Kangaroo Care and Improved Physiological Status in Preterm Infants: An Integrative Review

An Integrative Review

Submitted to the

Faculty of Liberty University

In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

Kira Harkonen

Liberty University

Lynchburg, VA

April 17, 2023

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Integrative Review Chair Approval:

Dr. Rachel Joseph	04-26-2023
Name	Date

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Abstract

Preterm births continue to cause long-term sequelae for infants worldwide. Interventions in the neonatal intensive care unit (NICU) that promote better outcomes can make an impact on preterm infants' futures. The purpose of this review was to determine if kangaroo care has positive physiological effects on preterm infants in the NICU. Practice changes to enhance kangaroo care in the NICU include reducing barriers such as medical complexity and staff misconceptions as well as facilitating increased parental presence. The review of the literature found evidence to support the positive outcomes that kangaroo care has on neonates' growth, vital signs, stress outcomes, and pain. Implications for practice include increased use of kangaroo care for preterm infants in the NICU. The findings in this literature review can potentially impact outcomes for preterm infants by improving their physiological status while in the NICU.

Keywords: neonatal intensive care unit, NICU, kangaroo care, benefits, preterm infant, physiological status

List of Abbreviations

Kangaroo care (KC)

Kangaroo mother care (KMC)

Kangaroo father care (KFC)

Neonatal intensive care unit (NICU)

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

Skin-to-skin contact (SSC)

Kangaroo Care and Improved Physiological Status in Preterm Infants: An Integrative Review

As preterm births worldwide continue to cause long-term sequelae for infants, it is imperative to implement interventions that promote better outcomes. Kangaroo care (KC) is a simple yet meaningful intervention for both infants and their parents. This intervention is cost-effective and only requires time and diligent monitoring. KC is a common practice among full-term newborns and their mothers or fathers. Similarly, KC can be implemented for preterm babies. This practice needs more attention and emphasis to be normalized in the neonatal intensive care unit (NICU).

Background

KC, often referred to as skin-to-skin contact (SSC), was first practiced in 1978 in an overcrowded NICU in a hospital in Bogota, Colombia. The practice was originally intended for use with preterm infants born before 37 weeks gestational age or with a birth weight under 2500 grams (Pados & Hess, 2020). This practice was started by a pediatrician and professor, Dr. Rey-Sanabria, and became standard in Colombia and then abroad with the help of the Kangaroo

Foundation (Pados & Hess, 2020). According to the World Health Organization (2021), over 15 million babies are born preterm (before 37 weeks gestational age) every year. Studies have shown the benefits of KC on preterm outcomes. It is prudent to continue to assess these benefits and address barriers to implementing this care.

The samples utilized in the literature review included preterm infants born at less than 34 weeks gestational age who were clinically stable enough to receive KC from their mothers in the NICU. Studies included sample sizes of 10–1,461 infants; the setting of each study included a single NICU and up to 11 NICUs. Gestational ages ranged from 22 weeks to 34 weeks with birth weights ranging from 370 grams to 1,410 grams.

Inclusion criteria for this integrative review consist of publications on preterm infants born before 34 weeks gestational age admitted to the NICU. Exclusion criteria included publications on infants with gestational age greater than 34 weeks, infants with congenital anomalies, infants requiring surgery, or those on sedation or analgesia (Hurley & Harrison, 2020).

Defining Concepts and Variables

The population of interest is preterm infants with gestational age less than 34 weeks. The intervention is defined as the use of KC and its relationship to the physiological status of preterm infants. According to Toronto and Remington (2020), establishing criteria is required. An integrative literature review was conducted and included publications on KC in multiple NICUs worldwide.

Prematurity is defined as any birth before 37 weeks' gestation (Quinn et al., 2016). This designation is further subdivided based on gestational age: extremely preterm (< 28 weeks), very preterm (28–32 weeks), and moderate or late preterm (32–37 weeks). A term birth is defined as a

birth between 37-42 weeks' gestation and is the optimal timing for good outcomes for mother and baby (Quinn et al., 2016).

KC is defined as early, continuous, and prolonged SSC between the mother and baby (Chan et al., 2016). In KC, the baby wears only a diaper and is held close against the parent's chest (Nationwide Children's, 2018). Parents usually engage in KC once or twice a day for at least one hour at a time if it is tolerated by the baby. The longer the baby is held, the better. During KC, parents should avoid doing other things such as rocking, talking to others, or watching television. It is meant to be a quiet time for the parent and baby. Activities that promote bonding during KC include talking softly to the baby, singing a lullaby, or reading a book (Nationwide Children's, 2018).

KC has been shown to improve preterm infants' physiological status when utilized in the NICU. KC can lead to an increase in mother's milk production, a better chance of breastfeeding, and increased bonding between parent and baby. Additionally, for the baby, KC can lead to staying warmer and regulating body temperature better, improved heart rate and breathing pattern, improved weight gain, lower stress level and less crying, improved sleep, decreased pain and risk of infection, and better brain growth and development (Nationwide Children's, 2018). KC has also been shown to reduce mortality rates, promote better sleep-wake cycles, reduce infections, promote weight gain, stabilize vital signs, and provide thermoregulation (Orahood, 2021).

Rationale for Conducting the Review

The rationale for selecting this population for this review is the desire to improve outcomes for preterm neonates and their families globally, as the occurrence of preterm births worldwide is on the rise, resulting in long-term implications for these families. Medicine and

technology continue to advance, but simple interventions can promote better outcomes for these vulnerable patients.

KC is a relatively easy intervention that has proven benefits to the neonate. Nurses in NICUs are reluctant to use this intervention for various reasons. This intervention must be a priority due to its proven benefit to the health and outcomes of the neonate. Support systems need to be made available for nurses and parents so that they can be educated about the benefits of KC and so that safe care can be provided.

Purpose

According to the World Health Organization (2021), every year an estimated 15 million babies are born preterm. Complications from preterm births are the leading cause of death among children under 5 years of age, resulting in approximately 1 million deaths. Three quarters of these deaths could be prevented with currently known interventions. KC is a proven, cost-effective way to improve physiological outcomes for preterm infants.

The purpose of this integrative review was to examine the association between KC and improved physiological status in preterm infants less than 34 weeks gestational age. This integrative review aims to determine if KC has positive physiological effects on preterm infants in the NICU. An additional goal of this review is to examine the barriers to implementing KC and ways to overcome these barriers.

Inclusion and Exclusion Criteria

Inclusion criteria included articles on infants less than 34 weeks gestational age in the NICU, articles that discussed physiological status, articles in English, and articles published within the past 7 years. Exclusion criteria were articles on infants greater than 34 weeks gestational age and articles published prior to 2016.

Conceptual Framework/Model

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework was utilized for this integrative review. This framework is utilized for systematic reviews of studies to evaluate effects of health interventions (Page et al., 2021). The PRISMA framework was designed to help systematic reviewers report why the study was done, what they did, and what they found. PRISMA provides a checklist that guides the search for, selection of, and appraisal of evidence. The PRISMA checklist is recommended for use for reporting systematic reviews and comprises 27 checklist items. For this integrative review, the PRISMA checklist was utilized to examine the eligibility criteria, information sources, search strategy, selection process, data collection process, data items, study risk of bias, effect measures, and synthesis methods. The PRISMA model was designed to evaluate the effects of health interventions, regardless of the study designs (Page et al., 2021). The PRISMA flow diagram is included in Appendix A.

