Effects of Kangaroo Care on Preterm Infant Growth

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**PICO Question and Significance**

Our PICO question states, “Is kangaroo care more effective than traditional incubator care in promoting parent-child interaction and infant growth and development in premature (low-birth weight) infants?” PICO is an acronym that stands for *population, intervention, comparison,* and *outcome*. In our question, the population is premature or low-birth weight (LBW) infants. The intervention is kangaroo care (KC), which is defined as the placement of an infant upright between its mother’s breasts while maintaining skin-to-skin contact. The comparison involves evaluation of infant growth, physiologic stability, cognitive development, and parent-child interaction in infants receiving KC versus infants receiving traditional incubator care. The projected outcome of such skin-to-skin contact (SSC) is increased infant growth and improved quality and frequency of parent-child interactions.

The study of KC is relevant to today’s nursing environment because of its cost-effectiveness, ease of implementation, and positive effects on participating parents and their children. Developed in the 1970s by Drs. Rey and Martinez in Bogota, Columbia, in response to limited incubator availability, KC gained popularity after practitioners realized that it reduced infant mortality and improved maternal caregiving (Dodd, 2004). KC does not require extensive staff training, costly equipment, or special pharmacological measures, making it a practical intervention for application in a wide variety of settings. Most parents find the technique easy to learn and feel that the practice improves their parenting skills (Dodd, 2004). In this evidence based practice project, we will explore whether the evidence supports the use of KC to promote infant development and parent-child attachment.

**Review of Evidence: Search Strategy**

We conducted our searches through the Auburn University and the Auburn University at Montgomery library databases. We used the databases Cochrane and CINAHL. We used the following key words to search the databases: “kangaroo care,” “skin-to-skin contact,” “preterm infants,” and “low birth weight infants.” Our group did not consider articles published before 2002. We found one systematic review from the Cochrane library and one systematic review from CINAHL. CINAHL also provided us with two clinical practice guidelines, one randomized controlled trial, and two quasi-experimental studies. One of the clinical practice guidelines was not linked to a full text through the database, so we consulted the librarian to help us locate the article. We also searched www.ahrq.gov for the clinical practice guidelines, but did not find any results that pertained to KC.

