Supplement

A Clinical Guideline for Implementation of Kangaroo Care With Premature Infants of 30 or More Weeks' Postmenstrual Age

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ABSTRACT

As part of the National Association of Neonatal Nurses (NANN) clinical reference series, a clinical guideline for kangaroo care (KC) with stable premature infants, usually those who are 30 or more weeks' postmenstrual age, is presented. The guideline begins with the evidence base regarding physiologic (heart rate, respiratory rate, apnea, periodic breathing, oxygen saturation level and desaturation events, temperature, weight gain, infection, and hypoglycemia), behavioral (crying, sleep, pain, and breastfeeding behaviors), and psychosocial (parental feelings, attachment, and interactions) outcomes of KC. The presented evidence is rated to guide adoption. Following summations of the evidence, criteria for assessing infant, parental, and institutional readiness for KC are provided along with recommendations for monitoring and documenting KC experiences. A sample protocol/policy that can be modified for specific unit use is provided to facilitate adoption of KC as a positive, potent nursing intervention, as is a list of the *Ten Steps to Successful Kangaroo Care*.

KEY WORDS: guidelines, kangaroo care, premature infants

OBJECTIVES

The objectives of this national guideline for the clinical practice of kangaroo care (KC) with premature infants who are at least 30 weeks' postmenstrual age and who do not have chronic lung disease are to:

1. review and evaluate the evidence base related to physiologic (heart rate, bradycardia, respiratory rate, oxygen saturation, apnea, desaturations, temperature, cortisol, weight gain, head circumference, infections, blood glucose level), behavioral (sleep, crying, breastfeeding, and response to pain), developmental (mental and motor, neurobehavioral organization), and psychosocial benefits (attachment, parental confidence) of KC;
2. provide assessment criteria to determine infant, parental, and institutional readiness for KC and make decisions about transfer and positioning of the infant;
3. make recommendations for monitoring and documentation throughout KC;
4. provide a sample protocol for KC that can be adapted and adopted for use in individual neonatal intensive care units (NICUs); and
5. conclude with *The Ten Steps for Successful Kangaroo Care.*

The authors and the NANN hope that the provision of this national clinical practice guideline for KC will 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 preterm infants are found, assist in the routine implementation of KC as the evidence supports, and encourage healthcare workers to seek additional education and skills training about KC

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through the International Network of Kangaroo Mother Care's certified kangaroo caregiver and training programs.[1,*]

Review and Evaluate the Evidence Base Related to Kangaroo Care Effects

A review of physiologic, behavioral, developmental, and psychosocial effects of KC with preterm infants of 30 or more weeks' postmenstrual age follows. Randomized clinical trials, quasi-experimental designs, and meta-analyses of studies with infants who are similar to those for whom this guideline is appropriate have been reviewed and distilled into statements with references to the original source of the evidence. Descriptive studies, that is, case studies and qualitative studies, have been identified as such and are included in the review. Each type of study yields evidence, but the strongest evidence comes from randomized clinical trials and meta-analyses. *Randomized clinical trials* are studies in which the subjects have been randomly assigned to either the treatment or the "no-treatment" (called *control*) group. Thus, randomized clinical trials always have 2 groups: treatment and control groups. Use of the word "trial" means a randomized study to determine the difference in effect between subjects who received the treatment and subjects who did not (control) receive the treatment. Many studies use only one group of subjects and measure the outcomes in the subjects before treatment (called *pretest*), sometimes during the treatment (called *test*), and usually after the treatment (called *posttest*). One-group pretest–(test)–posttest studies can be called controlled trials (because the study simply describes what happens before, during, and after a treatment) or sometimes called quasi-experimental, which means "somewhat experimental" because a treatment is administered to the subjects but there is no control group. Descriptive and quasi-experimental studies do not provide findings as generalizable as those from a randomized clinical trial. Once 3 or more randomized clinical trials have been conducted by different investigators examining the same effects, the data from all these studies are put together and analyzed to determine what the effect on the population (not just the subjects in one research investigation) would be. Population analysis studies are called *meta-analyses*, meaning overall analysis of effects. The results of a meta-analysis are the strongest evidence possible. Thus, randomized clinical trial and meta-analysis results provide the best evidence upon which to base an intervention. Summary statements for each area of literature review have been made on the basis of an evaluation of the evidence using the US Preventive Services Task Force's levels of recommendation.[2] Effectiveness is established to a degree that

A = merits application,
B = suggests application,
C = warrants consideration of applying findings,
D = is limited, and
E = effectiveness is not established.

Physiologic Effects

Many physiologic outcomes of KC have been found to be beneficial. In relation to cardiorespiratory effects, randomized clinical trials and quasi-experimental pretest–test–posttest studies have found that *heart rate* may not change or be different than when in an incubator[3–9] or may rise by 5–10 beats per minute during KC sessions,[10–12] rising initially in response to the head tilting upward[13] and later due to infant warming.[14] Thus, during the second hour of KC, heart rate may rise more than in the first hour.[15] During a heel stick, heart rate rises much less if the infant is in KC (8- to 10-beat rise) rather than in an incubator (36- to 38-beat rise).[16,17] During transfer into and out of KC, ventilated infants' heart rates rise.[18] A meta-analysis of 23 studies of stable preterm infants in an incubator, then in KC, and finally back in the incubator revealed that heart rate was not significantly different in KC than it was in the incubator.[19] Many descriptive[8,10,20–22] and pretest–test–posttest[11,23–25] reports indicate that *bradycardia* (heart rate < 100 beats per minute or $>33\%$ drop from baseline heart rate) is rare during KC, producing the recommendation to practice KC to minimize bradycardic events.[26] Only one randomized trial has been conducted and it showed that no bradycardic events (heart rate < 120 beats per minute) occurred during KC, whereas several occurred during incubator care.[27]

Respiratory rate, similar to heart rate, may be no different during KC than incubator periods[7,27] or may rise by up to 10 breaths per minute[12,28] or drop by 4 breaths per minute for 3 minutes.[13] One meta-analysis of heart and respiratory rate changes showed that respiratory changes of 5 breaths per minute (and heart rate change of 10 beats per minute) are common across independent studies and can be expected in the population of preterm infants of 30 or more weeks' postmenstrual age.[28] A Cochrane meta-analysis of A-level data confirmed

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that infants have a lower respiratory rate during KC than during incubator care.[29] In summary, heart and respiratory rates usually remain within clinically acceptable range,[10,27,30] and are more stable during KC than incubator periods.[12,27,31] Stability of heart and respiratory rates has been contested when one counts the number of boxes reflecting change on the pneumogram rather than using actual heart and respiratory rate values.[32] Nonetheless, the experimental trials suggest that KC has a stabilizing effect on these cardiorespiratory parameters and provide A-level evidence.

Effects of KC on *oxygen saturation* levels vary as well. Oxygen saturation levels have been found to increase by 2% to 3%[4,10,12,33,34] during KC as compared with incubator values, and statistically significant increases have been confirmed by meta-analysis.[28] No changes in oxygen saturation levels during KC have been reported in other randomized trials of similar preterm subjects.[7,9,11,30] In addition, no changes in oxygen saturation were seen during a heel stick in KC as compared with a heel stick in the incubator.[17] Statistically, but not clinically, significant drops in oxygen saturation level have been reported, with a mean 1.0% drop in a study of 3 hours of KC[27] and slightly more in a 2-hour study in which control over airway occlusion did not occur.[35] Meta-analysis of various durations of KC has shown that a 0.6% drop in oxygen saturation may occur with KC.[19] During transfer into KC, oxygen saturation levels dropped but stabilized within normal limits within 3 minutes of the onset of KC.[18] Thus, based on A-level evidence, oxygen saturation changes during KC are minimal and remain predominantly within acceptable clinical ranges.