The Whittemore and Knafl (2005) integrative review methodology was utilized to analyze journal articles. The framework has five stages: problem identification, literature search, data evaluation, data analysis, and presentation. Problem identification involves a clear identification of the problem and the review purpose. The literature search includes database searching, hand searching, ancestry searching, and networking. Data evaluation involves empirical and theoretical sources that are of good quality, authentic, informational, and representative. Further data evaluation takes place through theory analysis and critiquing and coding sources for their rigor and relevance using a two-point scale. subcategories: data reduction, data display, data comparison, and conclusion drawing. The final stage, presentation, includes synthesizing results to draw conclusions and reporting those conclusions. Presenting the

evidence to support conclusions with logic and explicit details allows the reader to follow the pathway from evidence to conclusion (Whittemore & Knafl, 2005).

Section Two: Comprehensive and Systematic Search

Search Organization and Reporting Strategies

To begin the literature search, the project leader accessed the Jerry Falwell Library through Liberty University online. Databases selected pertained to nursing and medicine specifically to ensure information was related to neonates in the hospital setting. The databases utilized in this literature review included: Medline, BioMed, and ProQuest. The keywords *neonatal intensive care unit, NICU, kangaroo care,* and *benefits* were used to begin the search, which resulted in 834 results.

Next, the advanced search option was utilized, which allowed for selection of content type and publication date. Filters that were selected included "full text online" and "peer-reviewed" as well as "journal article." The publication date was limited to within the last 7 years. This advanced search narrowed down the results to 528 articles. Further filters were selected, including the discipline as "nursing" resulting in 115 articles. After careful review, 12 articles were selected that would be helpful to the preliminary integrative review. After the preliminary review, further search was conducted, and in the final review, 17 articles were included (Appendix B).

Multiple articles were excluded due to lack of relevance of this integrative review. Several studies focused primarily on the barriers to implementing KC. Articles that were selected were required to focus on the benefits of KC on preterm infants. Therefore, articles discussing KC independent of its effects on the neonate were excluded. The types of studies included in this

literature review are systematic reviews, randomized controlled trials, cohort studies, qualitative studies, descriptive studies, and expert opinions.

Terminology

In this integrative review, the term *preterm infant* refers to infants born before 34 weeks' gestation. KC is also referred to as SSC throughout this literature review. *Database* refers to the electronic collection of published materials that include peer-reviewed journals.

Feasibility Analysis

The feasibility of this project depends on the availability of necessary resources, personnel, and technology. The resources and personnel needed for this integrative literature review include access to a library and peer-reviewed studies, project chair, and project leader. The technology needed includes access to an online library for peer-reviewed journal articles.

Section Three: Managing the Collected Data

The integrative literature review was initiated with a preliminary review, evaluation, appraisal, and synthesis of available evidence relevant to preterm infants and physiological outcomes with the use of KC. The project leader reviewed abstracts of articles for relevance and then conducted a thorough review of the article. The PRISMA flowchart was utilized to facilitate the article selection process (Appendix A). Permission was granted to use the Iowa Model (Appendix C), which can be used as a guide to identify issues, research solutions, and implement changes.

Data Collection

During the literature search process, the project leader collected articles that were pertinent to the study purpose. In the initial search, the articles to be read and examined were flagged in the Jerry Falwell Library through Liberty University. During the second literature

search, the relevant articles were entered into the leveling matrix, and the remainder of the table was filled out. The final 17 articles were utilized for this literature review and organized in the leveling matrix (Appendix B).

Section Four: Quality Appraisal

A literature matrix denoting Melnyk's level of evidence for each article is included in Appendix B, which presents the analysis of the journal articles included in the final review. Melnyk's level of evidence is a tool utilized to evaluate the quality of the article on a scale of 1–7 (2015). Of the 17 articles selected in the literature review, five are Melnyk's Level 1, two are Level 2, one is Level 4, four are Level 5, three are Level 6, and two are Level 7.

Sources of Bias

Bias can occur at any stage of the research process. It can occur when the research question, method of measuring outcomes, and which findings to publish are selected. Bias occurring in the initial stages of the review can be due to the researcher's prior knowledge on the topic or intervention and which outcomes produce favorable findings. Bias can also occur when studies and search criteria are selected. By selecting articles limited to a certain time frame or geographic location, the author may be selecting a biased sample. Another opportunity for bias is in the selection of certain databases and exclusion of those less known to the author. When the researcher analyzes studies, the risk of bias occurs with selective outcome reporting. In this case, the author selects findings that are statistically significant to their review (Keenan, 2018). Bias was evident in some of the articles included, such as Coutts et al.'s (2021) study, in which providers were interviewed in private some of the time but not always. This resulted in a change in comfort level and therefore potentially affected responses.

Internal Validity

Critical appraisal of data collection is utilized to strengthen the quality of evidence. Critical appraisal tools can be applied to various studies to measure the quality and rigor of the articles. To strengthen internal validity, the author applies the use of a critical appraisal tool, and that tool should be analyzed for reliability and validity (Lubbe et al., 2020). Internal validity refers to the risk of bias and the believability of results (Toronto & Remington, 2020). The risk of bias exists because the articles searched in this review exclude any adverse outcomes of KC.

Appraisal Tools

By organizing data into a hierarchy of evidence, the researcher can provide a critical appraisal of the evidence from various methods included in the review (Lubbe et al., 2020). The use of appraisal tools to evaluate studies can identify the strength of evidence (Toronto & Remington, 2020). The appraisal tool utilized in this review is Melnyk's level of evidence. Articles were evaluated and ranked from Level 1 to Level 7, with Level 1 being the highest level and Level 7 being the lowest. Articles covering most levels of evidence were utilized in this review.

Applicability of Results

A thorough article critique and leveling matrix is included in Appendix B. Melnyk's hierarchy of evidence was utilized to appraise the evidence (Melnyk & Fineout-Overholt, 2015). Of the 17 articles selected in the initial literature review, five are Melnyk's Level 1, two are Level 2, one is Level 4, four are Level 5, three are Level 6, and two are Level 7. The matrix presents the article information in an organized manner. The study purpose, sample characteristics, methods, study results, level of evidence, study limitations, and usability of

evidence to support a change are all included in the matrix. Results from the integrative review will inform nurses on the positive effects of KC.

Reporting Guidelines

Throughout the process of conducting this review, PRISMA flow diagram was used (Page et al., 2021). Use of the PRISMA diagram ensures adequate reporting and repeatability of the search and selection (Lubbe et al., 2020). The PRISMA diagram provides the minimum set of characteristics needed in an integrative literature review (Toronto & Remington, 2020). The PRISMA flow diagram is included in this review as Appendix A.

Section Five: Data Analysis and Synthesis

The data analysis and synthesis section include the data analysis methods, results, and synthesis of findings. The articles are described to reflect the PRISMA diagram and Melnyk's level of evidence matrix.

Data Analysis Methods

The following subheadings denote the five themes (see Appendix D) identified among peer-reviewed articles on KC and preterm infants' outcomes. Each theme will be discussed in detail with the support of the 17 articles that were included in this project. The first four themes include the relationship between KC and preterm infants' physiological status. The remaining theme focuses on the efforts to improve KC use in the NICU by eliminating barriers.

The data analysis method used in this integrative review is thematic analysis. This method allows the researcher to identify, analyze, and report patterns that are found through research (Toronto & Remington, 2020). The phases of this method include familiarizing oneself with the data, generating codes, searching for themes, defining and naming themes, and producing a report (Toronto & Remington, 2020).

