
Level of Evidence	II	II
Study Aim/Purpose	To determine the **effect** of different forms of **education** on nurses' abilities to position neonates in a developmentally supportive way and to determine nurses' perceptions of effectiveness of educational methods to enhance their **positioning** abilities	Aimed to determine the effectiveness of snuggle up positioning aid on clinical outcomes of preterm <32 week infants.
Population/Sample Size Criteria/Power	50 nurses	56 Preterm infants were enrolled between 27 and 32 weeks. Apgars of less than 7, infants who needed inotropes or arterial lines were excluded.
Methods/Study Appraisal Synthesis Methods	In a one-group, repeated-measures, alternating-treatment design, the effectiveness of nurses' abilities to position neonates in the context of developmentally supportive **care** before and after different **education** approaches was scored using an instrument designed for this study.	Investigated the effect of the snuggle up on the heart rate, respiratory rate, oxygen saturation duration of ventilation, weight gain and duration of stay were measured.
Study Tool/Instrument validity/Reliability	Instrument designed for this study.	Documentation and comparison of heart rate, respiratory rate, oxygen saturation, duration of ventilation, weight gain and duration of stay.
Primary Outcome Measure/Results	Formal **education** methods such as in-services and workshops improved nurses' abilities to position neonates in developmentally supportive positions; however, improvements declined in the absence of ongoing **education.**	There was a significant difference in respiratory rate, oxygen saturation, cardio/respiratory system stability of preterm infants and improved weight gain in the snuggle up group, which decreased length of stay. There was no difference in temp stability, heart rate, or duration of ventilation.
Conclusions/Implications	The results suggest that the physical therapist's role as a consultant is important to ensure continued performance of developmentally supportive **care** with respect to **positioning** of **infants** in the **neonatal intensive care unit.**	Increased stability of physiological parameters and weight gain and reduced duration of NICU stay.
Strengths/Limitations	Research study is the subjective nature of the scoring system used during data collection.	This was a strong study, good design, and nice that there was only 1 product being studied.
Funding Source		None listed
Comments	Formal education provided by the physical therapist at St. Joseph's Health Care has had the greatest positive effect on positioning practices of NICU nurses when compared with other methods of knowledge acquisition available.	We utilize the snuggle up incorrectly, and its good to see a study showing that using the snuggle up, and using it correctly can have improved outcomes.

Article/Journal	Physiological and Behavioral Effects of Preterm Infant Positioning in a Neonatal Intensive Care Unit. British Journal of Midwifery.	Neonatal Advanced Practice Nurses as Key Facilitators in Implementing Evidence Based Practice Neonatal Network
Author/Year	Santos A; Garcia V; Silveria C; Bertolini R; Osaku E; Costa C; Grebinski A; Giordani T 2017	Smith JR; Donze A; Cole FS; Johnston J; Giebe JM 2009
Database/Keywords	CINAHL Developmental Positioning + Neonatal	CINAHL NICU + Education
Research Design	Quantitative	Qualitative
Level of Evidence	II	VI
Study Aim/Purpose	To compare the effect of sleeping position on physiological and behavioral responses in preterm infants.	Review of Neonatal Nurse Practitioners roll in Implementing Evidence Based Practice
Population/Sample Size Criteria/Power	24 preterm newborns, gestational age ≤32 weeks, who were randomly separated into four groups: right side position, supine position, left side position and prone position.	
Methods/Study Appraisal Synthesis Methods	The physiological and behavioral variables were evaluated before, during and after positioning.	
Study Tool/Instrument validity/Reliability	The NIPS scale is a multidimensional instrument used routinely in the NICU to assess acute pain. The scale evaluates behavioral and physiological responses by scoring on six different parameters. The infant is considered to be in pain when the score is greater than or equal to 4.	
Primary Outcome Measure/Results	During the intervention, heart rate decreased in right side position, supine position, and prone position. The respiratory rate reduced in all positions and peripheral oxygen saturation remained stable in most positions	
Conclusions/Implications	Positioning according to a standard operating procedure was able to produce more positive responses in prone and supine position groups during the intervention.	As practice leaders, NNPs can promote and model EBP as an effective, efficient process for managing the complexity of patient care. They can also lead efforts to support and promote diffusion of innovation, creative practice, and evidence-based approaches to care delivery.
Strengths/Limitations		
Funding Source	This study received funding from the Conselho Nacional de Desenvolvimento Científico e Tecnológico,	
Comments		

