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Implementation of an evidence based quality improvement project to improve bathing practices in the neonatal intensive care unit.

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Implementation of an Evidence Based Quality Improvement Project to Improve Bathing Practices in the Neonatal Intensive Care Unit

by

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Dedicated

To

My Husband, Jason

A strong, loving man who has been alongside me on this journey, encouraged me to keep pushing onward in moments of doubt, and who also made sure our son was well taken care of on the many days I was required to travel away from home.

My Firstborn Son, Kobe

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Abstract

Background: Conventional bathing practices in the NICU have shown to be a stressful, and even painful, activity for neonates and one that can negatively impact the developmental and physiological outcomes of premature infants. To negate these negative outcomes, and provide a positive experience for neonates and their parents, AWHONN recommends the implementation of immersion swaddle bathing [ISB] over conventional bathing practices, in premature infants and newborns.

Purpose: The purpose of this quality improvement project was to implement and evaluate an evidence-based bathing practice in a Level III NICU that includes clinical practice guidelines and staff education.

Methods: A live, education session detailing what ISB is, its benefits, and the proper criteria and technique for performing the intervention was completed. Followed by a 4-week implementation period in which nurses employed use of the TurtleTub™ and ISB technique using a criteria checklist. A pre- and post- intervention Evidence-Based Practice Questionnaire [EPBQ] was available to evaluate nursing knowledge and satisfaction of a change in evidence-based practice.

Results: One-way ANOVAs were conducted to compare the effect of age and years of experience of registered nurses on the mean scores of questions included on the EBPQ. No significant effect was found on age or years of experience.

*Keywords***:** *Immersion swaddle bathing, immersion bathing, swaddle bathing, tub bathing, neonatal bathing, neonatal swaddle bathing*

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Implementation of Immersion Swaddle Bathing in the Neonatal Intensive Care Unit: A Project Proposal

The Centers for Disease Control and Prevention [CDC] (2019) estimates that 1 in every 10 births in the United States results in a preterm birth, less than 37 weeks gestation. Several, but not all, of these infants require admission to the Neonatal Intensive Care Unit [NICU] to receive proper treatment to enhance their growth and development, as time in the womb was shortened for various medical reasons resulting in the immature development of vital organs. There are many important, yet stressful events and procedures that cannot be avoided in such an environment, including the simple act of bathing.

Background

The Association of Women's Health, Obstetric, and Neonatal Nurses [AWHONN] (2018b) recommends that the frequency of routine bathing of infants should be individualized to the neonate's needs (p. 44). Bathing infants more than twice a week is unnecessary as less frequent bathing minimizes undue stress on premature infants (Dyer, 2013). Conventional bathing practices in the NICU have shown to be a stressful, and even painful, activity for neonates and one that can negatively impact the developmental and physiological outcomes of premature infants (Edraki et al., 2014). To negate these negative outcomes and provide a positive experience for neonates and their parents, AWHONN (2018a) recommends the implementation of immersion swaddle bathing [ISB], over conventional bathing practices, in premature infants and newborns.

Rationale

Through performing an informal need assessment of a 36-bed (Level III) NICU, it is evident that routine bath time (performed every 3 days) can be a very stressful, and sometimes

painful, event for neonates. There are currently no unit-based containment rules/policies in place to provide comfort during bathing. Infants are often found to be flailing around and vigorously crying during bath time, as they are quickly becoming cold stressed, which places them at an increased risk for hypoglycemia and hypoxemia (AWHONN, n.d.). The stress of bathing can be detrimental to these infants developmentally and often results in poor and unorganized feeding after bath time. Nurses choose to tube feed the infant after bathing, instead of offering oral feedings, because the infant is stressed and has exerted all energy in maintaining body temperature during the bath. Alongside the negative developmental impacts, this method of bathing potentially increases length of stay due to the physiological stress caused to the infant (apnea, bradycardia, and desaturation events, poor feeding, and so forth), thus, increasing healthcare costs.

Purpose

The purpose of this quality improvement [QI] project was to implement an evidence-based best bathing practice in a Level III NICU. Staff education on the intervention was guided by clinical practice guidelines adopted from AWHONN (Appendix A). The intended aims of this project were to:

1. Increase nursing knowledge and satisfaction of an evidence-based developmentally appropriate bathing practice.
2. Increase the percentage of infants who receive ISB from 0% to 30%.

Setting

The initial plan was to implement the project in the unit where the needs assessment, previously referenced, was conducted. However, due to unforeseen approval barriers the implementation site was changed. The project was carried out at a 400-bed level I trauma center,

in the Eastern United States, also known for medical research and academic education. The unit carrying out the intervention was a 24-bed Level III Neonatal Intensive Care Unit [NICU] who had similar bathing practices as the originally planned project site. The general population in this unit includes premature neonates born at 24 weeks gestation to full-term newborns with various medical conditions. This facility houses a high-risk obstetric unit that delivers approximately 1,500 newborns per year. The primary stakeholders for this unit include neonatal patients, family/caregivers, staff, providers, and unit leadership. The participants were comprised of infants that met the criteria listed in the Swaddle Bathing Clinical Practice Guideline (Appendix A), as well as 69 registered nurses who staff the unit day and night. There were many facilitators and barriers to the implementation of this project, which will be brought out in the later discussion.

Ethics

The proposal for this project was submitted to the University of Louisville IRB and was classified as Non-Human Subjects Research [NHSR] (Appendix B). Included in the proposal was the educational presentation and a link to the instructional video that was utilized for staff education. The project was later amended to change project sites. The amendment was submitted to the University of Louisville IRB and received approval to move forward (Appendix C). Additionally, this project received approval from the agency's Senior Research Regulatory Coordinator and System Evidence-Based Practice (EBP) Coordinator (Appendix D).

Conceptual Framework

There are two chosen frameworks or models that support the guidance and implementation of this QI initiative: The Iowa Model of EBP (Appendix E) and the Neonatal Integrative Developmental Care Model (Appendix F).

Iowa Model of EBP

The Iowa Model of EBP is a step-by-step guide to implementing change within a practice and promoting excellence in health care (Iowa Model Collaborative, 2017). The Iowa Model identifies seven key steps to translating evidence into clinical practice, to improve patient care and outcomes. The algorithm is as follows and a visual representation can be found in Appendix E: 1). Identify a problem, 2). Form the question/purpose, 3). Form a team, 4). Assemble, appraise, and synthesize the evidence supporting the resolution of the identified problem, 5). Design and pilot the practice change, 6). Integrate and sustain the practice change, and 7). Disseminate the results (Iowa Model Collaborative, 2017). Throughout this process, the clinician is evaluating, revising, and looking at necessary alternatives following each step to ensure successful implementation of evidence into clinical practice. The algorithm set forth in this model was followed throughout the implementation of this ISB QI initiative, with some minor setbacks that will be discussed later.

Neonatal Integrative Developmental Care Model

ISB is also backed by The Neonatal Integrative Developmental Care Model [NIDCM] an important and current framework that guides neonatal practice. The NIDCM outlines 7 core neuroprotective measures (Altimier & Phillips, 2016) as detailed in Appendix F. The ISB initiative successfully integrates the core measures of partnering with families, positioning and handling, protecting the skin, and minimizing stress and pain (Denton & Bowles, 2018) in premature infants. It could also be argued that providing this type of neuroprotective developmental care during bathing safeguards sleep and optimizes nutrition. Denton & Bowles (2018) explain that ISB is calming, promotes sleep, and aids in energy conservation which

supports organized feeding. With promotion of these 6 petals of the NIDCM, ISB essentially supports the overarching, core measure of a healing environment.

Intervention

ISB is the act of developmentally swaddling (placing in a flexed, midline position) an infant in a blanket and immersing the swaddled infant in a tub of water, up to their shoulders, leaving the head and neck exposed (Denton & Bowles, 2018; Edraki et al., 2014; Fernandez, D., & Antolin-Rodriquez, R., 2018). One at a time, each extremity is un-swaddled, washed, rinsed, and placed back in the swaddled position (Edraki et al., 2014). This act of containment allows for the neonate to remain in a developmentally appropriate position, in a calm state, while minimizing significant variation in thermoregulation, stress cues, and pain (Edraki et al., 2014).

