Feasibility of Using Kangaroo (Skin-to-Skin) Care With Colicky Infants

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Infant colic affects about 20% of all infants and the cause remains elusive. Healthcare providers typically view infant colic as a minor inconvenience that is harmless to the thriving infant and will go away with time; however, parents view caring for a colicky infant as a crisis situation.

The purpose of this feasibility study conducted via the internet was to examine the feasibility of implementing kangaroo care at the beginning of colicky episodes. Mothers of colicky infants began the study by completing the on-line Infant Colic Scale and recording in a baseline state-of-arousal diary for 3 days. Next, they implemented kangaroo care at the beginning of as many episodes of colic as possible for 2 weeks while recording in a second state-of-arousal diary. Then, they stopped kangaroo care for 2 days while continuing to record in the second state-of-arousal diary, and lastly they were asked how kangaroo care worked for them.

Seventy-five parents of colicky infants consented to participate in this study; however, only five of them actually did. Three of these completed only the baseline state-of-arousal diary, and two completed all parts of the study. This dropout rate showed that conducting such an intervention via the internet is not a feasible approach. Because kangaroo care for infants with colic is a promising intervention and because there are no other effective treatments for most of these infants, another feasibility study is warranted using different methods. Then if results are promising, a larger clinical trial should be conducted.

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Infant colic has been defined as episodes of persistent crying during which the infant suddenly begins to scream as if in severe pain (Lester, Boukydis, Garcia-Coll, & Hole, 1990). Associated with the onset of crying are flexion of the elbows, clenched fists, and generalized hypertonicity of musculature; the knees are drawn up or stiff and extended, the abdominal wall is tense, and the abdomen may become

distended. The infant's eyes may be tightly closed or opened wide, the back is arched, face is red, feet are cold, and brief episodes of breath holding have been observed. Bowel sounds are increased and there is considerable flatus. The infant is difficult, if not impossible, to console and may resist or struggle with attempts to soothe. Between episodes, the infant has a normal cry and is thriving (Lester et al.).

In a Scandinavian study of 1,400 mothers of firstborn infants (in a country in which healthcare is equally available to all), 18% of the mothers perceived their infants to have at least "quite a lot" of colic (Rautava, Helenius, & Lehtonen, 1993). The episodes of colic generally emerge at about 2 weeks of age, peak at 6 weeks, and usually disappear by 4 months of age (Barr, Chen, Hopkins, & Westra, 1996). This coincides with Brazelton's (1962) finding that the median duration of crying in 80 healthy infants at 6 weeks of age was 2.75 hours per day, leading some experts to view colic as the high anchor point on the continuum of crying. Several researchers have shown colic occurs in all infants and is not related to sex, race, or socioeconomic class (Baildam et al., 1995; Lehtonen & Rautava, 1996; St. James-Roberts & Halil, 1991; Stahlberg, 1984).

Many healthcare providers view colic as a minor symptom that will go away with time; however, parents very often view caring for a colicky infant as a crisis situation (Keefe & Froese-Fretz, 1991). Parents of an excessively crying infant may see the crying as an indictment of their caregiving ability or as evidence of biological illness, even as evidence the baby may not survive (Lehtonen & Rautava, 1996). Colic may also be a cause of child abuse in infants less than 6 months, as the behavior most frequently reported as triggering hard shaking is excessive crying (Mrazek, 1993).

Unfortunately, the cause of colic is still unknown, which suggests the cause may be multifactorial. Colicky infants are frequently referred to pediatric gastroenterologists by their primary healthcare providers if cow's milk protein intolerance or an immature gastrointestinal system is suspected to be the problem. Pediatric gastroenterology nurses become involved in providing parent education and offering support when parents call with questions, especially if the suggested medical treatment has not been successful in improving the infant's colic. What are needed at this point are evidence-based nursing interventions.