Several investigations of KC effects on *desaturation events* are available, but only 2 were randomized controlled trials.[4,36] Bier and associates[4] found that desaturations (<90%) decreased during KC as compared with swaddled holding, and Rojas and associates[36] found that desaturations (<88%) were also fewer during KC than swaddled holding. The quasi-experimental studies of Bohnhorst and associates[11,35] showed that the possibility of an increase in the number of desaturations (<80%) occurred during the second hour of KC, but the authors admit that infant airway occlusions contributed to desaturation events in the first report, weakening the results. The relationship between desaturations (<87%) and feedings was delineated by Chen and associates[37] who compared bottlefeeding to breastfeeding during KC. Twenty desaturations (<87%) occurred during bottle-feeding in the KC position, but none occurred during breastfeeding in the KC position. Clinical reports[20,25] relate that no desaturations (<88%) occurred during KC in medically stable preterm infants. The B-level data from the randomized clinical trials recommend that KC be used with the expectation that a decrease in the number of desaturation events (<88%) and a decrease in the number of infants having desaturation events will occur during KC, even during breastfeeding. Controlling infant head in the slightly sniffing position and neck in the midline position is mandatory to minimize desaturations.

Generic to understanding KC's cardiorespiratory effects is a review of *apnea* in response to KC. The predominant finding from randomized clinical trials is that the number of apnea episodes does not change during KC when compared with incubator care.[6,11,24,27,30,38] However, the trial of Hadeed and associates[39] found that apneic episodes decreased by 75% during 3 hours of KC as compared with incubator care, a finding that was supported in other randomized clinical trials.[27,40] Increased frequency of apneic episodes was reported by Bohnhorst and associates[35] in a quasi-experimental study in which, according to the authors, control over airway occlusion was lacking. When the study was repeated with control over airway patency, no change in isolated apnea episodes occurred during KC, but the number of apneas accompanied by desaturations (oxygen saturation, arterial [Sa_{O_2}] < 80%) did increase during KC.[11] One descriptive study revealed that no apnea occurred during breastfeeding in the KC position.[37] Thus, the A-level evidence relating no change in the number of apneic episodes merits application, whereas the B-level data showing decreased apnea suggests application. Bohnhorst and associates' findings are limited in terms of application, especially when one considers that most apneas occur during indeterminate sleep and arousals from sleep.[41] Because KC eliminates indeterminate sleep and greatly minimizes arousals from sleep,[42] a reduction in apnea, or at least no change in apnea, can reasonably be expected during KC. Still, monitoring the infant for apneas and desaturation events should occur as long as KC is continued because increased body warmth has been associated with an increase in apnea, especially in very immature infants.

The effect of KC on infant body *temperature* has been studied extensively, with the same outcome: when healthy preterm infants are placed in KC, infant body temperature rises.[5,11,14,27,35,43–49] Infant warming during KC has been confirmed by meta-analyses,[19,29,50–52] no matter how the body temperature has been measured. Temperature measurements have been axillary, tympanic, rectal, central artery, forehead, back, abdominal, foot/toe, and thigh, and still the areas under measurement increase during KC. Only one pretest–test–posttest study[38] found infant temperature was lower (but still within clinically acceptable limits) during KC than during incubator care. Infant temperature has remained within clinically acceptable limits and within each infant's neutral thermal zone when provided by the mother. Infant temperature can exceed 37.5°C when provided by fathers in tropical, un-air conditioned units.[48] Infant thermoregulation

occurs by maternal control over the amount of breast heat that is conducted to the infant.[14,53,54] Infants of more than 32 weeks' postmenstrual age have demonstrated the ability to thermoregulate their body temperature during KC by sticking an arm or foot out from under the covering blanket.[48] Regardless of providers (mothers, fathers, and surrogates [adoptive parents, healthcare staff]), infant temperature remains stable or increases. If an infant is febrile, do not place him or her into KC because no research has been conducted to determine febrile infant responses to KC. Fewer episodes of hypo- and hyperthermia occur during KC than during incubator care.[50,55] Compelling A-level evidence supports the use of KC with the knowledge that infant heat loss will not occur, infant temperature will remain within acceptable clinical parameters, and infant temperature will rise.

Cortisol has been studied as a sign of physiological *stress* in preterm infants. Most randomized controlled trials examining the influence of 20 minutes[56–58] or more of KC with stable premature infants have shown reductions in cortisol levels by 60% or more[59] when compared with infants left in an incubator. Because cortisol levels of continuing care infants at rest in incubators are generally 193–212 nmol/L,[60] values that far exceed the desired level of 50 nmol/L, a 60% reduction in cortisol levels in such a short time is important, given that an elevated cortisol level impairs immune function. One study of extremely low-birth-weight premature infants found no change in cortisol levels between incubator and KC periods,[61] suggesting a maturational influence on cortisol secretion. Cortisol in stable premature infants was measured over 4 days of KC in a descriptive study; no difference in cortisol levels was found between day 1 and day 4.[62] Although the studies of cortisol effect have been rigorous, the limited number of investigations suggests B-level evidence supporting nursing's use of KC to reduce infant stress as measured by serum or salivary cortisol levels.

Effects of KC on *weight gain* are controversial. Studies examining weight gain during hospitalization have shown no difference in weight gain[5] or increases in weight gain,[49,50] increases by as much as 19.72 g/d compared with a 10.0 g/d weight gain for infants who remained in incubators.[23,63] Meta-analysis confirms significantly more weight gain in infants receiving KC.[50] Infants who were exclusively breastfed before and after discharge had no greater weight gain with KC than infants who did not get KC when evaluated at 30 days postdischarge[64] and 1 year postdischarge.[65] Well preterm infants who received KC 24 hours per day, 7 days per week (called 24/7 KC) gained twice as much weight as a similar group that received no KC in one study.[62] But another study of 52 twins who received 24/7 KC from the 4th to 7th days of life reported 2 twins with poor weight gain who had to return to the NICU from the 24/7 KC unit.[66] An implementation study in India found that 1500-g preterm infants gained a mean of 29.00 g/d while receiving paternal KC.[67] In addition, KC increased *head circumference* at term age, and 6, 9, and 12 months' corrected age.[68] One randomized controlled and clinical trial showed that preterm infants who received KC 13.5 hours per day had weekly increased head circumference of 0.75 cm compared with 0.49 cm in infants who did not receive KC.[49] The same study also showed increased *body length* of 0.99 cm compared with 0.7 cm for infants who did not receive KC.[49] Although weight gain effects are controversial, the practice of KC to increase weight gain has been recommended.[69,70] But for the purpose of this review, the KC effect on weight gain is rated as level-C evidence with a need for more controlled trials.[71] The sparse data on head circumference and body length recommend that the evidence on these outcomes is level B at present.

Finally, the effects of KC on *nosocomial infections* need to be addressed because healthcare professionals frequently cite fear of increased infection as a barrier to the practice of KC.[72] Six of 52 Zimbabwean preterm twins who received 24/7 KC on the 4th to 7th days of life developed sepsis during KC and had to be returned to the NICU from a kangaroo mother care (KMC) unit in one descriptive study.[66] (A *KMC unit* is one in which the infants receive KC 24/7, with mothers sleeping in an upright position with their infants securely tucked up against their chests.) The 6 infants might have been exposed to sepsis before transfer to the KMC unit and manifested the sepsis only during KC. In contrast, another group of 50 preterm infants who received 4–6 hours per day of paternal KC had no infections during KC.[67] Three randomized trials found that infants who received KC 24/7 had fewer infections by discharge than infants who did not receive KC.[65,68,73] One randomized controlled trial of preterm infants who received KC a mean of 13.5 hours per day had significantly fewer nosocomial infections than preterm infants who did not receive KC.[49] Two other randomized trials found no difference in infection rate between infants who received intermittent, but not 24/7 KC, and infants who did not receive any KC,[6] even when KC was provided by the father too.[43] A Cochrane meta-analysis showed decrease in infections in infants who experience KC.[50] Thus, the effect of KC on infection evidence is strong and consistent among independent clinical trials, meriting application (A level). An ongoing randomized clinical trial suggests that KC's effect on nosocomial infections may be due in part to enhanced stratum corneum barrier function when hydration increases and transepidermal water loss decreases during KC.[74] However, everyone should be advised that nosocomial infections can spread from healthcare workers, visitors, and other mothers to infants receiving KC in multibed

designed units.[66,75,76] Infection control processes need to be vigilantly followed.