The TurtleTub™ is the preferred product to carry out ISB because of its features and benefits. The TurtleTub™ is an inclined infant bathtub with ribs and high sides, to assist in proper positioning and support of the infant (Catapult Products, LLC, 2020d). The TurtleTub™ was also designed with an integrated temperature strip to ensure the bath water is warmed to the recommended 101° Fahrenheit (Catapult Products, LLC, 2020d), and will also make the nurse aware if the water is too hot or becomes too cool. Fleece blankets are preferred over cotton blankets, for ISB, as they have greater thermal properties and absorb water in a way that makes the infant feel weighted and secured (Catapult Products, LLC, 2020b). Lastly, disposable liners were to be utilized, for infection control, as the TurtleTub™ acted as a multi-use tub for all infants meeting the criteria for ISB in the NICU. After removal of the disposable liner, each TurtleTub™ was properly cleaned and sanitized between patients using the recommended PDI Sani-Cloth Super (purple top) wipe (Catapult Products, LLC, 2020a). In the selected unit, the TurtleTub was available but not being utilized following the recommended ISB guidelines.

Literature Review

Thermal stability

Born with a large body surface area and very little fat (Chiocca, 2015), premature infants have limited ability to maintain adequate thermoregulation outside of the womb. Edraki et al. (2014), along with Swapna et al., (2017) and Bryanton et al. (2004), found that the infants who received ISB experienced a reduction in the variation of body temperature and heat loss, when compared to conventional bathing methods. Neonates are unable to self-regulate their body temperature in the way that adults can (Ceylan & Bolisik, 2018). The immaturity of the integumentary system places the infant at an increased risk of becoming cold stressed due to the increase in evaporation and dilation of the peripheral blood vessels, as a result of bathing (Ceylan & Bolisik, 2018). In ISB, covering and immersing the infant in warm water aids in reducing drastic changes in body temperature and ensures proper heat protection.

Physiologic parameters, pain, and stress

Coupled with the challenge of thermal stability is an immature nervous system and developing brain, when an infant undergoes a decrease in body temperature, though immature, the sympathetic nervous system is forced to respond to compensate for this adverse clinical outcome. The body's initial response is to increase its heart rate, respiratory rate, and blood pressure to increase blood circulation to the brown fat, necessary for thermogenesis in newborns. In doing so, the body is attempting to increase the transfer of heat to the rest of the body. However, as mentioned earlier, neonates are born with a large body surface area and very little fat (Chiocca, 2015). Therefore, this mechanism of response is unsuccessful as it essentially leads to an acceleration in calorie utilization and hypoxic tissues, leading to a decrease in oxygen saturations below baseline.

Premature infants are also born with an immature central nervous system, making the simplest of activities stress-provoking and painful for the neonate, and causing detriment to positive neurosensory development (Paran et al., 2016). Signs of distress in the neonate are easily observed on the infant's face, such as facial grimace, hiccoughs, yawning, and crying (Edraki et al., 2014; Paran et al., 2016). In comparing the ISB versus conventional bathing methods, ISB has shown statistical significance in decreasing crying duration and stress cues (Ceylan & Bolisik, 2018; Paran et al., 2016; Caka & Gozen, 2018; Edraki et al., 2014; Swapna et al., 2017). Gunay and Coskun (2018) also concluded that pain levels decreased significantly in ISB, explaining their findings in relation to the direct effect of heat during immersion on nerve endings that trigger pain. Pain is directly correlated with an infant's physiological status, thus decreasing pain through ISB will have a positive effect on the infant's vital signs and state of relaxation (Gunay & Coskun, 2018). This outcome can also be attributed to the effect of immersion as it mimics the familiar intrauterine environment and simulates a sense of security (Ceylan & Bolisik, 2018; Swapna et al., 2017).

A review of the literature (Table 1) collectively supports and adds to the growing body of evidence for the implementation of ISB, over conventional bathing methods. ISB is developmentally safe and favorable in decreasing pain and stress in neonates during bathing, while simultaneously controlling for physiologic changes and thermal stability (Bryanton et al., 2004). ISB also allows parents and caregivers to participate in their infant's care, yielding a more positive bonding experience. However, there are certain developmental criteria that must be met prior to being eligible for ISB that are consistent with the evidence for implementation of ISB.

Swaddle Bathing Clinical Practice Guideline

The Swaddle Bathing Clinical Practice Guideline (Appendix A), provided by Catapult Products, LLC. (2020c), lays the foundation for eligibility of ISB. Infants must be greater than or equal to 32 weeks gestation and weigh more than 1500 grams to be deemed eligible for ISB. In addition, infants cannot be immersed with any type of peripheral or central access and must be able to maintain thermal and cardiorespiratory stability, while remaining off monitors for greater than ten minutes. Furthermore, immersion should not take place with an intact umbilical cord as this increases the risk of omphalitis. Once each of these criteria have been met, routine ISB may be utilized every 2 to 3 days. It is important to bathe in a quiet, draft-free environment to help promote a positive bathing experience and thermal stability. It is also imperative to educate the parents about how to perform ISB, teaching them to keep baths as short as possible.

AWHONN (2018a) is a major supporter of the ISB initiative as it provides advantages such as "minimizing adverse clinical outcomes associated with bathing, saves nursing time, and supports developmental care". Alongside this, ISB is valuable in minimizing cold stress, conserving energy, and improving neurobehavioral state (Edraki et al. 2014; Denton & Bowles, 2018) and decreases the risk of hypoglycemia and hypoxemia (AWHONN, 2018a; Fernandez & Antolin-Rodriquez, 2018). As such, when providing developmentally supportive care to premature infants, parent satisfaction and increased confidence also plays an important role. ISB ultimately incorporates holistic and family-centered care as parents can take part in the care of their infant, while promoting a positive bonding experience for, both, neonate and parent. ISB is an evidence-based best practice bathing method supported by AWHONN (2018a), who recommends its implementation into clinical practice in all NICU's and newborn nurseries.

Methods

Prior to the implementation of this QI initiative, all full-time, part-time, and pier diem registered nurses were notified via email of the live, education session. This was deemed a QI project; therefore, informed consent was not required. The nurses were asked to complete the Evidence-Based Practice Questionnaire [EBPQ] (Appendix G), to be answered through the lens of neonatal bathing practices, to aid in identifying nursing perception of a change in practice. The EBPQ also included a short demographic section requesting the nurse's age range and years of practice. For this initial data collection, nurses identified themselves using the last four digits of their phone number.

The project was instituted and included a live, educational session with 17 registered nurses. Following the live session, the education session was made available to all staff via the institutions learning module or email, which included a voice over PowerPoint presentation. Follow-up emails and reminders were sent throughout the implementation process to the unit educator and nursing staff. Adequate copies of each of these handouts were made available to the nursing unit. The nursing staff were allotted one week to complete the pre-questionnaires, after watching the educational offering, if not previously completed in the live session. The 4 weeks following the live session were to be utilized to implement the project intervention. In doing so, staff were asked to complete a checklist (Appendix H) indicating if the infant met the criteria for the intervention, if the intervention was performed, as well as the infant's basic demographic information (day of life, birth gestational age, birth weight, and current weight). The Swaddle Bathing Clinical Practice Guideline was made available, at the nurses' station to guide the nursing staff in deciding when a patient meets the criteria to begin receiving routine ISB. Upon

determination of meeting the criteria for ISB, a turtle sticker was placed at the bedside to remind nursing staff to perform ISB when bathing was due, every three days.

The goal was to complete 80-100 ISB's within the 4-week implementation period.