The first phase of data analysis included the selection of 17 articles and the organization of these articles in the literature matrix (Appendix B). Additional sources utilized for the review included guidelines and policies on KC from Nationwide Children's Hospital. The second phase involved the analysis of the data that supported the integrative review. The data are displayed in the literature matrix and show the strength of the articles selected. The use of the matrix facilitated the comparison of data and identification of themes in the literature review. The last phase was to identify themes found in the literature review related to KC and preterm infant outcomes. The themes identified included the use of KC to reduce pain, the use of KC to promote preterm infant growth, increase in oxytocin during KC, and lower heart rate during KC. A final theme addressed barriers to implementing KC, which include physical environment, health care provider beliefs, clinical practice variations, and parental presence (Coutts et al., 2021).

Descriptive Results

A total of 115 articles were identified as relevant to the topic of the integrative review and met the inclusion criteria. The criteria included peer-reviewed journal articles, full-text articles, and articles published within the last 7 years. Of the 115 articles, 98 were excluded after further criteria were applied. Many studies focused primarily on the barriers to implementing KC. Articles that were selected focused on the benefits of KC for preterm infants. Therefore, articles discussing KC independent of its effects on the neonate were excluded.

Articles that supported the use of KC in preterm infants and demonstrated the physiological benefits are described as follows. One such example is a Level 1 journal article that analyzed randomized controlled trials that explored the effects of KC on physiological stress. This systematic review found that KC has positive effects on physiological parameters of

stress in preterm infants (Cristóbal Cañadas et al., 2022). Another Level 1 article included in this review explored the impact of KC on preterm growth. This article found that the effect of KC on growth was related to the duration of SSC (Charpak et al., 2021). The use of KC leads to a reduction in physiological stress on preterm infants, and as a result, they have higher rates of growth.

When examining the effects of KC on oxytocin levels, Vittner et al. (2018) found that SSC activates oxytocin release and decreases cortisol levels for infants. This rise in oxytocin level can result in a decreased level of pain experienced by preterm infants when KC is utilized. A Level 2 article examined KC for pain management in preterm infants. This randomized controlled trial found that KC is as effective as sucrose as analgesia for pain (Hurley & Harrison, 2020). During SSC, preterm infants have an increase in salivary oxytocin and decreased cortisol levels, which contribute to better pain management.

Descriptive and qualitative studies on NICU practices in implementing KC were utilized in this review. One such qualitative study examined barriers to implementing KC in 11 NICUs in British Columbia. This study found that barriers include environment, provider beliefs, practice variation, and lack of parent presence (Coutts et al., 2021).

To address these barriers to implementing KC, several studies examined interventions to increase parental presence and SSC with preterm infants. One single descriptive study showed that an intervention called Close Collaboration increased parental presence and SSC in nine hospitals in Finland (He et al., 2021). Further, a quality improvement project intended to increase frequency of SSC for extreme low-birth-weight infants was conducted. This study showed there was an increase in nursing comfort level with SSC for intubated patients and those with central lines after a quality improvement project was implemented (Nation et al., 2021).

Articles were included that provided recommendations to improve survival and outcomes in preterm infants by providing KC. One such article showed preterm infants who participated in KC had a reduced mortality rate, better sleep-wake cycle, fewer infections, and better weight gain (Orahood, 2021). To further support the use of KC, a Level 6 descriptive study examined preterm infants' heart rates after a family nurture intervention. The study showed that a significant lower heart rate occurred in the intervention group of 37 infants compared with the control group (Ludwig et al., 2021).

In addition to the articles utilized, policies and procedures from Nationwide Children's Hospital (2018) were included in this integrative review. These policies outline the procedures and appropriate criteria for implementing KC in the NICU. Information was included in this integrative review from this author's 11 years of experience as a registered nurse in the NICU. Implications for practice, education, and research as well as barriers to implementing KC come from direct exposure to needs arising in various NICUs across the country. Lack of education and resources contribute widely to the inadequate use of KC. The comfort level of nurses also played an important role in whether this intervention was utilized.

Synthesis

The integrative literature review revealed five themes related to the positive effects of KC on preterm infant outcomes as well as barriers to implementing this care. The themes identified to support KC in preterm infants included reducing pain, improving growth, increasing oxytocin, and lowering heart rate. The final theme addressed the barriers to implementing KC. Common barriers to providing KC included environment, provider beliefs, practice variation, and parent presence.

Kangaroo Care and Preterm Infant Outcomes

In the review of literature, strong evidence was found to support the positive relationship between KC and improved preterm infant outcomes. These outcomes have been examined, and the positive physiological outcomes seen in preterm infants when KC is utilized prompt further investigation. Physiological outcomes include reduced pain, increased growth, increased oxytocin levels, and decreased heart rate.

Kangaroo Care and Pain

KC can be an effective intervention to reduce neonatal pain. Hurley and Harrison (2020) found that KC is as effective in reducing pain in preterm neonates during painful procedures as 24% sucrose. The study highlighted that there is no added benefit to using both KC and sucrose; KC should be considered as an alternative to sucrose (Hurley & Harrison, 2020). A meta-analysis found that kangaroo mother care (KMC) has a statistically significant benefit over standard care in pain reduction (Sharma & Ruikar, 2022). According to this study, neonates in the NICU receive an average of 10 pain-inducing procedures, and 79% of them are without any analgesia. KMC is an important intervention in reducing procedural pain in infants due to its advantages over standard care (Sharma & Ruikar, 2022).

Kangaroo Care and Preterm Infant Growth

Preterm infant growth can be affected by KMC and its duration of use. Charpak et al. (2021) studied the effects of KMC on growth in preterm infants and found that the duration of KC was directly related to growth. Weight gain was higher when the duration of KC was at least 8 hours per day (Charpak et al., 2021). Orahood (2021) posited that KC improves mortality rates, promotes a better sleep-wake cycle, leads to fewer incidents of infections, and promotes increased weight gain in infants. KMC should be initiated as soon as possible and for as long as

possible to promote preterm infant and low birth weight infant growth (Charpak et al., 2021). A systematic review by Chan et al. (2016) found that KMC, when compared to conventional care, is more effective and reduces the risk of hypothermia and illness, shortens length of NICU stay, and improves growth, breastfeeding, and attachment. Interestingly, the benefits of KMC remained 20 years later in infants who were studied, and long-term social and behavioral improvements were identified (Stockwell, 2017). Although these findings were seen in infants who received KMC as low birth weight infants, the limitations exist that many of the positive changes were small and not directly attributable to KMC (Stockwell, 2017).

Skin-to-Skin Contact and Oxytocin

As seen in one study, SSC can raise oxytocin levels in infants and in parents. Vittner et al. (2018) examined the relationship between SSC and the levels of oxytocin in the mother, father, and infant. Results of this study showed salivary oxytocin levels increased significantly during SSC for mothers, fathers, and infants, indicating a release of oxytocin during SSC. This study indicates that SSC can be an effective intervention to reduce parent and infant stress in the NICU (Vittner et al., 2018). Pados and Hess (2020) studied the effects of SSC on short-term physiologic stress outcomes in preterm infants in the NICU. They found that SSC improves short-term cardiorespiratory stress outcomes and strong evidence that SSC reduces cortisol and increases oxytocin levels in preterm infants (Pados & Hess, 2020).