Although the effect of KC on *blood glucose levels* has been extensively studied in full-term infants[77–82] and consistently showed that KC at birth reduces frequency of hypoglycemia over first 90 minutes postbirth, only one study with preterm infants could be found. A randomized controlled trial of 103 preterm infants who received 13.5 hours of KC per day showed that fewer KC infants had hypoglycemia than control infants.[49] The limited evidence justifies a C-level appraisal.

Behavioral Effects

Many of the *behavioral outcomes* of KC have been found to be beneficial for preterm infants. One of the first observations researchers and clinicians made is that the infants appear relaxed, calm, and fall asleep easily during KC. The literature is rich with studies that have examined KC-induced behavioral state changes across the full spectrum of behaviorally based state (deep sleep–crying). Kangaroo care has been shown to increase both the length of time in *sleep*[3,23,42] and the amount of quiet sleep during the sleep period.[5,24,42,83] Overall, integrity of sleep is improved in KC[41,42] and sleep organization has been found to be more mature in infants who have had KC than those who have not.[42,84] Consistent findings indicate that the A-level evidence supports use of KC to promote sleep in infants (Figure 1).

Kangaroo care also has significant effects on behavioral state at the opposite end of the state spectrum: *crying*. Infants cry for a variety of reasons: separation from mother, hunger, and in response to pain. Regardless, trials have shown that infants rarely cry when in KC[7,23,24,48,85,86] and cry less than when in an incubator[5,7]; a Cochrane meta-analysis has confirmed a reduction in crying during KC.[52] Sontheimer and associates[15] found no crying at all when sick infants were transported in KC to a distant NICU. Kangaroo care can be implemented to reduce and prevent infant crying on the basis of A-level evidence.

Kangaroo care has also been shown to reduce *crying associated with painful procedures* in a descriptive study,[87] in randomized cross-over designs in which infants served as their own control,[17,88] and in a randomized clinical trial.[89] Ferber and Makhoul[90] found that having a blood test taken in KC reduced motor disorganization and extension movements in response to the acute painful event and decreased stressful neurobehavioral signs an hour later–findings that were not present when the blood test was taken without KC. Weller and Feldman[91] found that opioid peptides and cholecystokinins increased during KC, reducing the infant's sensitivity to painful stimuli and stress. Johnston and associates[92] learned that a recorded voice was not as effective in reducing pain-related crying as the multimodal sensory stimulation inherent in KC. The paucity of randomized clinical trials does not impair the rating of the evidence because pain is a very individualized experience. Comparing the pain in one infant with the pain in another infant may not be as valid as comparing the pain that one infant has with KC and without KC. Comparing pain with and without KC is the basis for these randomized crossover trials. The use of within-subject analyses is valid when randomized trials of developmental interventions are not possible or have impaired meaning.[93] Thus, the evidence warrants an A rating, supporting the American Academy of Pediatrics'[94] recommendation to use KC to reduce minor procedural pain–a recommendation commonly found in the literature.[95–102] Related literature suggests that maternal and paternal KC should be studied further as an analgesic for infants.[98,103–105]

Kangaroo care has long been known to promote and enhance *breastfeeding* in preterm infants. Numerous measures of breastfeeding have been examined, such as initiation, exclusivity, performance, success, duration, and milk production, and all show benefit from KC. More KC infants are breastfeeding at discharge and beyond[52,106,107] than non-KC infants. One randomized clinical trial showed that 98% of preterm infants who received KC for 13.5 hours per day were exclusively breastfeeding at 40 weeks' postmenstrual age compared with 76% of the infants who did not receive KC.[49] Milk production is increased in mothers who provide KC,[4,108,109] as is breastfeeding exclusivity[50,64,108] and duration of breastfeeding.[4,64,86,108] Even preterm infants have demonstrated the ability to complete the instinctive breast crawl, moving from between the mother's breasts over to a nipple and spontaneously latching on within the first hour of birth, if healthy and in KC within the first few minutes of birth[78] (Figure 2). Thus,

FIGURE 1.

Infant asleep in kangaroo care. Photo courtesy of Kathy Morgan.

FIGURE 2.

Preterm infant opens her mouth for feeding during kangaroo care. Photo courtesy of Amel Abouelfettoh.

the evidence supporting KC at birth to facilitate the initiation of breastfeeding in preterm infants is so convincing[26] that recommendations to initiate KC at birth or as soon as possible thereafter have been made by the American Academy of Pediatrics[110] and the Academy of Breastfeeding Medicine.[111] A breastfeeding support program called The Mother's Milk Club for inner-city low-income mothers delivering premature infants in Chicago has reported a 98% exclusive breastfeeding rate at NICU discharge[112] and beginning KC within 24 to 48 hours of the infant's arrival in the NICU is an integral part of the program, as is a daily KC session.[113] Randomized trials and Cochrane meta-analyses[29,52] of KC effects on breastfeeding constitute A-level evidence. Thus, KC should be implemented to initiate and promote positive breastfeeding outcomes and sustained breastfeeding. Healthy preterm infants at birth can be placed in KC and be given a chance to crawl toward the mother's unwashed, undried breast so that the many benefits of the breast crawl may be received both by the infant (sustained warmth, faster achievement of feeding skill, antibiotic-rich colostrum as first feed, promotion of euglycemia, and earlier passage of meconium promotes early and sustained breastfeeding, expression of natural instinctual mammalian process to go to breast at birth)[80] and by the mother (assisted uterine contractions and delivery of placenta, minimized bleeding,[80] and decreased maternal sensitivity to episiotomy repair discomfort).[82]

Neurobehavioral Development

Hospital stress impairs the preterm infant's *neurobehavioral* outcome.[114] Kangaroo care has already been shown in rigorous trials to minimize the negative impact of hospitalization on development. Kangaroo care practiced 5 or more times per week in sessions lasting at least 30 minutes has been shown to increase alertness and attention to the environment in infants tested at the postmenstrual ages of 37 and 40 weeks,[84,115] 6 months,[84,116] and 12 months.[115,116] When KC was provided to stable premature infants 24 hours per day, 7 days per week from 32 to 38 weeks' postmenstrual age, all performance and planning functions related to brain development were advanced at 1 year of age in KC infants but not in non-KC infants.[117] Infants who received KC had higher mental and motor development scores than non-KC infants at 6 months[84] and at 1 year.[115–117] Feldman and Eidelman[83] found that 30 or more minutes of KC daily during hospitalization resulted in more mature habituation and orientation scores on the Neonatal Behavioral Assessment Scale at 37 weeks' postmenstrual age, leading them to conclude that KC accelerates autonomic and neurobehavioral development. Hickson and associates[118] conducted a randomized clinical trial of 78 preterm infants of less than 32 weeks' gestation who received 8.5 hours of KC from the first to the fifth weeks of life. Overall developmental quotient and personal–social, hearing–language, eye–hand coordination and performance, but not motor, subscales were higher in KC infants. But the differences were not significant until brain injury manifested on imaging studies were accounted for; then, overall developmental quotient was significantly higher in the KC group. Improvements in development were also evident in a controlled trial of 20 minutes per day of KC for 4 weeks being given early, starting within 1 week of birth, or late, starting at 4 months postbirth[119]; starting time made no difference in memory or overall developmental ability at 1 year of age.[119] In contrast to studies showing changes in development, 2 controlled trials of 24/7 KC during continuing care hospitalization revealed no difference in motor development at 1 year,[120] leading to a meta-analytic result of no effect of 24/7 KC on motor development at 12 months' corrected age.[50] Nonetheless, consistent findings from rigorous randomized trials have provided A-level evidence supporting implementation of KC to promote neurobehavioral development, especially mental performance.