At the end of the 4-week period, the nursing staff was asked to complete the EBPQ and short demographic section, for a second and final time. Paper copies of this questionnaire were made available at the nurses' station. The same nurse identifier that was used in pre-intervention questionnaire data collection was also used for the post-intervention questionnaire data collection, to match pre and post questionnaires. After completion of each step, the pre- and post-questionnaires, and ISB checklists were placed in a locked box for pick-up by the project lead. The unit staffs 69 registered nurses. The goal was to have 80% of registered nurses complete the pre- and post-questionnaires.

This data was tracked throughout the implementation period. Data was entered into an excel spreadsheet, on a password protected laptop, and all paper documentation with patient demographics was shredded. The nursing staff was asked to chart in the electronic health record when an infant received an ISB. The project lead then used all data collected to begin the evaluation process. Data collection was in accordance with the facility's HIPAA procedures, ensuring anonymity and confidentiality. In total, from beginning to end, the project lasted approximately 6 weeks.

Funding was not required for this QI project as the unit of interest had an adequate supply of the requested inclined TurtleTub™'s with built-in thermometer strip, disposable liners, and fleece blankets.

Measurement

Identified process measures included soliciting assistance from additional personnel (nurse manager, physical therapist, unit-based practice team, clinical nurse educator, and lead neonatologist) to ensure eligibility criteria was appropriate, and to confirm that the educational materials met the needs of the registered nurses performing the intervention.

Two primary outcome measures were identified for this project: 1). Increase nursing knowledge and satisfaction of an evidence-based developmentally appropriate bathing practice, and 2). Increase the percentage of infants who received ISB from 0% to 30%.

Objective 1 was measured utilizing the EBPQ (Upton & Upton, 2005) as a pre- and post-assessment. Written permission was granted for the utilization of this questionnaire by the creators, Domonic Upton and Penney Upton. The EBPQ was developed by the authors, who realized that there were no available data or tools assessing the factors that influence EBP acceptance and implementation through the lens of neonatal care. The EBPQ instrument is a 24-item Likert-type, self-report questionnaire that analyzes three subscales of EBP among healthcare workers: 1). Practice/skills, 2). Attitudes, and 3). Knowledge (Upton & Upton, 2005). Each item on the questionnaire is scored from 1-7 (i.e., 1=Poor, 7=Best). An average score can then be calculated for each subscale. A higher score "indicates a more positive attitude towards clinical effectiveness and evidence-based practice" (Upton & Upton, 2005, p. 455).

Internal consistency and reliability were determined using Cronbach's alpha. The entire questionnaire received a Cronbach's alpha score of 0.87, with each subscale (Practice, Attitudes, and Knowledge) scoring 0.85, 0.79, and 0.91, respectively (Upton & Upton, 2005, p. 456). Correlation coefficients for construct validity were found to be 0.3-0.4 ($P < 0.001$), suggesting a positive relationship between questionnaire scores and an independent measure of awareness of

evidence-based practice (Upton & Upton, 2005, p. 456). Assessment of discriminant validity confirmed that those with knowledge of the initiative had better practice, attitudes, and knowledge of EBP (Upton & Upton, 2005, p. 456). Given the high consistency, reliability, and validity the EBPQ is an appropriate tool for this project as it has been used successfully in EBP projects.

Objective 2 was calculated using descriptive statistics, including mean, median, frequency and percentages.

Data Analysis

Descriptive statistics analysis, using a Microsoft Excel spreadsheet for Microsoft 365 Microsoft Office, was utilized for nursing and infant demographic data as well as stratification of questionnaire scores based on reported demographics. Nursing demographics included the age range of nursing staff, as well as their number of years of experience. The infant demographics included their day of life, birth gestational age, birth weight, and current weight. Statistical analysis was conducted, with the use of IBM SPSS Statistics Version 27, by performing one-way ANOVAs to determine comparisons between age range and years of experience of registered nurses and average scores on the EBPQ questionnaire. For significant differences between mean comparisons, $p = < .05$.

Data analysis could not be performed to test the specific aims because few infants received ISB and no post-EBPQ questionnaires were completed.

Results

The project leader received 15 pre-questionnaires at the conclusion of the live, educational session. From the pre-project EBPQ instruments that were returned, years of experience ranged significantly with the most participants having had 1-5 years of experience

(Figure 1). Of the participants returning the instrument, five were in the 20-29 age range, four in the 30-39 age range, one in the 40-49 age range, and five in the 50-59 age range, showing that there was as wide variety of age ranges represented in the nursing staff (Figure 2).

The average score per question ranged from 3.7 to 6.4. The first subscale evaluates practice/skills and scores ranged from 4.0-4.7, with an average score of 4.5. The overall lowest score was for question 1c; how often nurses critically appraise evidence/literature to fill a gap in knowledge. The second subscale evaluates attitudes of evidence-based practice. Scores ranged from 4.9-6.4, with an average score of 5.8. The overall lowest score was for question 2a; the nurse's attitude towards staying up to date on new evidence, in addition to current workload. The final and third subscale evaluates knowledge of evidence-based practice. Scores ranged from 3.7 to 5.2, with an average score of 4.7. The overall lowest score was for question 3d; the nurse's knowledge of how to convert information needs into a research question.

Based on the participants and their age (Figure 3) five participants were aged 20-29. Scores by age ranged from 4.0-4.7 with an overall average score of 5.4. Four participants aged 30-39 had scores ranging from 3.0-6.3 with an overall average score of 4.6. One participant was aged 40-49 and had an average score of 4.0. Five participants aged 50-59 had scores ranging from 2.7-5.8 with an overall average score of 4.5.

Looking at average scores in relation to years of experience (Figure 4), participants with less than 5 years of experience scored 4.3-6.5, with an average overall score of 5.2. Participants with 5-15 years of experience had scores ranging from 2.7-6.7, with an average overall score of 4.4. Participants with 16-25 years of experience scored 4.7-6.0, with an average overall score of 5.4. Participants with greater than or equal to 26 years of experience had scores ranging from 2.0-5.7, with an average overall score of 4.1.

Several one-way ANOVAs were conducted to compare the effect of age and years of experience of registered nurses on the mean scores of questions included on the EBPQ. There was no significant effect of age on the mean scores of: question 1, which evaluated practice/skills [$F(10, 4) = 2.07$, $p = .253$]; question 2, which evaluates attitudes [$F(9,5) = .317$, $p = .936$]; or question 3, which evaluates knowledge [$F(11, 3) = .988$, $p = .576$]. Similar findings were discovered when one-way ANOVAs were conducted to compare the effect of years of experience on the mean scores of questions 1 [$F (10, 4) = .736$, $p = .685$], questions 2 [$F(9,5) = .446$, $p = .862$], or question 3 [$F(11, 3) = 2.309$, $p = .266$].

In total, three infants met the criteria, according to the Swaddle Bathing Clinical Practice Guidelines, and received the intervention. Birth gestational age ranged from 34 1/7 weeks gestation to 39 3/7 weeks gestation, with an average birth gestational age of 37 1/7 weeks. Days of life ranged from 0 to 34 with an average day of life of 16, providing an average corrected gestational age of 39 3/7. Birth weights ranged from 2840 grams to 3510 grams with an average birth weight of 3163 grams. Infant weights at the time of the intervention ranged from 3110 grams to 3720 grams with an average current weight of 3375 grams.

The number of infants who received the intervention was limited, though the number of infants meeting the criteria and receiving the intervention were expected to be higher given the patient population of the unit and the occurrence of baths every three days. Unfortunately, no post-project questionnaires were returned. This was also unexpected given the volume of nursing staff for this unit. These factors greatly limited the data analysis for this project.

Barriers

There were several barriers to the implementation of this project. Initially, the project was slated to be carried out at a local facility to the project lead, with a slightly larger NICU.

However, the required IRB process to gain approval for implementation at this facility was rather extensive and the timeline from implementation to completion of the project simply did not permit this delay. For this reason, the project site was moved last minute to fulfill appropriate time requirements in project completion. In addition, the last-minute change created major barriers in implementation and data collection, as the project lead was not local to the project site. Therefore, there was an inability of the project lead to recruit nurse champions to advocate the change, promote it, and ensure its implementation.