Theoretical Framework

Keefe (1988) proposed an irritable infant model based on a developmental, psychobiological perspective in which the mother and infant are conceptualized as interdependent units or subsystems of a larger unit, the mother-infant dyad (Keefe, Kotzer, Froese-Fretz, & Curtain, 1996). In this model, the biologic rhythmicity of the infant and the interactional synchronicity of the mother-infant dyad are both deemed important. Infant colic is thought of as a developmental sleep disorder, termed irritable infant syndrome. Thus, colic is viewed as a delay or disturbance in the biorhythmic organization of the infant through which coordination of sleep-wake cycling is achieved. The colicky infant becomes overly stimulated and overly tired and is less able to initiate a downward shift in state from awake and crying to a sleep state (Keefe, 1988; Weissbluth, 1984). The disorganized infant emits inconsistent, difficult-to-read behavioral cues that lead to inconsistent responses or noncontingent care from the mother. This recurrent cycle is theorized in the model to affect the overall interactional synchrony of the mother-infant dyad (Keefe et al., 1996).

Review of Literature

States of Arousal

Infant state has been conceptualized as a level of arousal or state of consciousness on a continuum ranging from aroused, loud crying to deep, quiet sleep. Awake states are crying, active alert, quiet alert, and drowsy. In addition, there are two distinct sleep states—active or random eye movement (REM) sleep and quiet or non-REM sleep (Keefe, 1988; Wong, 1999).

Crying

Only human infants cry, inconsolably at times, while being held by a caregiver (Zeifman, 2001). Most human crying is caused by hunger, pain, or physical discomfort, or by merely being left alone. The composition of human breast milk (compared to that of other primates) is low in fat and extremely low in protein, suggesting the human infant is adapted to frequent feeding (Blurton-Jones, 1972; Lozoff & Brittenham, 1979). Additionally, human infants have poorly developed mechanisms for thermoregulation at birth and cry loudly for long periods of time when separated from their mothers (Zeifman). Finally, the excessive amounts of human infant crying in comparison to other primates may be partly the result of infant caregiving habits in modern times that are markedly different from those to which human infants were adapted earlier in the course of primate evolution (Zeifman).

CRYING IN POPULATIONS IN WHICH INFANTS ARE CONSTANTLY CARRIED

Carrying an infant either in the front or on the back of an adult (often the mother) is a common practice in most developing countries. These women must return to work or go about their usual household duties soon after giving birth to their infants. Wherever they go and whatever they do, they carry their infants in slings that allow easy access to breastfeeding. They are able to complete their tasks and at the same time keep their infants safe and close to their bodies. Infants are nursed on demand and sleep with their mothers at night. Even young infants adjust their postures as their mothers move and free their faces from positions in which they have difficulty breathing (Goldberg, 1972). Many of these cultures (Kung of Botswana and Zambian [Africa], Mayan Indians [Mexico]) have been studied extensively. Because infants are in constant contact, caregivers can detect subtle discomfort cues like fussing and whimpering and respond to them before full-blown crying occurs, and crying is met with universal and immediate response (Brazelton, 1972; Goldberg; Konner, 1972, 1976). Attachment between the mother and infant is very strong, there is little or no abandonment, and no colic has been reported.

Kangaroo Care

During kangaroo care, the adult holds the diaper-clad infant against his/her skin. The infant lies upright on the adult's

chest. A breastfeeding mother may allow the infant self-regulatory access to her breast. The adult is without clothing from the waist up; a blanket covers both the infant and adult. Anderson (1991) found premature infants held skin-to-skin were kept warm enough and had regular heart rates and respirations, more deep sleep and alert inactivity, less crying, no increase in infections, greater weight gain, and earlier discharge from the hospital. Lactation was more productive and of longer duration. This study also found parents became attached to their infants and felt more confident about caring for them. For example, one mother of a premature infant commented, "by the second night I knew what his cries meant" and "my body got into synch with my baby." The father reported "experiencing 'something like a phantom limb sensation,' in which he could still feel his son on his chest even when he was not holding him" (Moran et al., 1999, p. 76). One parent would "kangaroo" for about 3 hours before moving the baby to the other parent. Taking turns allowed both parents to become confident about and competent with care, provided rest periods for each of them, and gave them an important experience to share (Moran et al.). The effect on the premature infant of surrogate parents (such as grandparents) providing kangaroo care is currently being evaluated by this research team.