Brain development in infants is dependent upon sleep.[121] Kangaroo care has been found in well-designed trials to improve *sleep organization* as evidenced by an increase in the quantity of quiet sleep, an improvement in sleep cycles, and a decrease in arousals from sleep.[42,84] All changes in sleep behavior that occur during KC are analogous to more mature brain functioning, even with just one 2- to 3-hour session of KC,[42] because 2 to 3 sleep cycles are completed within this time frame. Cycling of sleep strongly predicts brain development.[122] Preterm sleep cycles generally require 60 minutes to complete and within 5 minutes of the onset of KC, cycling begins, but seldom occurs so swiftly in the incubator.[42] Thus, each KC session should be at least 65 minutes long so that the infant can complete at least 1 cycle of sleep. Sleep findings constitute A-level evidence and support the use of KC to promote

optimal infant sleep, as is now recommended to nurses.[69]

As the infant's brain develops, the complexity of brain signals increases. Brain signals picked up by electroencephalogram can be measured for their complexity as a sign of *brain maturation.*[121] Greater brain complexity at term age has been seen in preterm infants who received KC from 32 to 40 weeks' postmenstrual age than in infants who did not receive any KC, indicating more advanced brain maturation with KC than with incubator care.[123] Also, 5 brain regions in the right brain hemisphere had greater complexity in the KC infants, indicating more advanced right hemisphere maturation than left hemisphere maturation.[123] More advanced right hemisphere maturation confirms the right hemisphere's sensitivity to sensory input during the early stages of development. The limited number of studies and the fact that all brain maturation studies have been conducted by the same group of researchers warrant a C-level appraisal of the brain maturation and complexity evidence.

Because KC's positive influences on development have been uniformly found in independent randomized trials that constitute A-level evidence, KC is now recommended as an intervention to enhance neurobehavioral development and reduce the likelihood of developmental delay.[114,117]

Psychosocial Effects

Although preterm birth is stressful for mothers and fathers and often leads to thoughts of guilt and inadequacy, especially in mothers, KC has uniformly been found to improve *parental feelings* and adaptation to preterm birth. Mothers who provided KC have been able to come to closure over the preterm birth, stop the "psychological hemorrhage of guilt and inadequacy," and had greater confidence and competence about their nurturing abilities than mothers who had not engaged in KC.[23,124,125] Controlled trials, both randomized and nonrandomized, have confirmed less maternal anxiety,[7,61,126] more maternal satisfaction with the NICU experience,[127,128] better attachment,[129–132] and more positive *interactions* with the infant[84,132] for mothers who provide KC. More positive interactions may counteract the negative effects of hospitalization on preterm infant neurobehavioral development.[114] The effects of KC on paternal feelings and interactions with the preterm infant are quite similar. Most paternal KC studies, with the exception of quasi-experimental study of Feldman et al,[84] were descriptive studies. The descriptive studies report that fathers are eager to do KC,[133] love providing KC,[134,135] feel an intense connection and attachment to the infant,[133,136,137] feel protective of the infant,[133] feel more involved,[133] feel less anxiety,[136] and more confident[23,133,136] about their parenting role. Fathers who have given KC during hospitalization have also demonstrated sensitivity to infant cues,[138] good fathering interactions,[48,138] and provision of a better home environment months later.[138] Because maternal findings are based on well-designed independent trials and paternal outcomes data are uniformly positive but lack randomized controlled and clinical trials, the level of evidence for improved feelings and interactions is "A" for mothers and "C" for fathers. Still, KC should be implemented to enhance parental confidence, satisfaction, attachment, and interactions.

In summary, the strength of the evidence supporting the use of KC as an intervention for different purposes and predicted effects varies across the grading criteria, but predominantly ranks as A-level evidence. The evidence base, presented in Table 1, indicates

TABLE 1. Summary of the Evidence and Its Rating

KC Effects	Evidence Rating
Physiological	
Heart rate	A
Respiratory rate	A
Oxygen saturation	A
Desaturations	B
Apnea—no change/↓ Apnea	A/B
Temperature	A
Cortisol	B
↑ Weight gain	C
↓ Infections	A
Blood glucose	C
Behavioral	
Improve sleep	A
↓ Crying	A
Analgesic	A
Breastfeeding	
↑ Milk production	A
↑ Exclusivity	A
↑ Duration	A
↑ Initiation	A
Neurobehavioral	
↑ General development	A
↑ Mental/motor scores	A
↑ Brain maturation	C
Psychosocial	
↓ Maternal/paternal anxiety	A/C
↓ Maternal/paternal satisfaction	A/C
Better maternal/paternal attachment	A/C
More positive maternal/paternal interactions with infant	A/C

that strong support exists for the practice of KC to achieve specific physiologic, behavioral, and psychosocial objectives. All "A" and "B" level evaluations indicate that KC should be used as a treatment to achieve desired change in each of those areas. When the evaluation is "C" or less, KC may not accomplish the desired effect and more research is needed. Effects and benefits have been seen with as little as 10 minutes of KC and as much as 24 hours per day, 7 days a week for 2 year. Thus, any KC is better than none, and the only dosage guideline we could find was to try to do KC for at least 65 minutes to permit 1 complete cycle of sleep.[42] The overwhelming majority of reports relate positive effects of KC. Physicians and nurses commonly know about the positive effects of KC on maternal–infant attachment, but despite the extensive evidence base, do not know about the positive effects of KC on sleep, breastfeeding, and infections.[72] However, more evidence is needed to identify KC effects on preterm infant weight gain, pain (especially paternal KC effects on pain), blood glucose levels, and brain maturation, as well as on parental–infant interactions.

Assessment Criteria to Determine Infant, Parental, and Institutional Readiness for Kangaroo Care

Barriers to the use of KC continue to center on issues of infant safety as measured by apnea, bradycardia, and hypothermia incidence and issues of maternal readiness.[72,139,140] But institutional support also needs to be assessed because it may be a barrier to the implementation of KC.[141] Thus, 3 areas of assessment of readiness for KC need to be conducted: infant, parental, and institutional. Assessment criteria are given for each parameter in Table 2 and are discussed and accompanied by rationale as needed in the text that follows. Assessed parameters are heart rate (with bradycardia criteria), respiratory rate (with apnea and periodic breathing criteria), oxygen saturation level (with desaturations), temperature, and activity. Assessment of maternal readiness in relation to skin-to-skin holding, knowledge about the effects and benefits of KC, emotional preparedness, feeding intention and her own health is next, followed by assessing the resources within the institution, and determining the type of transfer and optimal position for the infant.

Infant Readiness

The primary concern of healthcare professionals is that of infant readiness for KC.[72] Assessing infant readiness should be accomplished when the infant is at rest and undisturbed in his or her radiant warmer/incubator/crib. Examination of the infant's vital signs offers the best indication of physiologic readiness for KC. With regard to heart rate, if the infant's skin is well perfused or heart rate is within normal range when infant is at rest and undisturbed in an incubator, then KC is allowed. If the infant's heart rate is tachycardic (more than one third of baseline increase while at rest and undisturbed), do not do KC because tachycardia may be due to fulminating sepsis. On the other hand, if tachycardia is due to agitation, then KC is allowed and heart rate should be monitored closely for return to normal limits within 10 to 15 minutes of the onset of KC. If heart rate does not return to baseline, discontinue KC.

The presence or absence of *bradycardia* is another parameter that requires assessment. Though cardiac monitor limits are commonly set at 100 to 200, bradycardic events are defined according to the specifics of each NICU. If the infant's heart rate is 85 to 100 beats per minute and less than 5 seconds long with self-recovery, a trial of KC may be given with close monitoring. A trial of KC is permitted because no increase in bradycardic events has been seen during KC[11] and bradycardia is rare during KC.[8,20–22] If bradycardias of less than 85 have occurred 4 to 6 times or more in the 24 hours before KC, do not do KC because unstable infants may have exacerbation of bradycardia during KC.[10,11,35] If bradycardia is accompanied by desaturation ($SaO_2 \leq 85\%$ for infants on oxygen support and $\leq 88\%$ for infants in room air), do not do KC. Bohnhorst and associates[11] reported that although desaturations of 80% or less are rare during KC, desaturation events may increase during KC in stable 32 weeks' postmenstrual age infants in room air.