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| **Authors of Article, (Yr)**  **Level of Evidence of article (I-VI)** | **Purpose of Study/or Review** | **Outline:**  **A) Design**  **B) Population**  **C) Sampling Method and Size**  **D) Description of Interventions (if any)**  **E) Instruments used**  **F) Outcomes measured (may use bullet points)** | **Major findings/findings relevant to your project** | **Critique of Study/review for your project (what makes it strong or weak evidence for you to use)** |
| Conde-Agudelo A, Belizán JM, Diaz-Rossello J (2011)  Level I: Systematic Review | The purpose of the study is to determine the effectiveness of Kangaroo Mother Care (KMC) on low birth weight (LBW) infants.  “This systematic review was undertaken because of the need to determine if KMC reduces morbidity and mortality in LBW infants” (2011, p. 3) | A) Each study used in this systematic review was experimental in nature because they only included randomized controlled trials in their data. The authors searched the Cochrane Neonatal review Group that included searches of MEDLINE, EMBASE, LILACS, POPLINE, and CINAHL databases from inception to January 31, 2011. They used a combination of keywords and text related to KMC, skin-to-skin contact (SSC), LBW, and preterm infants.  B) LBW infants (defined as birth weight less than 2500 g)  C) Probability Sampling Method: Randomized controlled trials including cluster randomized trial;  Sample size – 2,518 infants  D) Compares KMC with conventional neonatal care in LBW infants regardless of duration, breastfeeding, and discharge time (2011, p. 4)  E) Each individual study used different tools according to what outcomes they were measuring. For example, weight was measured in grams and hospital length of stay was measured in days.  F) Primary Outcomes:  Mortality, severe infection/sepsis, severe illness, infant growth, neurodevelopmental disability  Secondary Outcomes: Nosocomial infection/sepsis, mild/moderate infection or illness, lower respiratory tract disease, diarrhea, hypothermia, readmission to hospital, breastfeeding, length of hospital stay, mother-infant attachment, mother-infant interaction, parental and familial satisfaction, home environment and father involvement, and costs of care | As a result of the reviewed studies, the authors concluded that when a LBW infant receives KMC the chances of mortality are reduced, length of hospital stay is reduced, risk of nosocomial infections is reduced, weight increases, and maternal bonding increases.  “KMC is associated with a reduction in mortality at discharge or 40-41 weeks’ postmenstrual age and at latest follow up, severe infection/sepsis, hypothermia, and length of hospital stay, and an increase in weight gain and exclusive or any breastfeeding at discharge or 40-41 weeks’ postmenstrual age and at one to three months follow up” (2011, p. 18)  “KMC reduces the risk of nosocomial infection/sepsis…, increases head circumference gain, maternal satisfaction with the method, maternal-infant attachment, and home environment” (2011, p. 18) | This article is an evidence level of I because it is a systematic review. The authors only included randomized controlled studies that specifically pertained to the purpose of their research. They excluded over 33 studies because they were either non-randomized trials, did not include the intended subjects, only reported physiological outcomes, were quasi-randomized, or were from a crossover design. The authors organized all of the study information by outcomes they were interested in determining. All of the outcomes were defined by statistical analysis of each study. One of the weaknesses of this review is that some of the randomized controlled trials included in the evidence are over 10 years old from publication date. |
| Ludington-Hoe SM, Morgan K, Abouelfettoh A (2008)  Level I: Clinical Practice Guideline | The purpose of this clinical guideline is to promote the routine use of kangaroo care (KC) in premature infants by prompting healthcare professionals to receive further education and skills on KC.  The purpose of the clinical practice guideline is to “promote widespread use of KC with premature infants of 30 or more weeks’ postmenstrual age, provide information for interdisciplinary discussions related to KC practice in any setting in which implementation of KC as the evidence supports, and encourage healthcare workers to seek additional education and skills training about KC through the International Network of Kangaroo Mother Care’s certified kangaroo caregiver and training programs” (2008, p. 3-4) | A) Clinical Practice Guideline  B) Preterm infants of 30 or more weeks’ postmenstrual age  C) Probability sampling method: randomized controlled trials, quasi-experimental designs, and meta-analyses; the sample size was 167 articles.  D) The intervention is implementing KC. Successful KC includes policies, training, education, and consistency.  