Kangaroo care originated in Bogota, Columbia because of a lack of incubators for preterm infants and was studied and developed by two physicians, Edgar Rey Sanabria and Hector Martinez (Anderson, 1989). Their findings of dramatic improvement in infant outcome and parental attachment were published by UNICEF in 1984. This report stimulated interest, visits to Bogota, and research in developed countries. The findings were replicated in Kenya and Mozambique (Anderson).

Kangaroo care has been used most with preterm infants in the United States. Ludington-Hoe and co-researchers (1999) reported beginning kangaroo care immediately after birth and continuing it for 6 hours in 6 preterm infants born $\leq$ 34 weeks gestation. The neonates' mean 1-minute Apgar score was 7.3 and the mean 5-minute Apgar score was 9.2. Neonates' heart rates, respiratory rates, oxygen saturations, abdominal temperatures, and behavioral states were recorded. All gradually improved. All were breastfeeding within 24 hours, and all were discharged from the hospital within 48 hours.

In a second example, kangaroo care (begun 2 hours after birth with a preterm infant born at 35 weeks gestation weighing 2,430 grams) helped the mother work through her feelings of depression (Dombrowski, Anderson, Santori, & Burkhammer, 2001). In a third example, adoptive parents of a preterm infant (born at 27 weeks gestation weighing only 917 grams) began kangaroo care on the 3rd day post-birth while the infant was still on the ventilator. The parents reported kangaroo care gave them the opportunity to bond with their daughter in a way most adoptive parents are not able to do (Parker & Anderson, 2002).

In a fourth example, a mother of four children was afraid she would have trouble bonding with three additional infants (triplets). Shared kangaroo care (holding three infants at one time) beginning the 6th day after birth helped her feel confident in delivering love and attention to all three infants. After three sessions lasting at least 1 hour each, the mother stated, "I can do this...I can love and bond with all three at the same time" (Swinth, Nelson, Hadeed, & Anderson, 2000).

A fifth example involved three mothers who were having difficulties breastfeeding their full term infants. After 30 minutes of kangaroo care, the first infant began nursing without assistance. The second mother had inverted nipples so a breast pump was used first to harden her nipple. After many attempts, the infant latched on and fed for 45 minutes; however, the mother was unsuccessful in breastfeeding attempts the next day and at post-discharge from the hospital. The third mother was having difficulty breastfeeding and was not bonding with her infant. Kangaroo care helped her overcome both problems. The mother stated, "It seemed so easy to get her to latch this time. It didn't hurt at all" (Meyer & Anderson, 1999). Kangaroo care has been used with preterm infants, as described, but has never been tried with colicky infants.

Summary

Keefe's model was used to guide this study; however, the model was broadened to include the father (Figure 1). Parents were taught how to identify their infant's states of arousal and use these in completing the state-of-arousal diaries. Kangaroo care was instituted at the first sign an episode of colic was beginning. The researchers hypothesized kangaroo care would decrease the time the infant spent crying and fussing and increase the time the infant spent sleeping because colic usually begins shortly after birth, when the infant is 2 to 4 weeks old. When the mother is kangarooing, the infant will be in a near-womb environment. The infant will smell some of the same smells, hear the same noises (heart beat and respirations), and be kept warm by the mother's body heat. When the father or a parent surrogate "kangaroos," the infant will hear similar sounds to those he or she is familiar with (albeit a different heart and respiratory rate) and will be kept warm by that person's body heat. If the parent or parent surrogate can