If infant *respiratory rate* is within normal range for the infant at rest and undisturbed in incubator/open crib, KC is allowed, just as it should be if the infant's respirations are easy with minimal retractions. But when *periodic breathing*, defined as 3 or more central apneic pauses of 4 or more seconds, separated by less than 20 breaths, has been present in the 24 hours before the anticipated KC session, continuously monitor breathing patterns during a 10- to 15-minute trial of KC. Periodic breathing rarely occurs during KC,[11,30] but may increase during KC.[23] Similar caution should be used if *apnea* has been present. If apnea is of less than 10 seconds' duration or apneic episodes are minimal in number (≤ 3 per hour and self-limiting), KC is allowed. If self-limiting apneas of 10 or more and less than 20 seconds' duration are present, then permit a 30-minute trial of KC. A trial is recommended because apneas of 10 or more seconds' duration are rare in KC.[11] If apneas of 20 or more seconds are present, or if apneas require tactile stimulation or more intense stimulation (ie, blow-by fraction of inspired oxygen), then do not do KC. Furthermore, if apnea of any duration is accompanied by desaturation ($SaO_2 < 88\%$ for infant in room air and $SaO_2 < 85\%$ for infant on oxygen support) and/or color change, then do not do KC.

TABLE 2. Readiness Assessment for Kangaroo Care With Infants 30 or More Weeks' Postmenstrual Age

Assessment Parameter	Do Kangaroo Care	No Kangaroo Care
Vital signs	Within normal limits, stable	Exceeds clinical limits (see below)
Temperature	Normothermic	Hyperthermic
Tachycardia	None Tachycardia due to agitation give trial of KC with close monitoring	HR more than increase from baseline at rest
Bradycardia (clinically defined as HR <85 beats/minute)	None If HR drops to 85–100 beats/minute and recovers spontaneously and does not occur more than 1–3 times per hour	HR <85 beats/minute requiring stimulation for recovery If HR drops to 85–100 beats/minute and occurs 4 or more times per hour
APNEA	None Apnea <10 s give trial of KC with close monitoring 3/hour, self-limiting with no desats	Any duration with desaturation <85% if on oxygen support; desaturation <88% if not on oxygen support Any apnea longer than 10 s requiring stimulation
Desaturation (defined as saturation <88% for infants on room air and <85% for infants on oxygen support)	None Desaturations ≥85% with self-recovery	Any desaturation <85% for infants on oxygen support or <88% for infants in room air requiring stimulation
Tolerance to care (sensitivity to care)	No physiological changes with care Minimal physiologic changes with care, ie, within normal parameters	Physiologic changes with care that exceed normal parameters
Lines (Peripheral intravenous [PIV], Percutaneously inserted central catheter [PICC], Broviac) & Considerations (Chest tubes, Umbilical Arterial Catheter [UAC])	No lines Well-secured, patent, nonpositional PIVs, PICCs, and Broviacs	Any unstable line Any positional line Arterial lines UAC Chest tube Vasopressor medications
Blood pressure	Stable within clinically acceptable parameters	Labile Hypotension Hypertension Vasopressor medications
Oxygen support	None/room air Fio_2 via hood,[23] nasal cannula <50% Continuous positive airway pressure (NCPAP) with Fio_2 < 50% Stable mechanical ventilation[147] (Note: if in Oxy hood obtain order for Fio_2 via nasal cannula while doing KC)	Active weaning or increasing ventilator support First 24 hours of mechanical ventilation Oscillating ventilation
Blood gases	Within clinically acceptable parameters	Unstable blood gases Blood gases exceeding acceptable clinical parameters

(continues)

TABLE 2. Readiness Assessment for Kangaroo Care With Infants 30 Or More Weeks' Postmenstrual Age *(Continued)*

Assessment Parameter	Do Kangaroo Care	No Kangaroo Care
Sepsis	None No emerging signs of sepsis IV antibiotic therapy but clinically stable	Emerging signs of sepsis Sepsis workup in progress Presence of sepsis
Phototherapy	Total serum bilirubin (TsB) is stable and not rising Total serum bilirubin is not in high risk zone consider KC with BiliBlanket	Rapidly rising total serum bilirubin 2–3 banks of phototherapy in use TsB at exchange level
Parental readiness	Has appropriate knowledge of KC and its effects Requests opportunity to hold or do KC Appropriately dressed or changes into gown Able to sit for at least 60 minutes Is "well" no cold, fever, rash, illness Good personal hygiene Willing to let infant go to breast	Does not have appropriate Afraid/anxious about holding infant Unaware of KC effects on infant and family Mother does not want to remove bra Unable to sit for given period of time Is "sick": has cold, fever, or rash If the parent just smoked cigarette, have the parent shower before KC and refrain from smoking prior to KC sessions
Nursing readiness	Aware of KC effects on infant and family Has mentored experience in providing KC Other RN available to assist if needed Has time to support mother through early sessions of KC	Unaware of KC effects on infant and family No mentored KC experience for at least 2 sessions Unavailability of other RN for assistance, especially with ventilated infants
Environmental support	Chairs/loungers/screens available No medical perturbations in immediate environment (ie, no major procedures on nearby infants)	Chairs/loungers/screens cannot be found Major medical procedures on nearby infants
Institutional support	Management encourages KC KC policy/Guidelines exist Provides education time for staff Medical staff informed of and support KC	Management has policy of "No KC" KC policy/guidelines are not official or do not exist Staff education time not provided Medical staff have policy of "No KC"

Abbreviations: HR, heart rate; KC, kangaroo care.

An infant's *oxygen saturation* level should be considered as well. For infants in room air, if SaO_2 is 88% or more when in incubator at rest, KC is allowed. For infants in room air, if oxygen *desaturations* of less than 88% occur less than 3 times per hour, are instantaneous, and are self-limiting, KC is allowed with close monitoring. For infants in room air, if desaturations of less than 88% are prolonged (≥6 seconds) or need stimulation for recovery, or occur with a frequency of 4 or more per hour, then do not do KC. For infants receiving oxygen, if SaO_2 is 85% or more when at rest in the incubator, KC is allowed, but if SaO_2 is less than 85% when at rest in the incubator, then do not do KC. For infants with chronic lung disease or frequent transient self-recovering oxygen desaturations, a trial of KC may be given with very close monitoring for worsening of desaturations due to rapidly increasing body temperature, especially during the second hour of KC.[143] If the infant has experienced any desaturations of less than 80% of any duration in the previous 12 hours, do not do KC because these severe desaturations may increase during KC.[10,11]

In relation to *temperature*, if the infant is normothermic within his or her neutral thermal environment, KC is allowed. If the infant is hypothermic within his or her neutral thermal environment, initiate KC right away and monitor infant temperature every 5 to 15 minutes to confirm that the temperature is reaching and not exceeding normal range. Preterm infants warm up faster in KC than in incubators,[14] and when given KC by their fathers, infants may become too warm during the second hour of KC.[48] KC should not be allowed if the infant is

hyperthermic within his or her neutral thermal environment in the incubator, because as little as 10 minutes of KC increases infant body temperature.[10]

Infant activity can signal infant readiness for KC, too. If the infant has normal activity for his or her gestational age, normal responsiveness to stimuli, and normal tone, KC is allowed. But if the infant is lethargic and/or has decreased responsiveness or decreased tone, do not do KC because change in activity may be a sign of emerging sepsis that can be accompanied by severe apneas, mandating discontinuance of KC. Discontinuing KC for infant intolerance can be upsetting to the mother, especially if the mother has not had her infant's condition explained to her and she perceives skin-to-skin holding as a cause of infant compromise.