In addition, the COVID-19 pandemic was a barrier due to visitor restrictions and the inability of parents to visit their infants outside of a specified time range. Baths are generally performed on night shift, meaning that most parents were unable to participate in the baths unless performed within the specified visitation hours, at the nurse's discretion. This caused a great hinderance to the NICDM core measure of partnering with families and providing family-centered care and satisfaction, in terms of bathing practices.

Another significant barrier was intact umbilical cords. Typically, umbilical cords do not fall off for 10-14 days after birth. Immersing umbilical cords is a chief concern among health care providers as there is potential for the development of an umbilical cord bacterial infection, known as omphalitis. Therefore, the intervention could not be carried out for many infants who met the criteria for ISB until their umbilical cord was no longer intact.

Perhaps one of the greatest barriers to the implementation of this evidence-based, best bathing practice was staff buy-in. It is vital that staff understands the evidence-based benefits that are guiding the practice change. Hence, the emphasis on staff education prior to implementation.

Facilitators

The faculty lead was local to the new project site and was deemed a point of contact to assist in facilitation of the implementation process at the chosen facility. Electronic communications were also sent throughout the implementation process to check in and remind staff to perform the intervention when an infant met the criteria. While a barrier, staff buy-in is also a facilitator to the implementation of an evidence-based practice change. It is ultimately the nurse's discretion whether an intervention is instituted, and a practice change is sustained.

Discussion

Summary

Conventional bathing practices in the NICU have shown to be a stressful activity for neonates and one that has the potential to negatively impact the developmental and physiological outcomes of premature infants. To negate these negative outcomes, the Association of Women's Health, Obstetric, and Neonatal Nursing [AWHONN] recommends ISB to be the best, evidence-based, developmentally appropriate bathing practice. The proposed outcomes of this project were to increase the percentage of premature infants receiving a developmentally appropriate bath, by 30%, and to see an increase in nursing knowledge and satisfaction regarding an evidence-based, developmentally appropriate bathing practice.

Interpretation

As evidenced by the data previously presented, there was a wide variety of age ranges represented in the nursing staff participants. With an increase in the age of participants, there was a linear but not statistically significant decline in positive attitudes towards clinical effectiveness and EBP. Lewin's Change Theory explains that change occurs in three phases: unfreezing, change, and re-freezing (Shirey, 2013). Nurses ultimately have power over recommended change as they are required to unfreeze their current practices to institute new processes, which

subsequently drives the outcomes. Further solidifying the fact that staff buy-in is essential when an EBP change is presented.

In the unit of interest, of the 15 pre-questionnaires completed by the nursing staff and the three EBP subscales that were evaluated, the "attitudes" subscale received the highest rating. This indicates that there is a positive attitude towards clinical effectiveness and EBP among nursing staff indicating a positive work environment. However, with an increase in the age of the participants, there was a linear decline in positive attitudes toward clinical effectiveness and EBP. The two overall lowest subscale scores, "practice/skills" and "knowledge", show a linear correlation indicating that while the nursing staff may have positive attitudes towards EBP change, they lack the appropriate knowledge of EBP to convert information needs into a research question. Therefore, this flows into the nurse's practice as they are not knowledgeable of how or what to search in the literature and, therefore, are unable to critically appraise the evidence/literature to fill their gaps in knowledge and to improve their practice/skills. This is further evidenced by the overall lowest score for question 2a on the pre-project EBPQ instrument; nurse's attitude towards staying up to date on new evidence, in addition to current workload. Average scores by years of experience also seem to have a linear relationship with a decrease in average scores as years of experience increases. There was a slight increase in average scores in those participants with 16-25 years of experience.

Due to the lack of data that resulted the first outcome measure, increase in nursing knowledge and satisfaction regarding an evidence-based, developmentally appropriate bathing practice, was not met. Though a limited number of infants received ISB, the second outcome measure (increase the percentage of premature infants receiving a developmentally appropriate

bath, by 30%) was met as the unit of interest did not previously or consistently utilize ISB as recommended.

Limitations

Unfortunately, due to lack of data and small sample size, the outcomes of this project cannot be generalizable to the NICU populations locally, nationally, or globally. Though the instrument utilized in measuring the outcomes was deemed valid and reliable, there was not an appropriate amount of data available to for this QI initiative to test validity or reliability due to unforeseen and unpreventable flaws in the process measures.

The last-minute change in the site location greatly hindered the process measures initially planned for this QI initiative. In the planning stages, a logic model (Appendix I) was completed to guide the process and implementation of this QI project. To that, the Iowa Model of EBP (Appendix E) was also utilized as a guide for implementing this QI initiative, however, there was a break in the cycle preventing an integration and sustainability of EBP change.

The processes failed within the new site location as project lead did not have ample accessibility to recruit nurse champions to assist in pushing the initiative forward. In the same regard, because the project lead was not local to the site, a small group of registered nurses were educated during the live session as the project lead was unable to present more than one live session. Though it was discussed that the voiceover PowerPoint and education would be distributed to the staff, there was no way to confirm that education was distributed or completed as planned. Did the nursing staff know about the QI project? Did the unit leadership distribute the education to the staff or encourage the initiative? Did the nursing staff receive and view the education to know how to properly perform an ISB? Was the staff aware of the data collection that was to be completed?

There are many unanswered questions as to why this QI initiative resulted in the limited data that it did. Due to the distance of the project lead, the restrictions of the global pandemic, and the lack of processes available for effective communication with the project site and unit leadership, efforts to minimize/adjust for the identified limitations were lacking. There are many areas within the process measures that could have been adjusted/improved upon had time allowed for continued re-evaluation during the implementation cycle to correct unsuccessful process measures and yield successful outcomes of an EBP change in developmentally appropriate bathing techniques.

Conclusions

Usefulness/Sustainability

Based on substantial literature, ISB has the potential to be a useful practice in the NICU. Specifically, the use of the TurtleTub™ is cost effective as it allows for multiple patient use while maintaining cleanliness. Simple on-site education with the equipment is quick (10-20 minutes). Education can be supported through multiple portals. There is potential for the project to be sustainable through proper education, policy change, and nurse champions to promote the change. ISB is a feasible QI initiative as bathing is a routine standard of care in the NICU, typically every third day. This intervention simply requires a unit to change the technique in which they bathe.

Though the project did not yield the expected participation and results, the procedures developed in this QI project have the potential to be sustainable in an environment where there is unit and organizational levels of support for the change. The outcomes of this QI initiative show how any break within an implementation cycle can affect the success of the QI project.

Future implications

Given the overall results of the pre-project EBPQ questionnaire, it gives the impression that nurses who participated in the intervention do not immerse themselves in literature or research. It is imperative to encourage staff to be more involved in filling their knowledge gaps regarding EBP. To do so, it may be beneficial for the unit leaders to implement the following to improve attitudes and skills regarding EBP:

- Encourage nurses to become part of a professional organization (such as AWHONN) where they can have access to peer reviewed journals in their area of specialty.
- Provide opportunities for staff to work together on different project teams within the unit, such as QI initiatives.
- Use mandatory staff meetings as an opportunity to introduce brief evidence-based topics and/or how to research information for gaps in knowledge.

Nurses play a huge role in the success of EBP change and it is imperative to find innovative ways to bring them on board to integrate and sustain change.

Lastly, it is necessary to ensure that QI projects are in line with a conceptual framework, such as The Iowa Model of EBP, to guide successful EBP change and ensure an appropriate team of stakeholders have been identified and urged to drive the QI initiative. The success of QI initiatives cannot be expected if there is any break in the cycle. Thus, every conscious effort must be made to re-evaluate the process and make changes throughout the implementation period to ensure the intervention is carried out appropriately, and to ensure successful integration and sustainability of an EBP change.