E) Nursing assessments and observations of the individual preterm infant, measurement of vital signs, safety assessments, parental preparedness  F) Physiological changes such as heart rate, respiratory rate, oxygenation, temperature; growth including head circumference, weight; behavioral effects including sleep, feeding, emotions; psychosocial effects including maternal and paternal bonding, hospital length of stay | During the use of KC, heart and respiratory rates remain more stable than when the infant is in the incubator. Oxygen saturation and temperature increase during the use of KC. KC decreases stress related to elevated cortisol levels. The results of KC on weight gain are controversial, but have positive effects on head circumference growth. KC allows infants to be more relaxed, calm, and fall asleep more easily. Mothers that participate in KC are more likely to exclusively breastfeed. KC reduces the risk of developmental delay. KC improves parental confidence and adaptation to preterm delivery. | This clinical practice guideline suggests that KC be routinely practiced with preterm infants to increase their well being. Every reference used is evaluated for its evidence and graded according to the strength of the research. All of the results are organized into separate outcomes. Listing how to further implement the use of KC identifies gaps in knowledge. The majority of the research used is current, but there are a few articles that are slightly outdated. |
| Chiu S, Anderson GC (2009)  Level II: Randomized controlled trial | The purpose of this randomized controlled trial is to determine if KC and SSC facilitate positive interaction between mothers and their preterm infants. | A) The study was experimental in nature because it was a two group randomized controlled trial. The eligible participants were randomized using minimization to either the group using KC or the control group. To avoid potential bias, one of the researchers developed a block sequence with randomly selected blocks of six and four. They used randomly drawn papers from a bag to minimize the threat to internal validity. The instruments used to measure MPI established validity and reliability.  B) Preterm infants and mothers (dyad) at University Hospitals of Cleveland in Ohio, Kadlec Medical Center in Washington, and a regional hospital in a rural setting  C) Probability Sampling Method: Two group randomized controlled trials; Sample size – 100 dyads  D) Dyads in both the control and KC groups received routine care. The control group received care from an incubator, warmer beds, or bassinettes with blankets. The SSC group infants were immediately placed prone between their mother’s breasts and covered with a warming blanket and a cap on their head.  E) The data collectors used the Nursing Child Assessment Satellite Training Program Feeding and Teaching scales to measure mother-preterm infant (MPI) interaction during a videotaped session.  F) The outcomes measured are the mother-preterm infant interaction according to their feeding and teaching efficiency. Mother-infant interactions include sensitivity to cues and distress, social-emotional and cognitive growth fostering, and responsiveness. The feeding sessions were videotaped at 6 and 12 months. The teaching sessions were videotaped at 6, 12, and 18 months. | Both the control group and the KC group had similar feeding scores at 6 and 12 months. The SSC infants had lower teaching scores at 6 months but evened out with the next assessments. | This study is an evidence level of II because it is a well designed randomized controlled trial. Internal validity, reliability, and bias were addressed in the design of the study. The teaching and feeding scale used in the study may not reflect the complete benefits because mother-infant interactions are so complex. Only 53% of the women approached about participating in the study actually participated in the study, so the sample size was small. |
| Dodd VL (2005)  Level I: Systematic Review | The purpose of this article is to assemble data related to kangaroo care (KC) and its effect on growth and development of preterm infants.  “The purpose of this article is to summarize the research literature on KC in preterm infants and discuss implications for research related to growth and development” (2004, p. 218). | A) This systematic review included 13 randomized controlled trials, 3 quasi-experimental designs, 12 with nonexperimental single group pretest/test/posttest designs, 4 nonexperimental comparative designs, 17 descriptive reports, and 17 case studies. The author searched PubMed studies through 2003. Dodd used the search words: kangaroo care, skin-to-skin, growth, development, and premature infants.  B) Preterm infants  C) Studies included in the article are randomized controlled trials, pretest-posttest designs, and other comparative studies. Sample size varied for each study totaling to 3,581 infants.  D) Compares KC implementation to conventional care in preterm infants according to physiological measures, nurturing elements, and physical growth.  E) Each individual study used different tools according to what outcomes they were measuring. For example, temperature was measured continuously through an abdominal skin probe or rectal probe and the Bayley Scales of Infant Development measured development.  