Parental Readiness

Assessment of the mother and father begins with determining their willingness to hold their infant skin-to-skin, which is an intimate form of contact and one that may be difficult for some mothers to practice.[144] Mothers and fathers begin their relationship with the newborn premature infant from different emotional starting points: fathers experience the birth as a shock, but are often immediately ready to be involved and do KC; mothers are dealing with the loss of the expected infant and need time to start a new relationship.[133] In fact, although mothers want to do KC or express a need to do KC, mothers may be initially hesitant because doing KC can make the mother aware that she is not able to care for her own child.[133] Checking parental emotional readiness, feeding intentions, and parental health status will help ensure a positive KC experience for both infant and parent.

Two criteria need to be met to establish *parental willingness* for KC. First, both the mother and the father need to have been given adequate information about KC so that an informed decision is being made. If the parent then agrees, KC is allowed. Second, parental readiness is signaled by the parent requesting an opportunity to hold the infant. If the parent does not request skin-to-skin contact when asking to hold the infant, encourage skin-to-skin contact rather than swaddled holding so that the infant receives the multiple benefits of KC. If the parent requests an opportunity to hold the infant in KC and infant criteria are met, KC is allowed and parental willingness has been established.

Parental emotional readiness should be considered too. If the mother or the father seems emotionally inappropriate (unavailable to infant, withdrawn, uninterested, weepy/crying, not touching the infant, not questioning about the infant, not holding the infant, not bonding or attaching well, uninvolved, uncommunicative, having only short/infrequent visits, etc) and/or expresses helplessness, hopelessness, or guilt, we recommend encouraging the parents to do KC because KC helps parents overcome feelings of guilt, empowers mothers and fathers, facilitates maternal emotional resolution of preterm birth, and promotes bonding, involvement, and better parental–infant interaction patterns.* Also, encouraging KC proved beneficial to a mother with a history of still birth. With encouragement, she tried KC with her newborn and reported that doing so decreased her guilt and sadness associated with previous stillbirth.[146]

Assessing *maternal feeding intentions* is wise for securing maternal agreement to do KC. If the mother intends to provide breast milk, encourage KC as soon as possible and as often as possible. At least 20 minutes of KC each day promotes breastfeeding, and suckling at the breast during KC facilitates the hormonal cascade that supports breast milk production.[112,113] If the mother is receptive to having the infant go to the breast, encourage KC because most infants, including prematures, can spontaneously move toward a nipple[147] and try to suckle during KC.[113] Having the infant in KC often enhances maternal commitment to breastfeeding.[148] If the mother has chosen not to provide mother's milk, encourage her to provide KC anyway because many physiologic and emotional benefits to both the infant and the mother occur as part of KC.[37,52]

Because preterm infants have immature immune function, assessing *maternal health* is mandatory before KC. If the mother has a cold, fever, influenza, or any skin rash, do not do KC. Maternal peripartum and postpartum dermatologic lesions may be a source of morbidity for the infant.[149] Also, if the mother smokes, KC is still allowed, but the mother needs to know that the scent of smoke lingers and can be detected by preterm infants.[150] Encourage the mother to shower before providing KC and delay smoking until KC has ended for the day.

Institutional Readiness

The assessment of institutional readiness encompasses the areas of physical, human, and educational resources. *Physical resources* that should be available are space, lounger/chair with foot support, screen, gown that closes in front for mother to wear or a wrap or a tube top that extends to the mother's waist so that her midriff is not exposed, a receiving blanket folded in fourths to insulate against heat loss across the infant's back, and a head cap for the infant. *Human resources* that should be addressed are as follows:

- Is there adequate nurse experience? Nurses who have 5 or more years of experience are more likely to do KC.[141] One-day training sessions are offered by the International Network of

*References 48, 84, 125, 131–133, 136, 137, 145.

Kangaroo Mother Care: US Division[1] in which KC trainers go to units to provide education and supervised hands-on experience. In addition, continuing education offerings include an international conference held every 2 years and courses for credentialing as a Certified Kangaroo Caregiver by the International Network of Kangaroo Mother Care.[1] The next international conference is to be held on October 6 and 7, 2008,[151] at Uppsala University Medical Center in Uppsala, Sweden, a unit in which all infants of 24 or more weeks' gestation are placed in 24 hours per day KC within 24 hours of birth with much success.

- Is there adequate nurse experience with KC? Some staff are reluctant to practice KC and need mentoring through 2 to 3 sessions to become comfortable.[141]
- Is there adequate staffing available to help if needed? Some transfers require 2 staff members, and novice practitioners of KC may need the support of a more experienced nurse.[141]
- Is there support for the practice of KC from obstetrics, neonatal medicine, nursing administration, and neonatal nurse practitioners? Administrative recognition by having a policy in place and administrative support and collegial encouragement are needed for optimal implementation of KC.[141,152–154]

Educational resources that inform practitioners and parents, such as in-services, videos, articles, pamphlets, continuing education courses, and mentoring, should be available and accessed before starting KC because staff education is needed for successful implementation of KC.[72,155] A trifold that contains all essential information about KC with preterm infants; that is, information that health staff should convey to parents is available by e-mail at no cost[1] and can be reproduced for use by hospital units and healthcare professionals.

Transfers

Before initiating KC, decisions need to be made about the transfer technique that is to be used and the position in which the infant is to be placed. Two types of *transfer* into and out of KC exist: standing and sitting transfer. Step-by-step procedures for both types of transfer have been reported earlier.[144] Sitting transfer is appropriate when the infant has multiple lines, an endotracheal (ET) tube, nasal continuous positive airway pressure (CPAP), position-sensitive intravenous lines, and extensive monitoring equipment, if the nurse is inexperienced, or if mother prefers the infant to be handed to her rather than moving and sitting down while holding the infant.[144] Standing transfer is appropriate when the monitoring equipment of the infant is minimal and easily managed and when both mother and nurse are comfortable with moving the infant on to the mother's chest where the infant remains while the mother moves back to the lounger/chair and sits down with the infant in place.[18,144] Nurses generally need to practice the step-by-step procedures for sitting and standing transfers 1 to 3 times before conducting either technique independently, and use of published procedures,[142,144] and videos[156] can help build confidence and ease with transfer. Mothers commonly request transfer assistance 2 to 3 times with either technique before feeling comfortable and before independently conducting transfer.

Several *position* concerns need to be recognized so that problems do not develop. Checking the infant's head and neck position so that the infant's head does not bend forward or backward is essential because both hyperflexion and hyperextension can result in obstructive apnea.[11] The infant can be positioned either upright or reclined between the breasts or on one of the breasts. If the infant is small for gestational age or has low tone and poor structural integrity when upright, place him or her obliquely on a breast. Despite being either upright or oblique, the baby's head should not be too high on the mother's chest because some infants spontaneously adjust their head by flexing (or extending) it so that the nose is closer to the nipple. Ascertaining that the full ventral surface (from navel to neck) of the infant is in skin-to-skin contact with the mother is very important because it is the ventral area that is rich in vagal nerve receptors and thermal receptors–receptors that play an integral role in providing cardiorespiratory and thermal stability during KC. If the mother wears a bra or any material that prevents full ventral skin-to-skin contact, infants may not warm and will not receive developmental benefits of KC. The infant's extremities should be in a flexed position so that motor development is facilitated. The feet and legs need to be tucked in under a blanket or a tube top to prevent body heat loss. Ensure secured containment of the infant by having the mother fold her arms across the infant's back; doing so prevents slippage of the infant as he or she falls into quiet sleep. Support for mothers' legs is important to minimize the threat of thrombophlebitis during the first 6 weeks postpartum. Zero-gravity lounge chairs support the mother's legs, are comfortable for women with episiotomies and cesarean incisions, and enable the mother to move and control the position of the chair with her trunk rather than her arms (which are holding the infant securely in place). Zero-gravity lounge chairs are seasonably available at patio and house supply stores. Determining which transfer technique and infant and maternal positions will be utilized completes the assessment of readiness for KC.