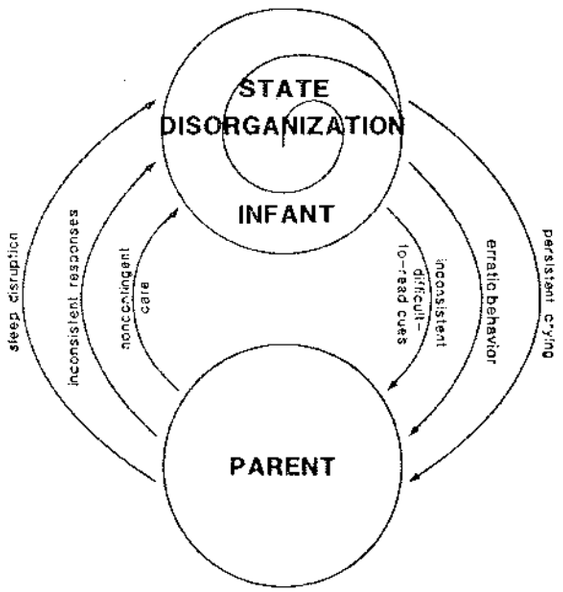

FIGURE 1. Theoretical model of Irritable Infant Syndrome. Adapted from Maureen Keefe, 1987.

remain relaxed, kangaroo care initiated at the beginning of a colic episode should stimulate quiet sleep in an overly stimulated, sleep-deprived infant.

Purpose & Research Questions

The purpose of this pilot study was to examine the feasibility of implementing kangaroo care at the beginning of as many colicky episodes as possible. The research questions were as follows:

1. Can this intervention study be conducted via the Internet?
2. Is kangaroo care acceptable to participants?
3. Does the preliminary data warrant a large clinical trial of kangaroo care in colicky infants?

Methods

Sample

Parents of colicky infants accessed the Infant Colic Study Website by typing "infant colic" on any of 1,500 search engines worldwide. On the website, infant colic was defined, and the study and what study participation would entail were explained briefly. Parents decided if their infant had colic after reading the definition provided by the researchers. If parents were interested in participating in the study, they clicked on the informed consent, read it, and if they remained interested in participating, clicked on the "I agree to participate" button. The researcher then responded by e-mail within 48 hours offering to answer any questions the participant might have about study participation.

Procedure

Prior to beginning this study, approval was obtained by the appropriate institutional review board. After agreeing to participate in this study, the parent providing most of the infant's care during the episodes of colic completed the online Infant Colic Scale. This instrument is a researcher-developed 22-item multidimensional scale with Likert-type responses. It has subscales for each of five current theoretical explanations for infant colic (cow's milk protein allergy/intolerance, immature gastrointestinal system, immature central nervous system, difficult infant temperament, and parent-infant interaction problem). Information from this scale and the accompanying demographic data form are used to determine the two most likely explanations for the colic in each infant (Ellett et al., 2003).

When the researchers received the completed Infant Colic Scale, they sent the participant general information about infant colic, information about infant states of arousal, and the baseline 3-day state-of-arousal diary by return e-mail using the reply function to eliminate errors from retyping e-mail addresses. If infants were exposed to cow's milk either through dairy products in the breastfeeding mother's diet or in infant formula, a 2-week trial of strict removal of all dairy products in the mother's diet or a 1-week trial of a hypoallergenic formula (Nutramigen, Alimentum, or Progestimil) was suggested, because research shows cow's milk intolerance or allergy is responsible for up to 35% of infant colic (Oggero, Garbo, Savino, & Mostert, 1994; Treem, 2001). Removal of cow's milk resulted in almost overnight cessation of the colicky symptoms in a few infants whose parents contacted the researchers.

When the researchers received the completed baseline state-of-arousal diary, they mailed the participant a 60-minute telephone card as an incentive to continue participation and e-mailed the participant instructions for implementing kangaroo care and the second state-of-arousal diary to record the infant's states of arousal for a total of 16 days—14 days while implementing kangaroo care at the first sign a colic episode was beginning (whenever possible) and for 2 days after stopping kangaroo care. The researchers wanted to include two pictures—one of a mother and one of a father kangarooing their infant, but they received too many complaints of parents not being able to open the attachment containing the kangaroo care instructions because of older computer equipment, so the pictures had to be removed from the website.