Preterm Infant Heart Rate and Kangaroo Care

Ludwig et al. (2021) studied preterm infant heart rates during a Family Nurture Intervention consisting of, on average, four 1-hour SSC sessions per week. Results showed a significantly lower heart rate in the Family Nurture Intervention group compared with controls (Ludwig et al., 2021). Cristóbal Cañadas et al. (2022) studied the effects of KMC on the

physiological stress parameters of premature infants. The authors found that infants who received KMC had a higher mean heart rate, oxygen saturation, and temperature; however, the results were not statistically significant (Cristóbal Cañadas et al., 2022). A study conducted by Vogl et al. (2021) examined the effects of KMC and kangaroo father care (KFC) on preterm infant heart rate, periodic breathing, and apnea. The results showed a significant difference between heart rate variability pre-KC and during KC with no significant difference in number of apneas but a trend toward reduction in periodic breathing (Vogl et al., 2021).

Quality Improvement and Kangaroo Care

Several factors were reported as reasons for the lack of utilization of KC, and the barriers to its implementation were studied. Nation et al. (2021) studied a quality improvement project designed to increase SSC for infants born before 29 weeks' gestation. The study examined barriers to implementation, including medical complexity and staff misconceptions. Pre- and post-surveys were utilized to evaluate comfort level with SSC and perceived barriers to its use. The quality improvement project included an updated unit-specific SSC protocol and education tailored to identified barriers (Nation et al., 2021). The study found a statistically significant increase in nurses comfort level when utilizing SSC for intubated patients as well as patients with central lines postintervention. Overall, rates of SSC increased in infants younger than 29 weeks' gestation who required intubation and central lines, possibly due to an increase in nursing comfort level (Nation et al., 2021).

A qualitative study by Coutts et al. (2021) conducted in 11 NICUs in British Columbia examined the barriers to and enablers of KC. There were four major barriers identified to KC: the physical environment, health care provider beliefs, clinical practice variations, and parent presence (Coutts et al., 2021). Fluharty et al. (2021) examined barriers to KC that originated

from policies. The study revealed inconsistencies in the implementation of KC practice due to policies, including variability in infant age and weight criteria, medical equipment in place, duration and frequency, documentation, and ongoing monitoring requirements (Fluharty et al., 2021).

Parent Infant Closeness in the NICU

Increased parental presence and the availability of family rooms in the NICU have been shown to shorten infants' hospital stays (He et al., 2021). A quality improvement project called Close Collaboration With Parents was implemented to examine the benefits of increased parental presence and SSC in the NICU (He et al., 2021). This intervention increased parental presence from 453 minutes per day before the intervention to 620 minutes after the intervention. The time spent in SSC before the intervention was 76 minutes per day and 114 minutes after. The study concluded that this project aimed at parenting interventions could promote parent-infant closeness and SSC in the NICU (He et al., 2021). Another study showed that SSC provides physical closeness as well as a serenity state and enhances bonding and breastfeeding (Shattnawi et al., 2022).

The review of the evidence revealed a correlation between KC and improved neonatal physiological outcomes. KMC is shown to reduce mortality and morbidity in preterm neonates, prevent hypothermia and infection, improve maternal infant attachment, and increase exclusive breastfeeding (Mohammadi et al., 2021). Studies also showed that KC led to reduced pain, higher weight gain, increased oxytocin, improved cardiorespiratory stress, lowered heart rate, higher oxygen saturation, and increased temperature (Orahood, 2021). The results support the use of KC in the NICU for preterm infants and address ways to overcome barriers to implementing this care.

Ethical Considerations

The leader and project chair of this integrative literature review have completed the Collaborative Institutional Training Initiative modules on biomedical and health science research (see Appendix E). The integrative literature review was submitted to Liberty University's Institutional Review Board (IRB) and received approval (see Appendix F).

Timeline

The process for the integrative literature review is outlined in the timeline presented in Table 1. The development of the integrative literature review started with a meeting between the project leader and the project chair to discuss potential ideas and feasibility. The topics were narrowed down, and a focused problem was identified. The next step was the literature review and synthesis of information into the leveling matrix. An application was submitted to the IRB, and data collection and outcomes evaluation followed. IRB approval was received and is included in Appendix F. This process was completed as set forth by the weekly objectives of the course, and all requirements were fulfilled according to the timeline.

Table 1

Project Timeline

Milestone	*Deliverable*	*Description*		*Completion Date*
Phase One: Proposal Development and Defense	The project leader will develop, revise, and defend the project proposal by November 15, 2022.	The project leader will select 30 peer-reviewed articles to support the project by November 15, 2022.	The project leader will create a tentative timeline with anticipated completion dates of each phase of the project by November 15, 2022.	The project leader will submit the project to the Institutional Review Board for approval by December 1, 2022. IRB approval received by November 30, 2022.
Phase Two: Project Implementation and Evaluation	The project leader will complete a data summary and analysis report by February 1, 2023.	Data summary and analysis report.		The project leader will complete a data summary and analysis report by February 1, 2023.
Phase Three: Final Project and Dissemination	The project leader will complete a first draft of the final project by April 1, 2023.	First draft and revisions of final project		The project leader will complete revisions of the final project and complete a final defense by May 1, 2023.

Section Six: Discussion

The literature review consisted of the evaluation of 17 articles related to the physiological benefits of KC in preterm infants in the NICU. In addition to the articles reviewed, policies and procedures for the implementation of KC were evaluated. The literature review provided

evidence to support the use of KC for preterm infants in the NICU. The review also presented barriers and challenges to implementing this intervention and ways to overcome these.

Overall, the use of KC in preterm infants less than 34 weeks' gestation has been shown to reduce pain, improve weight gain, increase oxytocin, improve cardiorespiratory stress, lower heart rate, increase oxygen saturation, and increase temperature in the infant. The literature review provided ways to overcome barriers to implementation of this intervention in the NICU. These strategies included unit-specific protocols and education as well as increased parental presence.

This integrative review supported the continued education of staff and parents on the benefits of KC. The use of this intervention to improve outcomes for preterm infants is dependent on the availability of the resources to provide the education and training as well as appropriate staffing to ensure a safe and quality experience. Quality improvement projects such as those mentioned in this review have been shown to increase the use of the intervention.

Limitations

Limitations to this integrative review include a limited amount of literature utilized among a vast number of studies. The selection of articles excluded those in languages other than English. The integrative review was only conducted by one individual, the project leader, which is also a limitation.

Overall, the literature supported the purpose of this review. The purpose of this integrative review was to examine the direct relationship between KC and the physiological status of preterm infants less than 34 weeks' gestational age. The gaps identified include small sample sizes and lack of randomizing of subjects. In addition to examining the positive effects of KC, some of the articles examined the barriers to implementing KC in the NICU. Another gap in

the research is most articles examined the effects of KMC and fewer examined the effects of KFC. Further research solely examining the correlation between KC and the outcomes of the neonate would be useful.

Implications for Practice

The review of literature supports KC as an intervention to improve physiological outcomes of preterm neonates. There is evidence to support the positive outcomes that KC has on neonates' growth, vital signs, stress outcomes, and pain. The purpose of this integrative review was to support the use of KC in the NICU to impact outcomes positively. Implications for practice include improved use of KC for preterm infants in the NICU. The findings in this literature review can potentially impact outcomes for preterm infants by leading to improved physiological status while the infants are in the NICU. Among the studies included in this integrative review, all had results that indicated that the use of KC for preterm neonates had more positive than negative implications.