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Table 1

Literature Matrix

Intervention: Immersion swaddle bathing	**Ceylan & Bolisik (2018)**	**Caka & Gozen (2018)**	**Paran et al. (2016)**	**De Freitas et al. (2004)**	**Bryanton et al. (2004)**	**Edraki et al. (2014)**	**Gunay & Coskun (2018)**	**Swapna et al. (2017)**
Comparisons/ Terms	-swaddle bathing vs sponge bathing	-swaddle bathing vs tub bathing	-swaddle bathing vs conventional bathing	-swaddle bathing vs conventional bathing	-tub bathing vs sponge bathing	-swaddle bathing vs conventional bathing	-tub bathing vs non-bathing	-swaddle bathing vs conventional bathing
Thermoregulation	-swaddled bathing protects infants from heat loss.	- Post-bath body temperature decreased significantly less in swaddle bathing vs tub bathing	-not studied	-body temperature decreased over time -no difference between groups	- between group comparison showed that the tub-bathed babies had significantly less temperature loss, compared to sponge-bathed babies.	- There was no significant statistical difference in body temperature before and after swaddle bathing. -in conventional bathing, body temperature before and after bathing was	- Body temperature was found to be insignificant between the groups.	- The mean temperature loss was less in preterm infants who underwent swaddle bath and mean temperature loss was high in conventional bath. This was statistically significant.

						statistically different. - The mean body temperature after the conventiona l bath was significantly lower than in the swaddle bath group. - The comparison of the infants mean body temperature changes 10 minutes after, compared to 10 minutes before, the bath between the two groups showed a significantly lower mean		

						temperature change in the swaddle bath group and a higher temperature loss in the conventiona l bathing group		
Physiological parameters	- Swaddled bathing has a positive effect on cardiorespira tory status in premature infants, compared to sponge bathing.	- Oxygen saturation was higher in SB after bathing -Heart rate after bathing was significan tly lower in swaddle bathing vs tub bathing but this was not statisticall y	-not studied	-HR decreased over time -oxygen saturation levels increased over time -no difference between groups	-not studied	-not studied	- Heart rate was found to be statisticall y significant between groups at 15 minutes after bath. - respirator y rate was found to be statisticall y significant at 15 and 30	- Heart rate, respiratory rate, and oxygen saturations were maintained in swaddled bath group. However, heart rate and respiratory rate increased above normal in the conventional bath group. This was statistically significant.

		significant					minutes post-intervention between groups. -systolic blood pressure was statistically significant at 15 minutes post intervention, between groups. -diastolic blood pressure and oxygen saturations between the groups was insignificant	

Pain/Stress	-swaddled bathing reduces signs of pain and stress in premature infants.	- NIPS scores were less in swaddle bathing vs tub bathing, after bathing	-the mean occurrence of distress and behavior responses was statistically lower in swaddled bathing compared to conventiona l bathing -the percentage of eyes closed was significantly higher in the experimenta l group than the control group.	-cortisol levels increased over time -no difference between groups - Changes in the sleep-wake states over time did not differ significant ly between the two types of baths.	- Tub bathed babies were significantl y and clinically more content than sponge bathed babies.	-not studied	- There was a statisticall y significant difference between state of pain of newborns, when comparing both groups, at 15, 30, and 60 minutes after interventi on.	-swaddled bathing reduces pain and behavioral distress in infants
Crying duration	-statistically significant decrease in crying duration, in swaddle bath group	-crying duration was less in swaddle bathing vs	-not studied	-not studied	- Tub bathed babies were statistically more content than sponge	- crying time was significantly lower in the swaddle bath group than in the	-not studied	- Study found that preterm infants had a less duration of crying in swaddle bath

	compared to sponge bath group	tub bathing			bathed babies.	conventiona l group.		compared to conventional bath