Article/Journal	Adult Learning: What Educators Need to Know About Mature Students. Curationis	The Effectiveness of a Standardized Positioning Tool and Bedside Education on the Developmental Positioning Proficiency of NICU Nurses. Intensive and Critical Care Nursing
Author/Year	Spies C; Seale I; Botma Y 2015	Spilker A; Hill C Rosenblum R 2016
Database/Keywords	Medline Adult Learning	Medline Developmental Positioning + NICU
Research Design	Qualitative	Quasi-Experimental Pre/Post test - Quantitative
Level of Evidence	V	III
Study Aim/Purpose	This article is a report of a secondary analysis of data that were collected to explore the high-fidelity simulation learning experiences of a group of postgraduate nursing students.	In order to improve the developmental proficiency of neonatal intensive care unit nurses, a standardized infant positioning assessment tool and a bedside education program were introduced to the registered nurses in a 46 bed level III neonatal intensive care unit in the western United States.
Population/Sample Size Criteria/Power	Data was gathered from 18 postgraduate nursing students who participated in high-fidelity simulation in a nursing school at a higher education institution in South Africa.	54 Pre-intervention scores 55 post-intervention scores ~80 nurses on staff at the time.
Methods/Study Appraisal Synthesis Methods	The nominal group technique was used to collect the students' ideas about improving their simulation learning experiences. A secondary qualitative analysis of the primary nominal group data was done.	This was followed by a survey of the registered nurses beliefs and attitudes, the introduction of the standardized assessment tool and an informal education program.
Study Tool/Instrument validity/Reliability	The facilitator tallied all the votes of the captured suggestions and arranged them in order of priority. Thus, the quantitative analysis of the data was derived from the scoring and ranking (prioritizing) of the participants' ideas at the end of the meeting	After determining inter-rater reliability (IRR), the develop- mental positioning team collected IPAT scores for infants in the NICU.
Primary Outcome Measure/Results	Although the findings suggested self-directed and independent learner behavior, they also revealed behavior evident of dependence on the educator.	This research indicates the use of a standardized infant positioning assessment tool and bedside education may be useful strategies for improving the developmental positioning proficiency of NICU nurses.
Conclusions/Implications	Mature students have well established ways of thinking and doing that may hinder learning.	Implementing a standardized positioning assessment tool may improve the developmental positioning proficiency of NICU nurses. Informal bedside education may be an effective strategy to educate registered nurses. Improving developmental positioning remains a goal for practice.
Strengths/Limitations	Confined to a particular context and does not necessarily apply to all adult education environments.	The acuity of the infants may have differed pre-intervention and post-intervention which could have impacted the change in IPAT scores.
Funding Source	No financial or personal relationships which may have inappropriately influenced them in writing this article.	The authors have no sources of funding to declare.
Comments		

Article/Journal	Musculoskeletal Implications of Preterm Infant Positioning in the NICU Journal of Perinatal and Neonatal Nursing	Comparative Effects of 2 Positional Supports on Neurobehavioral and Postural Development in Preterm Neonates Journal of Perinatal and Neonatal Nursing
Author/Year	Sweeney JK; Gutierrez T 2002	Valvre-Dourent, PHD, Bernard Golse, MD 2007
Database/Keywords	CINAHL Developmental Positioning + Neonatal	Positioning, Preterm
Research Design	Qualitative	Quantitative
Level of Evidence	VI	II
Study Aim/Purpose	No study – Review of Musculoskeletal Implications	The purpose of this prospective study is to assess the effects of 2 different lying position body supports for physiologic and functional positioning
Population/Sample Size Criteria/Power	NA	30 preterm infants who were born between 28 ad 35 weeks gestation.
Methods/Study Appraisal Synthesis Methods		Home-cocoon support made by the nurses with a rolled up sheet, or a coconou support that is made by a rolled pad.
Study Tool/Instrument validity/Reliability		Assessments of the body posture and of neurobehavior were pretested without support, and tested at discharge. Nurses were also given a questionnaire about motor behavior.
Primary Outcome Measure/Results		All infants showed gains in postural development, but the coconou group had significantly better than the home cocoon group, with fewer cranial deformities with head positioning, arm relaxation, and better orthopedic leg positioning.
Conclusions/Implications	Plasticity in the musculoskeletal system of neonates can be considered a double edged sword.	The benefits of positioning with a specifically designed support promotes optimal prophylactic neurobehavioral and postural developmental care for preterm infants.
Strengths/Limitations		
Funding Source		N/A
Comments	Critical times for musculoskeletal and neuromotor monitoring; adjusted ages 2.4,8,12 and 18 months.	Great article since the homemade roll is still frequently used, even inside of snuggle up positioning aids.