Education is needed for NICU staff and providers as well as for parents. This can be accomplished by utilizing quality improvement projects and interventions. To increase the use of KC in the NICU, parental presence must be increased. NICUs can provide better opportunities for privacy for parents visiting the bedside that would make the environment more comfortable. Many NICUs have options for private rooms or for curtains between patients that can help make the environment more conducive to KC. To further improve the environment, education is needed for staff to promote a quiet, low-light atmosphere that is calming to parents and infants.

Further research is needed to examine the use of KC for preterm infants who are critically ill. Determining which preterm infants are good candidates for KC needs to be a joint effort among provider, nurse, and parent. To facilitate optimal decision making, more research needs to

be conducted to evaluate the safety and effectiveness of the use of KC among extremely preterm infants because extremely preterm infants typically require extra hands during KC to help with endotracheal tubes, central lines, and other assistive technology. Further research comparing KMC and KFC needs to be conducted. Most research is solely focused on the mother providing this intervention. However, when the mother is unstable or unable to provide SSC, the next best thing is KFC.

Dissemination

The results of the integrative literature review will be presented at Liberty University in front of a panel. In addition, the results have been submitted to Liberty University Research Week in the form of an abstract and poster presentation. Following approval, the results will be submitted to Scholars Crossing at Liberty University.

DNP Essentials addressed in this integrative literature review include Essentials III and VI. Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice is evidenced in this review by the translation of research in practice, evaluation of practice, and participation in collaborative research (Zaccagnini & White, 2015). This integrative review aimed to apply relevant findings to develop guidelines and improve practice and the practice environment. The integrative review was also intended to prove the benefits of KC for preterm infants less than 34 weeks' gestation in the NICU as well as evaluate the barriers to implementing this care. DNP Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes is evidenced in this review by the interprofessional dimension of health care that enables collaborative team functioning and overcoming of barriers to interprofessional practice. This integrative review aimed to address barriers to the

implementation of KC in the NICU and to provide interventions to encourage a collaborative approach among the health care team.

Conclusion

In conclusion, there is a positive correlation between KC and improved neonatal physiological outcomes. This is evidenced through the examination of 17 journal articles included in this integrative review. Studies showed that KC led to reduced pain, greater weight gain, increased oxytocin, improved cardiorespiratory stress, lowered heart rate, higher oxygen saturation, and increased temperature. The results support the use of KC in the NICU for preterm infants and address ways to overcome barriers to implementation of this care.

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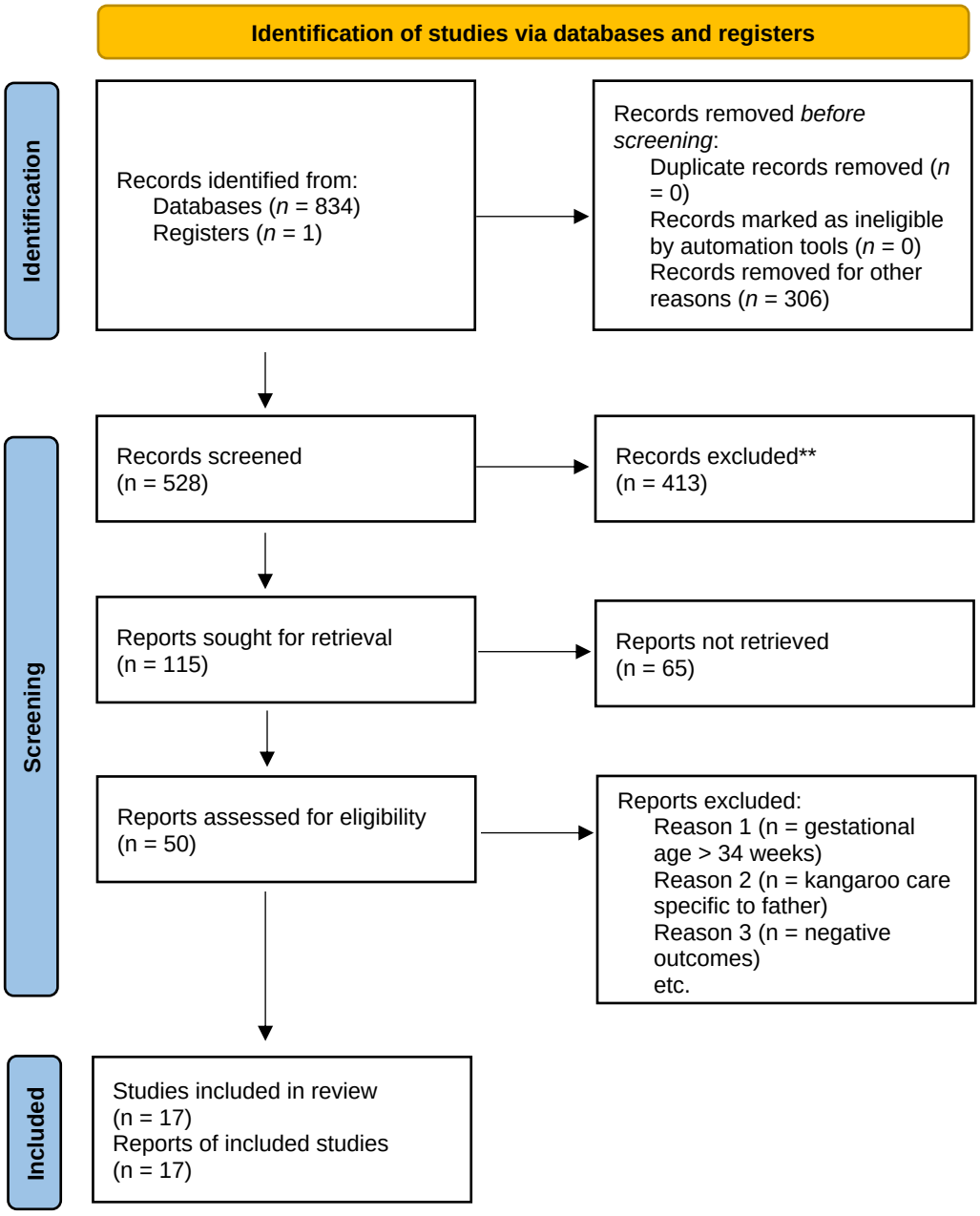
Appendix A

PRISMA Flowchart



Note. Adapted from "The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews," by M. J. Page, J. E. McKenzie, P. M. Bossuyt, I. Boutron, T. C. Hoffmann, C. D. Mulrow, L. Shamseer, J. M. Tetzlaff, E. A. Akl, S. E. Brennan, R. Chou, J. Glanville, J. M. Grimshaw, A. Hróbjartsson, M. M. Lalu, T. Li, E. W. Loder, E. Mayo-Wilson, S. McDonald, . . . Moher, D. 2021, *BMJ*, *372*(71). https://doi.org/10.1136/bmj.n71

Appendix B

Literature Matrix

Article	Study Purpose	Sample	Methods	Study Results	Level of Evidence	Study Limitations	Would Use as Evidence to Support a Change?
Chan, G. J., Valsangkar, B., Kajeepeta, S., Boundy, E. O., & Wall, S. (2016). What is kangaroo mother care? Systematic review of the literature. *Journal of Global Health*, *6*(1), Article 010701. https://doi.org/10.7189/jogh.06.010701	Does KMC, exclusive breastfeeding, and early discharge reduce risk of mortality among preterm and low birthweight infants	1035 articles and reports, 299 contained data on KMC and neonatal outcomes	Systematic review	There is evidence that KMC when compared to conventional care reduces the risk of mortality in infants weighing less than 2000g and clinically stable. KMC also reduces the risk of hypothermia, illness, length of stay, improves growth, breastfeeding, and attachment.	Level 1: Systematic review	Lack of a clear definition of KMC, lack of data on the duration of SSC, reports of SSC duration based on mothers' reports vs observation	Yes, the results of this study provide evidence for mortality reduction in low to middle income settings