Recommendations for Monitoring and Documentation Throughout Kangaroo Care

Throughout the KC session, which ideally lasts at least 65 minutes, both the infant and the mother should be *monitored* for their individual responses to KC. Visually monitor infant heart rate, respiratory rate, oxygen saturation, and temperature every 5 minutes for first 15 minutes when the infant is experiencing his or her first KC session. Do not disturb the dyad by taking vital signs directly from the skin; take them instead from the bedside monitors. The vital signs can be monitored closely at first because the infant's response to transfer and adaptation to KC may take 5 to 15 minutes to complete.[144] If physiologic compromise or discomfort is going to emerge, it most likely will occur during the first 15 minutes. Visual assessment of data on the clinical cardiorespiratory monitors thereafter can occur every 15 to 30 minutes, being sure to monitor during second and third or more hours of contact because during the second and third hours of contact, the infant may become quite warm, causing additional cardiovascular changes.[143] Respond to all alarms.

Each KC session should be *documented* in the infant's medical record. Documentation should begin before the start of KC and continue throughout the session. Included in the documentation before the KC session should be the infant's clinical stability, vital signs, SaO_2, activity in the incubator; patency and security of all leads, lines, monitoring probes, and parental readiness. Documentation of the oxygen being administered and the patency of the mode of delivery, that is, ET tube, nasal CPAP, or nasal cannula, must be included. The exact time and type of transfer into KC and the position of the infant in KC ("reclining and flexed" or "upright and flexed") should be included in the record. During the KC session, the monitored vital signs should be documented on the KC record. With each set of vital signs, be sure to document that the oxygen ordered and mode of oxygen delivery are being maintained. The activities of the infant, that is, crying, alert, sleeping, or breastfeeding, should be recorded in the KC record each time vital signs are documented. The mother's activity and tolerance to KC should also be documented. At the end of the KC session, document the time and type of transfer back to the incubator. Document how the infant tolerated the KC session and any comments that the mother may make about the KC session. Adverse events such as apnea, bradycardia, desaturations, or hyperthermia that result in ending the KC session sooner than anticipated should also be documented on the KC record. If the infant's condition does not return to baseline after the KC session is terminated, notify the neonatal nurse practitioner or the doctor and document in the KC record. If one does not have a specific KC documentation record, one such as that in Table 3 can be developed for use by the unit.

Sample Protocol for Kangaroo Care

The sample protocol provided here is a modification of protocols made available by Vanderbilt University Medical Center[157] and Children's Hospital of Philadelphia[158] on their respective hospital Web sites. Any item that does not have 1 of these 2 references attached to it is original material.

Title: Guideline for Kangaroo Care With Premature Infants

Definition of skin-to-skin contact (KC): Ventral skin-to-skin contact between an infant and his or her parents.[158]

Outcome goal: To provide guidelines for nurses in the NICU who wish to provide skin-to-skin holding (KC) to infants/families who would derive physiologic/psychologic benefits from this method of care.[157]

Desired patient outcomes:

1. Maintain neurobehavioral organization and physiologic stability (oxygenation, heart rate, thermoregulation) during transfers and holding.[158]
2. Remain free from any adverse effects associated with transfer or skin-to-skin holding of infant, such as extubation and thermal instability.[157]
3. Begin a bonding process.
4. Improve breastfeeding outcomes.
5. Promote sleep and brain development.

Policy: Infants who meet the criteria below can do KC.[157]

Equipment:

1. Blankets
2. Recliner (recliner or chair/rocker with footstool)
3. Privacy screen[157]

Eligibility criteria:

1. Stable neonates are eligible.[157,158] *Stable* means no deterioration of condition within 24 hours before KC.
2. All neonatal lines and tubes must be well secured.[157]
3. Neonatal respiratory support in the form of oxygen supplementation or nasal CPAP is *not* a contraindication.[157,158]
4. Mothers and fathers should be willing to give KC.[158]

Infants not eligible for KC/exempt infants:

1. Any infant with a chest (thoracostomy) tube.
2. Any infant with an intracardiac line (right atrium, left atrium).[158]

TABLE 3. Sample Kangaroo Care Flow Sheet

Name:

Date	Start Time	Pain	End Time	Pain	Transfer: Sit or Stand	KC HR	KC RR	KC $Sa0_2$	KC Temp	Infant activity*	Infant tolerance	Adverse events Y or N	Maternal response

*Activity can be cry, sleep, feeding, calm, or agitated.

Journal of Family Comments/ Infant Reactions

3. Any infant with an arterial line.[157]
4. Any infant who is being actively weaned from a ventilator.
5. Any infant having apneas and/or bradycardias that require stimulation.
6. Any infant who has had an acute or sudden deterioration in condition within the past 24 hours.[158] Also consider intubated infants and infants on oscillating and jet ventilation.
7. Parents with rashes, open skin lesions, and active colds should abstain from KC.[157]

PROCEDURE

Preparation

1. Educate parent(s) about KC by giving them an informative pamphlet, showing a video, or verbally educating them about benefits and need to provide at least 1 hour of KC per session. (Pamphlet is available from Susan.ludington@case.edu)
2. Determine parental readiness for KC and obtain their agreement to provide KC to their infant for at least 1 hour at a time.
3. Secure all tubes and lines.[157]
4. Perform any needed procedures that may later interrupt infant holding, if possible.[157]
5. Set up rocker/recliner and privacy screen beside incubator.[157]
6. If infant weighs 1000 g or less or is within 1 hour of birth, dress in diaper and hat (booties are optional). If infant weighs more than 1000 g and is not within the first hour of life, dress in diaper (booties and hat are optional and may produce over-warming of infant[40]).
7. Check heart rate, respiratory rate, oxygen saturation, and temperature and assess pain score before and 15 minutes after transfer.[158]

Transfer

1. Transfer infant by standing (mother receives infant while standing beside incubator) or sitting (mother receives infant while sitting in recliner) method gently with arms and legs contained in midline. Type of transfer depends on parent's comfort and ability to get in and out of the chair by himself or herself.[158]
2. Transfer for intubated infant follows either a seated or a standing transfer procedure enumerated step by step in Table 4 and includes checking ventilator tubing for water and ET tube for secure positioning.[142] Case–control studies of intubated infants who have been given 1 to 2 hours of KC have shown 1) physiologic stability as measured by heart rate, respiratory rate, SaO_2, and blood pressure during KC as compared with incubator time,[21,156,159,160] 2) autonomic control,[143] 3) oxygen needs decrease,[144,161,162] stay as is, or increase slightly,[22,144] 4) fewer apnea and bradycardia spells,[22] 5) fewer or no desaturation events,[22,25] 6) skin temperature remaining stable[18,144] or increasing during KC,[163] 7) decreased number of days on a ventilator,[164] 8) good sleep,[22,162] and 9) an intense maternal connectedness with the infant[137,165] after pre-KC apprehension.[166] Transfer is associated with some desaturations,[18] but recovery, once in KC, is swift.[18,22]
3. Place infant upright on parent's chest between breasts or on either breast.[157]
4. Place blanket over the infant's back. Blanket should be folded in fourths if infant weighs 2000 g or less and folded in half if weighs more than 2000 g.
5. Close cover gown over the blanket covering the infant's back to protect from side drafts and slipping.

Kangaroo Care Position

1. Infant should be chest-to-chest, upright, inclined at approximately 30° to 40° above horizontal, and legs and arms should be in flexed position.
2. Care should be taken to position the head and neck in slight sniffing position to prevent airway obstruction.
3. If possible, position the face of the infant so that the parent can see the infant's facial expression or give the parent a hand mirror to look at the infant.
4. Assess parent's comfort level during KC and need for a positioning device to support the infant (Figure 3).[158]

Monitoring Vital Signs

1. Continue infant on all routine cardiorespiratory monitoring.[157]
2. Continue pulse oximetry as ordered.[157]
3. Monitor temperature before and after KC and during KC per NICU protocol (ie, every 30 minutes) and as needed.[157]
4. Allow infant 15 to 20 minutes after transfer to stabilize vital signs.
5. Monitor and document any sign of distress.