F) Temperature, heart rate, respiratory patterns, oxygenation by oxygen saturation, mother-child attachment, mother’s confidence, weight gain | KC is a well-known way to increase a preterm or term infant’s weight. Six studies reviewed in this article showed an increase in a preterm infant’s heart rate during KC, but this increased rate is most likely due to the change from horizontal to vertical position. The upright and chest-to-chest position of the infant during KC stabilizes the infant’s chest wall and improves respiratory excursion. KC's effects on infant oxygenation levels are so minimal as to be clinically insignificant. KC is also beneficial to the infant’s parents because it furthers attachment and enhances feelings of nurturing. It also increases the parents’ confidence in their parenting skills during stressful situations. KC also promotes more efficient calorie utilization. | This article is an evidence level of I because it is a systematic review that discusses and summarizes several different research studies related to our topic of KC. The author only evaluated data that was relevant to KC and the effect it has on preterm infant growth and development. The author organized all of the data according to the individual outcomes. Dodd also identifies possible limitations in the reviewed research and lists recommendations for future studies. Two of the weaknesses in this review are that some of the data was collected through non-experimental design and some of the sources were outdated. |
| Nyqvist KH, Anderson GC, Bergman N, Cattaneo A, Charpak N, Davanzo R, Ewald U, Ludington-Hoe S, Mendoza S, Pallas-Allonso C, Pelaez JG, Sizun J, Widstrom A-M (2010)  Level I: Clinical Practice Guidelines | The purpose of this clinical practice guideline is to promote KMC in low birth weight infants and also to demonstrate the proper methods of KC in high tech environments.  “Recommendations are given for three different levels for applying the method, depending on availability of health and medical care resources…” (2010, p. 813). | A) The design of this study is a clinical practice guideline.  B) Preterm/low birth weight infants less than 2500 g  C) This clinical practice guideline includes many different studies’ data. Some of the sampling methods included are surveys of NICUs, which are nonexperimental, and randomized controlled trials, which are experimental. The sample size includes 53 articles.  D) The main intervention is implementing KC in routine care, providing guidelines for proper KC between mothers and infants, and establishing the role of the healthcare providers in the entire process.  E) Each individual study used different tools according to what outcomes they were measuring. For example, a survey was used to determine how often KMC was offered in participated NICUs.  F)   * routine offers of KMC to mothers * duration of KMC in different settings * improved or maintained stability * infant physiological response like heart rate, respiration, oxygen saturation, and temperature * cortisol levels of infants * breastfeeding competence * psychosocial aspects of parent-infant KMC * safety of infant during KMC * presence or absence of clear protocols of KMC implementation for healthcare providers | Kangaroo Mother Care should be considered normal protocol for low birth weight infants because KC improves physiologic responses in infants, decreases the pain response, positively affects the parent-infant interaction, and increases breastfeeding. Emphasis should be placed on the safety of the infant in KC. Providers of KMC should be able to describe that parent-infant bonding is one of the main goals.  With the stated benefits, practices of KC should be promoted everywhere including the high-tech NICUs. | This clinical practice guideline suggests that KMC be routinely practiced with preterm infants no matter what the setting. The authors represent countries from around the world, which allows for generalization for more places. They use many different sources of data but do not state why or why not each was included. A majority of the research used is current, but there are a few articles that are slightly outdated. |
| Chiu, S.H., Anderson, G.C., Burkhammer, M.D. (2005)  Level III: Quasi-Experimental | The purpose of the study was to investigate the relationship between skin-to-skin contact and temperature fluctuations in full-term infants during breastfeeding sessions, particularly in mother-infant dyads experiencing breastfeeding difficulties. | A) This study was quasi-experimental in nature because it utilized a one-group, pretest-posttest design. No randomization was employed when assessing the mother-infant population.  B) Forty-eight mother-baby dyads (full-term infants and their mothers) at the University MacDonald Women's Hospital, University Hospitals of Cleveland, Ohio. Mothers were at least 18 years of age, and their full-term singleton infants were sufficiently healthy to experience skin-to-skin contact and were having breastfeeding difficulties identified between 12 and 24 hours after birth.  C) Non-probability sampling method: convenience sampling. Nurse researchers recruited volunteers from mother-infant couples who met the inclusion criteria at a local Level III perinatal center. Sample size—50 dyads.  D) The temporal artery temperature of 48 full-term infants was measured before skin-to-skin contact, 30 minutes into skin-to-skin contact, and just before the end of the contact session during 3 consecutive breastfeeding interventions. This process was also repeated during 1 breastfeeding session 24 hours after the first set of interventions.  