Figures 1

Participant's years of nursing experience

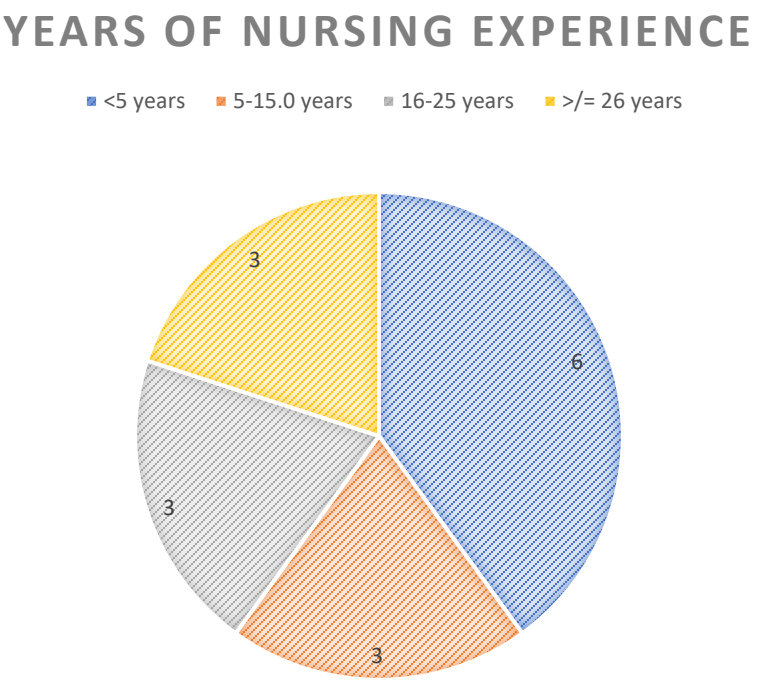


Figure 2

Age range of participants

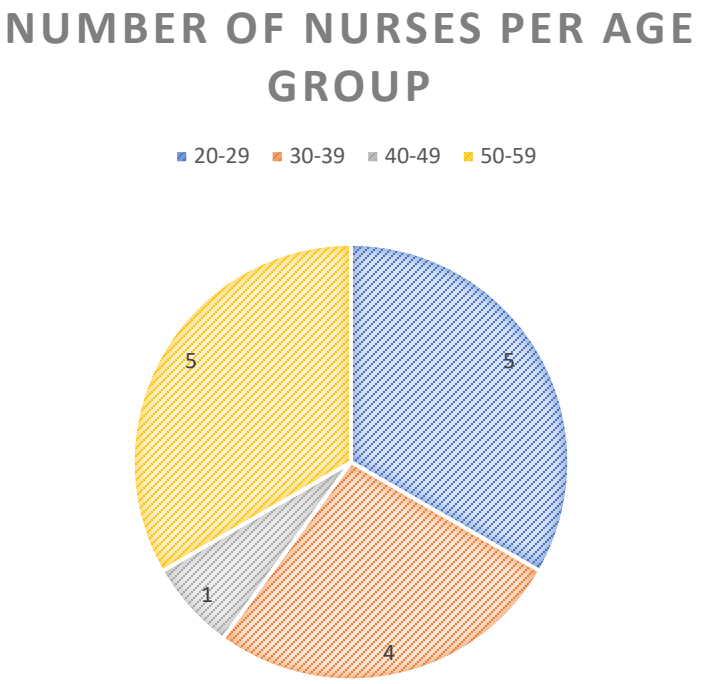


Figure 3

Overall average score per age range of participants

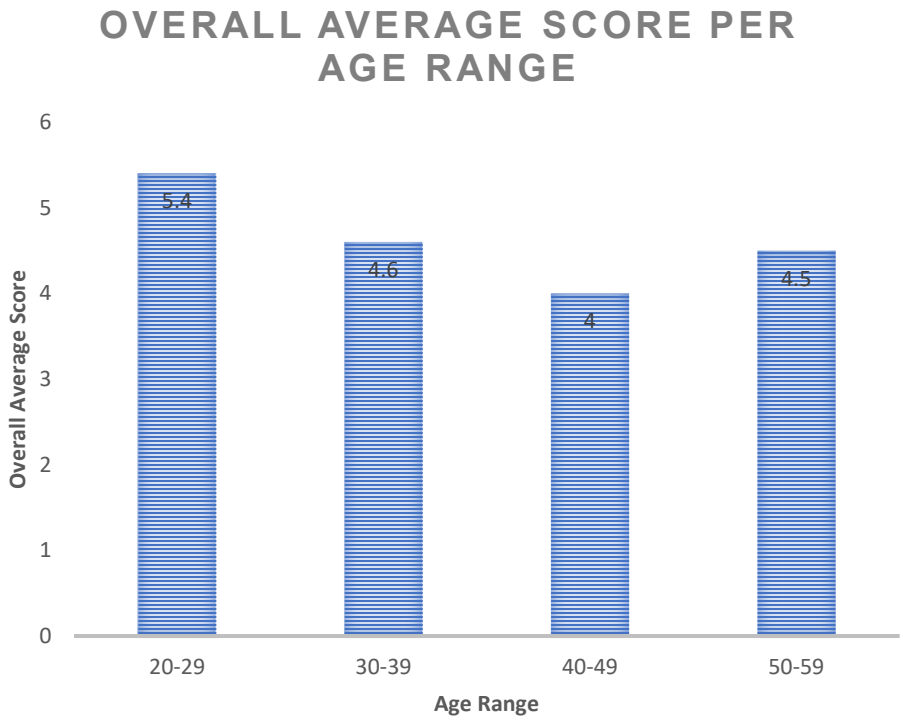
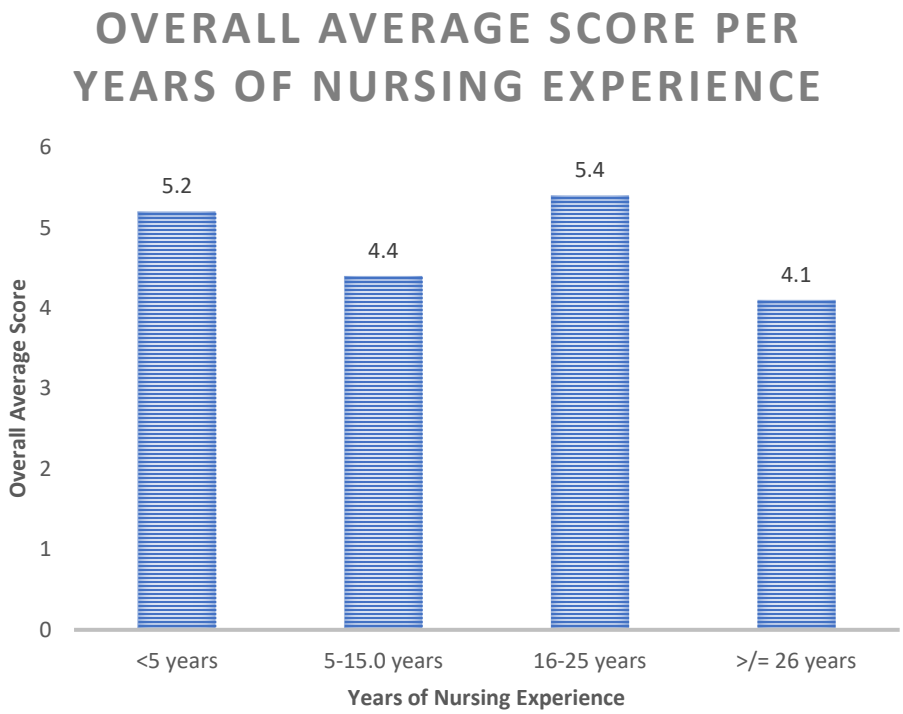


Figure 4

Overall average score per years of experience of participants



Appendix A

Swaddle Bathing Clinical Practice Guideline

(Catapult Products, LLC., 2020c)

Swaddle Bathing Clinical Practice Guideline*

Swaddle Bathing...

- Supports family centered care
- Decreases behavioral stress
- Improves thermoregulation
- Enhances ability to feed after bath
- Can be routine bathing practice in hospitals

CAUTION:
For mothers with a bloodborne pathogen, bathe infant as soon as possible after birth.

Is Immersion Swaddle Bathing indicated?

Is your patient in the NICU?

Y

N

Bathe in a quiet draft-free environment

Educate family about how to bathe

<32 weeks gestation

32-33 weeks gestation

≥34 weeks gestation

Healthy infant

N

>7 days after birth

Y

Routine bathing not indicated.

Delay bath for at least 6-24 hours or per hospital protocol.

If vernix is present, leave on skin

Keep bath as short as possible (7-10 min.)

N

- No IV's or central lines
- Thermal and cardiorespiratory stability
- Adequate stability to be off monitors for 10+ minutes
- Infant weighs 1500g or more

Y

Has umbilical cord fallen off?

N

Y

Immersion swaddle bath every 2-3 days using mild, pH neutral cleanser

Immersion swaddle bath or shallow swaddle bath (depending on umbilical cord hospital policy) every 2-3 days using mild, pH neutral cleanser

TurtleTub™

*This guideline was compiled from available literature and is for educational reference only. Although every effort has been made to report faithfully the information, the editors and publisher cannot be held responsible for the correctness. Catapult Products LLC and their editors disclaim any liability arising directly or indirectly from the use of this guideline.

Appendix B

University of Louisville Outcomes Letter

UNIVERSITY OF LOUISVILLE

Human Subjects Protection Program Office
MedCenter One – Suite 200
501 E. Broadway
Louisville, KY 40202-1798

DATE:	December 15, 2020
TO:	Lela A Baker
FROM:	The University of Louisville Institutional Review Board
IRB NUMBER:	20.0901
STUDY TITLE:	Implementation of an Evidence Based Quality Improvement Project to Improve Bathing Practices in the Neonatal Intensive Care Unit (NICU): A Project Proposal
REFERENCE #:	715817
DATE OF REVIEW:	12/14/2020
IRB STAFF CONTACT:	Sherry Block 852-2163 slbloc04@louisville.edu

The IRB Chair/Vice-Chair (or An IRB member) has reviewed your submission. The project described does not meet the "Common Rule" definition of human subjects' research. The IRB has classified this project as Non-Human Subjects Research (NHSR). The project can proceed.

This submission has been determined to be quality improvement, and not human subjects research, based on the goal(s) stated in the protocol.

Institutional policies and guidelines on participant privacy must be followed. If you are using protected health information, the HIPAA Privacy rules still apply.

Any changes to this project or the focus of the investigation must be submitted to the IRB to ensure that the IRB determination above still applies.

Amendments for personnel changes are not required.

If you have any questions, please contact: Sherry Block 852-2163 slbloc04@louisville.edu

Sincerely,

Paula Radmacher, Ph.D., Vice Chair,
Biomedical Institutional Review Board
PR/slb

Appendix C

University of Louisville Amended Outcomes Letter

UNIVERSITY OF LOUISVILLE

Human Subjects Protection Program Office
MedCenter One – Suite 200
501 E. Broadway
Louisville, KY 40202-1798

DATE:	March 01, 2021
TO:	Lela A Baker
IRB NUMBER:	20.0901
STUDY TITLE:	Implementation of an Evidence Based Quality Improvement Project to Improve Bathing Practices in the Neonatal Intensive Care Unit (NICU): A Project Proposal
REFERENCE #:	722395
IRB STAFF CONTACT:	Sherry Block 852-2163 slbloc04@louisville.edu

The amendment request has been received by the Human Subjects Protection Program Office and approved by the Chair/Vice Chair of the Institutional Review Board (IRB) on 02/26/2021 through the expedited review procedure according to 45 CFR 46.110(B). The following documents have been reviewed and approved:

Submission Components			
Title	Version #	Version Date	Outcome
Johnson - IROC Letter	Version 1.0	02/18/2021	Approved
DNP Immersion Swaddle Bathing Defense PowerPoint	Version 1.0	12/01/2020	Approved
Immersion Swaddle Bathing Staff Education	Version 1.0	12/01/2020	Approved

The modifications include:

- This amendent is to add a new site - UofL Health Research Office Research

The committee will be advised of this action at a regularly scheduled meeting.