Charpak, N., Montealegre-Pomar, A., & Bohorquez, A. (2021). Systematic review and meta-analysis suggest that the duration of kangaroo mother care has a direct impact on neonatal growth. *Acta Paediatrica, 110*(1), 45–59. https://doi.org/10.1111/apa.15489	KMC had a moderate impact on preterm growth	Preterm or low birthweight infants were included, 1368 papers, 13 RCTs with 743 KMC infants, 718 controls	Systematic review and meta-analysis	Infants held in KMC for at least 6 hours per day gained more weight than the controls	Level 1: Systematic review	The quality of the studies included was moderate, due to the lack of blinded interventions	Yes, meta-analysis of studies suggests the effect of KMC on growth was related to duration, provided new evidence on impact of KMC on growth, head circumference, level 1
Coutts, S., Woldring, A., Pederson, A., De Salaberry, J., Osiovich, H., & Brotto, L. A. (2021). What is stopping us? an implementation science study of kangaroo care in British Columbia's neonatal intensive care units. *BMC Pregnancy and Childbirth, 21*(1), Article 52. https://doi.org/10.1186/s12884-020-03488-5	Identify and describe providers' perspectives on barriers and enablers of implementing KC	11 NICUs in British Columbia, Canada ranging in size from 6-70 beds, 35 semi-structured provider interviews were conducted	Qualitative review	Four themes were identified as barriers and enablers to KC including the physical environment, provider beliefs, practice variation, and parent presence	Level 5: Qualitative study	Providers were often interviewed in private but not always, the interview sometimes took place in the NICU or at the bedside where others were present, and	Yes, does provide support to address barriers and enablers to KC even though it is a Level 5

						this may have influenced their comfort level	
Cristóbal Cañadas, D., Bonillo Perales, A., Galera Martínez, R., Casado-Belmonte, M. D. P., & Parrón Carreño, T. (2022). Effects of kangaroo mother care in the NICU on the physiological stress parameters of premature infants: A meta-analysis of RCTs. *International Journal of Environmental Research and Public Health, 19*(1), Article 583. https://doi.org/10.3390/ijerph19010583	Analyze the randomized controlled trials that explore the effect of kangaroo mother care on physiological stress	Preterm infants with a gestational age of 37 weeks or less	Systematic review of studies, randomized controlled trials, meta-analysis	KMC is a safe method with positive effects on certain physiological stress. KMC has a positive impact on physiological markers in preterm infants.	Level 1: Systematic review of RCTs	Due to clinical heterogeneity, more studies are needed	Yes, provides evidence that KMC has positive effects on physiologic parameters of stress in preterm infants and is level 1
Fluharty, M., Nemeth, L. S., Logan, A., & Nichols, M. (2021). What do neonatal intensive care unit policies tell us about kangaroo care implementation? A realist review. *Advances*	What NICU policies tell us about practices to implement kangaroo care	51 internal NICU policies were included in the review, organization locations included Australia, Canada, Italy,	realist reviews are systematic reviews to examine complex interventions	Benefits and positive outcomes such as stabilizing vital signs, stabilizing temperature, improving	Level 5: Systematic reviews of descriptive and qualitative studies	Which infants should be participating, when should they be participating, how	Yes, does provide evidence to support PICOT even though it is a Level 5

in Neonatal Care, 21(4), E76–E85. https://doi.org/10.1097/ANC.0000000000000808		Netherlands, New Zealand, South Africa, UK, USA		brain growth, decreasing stress		kangaroo care (KC) varies and the effects on short- and long-term outcomes requires further research	
He, F. B., Axelin, A., Ahlqvist-Björkroth, S., Raiskila, S., Löyttyniemi, E., & Lehtonen, L. (2021). Effectiveness of the close collaboration with parents' intervention on parent-infant closeness in NICU. *BMC Pediatrics, 21*(1), Article 28. https://doi.org/10.1186/s12887-020-02474-2	Evaluate effectiveness of an educational intervention, Close Collaboration with Parents, to increase closeness during hospital care	Nine hospitals in Finland, parents of hospitalized infants	Statistical analyses using a linear model	The Close Collaboration with Parents increased parental presence and skin to skin contact in nine hospitals	Level 6: Single descriptive study	A cluster, randomized study design would provide more solid evidence, data did not prove that effects are similar in other countries or healthcare systems, potential selection bias	Yes, provides evidence that parental presence increased after the intervention and skin to skin increased after the intervention, even though it is Level 6
Hurley, A., & Harrison, C. M. (2020). Kangaroo care was as effective as sucrose for painful	KC was as effective as sucrose for painful	Single tertiary NICU in Eastern Canada,	Single center, randomized	KC is as effective in reducing pain as 24%	Level 2: Single RCT	Lack of blinding with KC, lack of clear	Yes, study shows alternative to using

procedures for babies in the neonatal intensive care unit. *Archives of Disease in Childhood - Education and Practice Edition, 105*(5), 317–318. https://doi.org/10.1136/archdischild-2019-318095	procedures for babies in the NICU	infants born less than 37 weeks within 7 days of birth	clinical trial	sucrose for repeated painful procedures during NICU admission		explanation of the use of rescue doses of sucrose	sucrose as analgesia for pain, shows increasing awareness on family centered care and KC as an alternative, Level 2
Ludwig, R. J., Grunau, R. E., Chafkin, J. E., Hane, A. A., Isler, J. R., Chau, C. M. Y., Welch, M. G., & Myers, M. (2021). Preterm infant heart rate is lowered after family nurture intervention in the NICU: Evidence in support of autonomic conditioning. *Early Human Development, 161*, Article 105455. https://doi.org/10.1016/j.earlhumdev.2021.105455	Heartrate will decrease after the Family Nurture Intervention (FNI) over the course of the NICU stay	37 infants born 30 weeks gestational age in a level 4 NICU	Case matched design	Significant lower HR in the FNI group compared with controls	Level 6: Single descriptive study	Not able to randomize subjects due to time constraints and funding limitations	Yes, study shows that FNI may lower infant HR in a dose response manner during NICU stay, even though it is Level 6
Mohammadi, M., Bergh, A.-M., Heidarzadeh, M., Hosseini, M., Jahdi, N. S., Valizadeh, L.,	Implementing a KMC program for neonates to	A Level 3 NICU with 25 beds	Case control study	KMC is shown to reduce mortality and	Level 4	Employees' lack of awareness, insufficient	Yes, the KMC intervention improves