E) The researchers used a Mother-Baby Assessment form that they had developed in order to identify qualifying dyads (i.e., mothers and infants experiencing breastfeeding difficulties). A temporal scanner (TAT-5000, Exergen Corporation) was used to measure infant temperature.  F) The outcomes measured were infant temperatures at the beginning, middle, and end of skin-to-skin contact sessions involving breastfeeding. | During breastfeeding with skin-to-skin contact, most infant temperatures reached and remained in the thermoneutral range (between 36.5 and 37.6°C), leading the authors to conclude that newborn infants may safely breastfeed with their mothers during KC. “Hospital staff and parents can be reassured that, with respect to their temperature, healthy newborn infants, with or without breastfeeding difficulties, may safely breastfeed in skin-to-skin contact with their mothers” (2005, p. 115). | This study has an evidence level of III because it is a well-designed but non-randomized controlled trial. Data was analyzed using percent, mean, standard deviation, and range. Possible confounding variables were addressed by dividing infant data into subgroups based on demographics and whether or not the infants were breastfeeding at 30 minutes into the skin-to-skin contact. Although the study was conducted on full-term infants rather than preterm ones, it remains relevant to our project by providing a baseline for infant temperature comparison and demonstrating that, in healthy neonates, adequate thermoregulation can be achieved during skin-to-skin breastfeeding sessions. |
| Feldman, R., Eidelman, A., Sirota, L., Weller, A. (2002)  Level III: Quasi-Experimental | The objective of this study was to examine whether the kangaroo care (KC) intervention in premature infants affects parent-child interactions and infant development. | A) This study was quasi-experimental in nature because it utilized an after-only non-equivalent control group design. No randomization was employed; infants in the experimental group were matched with infants of equivalent health and demographic status in the control group.  B) 146 premature infants with mean birth weight 1270 g and mean gestational age 30.65 weeks at two hospitals in Israel. All infants were from middle-class families, representing the majority of young families in the Israeli population.  C) Non-probability sampling method: matching. 73 preterm infants who received KC in the NICU were matched with 73 control infants who received standard incubator care for birth weight, gestational age (GA), medical severity, and demographics. Sample size—146 infants.  D) Infants were enrolled at 31 to 33 weeks' postconception, once their medical conditions were stabilized; KC was begun between 31 and 34 weeks' GA. During this period, infants in the experimental group received an average of 26.62 hours of kangaroo contact, while infants in the control group received standard incubator care. Infants and their mothers were observed before discharge at 37 weeks' GA and after discharge at 3 and 6 months' corrected age.  E) Infant medical risk was measured using the Clinical Risk Index for Babies (CRIB). Ten minutes of mother-infant interaction were videotaped; for each 10-second segment, behaviors were coded using a Mother-Newborn Coding System. The Beck Depression Inventory (BDI) and Neonate Parental Inventory (NPI) were used to assess maternal outcomes, while the Infant Characteristic Questionnaire (ICQ) was used to assess maternal and paternal attitudes toward parenting. Lastly, the Home Observation for the Measurement of the Environment (HOME) was used to evaluate the quality of the child's home environment during post-discharge assessments.  F) The outcomes measured were mother-infant interaction, maternal depression, and mother perceptions (37 weeks GA); infant temperament, maternal and paternal sensitivity, and home environment (3 months' corrected GA); and mother-infant interaction and infant cognitive development (6 months' corrected GA). | After implementation of KC, mother-infant interactions were increasingly positive, with mothers showing more adaptation to infant cues and infants showing more alertness instead of gaze aversion. The authors concluded that KC had “a significant positive impact on the infant's perceptual-cognitive and motor development and on the parenting process” (2002, p. 16). | This study has an evidence level of III because it is a well-designed but non-randomized matched study. “As KC is a standardized care option in many hospitals in Israel and was not considered an experimental technique, prospective randomization of KC and control subjects was precluded by the institutional research boards. Comparison thus was performed between matched infants cared for in 2 different hospitals, one of which provided KC care and one that did not” (Feldman, Eidelman, Sirota, & Weller, 2002, p. 17). The researchers' recruitment methods helped to minimize the selection bias that have occurred had all the infants been from the same hospital, or had comparison been made between infants whose mothers chose KC and those whose mothers declined. In addition, this recruitment took place during a defined time period, resolving the problem of historical controls. |