If you have any questions, please contact: Sherry Block 852-2163 slbloc04@louisville.edu

Sincerely,

Serge A Martinez

Serge A. Martinez, M.D., J.D., Vice Chair,
Biomedical Institutional Review Board
SM/slb

Appendix D

Letter of Approval from Agency

February 11, 2021

Re: Implementation of an Evidence-Based Quality Improvement Project to Improve Bathing Practices in the Neonatal Intensive Care Unit

Kimberly Johnson
UofL Hospital
530 S. Jackson St.
Louisville, KY 40202

Dear Ms. Johnson,

On February 11, 2021 the Interdisciplinary Research Oversight Council (IROC) completed a scientific review of your proposed research study. The committee members determined that there were no threats to internal and external validity of the study, and that the study had the potential to advance scientific knowledge in the field. In addition, the study does not appear to have an adverse operational or financial impact on any nursing unit. As a means of follow-up, the IROC would appreciate an update on your progress the last month of each quarter at their monthly business meeting.

The next step in the project approval process is submission to the Human Subjects Protection Program (HSPP) at the University of Louisville (UofL) for review by their Institutional Review Board (IRB). Applications are made using their iRIS system, which requires a sponsored account through UofL. The request form is located on the UofL HSPP website at https://louisville.edu/research/humansubjects. You can contact the IRB at hsppofc@louisville.edu or (502) 852-5188.

You may access the iRIS system online at the following web address: https://iris.louisville.edu:444 or contact the UofL Health Research Office (ULHRO) for assistance at umcresearch@ulh.org. If you complete the submission process in iRIS, please select UofL Health as a Department, include UofL Health Research office as a contact, and select UofL Hospital as a study site. All study specific correspondence should be sent to the ULHRO via their service account.

Once the iRIS submission is complete, your proposal will be received and reviewed by the IRB and the ULHRO. Note that both offices will issue an approval letter upon review completion.

Please note that data collection at UofL Health cannot begin until all approvals have been received.

Thank you for advancing the nursing research enterprise at UofL Hospital.

Sincerely,

Kathryn L. Robinson, MSN, RN, NPD-BC, OCN
Interdisciplinary Research Oversight Council
System Evidence Based Practice Coordinator
University of Louisville Hospital
(502) 541-9770
kathrob@ulh.org

cc: umcresearch@ulh.org , , Kathy Wohlschlegel

Appendix E
Iowa Model for Evidence-Based Practice
(Iowa Model Collaborative, 2017)

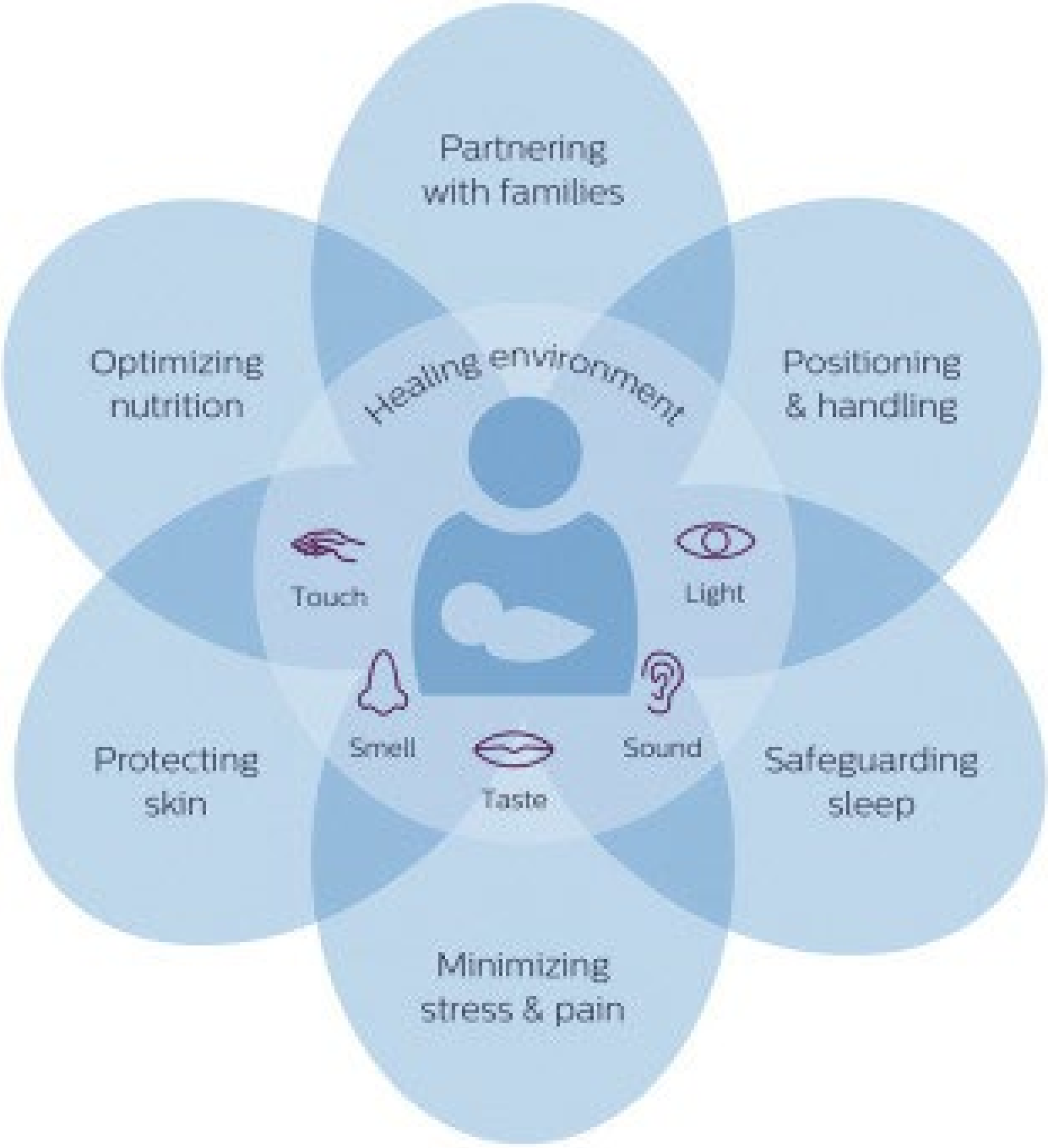
Iowa Model for Evidence-Based Practice	Immersion Swaddle Bathing
1). Identify a problem	Conventional bathing is not developmentally appropriate for newborns. ISB is an evidence-based best practice bathing method.
2). Form the question/purpose	The purpose is to implement an evidence-based bathing practice in a Level III NICU that includes an updated bathing policy, clinical practice guideline, and staff education.
3). Form a team	Project lead, nurse manager, clinical nurse educator, lead neonatologist, physical therapist, and champion staff nurses.
4). Assemble, appraise, and synthesize the evidence supporting the resolution of the identified problem	A literature search was performed, using inclusion and exclusion criteria, yielding a final literature sample of 11 full-text articles to support the implementation of ISB over conventional bathing.
5). Design and pilot the practice change	All nursing staff took part in a brief, online, education session detailing ISB. After, a 6-week implementation period the nurses were asked to employ the ISB technique on all infants who met criteria for ISB.
6). Integrate and sustain the practice change	The intervention is feasible as the unit utilizes routine bathing measures every three days. The principal change in practice was the technique of routine bathing.
7). Disseminate the results	Quantitative data analysis (descriptive and one-way ANOVA) was performed to evaluate the effectiveness of the intervention.

Note: This table demonstrates the seven key steps to translating evidence into clinical practice, to improve patient care and outcomes, and how it has been utilized to guide the development and implementation of this project.

Appendix F

Neonatal Integrative Developmental Care Model [NIDCM]

(Altimier & Phillips, 2016)



Appendix G

Evidence-Based Practice Questionnaire [EBPQ]

(Upton & Upton, 2005)

Evidence Based Practice Questionnaire (EBPQ).