Sarvaran, B., & Hakimi, S. (2021). Implementation and effectiveness of continuous kangaroo mother care: a participatory action research protocol. *International Breastfeeding Journal, 16,* Article 24. https://doi.org/10.1186/s13006-021-00367-3	compare length of stay and exclusive breastfeeding at discharge			morbidity in preterm neonates, prevent hypothermia and infection, improve maternal infant attachment, and increase exclusive breastfeeding .		facilities, problems related to the mother	neonatal development and reduces risk of growth retardation in the first 24 months
Nation, H., Sanlorenzo, L., Lebar, K., & Brandon, D. (2021). A quality improvement project to increase frequency of skin-to-skin contact for extreme low-birth-weight infants in the neonatal intensive care unit. *The Journal of Perinatal & Neonatal Nursing, 35*(3), 247–257. https://doi.org/10.1097/JPN.0000000000000556	Increase SSC utilization in infants born before 29 weeks gestational age regardless of respiratory support	81 patients, 22-28 weeks, 370g-1410g	Pre/post quality improvement project	Increase in nursing comfort level with SSC for intubated patients and those with PICC lines or UVC, SSC rates increased with infants younger than 29 weeks requiring intubation and central line	Level 6: evidence from a single quality improvement project	Lack of data surrounding number of days parents were present in the NICU limits knowledge of number of opportunities available for SSC	Yes, quality improvement project shows an improvement in nursing comfort with SSC, an increase in SSC in infants less than 29 weeks, increase in frequency within first 30 days, increase in

							initiation within the first 7 days of life
Orahood, J. (2021). Kangaroo care in the neonatal intensive care unit. *Contemporary Pediatrics, 38*(9), 26.	Recommendations to improve survival and outcomes in preterm infants is kangaroo care	Preterm infants in the NICU	Expert opinion	Infants in the NICU who participate in kangaroo care have a reduced mortality rate, better sleep-wake cycle, fewer infections, and weight gain	Level 7: Evidence from expert opinion	Experts can receive information about the topic on which to base their opinion	Yes, article highlight benefits of kangaroo care for infants and caregivers, even though it is level 7
Pados, B. F., & Hess, F. (2020). Systematic review of the effects of skin-to-skin care on short-term physiologic stress outcomes in preterm infants in the neonatal intensive care unit. *Advances in Neonatal Care, 20*(1), 48–58. https://doi.org/10.1097/ANC.0000000000000596	In premature infants in the NICU, does SSC improve short term physiologic stress outcomes	19 research studies comparing SSC with incubator care	Systematic review	SSC improves short term cardiorespiratory stress outcomes	Level 1: Systematic review	Many studies did not find statistically significant differences in stress outcomes, the reason for this can be due to small sample sizes	Yes, the review shows more evidence to support that SSC has positive effects on short term physiologic stress outcomes

Sharma, H., & Ruikar, M. (2022). Kangaroo mother care (KMC) for procedural pain in infants: A meta-analysis from the current evidence of randomized control trials and cross-over trials. *Journal of Family Medicine and Primary Care, 11*(4), 1250–1256. https://doi.org/10.4103/jfmpc.jfmpc_1383_21	Determine the effect of KMC on procedural pain in infants	RCTs and cross over trials within 10 years	Meta analysis	KMC minimizes mortality in infants and lessens infant pain in medical settings. KMC has a statistically significant benefit over standard care in pain reduction	Level 1 meta-analysis	Overall heterogeneity due to a difference in study design or type of procedure	Yes, thorough search with precise inclusion criteria focusing solely on the effects of kangaroo care on procedural pain in infants receiving KMC vs conventional care
Shattnawi, K. K., Al-Shdayfat, N. M., & Joseph, R. A. (2022). Maternal experiences of providing skin-to-skin contact to pre-term infants in a neonatal intensive care unit in Jordan. *Jordan Journal of Nursing Research, 1*(1), 64–74.	Exploring Jordanian mothers' experiences when providing SSC to their preterm infant for the first time	10 Jordanian mother in one Jordanian NICU	Qualitative study	SSC provides physical closeness as well as a serenity state. SSC enhances bonding and breastfeeding. SSC barriers were identified.	Level 5: Qualitative study	One NICU in Jordan, experiences may vary among countries and cultures, sample size is small	Yes, the results of this study provide the experiences of mothers providing SSC to their preterm infants for the first time. Demonstrates the positive

							outcomes of utilizing SSC.
Stockwell, S. (2017). Benefits of kangaroo care for premature babies continue into young adulthood. *American Journal of Nursing 117*(3), 15. https://doi.org/10.1097/01.NAJ.0000513272.38141.e3	Does KMC increase survival and improve neurological development and bonding	Previous studies of babies and families in Colombia followed for one year. Infants weighed no more than 1800g at birth	Expert opinion	Original infants in previous studies were followed Found that benefits of KMC remained 20 years later and that long term social and behavioral improvements existed	Level 7: Expert opinion	Many of the positive changes were small and not attributable to KMC.	Yes, KMC has been incorporated into standard care in many NICUs, it provides preterm and low birthweight infants with fewer long term health problems. Findings support introducing KMC.
Vittner, D., McGrath, J., Robinson, J., Lawhon, G., Cusson, R., Eisenfeld, L., Walsh, S., Young, E., & Cong, X. (2018). Increase in oxytocin from skin-to-skin contact enhances development of parent–	Examine changes that occur in infants' salivary oxytocin and cortisol levels during skin-	NICU with 28 stable preterm infants	Randomized crossover study	Salivary oxytocin levels increased significantly during SSC for infants and cortisol levels	Level 2: One well-designed RCT	Research with a larger sample size is needed, sample was primarily Caucasian with college-	Yes, study shows that SSC activates oxytocin release for infants and decrease cortisol

infant relationship. *Biological Research for Nursing*, *20*(1), 54–62. https://doi.org/10.1177/1099800417735633	to-skin contact			decreased significantly		educated parents which may influence findings	levels and is level 2
Vogl, J. L., Dunne, E. C., Liu, C., Bradley, A., Rwei, A., Lonergan, E. K., Hopkins, B. S., Kwak, S. S., Simon, C. D., Rand, C. M., Rogers, J. A., Weese-Mayer, D. E., & Garfield, C. F. (2021). Kangaroo father care: A pilot feasibility study of physiologic, biologic, and psychosocial measures to capture the effects of father–infant and mother–infant skin-to-skin contact in the neonatal intensive care unit. *Developmental Psychobiology*, *63*(5), 1521–1533. https://doi.org/10.1002/dev.22100	Examine kangaroo father care (KFC) effects on premature infants compared to kangaroo mother care (KMC)	Level 3 NICU at Northwestern Medicine Prentice Women's Hospital, eligible participants were preterm infants between 30 0/7 and 36 6/7 weeks in the first 20 days of life	Single center, prospective pilot study	Demonstrated similar infant physiologic responses between KMC and KFC, including significant differences in measures of heartrate variability	Level 5: Single prospective study	The sample size was small, would benefit from expansion to larger, more diverse cohort	Yes, does provide evidence supporting the physiologic benefits of KC, even though it is level 5

Appendix C

Permission to Use Iowa Model

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care.* Click the link below to open.