**Synthesis Summary of Findings**

Kangaroo care (KC), also known as skin-to-skin contact (SSC), involves placement of an infant with its ventral surface against the mother’s bare chest, typically with the child positioned upright between the mother’s breasts (Chiu & Anderson, 2009; Ludington-Hoe, Morgan, & Abouelfettoh, 2008; Nyqvist et al., 2010). During this process, a head cap, warm blankets, and other insulating covers are often used to maintain stable infant body temperatures (Ludington-Hoe et al., 2008). According to one source, “skin-to-skin contact has been reported to improve infant state organization, thermal regulation, respiratory patterns, and oxygen saturation; reduce apnea and bradycardia; increase rate of infant weight gain and maternal milk production; shorten hospital stay; and function as an analgesic during painful medical procedures” (Feldman, Eidelman, Sirota, & Weller, 2002, p. 16). The practice of KC in preterm infants has been shown to improve infant development (both cognitive and physical) and maternal-infant interaction in particular (Conde-Agudelo, Belizán, & Diaz-Rossello, 2011; Feldman et al., 2002).

Foremost among KC’s benefits are the physiologic changes it induces in premature infants. A systematic review by Dodd (2005) suggests that KC facilitates more efficient utilization of calories in preterm infants, leading to enhanced growth and weight gains. In addition, infants receiving KMC gained more length (0.29 cm) and head circumference (0.18 cm) each week and weight (3.9 g) each day, on average, than infants that did not receive KMC (Conde-Agudelo et al., 2011). Skin-to-skin contact also has a stabilizing effect on infant vital signs. Infants maintain clinically acceptable heart and respiratory rates during KC sessions, and their oxygen saturation levels tend to increase by as much as 2 to 3% compared to readings taken during incubator care (Ludington-Hoe et al., 2008). Infant temperature during SSC has been shown to increase regardless of the measurement method used, and infant cortisol levels dramatically decrease, often by 60% or more, compared to incubator levels (Ludington-Hoe et al., 2008). This drop in cortisol levels indicates a decrease in infant stress, a finding corroborated by the fact that infants undergoing KC display increases in both amount and duration of quiet sleep (Ludington-Hoe et al., 2008). Overall, KC encourages increased physical stability in the preterm infant population.

Further prominent outcomes of kangaroo care include long-term cognitive gains and prevention of developmental delays in participating infants. While one article claims that “no statistically significant differences were found between KMC infants and controls in Griffith quotients for psychomotor development, cerebral palsy, deafness, and visual impairment” (Conde-Agudelo et al., 2011, p. 16-17), many researchers support the idea that SSC positively impacts infants’ motor maturity and long-term cognitive development (Feldman et al., 2002; Ludington-Hoe et al., 2008; Nyqvist et al., 2010). Infant awareness of surroundings increases in response to maternal interaction. Tactile contact increases premature infants’ visual habituation and motor control; the combined sensory, rhythmic, and psychological components of mother-infant interaction serve to stimulate infant alertness and accelerate cerebral maturation (Feldman et al., 2002; Ludington-Hoe et al., 2008). Infants who receive KC exhibit greater brain complexity at term age than those who do not receive such stimulation (Ludington-Hoe et al., 2008). At 37 weeks’ postmenstrual age, KC infants exhibited less gaze aversion than control infants, and at 6 months scored higher on the Bayley Scales of Infant Development (Feldman et al., 2002). These gains serve to minimize the likelihood of developmental delay, leading many experts to recommend the use of kangaroo care as a neurobehavioral promotion strategy (Ludington-Hoe et al., 2008). KC’s promotion of mother-infant interaction encourages infant awareness and provides an energizing environment for cognitive gains.

Mothers of premature infants are often less responsive to infant signals and show decreased bonding when traditional incubator care is used, since opportunities for interaction and attachment are limited (Feldman et al., 2002). This lack of mother-infant interaction can lead to diminished developmental outcomes and disorganized infant behavior (Feldman et al., 2002). Kangaroo care, however, allows for increased bonding time, leading to both cognitive gains on the part of the infant and increased maternal satisfaction (Conde-Agudelo et al., 2011; Feldman et al., 2002). KC has been shown to foster maternal nurturing practices and facilitate parent-child attachment; mothers who participated in KC reported 13% higher parenting satisfaction levels than those who participated in standard NICU care (Conde-Agudelo et al., 2011; Dodd, 2005). According to one study, mothers who practice KC are 10.6% more likely to exclusively breastfeed their children by discharge or infant term age (Conde-Agudelo et al., 2011), while another randomized controlled trial reports a 28% increase in exclusive breastfeeding by 40 weeks’ postmenstrual age in premature infants receiving 13.5 hours daily of KC versus infants not receiving KC (Ludington-Hoe et al., 2008). Lastly, mothers who perform skin-to-skin contact display higher feeding scores on the Mother Total assessment at 6 and 12 months than mothers of control infants (Chiu & Anderson, 2009), a finding corroborated by another study in which mothers demonstrated the ability to regulate their infants’ temperatures during skin-to-skin breastfeeding sessions (Chiu, Anderson, & Burkhammer, 2005).