This questionnaire is designed to gather information and opinions on the use of evidence-based practice amongst health professionals. There are no right or wrong answers for we are interested in *your* opinions and *your* own use of evidence in *your* practice.

Please answer the following questions through the lens of neonatal bathing practices

1. Considering your practice in relation to an individual patient's care over the *past* year, how often have you done the following in response to a gap in your knowledge (please √ or X):

Formulated a clearly answerable question as the beginning of the process towards filling this gap:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Tracked down the relevant evidence once you have formulated the question:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Critically appraised, against set criteria, any literature you have discovered:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Integrated the evidence you have found with your expertise:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Evaluated the outcomes of your practice:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

Shared this information with colleagues:

Never ☐ ☐ ☐ ☐ ☐ ☐ ☐ **Frequently**

2. Please indicate (by √ or X) where on the scale you would place yourself for each of the following pairs of statements:

My workload is too great for me to keep up to date with all the new evidence	☐ ☐ ☐ ☐ ☐ ☐ ☐	New evidence is so important that I make the time in my work schedule
I resent having my clinical practice questioned	☐ ☐ ☐ ☐ ☐ ☐ ☐	I welcome questions on my practice

Evidence based practice is a waste of time	☐ ☐ ☐ ☐ ☐ ☐ ☐	Evidence based practice is fundamental to professional practice
I stick to tried and trusted methods rather than changing to anything new	☐ ☐ ☐ ☐ ☐ ☐ ☐	My practice has changed because of evidence I have found

3. On a scale of 1 to 7 (with 7 being the best) how would you rate your:

Please circle one number for each statement							
	Poor						**Best**
Research skills	1	2	3	4	5	6	7
IT skills	1	2	3	4	5	6	7
Monitoring and reviewing of practice skills	1	2	3	4	5	6	7
Converting your information needs into a research question	1	2	3	4	5	6	7
Awareness of major information types and sources	1	2	3	4	5	6	7
Ability to identify gaps in your professional practice	1	2	3	4	5	6	7
Knowledge of how to retrieve evidence	1	2	3	4	5	6	7
Ability to analyse critically evidence against set standards	1	2	3	4	5	6	7
Ability to determine how valid (close to the truth) the material is	1	2	3	4	5	6	7
Ability to determine how useful (clinically applicable) the material is	1	2	3	4	5	6	7
Ability to apply information to individual cases	1	2	3	4	5	6	7
Sharing of ideas and information with colleagues	1	2	3	4	5	6	7
Dissemination of new ideas about care to colleagues	1	2	3	4	5	6	7
Ability to review your own practice	1	2	3	4	5	6	7

4. Finally, some information about you:

Years of nursing experience _____

Please circle the most appropriate answer as it concerns you:

Your age range: 20-29 30-39 40-49 50-59 60-69

Last 4 digits of your phone number _____(for data collection purposes, will be discarded

Appendix H

ISB Criteria Checklist

Immersion Swaddle Bathing Checklist

Infant must meet all 5 criteria for ISB

___ ≥ 32 weeks gestation
___ > 1500 grams
___ No IV access or lines
___ Thermal/cardiorespiratory stability
(if 'stable' enough for conventional bath, meets criteria)
___ Umbilical cord off

Does infant meet criteria? YES___ NO___

Which bathing technique was utilized? (Circle)

Immersion Swaddle Bathing
Swaddle Bathing
Sponge Bathing

Do not immerse if circumcision not healed

Please complete the following:

Birth GA _____ Day of Life _____ Birth Wt _____ Current Wt _____

If criteria met and ISB not utilized, provide brief explanation:

_____

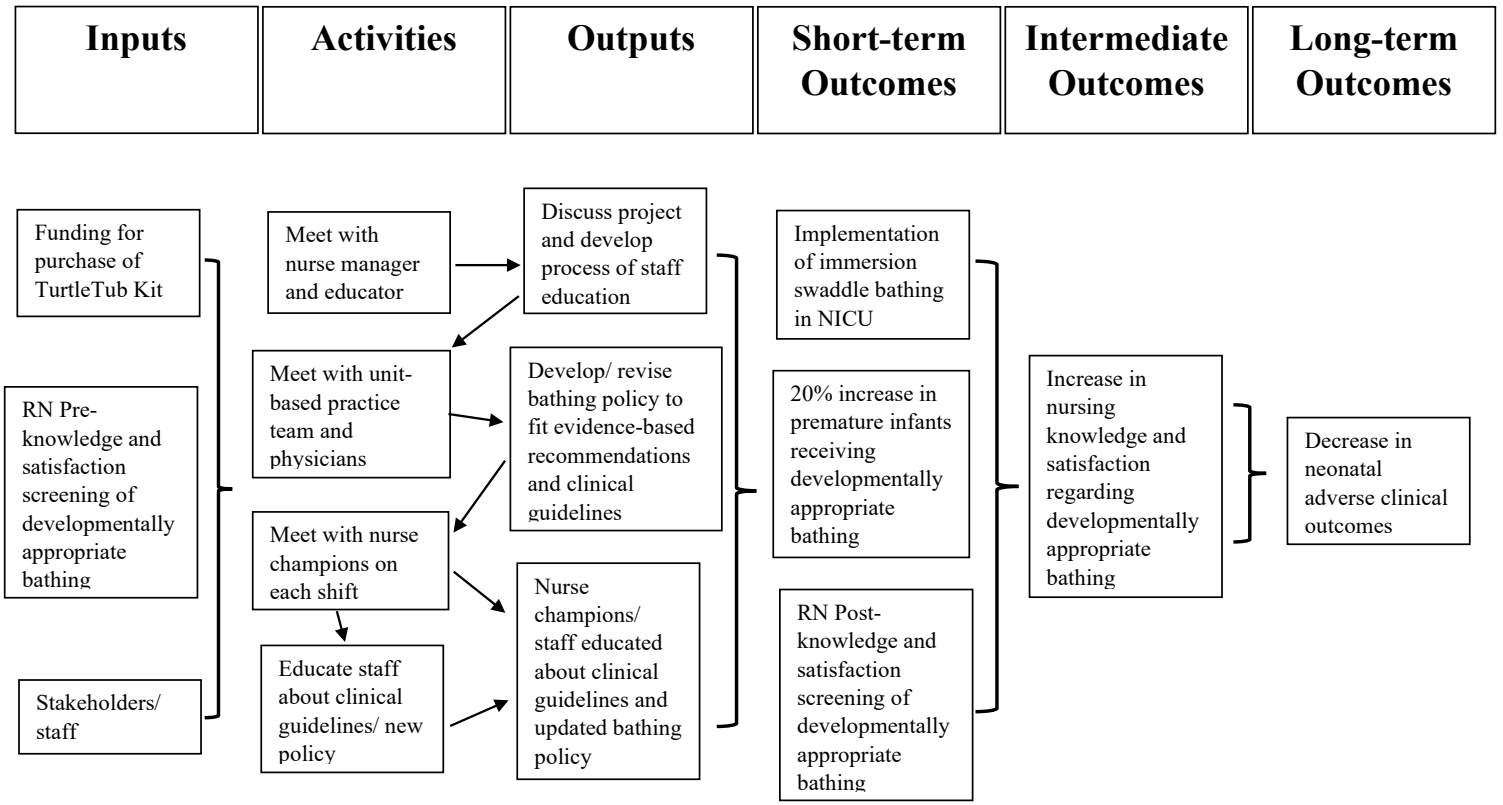
_____

Please place completed form in locked box at nurses' station. Thank you!!

Appendix I

Review of the Literature – Logic Model

***Situation**:* Bath time (performed every 3 days) can be a very stressful, and even painful, event for neonates. There are currently no containment policies in place to provide developmentally appropriate care during bathing in the NICU, to reduce adverse clinical outcomes.



Assumptions: TurtleTub kits will be special ordered for implementation of intervention. Policy changes will be maintained in the NICU. Neonates will maintain stable physiological parameters.

External Factors: Though educated, unable to ensure every nurse performs immersion swaddle bathing at all or according to guidelines set in place.