[redacted]

Reference: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223*

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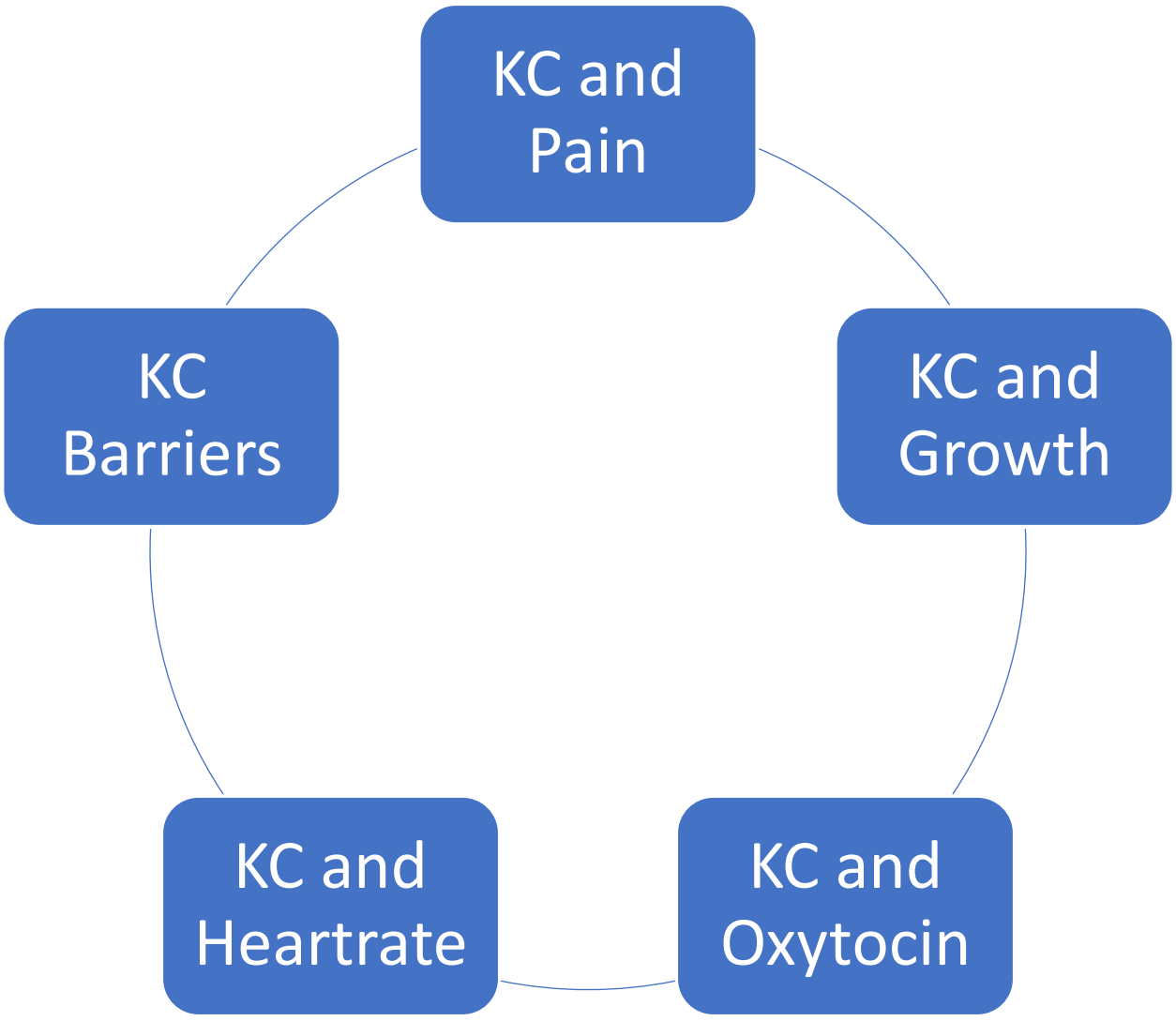
Please contact UIHCNursingResearchandEBP@uiowa.edu

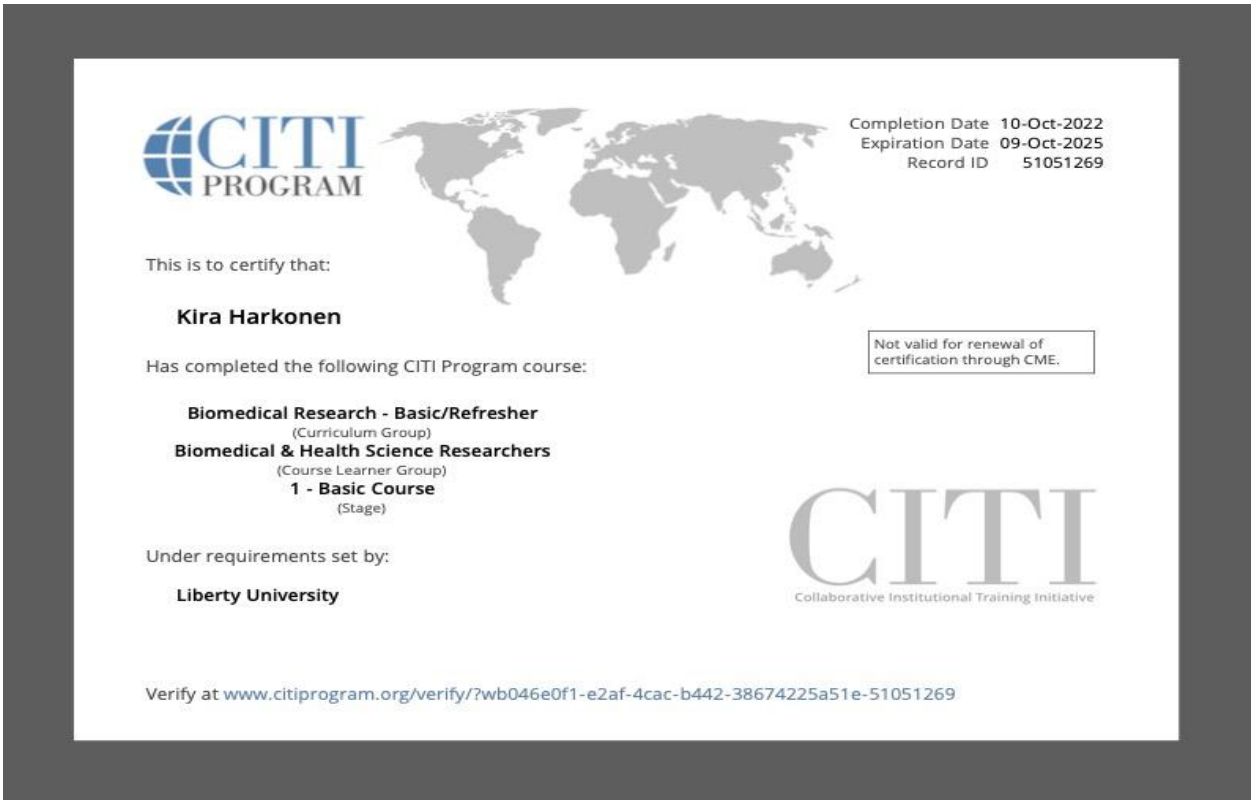
Appendix D

Kangaroo Care Diagram



Appendix E

CITI Completion Certificate



Appendix F

IRB Approval Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

November 30, 2022

Kira Harkonen
Rachel Joseph

Re: IRB Application - IRB-FY22-23-601 Kangaroo care and improved physiological status in preterm infants: An Integrative Literature Review

Dear Kira Harkonen and Rachel Joseph,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds that your study does not meet the definition of human subjects research. This means you may begin your project with the data safeguarding methods mentioned in your IRB application.

Decision: No Human Subjects Research

Explanation: Your study is not considered human subjects research because it will not involve the collection of identifiable, private information from or about living individuals (45 CFR 46.102).

Please note that this decision only applies to your current application. Any modifications to your protocol must be reported to the Liberty University IRB for verification of continued non-human subjects research status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this determination or need assistance in determining whether possible modifications to your protocol would change your application's status, please email us at irb@liberty.edu.

Sincerely,

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office