Compared to traditional incubator care, KC has consistently been shown to improve infant physiological function, including thermoregulation, oxygen levels, and heart rate with additional gains in infant weight and cognitive maturation (Feldman et al., 2002). KC has equally positive effects on both infant growth and development and maternal childcare practices, making it an effective intervention for application in the neonatal intensive care setting.

**Consistency of Evidence Questions**

A. The systematic review from the Cochrane library contains many randomized controlled trials, including the studies by Chiu & Anderson (2009) and Feldman et al. (2002) cited in this paper. Ludington-Hoe et al. (2008) utilizes data from the Feldman et al. (2002) study. The randomized controlled trial by Chiu & Anderson (2009) and the systematic review by Dodd (2005) also reference the Feldman et al. (2002) study. Nyqvist et al. (2010) includes data from the clinical practice guideline by Ludington-Hoe et al. (2008). These authors have conducted numerous studies and have consistently updated their systematic reviews, with a continuing trend of positive evidence for the use of kangaroo care.

B. Most of the studies are well designed. Two studies included are level one systematic review, which use a rigorous method to identify, critically discuss, and then produce relevant studies in the research of kangaroo care. The systematic reviews also include mostly randomized controlled trials, which makes these studies well designed. The systematic review conducted by Conde-Agudelo et al., (2011) discusses the weaknesses in its design in that it reviews biases, lack of blinding of participants, and some incomplete data (not every infant was available for follow up). However, it was well designed because it included statistics for each section that affects KC. Two level one clinical practice guidelines were also included in our research. These are well designed because they are based on the standardized best practice and show the ability to support improvements in preterm infant quality of life because of kangaroo care (Ludington-Hoe et al., 2009; Nygvist et al., 2010). They also focus on promoting the use of proper KC and demonstrate that there is still a need to establish clearly defined protocols for safe KC in neonatal intensive care units (Nygvist et al., 2010). Level III Quasi-experimental designs were another design of the articles used in our paper. They are well designed because they test the cause and effect relationship between KC and improved infant stability; however, they do need to be replicated to strengthen their validity (Feldman et al., 2002). These studies are generalizable to the population and make the findings easier to adapt to real life. The Feldman (2002) study backed their findings with statistical analysis. The Chiu & Anderson (2009) study discussed possible threats to the study including the loss of participants, dissimilarities across comparison studies, confounding variables that may affect the results, and the heterogeneity of the study.

C. The recommendations are mostly consistent among the systematic reviews, evidence-based practice guidelines, and individual studies. A highly supported recommendation is that KC be used as a positive alternative to traditional care to increase physiologic status, promote growth and development, and further positive mother-infant interaction (Conde-Agudelo et al., 2011; Dodd, 2005; Feldman et al., 2002; Ludington-Hoe et al., 2008; Nyqvist et al., 2010). Secondly, proper positioning and safety of the infant are top recommendations included in most of the articles as well (Dodd, 2005; Ludington-Hoe et al., 2008; Nyqvist et al., 2011). One last major recommendation for KC is that it should be used to promote exclusive breastfeeding in preterm/LBW infants (Chiu & Anderson, 2009; Conde-Agudelo et al., 2011; Ludington-Hoe et al., 2009; Nygvist et al., 2010). Based on the citing in this section, it can be seen that the majority of the articles-whether a systematic review, clinical practice guideline, or individual study-supported one another in the recommendations for kangaroo care.

D. The identified benefits of kangaroo mother care are numerous, with the most prominent benefits being increased physiologic stability of preterm infants, promotion of infant cognitive development, and improved quality of mother-infant interactions. Other benefits include increased likelihood of successful breastfeeding after implementation of kangaroo care. These benefits were consistently demonstrated across the studies we investigated, with little to no risk cited for participating subjects. Only one study showed kangaroo care as having no effect on infant cognitive development (Conde-Agudelo et al., 2011); every other study reviewed cited significant gains in both physical and mental growth of infants involved. There were no overt risks identified in the articles, as kangaroo care has not been demonstrated to have any negative effects on mothers or their infants. Overall, the researchers expressed more concern that skin-to-skin contact would have no effect on participants rather than a harmful effect.