Article/Journal	Effect of Positioning on the Incidence of Abnormalities of Muscle Tone in Low-Risk, Preterm Infants European Journal of Paediatric Neurology	Individualized Developmental Care for High Risk Newborns in the NICU: A Practice Guideline. Early Human Development
Author/Year	Vaivre-Douret; Ennouri K; Jrad I; Garrec C; Papiernik 2004	VandenBergK 2007
Database/Keywords	Preterm Infants, Positioning, Neurodevelopment, Muscle	CINAHL Developmental Positioning + NICU
Research Design	Quantitative	Quantitative
Level of Evidence	II	VI
Study Aim/Purpose	To Investigate short term effects of varied post-natal lying positions in order to prevent neuromuscular and postural abnormalities.	Review of Positioning and Newborn Individualized Developmental Care and Assessment Program (NIDCAP)
Population/Sample Size Criteria/Power	60 preterm infants 31-36 weeks.	N/A
Methods/Study Appraisal Synthesis Methods	Infants underwent neurological and psychomotor asessments which included tonus, behavioral, sensory motor and postural exams. 1 groups position was changed and a moldable mattress was used, the other group was on their stomachs with a bolster under their hips. And infants were reassessed at discharge.	N/A
Study Tool/Instrument validity/Reliability	Assessment of , behavior, sensory motor and posture	N/A
Primary Outcome Measure/Results	Significant abnormalities in the control group. There was dominance of the extensor muscles due to muscles shortening, hyper abduction and flexion of the arms, and global neuromuscular rigidity. There were also delayed developmental muscular acquisitions for infants in the control group.	Individualized developmental care for NICU infants has as its goal the preservation of energy for the infant, fostering self-regulation, prevention of agitation and stabilization of the physiological system.
Conclusions/Implications	Regular changes in posture, while retaining correct functional positions allowed maintenance of normal neuromuscular and osteo-articular function and permitted the development of spontaneous and functional motor activity in low-risk preterm infants.	It is now recognized that implementation of the NIDCAP approach involves much more than offering reduced light and noise and provision of a positioning aide for infants.
Strengths/Limitations	Good sample size, and good to know what the hip roll does	
Funding Source	N/A	NA
Comments	Hip rolls are often still used by older nurses. Good to have information that does not support the use of them.	

Article/Journal	Neonatal Nurses and Therapists Perceptions of Positioning for Preterm Infants in the Neonatal Intensive Care Unit. Neonatal Network	
Author/Year	Zarem C; Crapnell T; Tiltges L; Madlinger L; Lukas K; Pineda R 2013	
Database/Keywords	Neonatal Positioning	
Research Design	Survey/Qualitative	
Level of Evidence	VI	
Study Aim/Purpose	Determining Perceptions about developmental positioning	
Population/Sample Size Criteria/Power	68 Neonatal Nurses 8 occupational therapists	
Methods/Study Appraisal Synthesis Methods	1 year after beginning to use the DandleRoo, survey was geared at determining perceptions of the importance and effect of positioning, and what is considered the most optimal position.	
Study Tool/Instrument validity/Reliability	Questionnaire	
Primary Outcome Measure/Results	It was found that staff did find the importance of positioning for infants well being. (99%)	
Conclusions/Implications	The Dandleroo was found to be the easiest to use in their survey	
Strengths/Limitations	Large amount sent survey to, however small response group.	
Funding Source	Unknown	
Comments		