Nursing Implications

1. Parent should be encouraged to wear a loose shirt/blouse that opens in front.[157]
2. Initially, KC should be given for at least 1 hour to allow infant to complete 1 sleep cycle and derive benefit from KC after undergoing the potentially stressful transfer. Kangaroo care can be given up to 24 hours per day, 7 days a week.

TABLE 4. Procedure for Ventilated Kangaroo Care

Before transfer

1. Record synchronized intermittent mandatory ventilation/intermittent mandatory ventilation, peak inspiration pressure, positive end-expiratory pressure, fraction of inspired oxygen, heart rate, respiratory rate, oxygen saturation (arterial), and axillary temperature.
2. Place infant supine. Note infant's tolerance to repositioning.
3. Auscultate chest, suction the endotracheal (ET) tube if needed, check security of ET tube, drain excess moisture from ventilator circuit.
4. Change diaper, place head cap, and place folded blanket **under** infant.
5. Wait until all physiological parameters have returned to baseline before placing the infant into KC.
6. Position KC chair beside the incubator/warming table.

Transfer from incubator into KC position (additional staff member is required)

Note. If the mother is comfortable, use a *standing transfer* procedure that follows; if mother is uncomfortable, transfer infant to seated mother as follows.

Standing transfer

1. Mother stands next to the incubator.
2. Gather and free all lines by incubator door.
3. Another RN or RT disconnects ventilator from the infant.
4. Mother places hands under blanket, lifts, and places infant on her chest.
5. Mother steps backward to chair and sits.
6. Reconnect ventilator. Drape and loosely tape tubing over mother's shoulder so that infant can move head without risk of extubation.
7. Arrange blanket so that infant is in full ventral skin-to-skin contact and back is covered.
8. Infant's extremities should be in well flexed position.
9. Head/neck should be in slight sniffing position to maintain airway.
10. Auscultate breath sounds, close mother's gown or blouse around the infant.
11. Assist mother into comfortable position with feet elevated to prevent thrombophlebitis.
12. Monitor and record VS and vent parameters every 10 to 15 min.
13. Encourage KC for a minimum of 1 full hour to organize sleep and promote brain development.[42,123]
14. Set incubator to air control to maintain appropriate NTE.

Sitting transfer

1. Mother sits in the chair next to incubator door.
2. Gather and free all lines by incubator door.
3. Another RN or RT disconnects ventilator from infant.
4. RN closes the ends of blanket across the infant's chest to contain the infant and to minimize physiological changes during transfer.
5. RN places hands under blanket, lifts, and places infant on to mother's chest.
6. Reconnect ventilator. Drape and loosely tape tubing over mother's shoulder.
7. Arrange blanket so that infant is in full ventral skin-to-skin contact and back is covered.
8. Infant's extremities should be well flexed.
9. Head/neck should be in slight sniffing position to maintain airway.
10. Auscultate breath sounds, close mother's gown around infant.
11. Assist mother into comfortable position with feet elevated to prevent thrombophlebitis.
12. Monitor and record VS and vent parameters every 10–15 min.
13. Encourage KC-vent for a minimum of 1 full hour to organize sleep and promote brain development.[42,123]
14. Set incubator to air control to maintain appropriate NTE.

(continues)

TABLE 4. Procedure for Ventilated Kangaroo Care *(Continued)*

Transfer from KC-vent back to the incubator

The process is reversed for the transfer back to incubator.

Standing transfer

1. Assist mother to move to front of chair with her feet on floor.
2. Disconnect ventilator tubing.
3. Assist mother to stand with infant; be sure to secure all lines.
4. After standing, RN helps mother place infant supine in incubator while RN stabilizes ET tube and lines.
5. Reconnect ventilator tubing and position infant in incubator.
6. Assess breath sounds to ensure ET tube placement.
7. Reset incubator to patient control.
8. Monitor infant's VS until they return to pre-KC baseline.

Sitting transfer

1. Put recliner in upright position, or remove footstool in front of the chair.
2. Disconnect ventilator tubing.
3. RN lifts infant, blanket, and all lines from mother's chest, closing blanket around infant.
4. RN places infant in incubator in supine position.
5. Reconnect ventilator tubing.
6. Assess breath sounds to ensure ET tube placement.
7. Reset incubator to patient control.
8. Monitor infant's VS until they return to pre-KC-vent baseline.

Abbreviations: NTE, neutral thermal environment; VS, vital signs.

3. Parent–infant interaction should be uninterrupted as much as possible except for necessary nursing and/or medical care.[157]
4. Infants who sleep during KC should be allowed to continue to sleep as long as possible.[157]
5. The infant may be fed during KC either by mouth or by gavage.[157]
6. Ordinary daily hygiene and cleansing of the skin is satisfactory for parents participating in KC.[157]
7. Maintain incubator/warmer temperature during KC.[157]
8. Suggest to lactating mother that after KC may be a good time to pump breasts because KC increases milk production.[157]

FIGURE 3.

A comfortable father and support for the ventilatory circuit during ventilated kangaroo care. Photo courtesy of Susan Ludington-Hoe.

Patient/Family Education

1. Educate the family about the rationale for skin-to-skin holding.[157]
2. Distribute pamphlet for parent information, such as the one available from Susan.ludington@case.edu.[157]
3. Tell parents that a change in infant vital signs may occur during transfer but should return to baseline during KC. If vital signs do not return to baseline, they may indicate infant intolerance of KC and he or she may need to be returned to the incubator.[158]

Documentation

1. Document vital signs, oxygen saturation, and temperature before, during, and after KC.[157]
2. Document infant's state as sleep, awake, or crying before, during, and after KC session.

3. Indicate KC session start and stop times on nursing flow sheet.[157,158]
4. Write brief note indicating how infant tolerated KC including parent's comments and positive reflections. Include amount of time spent in KC and teaching given.[157,158]

Web References

- NICU Web page http://vuneo.org-KangarooCare
- General KC Web page: www. Kangaroo MotherCare.com
- General KC Web page: http://kangaroo.javeriana.edu.co

Ten Steps to Successful Kangaroo Care

Just as the *Ten Steps to Successful Breastfeeding*[167] have been helpful in promoting breastfeeding around the world, the *Ten Steps to Successful Kangaroo Care* can guide efforts to promote nonseparation of mother and preterm/full-term infant through skin-to-skin contact. *The Ten Steps to Successful Kangaroo Care* have been developed using the format of the *Ten Steps to Successful Breastfeeding* and are as follows:

Every facility providing services and care for newborns and infants up to 3 months' age should:

1. Have written KC policies (for very sick and very low-birth-weight neonates, for relatively stable preterm neonates [such as the one provided within this review], for healthy term infants within 2 hours of birth, and for healthy term infants until discharge) that are routinely communicated to all healthcare staff.
2. Train all healthcare staff in skills necessary to implement the policy pertaining to their area of care.
3. Inform all pregnant women about the benefits and management of KC.
4. Help mothers of healthy term infants initiate KC within a few minutes of birth. Help mothers of cesarean infants and premature or sick infants initiate KC as soon as possible (able to tolerate transfer and skin contact without physiologic or behavioral compromise), and monitor infant to ensure tolerance without physiologic and behavioral compromise.
5. Show mothers how to position the infant for both safe transfer and safe KC (head sustained in midline, not flexed or hyperextended, and infant secured so that infant cannot fall down or out of KC position).
6. Practice 24/7 KC, allowing mothers and infants to remain in skin-to-skin contact 24 hours a day, 7 days a week until discharge.
7. Give newborns and infants at least 1 hour of KC per session, if not continuous 24/7 KC.
8. Encourage KC for all warming and comforting needs of infants.
9. Give adequate thermal insulation (head cap, warm blankets, insulating cover as needed) to the infant throughout KC.
10. Foster the establishment of KC support for mothers through posters, patient scrapbooks, patient record of KC, and support groups that may assist even after discharge.

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