E. No cost studies have been done on kangaroo care therapies to date. However, kangaroo care was originally developed in response to limited resources in hospitals in third-world nations, implying cost efficiency. The staff training required in order to implement this therapy is minimal, and the technique does not require extraneous equipment. None of the studies we reviewed suggested cost as a barrier to effective use of this therapy; in contrast, many promoted it as a practical alternative to more expensive incubator care (Dodd, 2004; Conde-Agudelo et al., 2011; Nyqvist et al., 2010). Kangaroo care has been consistently shown to decrease length of hospital stay in premature infants, leading to decreased medical costs and improved outcomes for mothers and their infants.

**Recommendations for Evidence-based Practice**

* Educate the parents to position the infant’s chest upright against the holder’s chest with the arms and legs flexed and where the holder can see the infant’s face and any sign of airway obstruction.
  + Grade: A
  + Ludington-Hoe, S.M., Morgan, K., & Abouelfettoh, A. (2008). A clinical guideline for implementation of kangaroo care with premature infants of 30 or more weeks’ postmenstrual age. *Advances in Neonatal Care, 8*(3S), S3-S23. Retrieved from http://www.nursingcenter.com/library/JournalArticle.asp? Article\_ID=799983
  + Nyqvist, K.H., Anderson, G.C., Bergman, N., Cattaneo, A., Charpak, N., Davanzo, R., … Widstrom, A.M. (2010). State of the art and recommendations kangaroo mother care: application in a high-tech environment. *Breastfeeding Review, 18*(3), 812-819. doi: 10.1111/j.1651-2227.2010.01794.x
* KC should be implemented to promote infant growth and development, enhance parental-infant attachment, and encourage emotional investment.
  + Grade: B
  + Dodd, V.L. (2005). Implications of kangaroo care for growth and development in preterm infants. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 34*(2), 218-232. doi: 10.1177/0884217505274698
  + Feldman, R., Eidelman A.I., Sirota, L., & Weller, A. (2002). Comparison of skin-to-skin (kangaroo) and traditional care: Parenting outcomes and preterm infant development. *Pediatrics, 110*(1), 16-26. Retrieved from http://web.ebscohost. com.spot.lib.auburn.edu/ ehost/detail?sid=4af6a493-9872-4491b7c7-eb0020a0 8818%40sessionmgr13&vid=5& hid=11&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ %3d%3d#db=cin20&AN=2002171518
* Continuous or intermittent KC should only be used in stabilized LBW infants. KC should not be used in infants with a chest tube, an intracardiac line, or an arterial line. Infants being weaned from a ventilator or experiencing apnea or bradycardia should also abstain from KC. Parents should not participate in KC if they have a cold, open lesions, or rashes.
  + Grade: A
  + Conde-Agudelo, A. Belizan, J.M., & Diaz-Rossello J. (2011). Kangaroo mother care to reduce morbidity and mortality in low birth weight infants. *Cochrane Database of Systematic Reviews,* (3), 1-56. doi: 10.1002/14651858.CD0027 71.pub2
  + Ludington-Hoe, S.M., Morgan, K., & Abouelfettoh, A. (2008). A clinical guideline for implementation of kangaroo care with premature infants of 30 or more weeks’ postmenstrual age. *Advances in Neonatal Care, 8*(3S), S3-S23. Retrieved from http://www.nursingcenter.com/library/JournalArticle.asp? Article\_ID=799983
* Individual responses of both mother and baby should be monitored during each KC session. Monitor and document the infant’s vital signs before, during, and after KC. Also document if the infant is crying or content and awake or asleep. Assess the parent’s level of comfort throughout the session.
  + Grade: A
  + Ludington-Hoe, S.M., Morgan, K., & Abouelfettoh, A. (2008). A clinical guideline for implementation of kangaroo care with premature infants of 30 or more weeks’ postmenstrual age. *Advances in Neonatal Care, 8*(3S), S3-S23. Retrieved from http://www.nursingcenter.com/library/JournalArticle.asp? Article\_ID=799983

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