When the researchers received the second completed state-of-arousal diary, the participant was mailed a second 60-minute telephone card and was queried by e-mail regarding how kangaroo care went for them and if the infant still had colic. If the infant still had colic, parents were sent a list of suggested interventions based on the two most likely explanations for infant colic determined by analyzing data from the Infant Colic Scale. Throughout study participation, the researchers responded promptly to participant questions. Also, when the completed state-of-arousal diaries were not received in a timely manner, reminders were sent to the participant's e-mail address up to three times as necessary.

Results

Demographics

Seventy-five participants (71 mothers and 4 fathers) agreed to participate in this pilot study by clicking on the "I agree to participate" button; however, only five mothers actually did. Two mothers completed all parts of the study, and three mothers returned the completed baseline state-of-arousal diary only. The parents (N = 7) who shared with the researcher their reasons for withdrawing from the study reported either kangaroo care did not fit well into their lives because they were much too busy to sit and hold their infants for 2 to 3 hours at a time even if their infants were crying or, even though they were willing to implement kangaroo care, recording their infants' states of arousal took too much time.

The ages of the five mothers who participated in the study varied from 23 to 34 years. They were racially diverse (3 White, 1 Asian, and 1 African American), and their education varied from 13 to 18 years. Their occupations included homemakers, white collar, and professional, and they resided in different states in the United States. The infants' ages varied from 1 to 19 weeks, both sexes were nearly equally represented, the sample was racially diverse, 4 of the 5 infants were firstborns, and all were breastfed with one also receiving formula.

Dependent Variables

The large dropout rate precluded any statistical analysis. As shown in Tables 1 through 3, participants 1 and 3 com-

TABLE 1

Time Infant Spent Crying, Fussing, Active Sleep, and Quiet Sleep—Baseline (3 Days)

Participant Number	Total Crying (Minutes)	Mean Crying (Minutes)	Total Fussing (Minutes)	Mean Fussing (Minutes)	Total Active Sleep (Minutes)	Mean Active Sleep (Minutes)	Total Quiet Sleep (Minutes)	Mean Quiet Sleep (Minutes)
1	555	185	300	100	105	35	2325	775
2	1041	347	270	90	350	117	1328	443
3	372	124	195	65	635	212	2195	732
4	620	207	170	57	235	78	2170	723
5	79	26	39	13	494	165	2185	728

pleted all parts of the study. At baseline, the time the five infants spent crying varied from a mean of 0.5 hours to nearly 6 hours per day. The time the infants spent fussing varied from a mean of 0.25 hours to slightly less than 2 hours per day. The time they spent in active sleep varied from a mean of 0.5 hours to 3.5 hours per day. The time spent in quiet sleep varied greatly, from slightly more than 7 hours to approximately 13 hours per day.

While infant one was receiving kangaroo care during colicky episodes, the mean time he spent crying decreased 1 hour per day. The mean time he spent fussing decreased nearly one-half hour per day. The time he spent in active sleep increased a mean of approximately one-half hour per day, and the time he spent in quiet sleep decreased a mean of approximately the same amount of time per day. While infant three was receiving kangaroo care during colicky episodes, the time she spent crying also decreased approximately 1 hour per day. However, the mean amount of time she spent fussing, in active sleep, and in quiet sleep remained nearly constant.

When the kangaroo care was stopped for 2 days, the time spent crying by both infants continued to decrease. In fact, infant three had no crying; however, her time spent fussing increased. The time the infant one spent fussing decreased slightly. The amount of time both infants spent in active and quiet sleep did not change much.

The follow-up qualitative data revealed the mother of infant one reported that if her son was very upset, kangaroo care alone did not work. It required some rhythmic patting of his back or rocking along with kangaroo care to soothe him. The mother of infant three reported kangaroo care did help; however, swaddling paired with closeness seemed more convenient and worked as well.

Discussion

Can this intervention study be conducted via the internet?

The researchers learned much from this pilot study. First, this study cannot be successfully conducted via the internet. Caring for an infant with colic is very stressful for parents, but no matter how hard the researchers tried, they could not provide enough support for an adequate number of the 75 participants who initially consented to participate in this study to finish.

TABLE 2

Total and Mean Time in Minutes Spent in Each State of Arousal—Kangaroo Care (14 Days)

Participant Number	Total Crying (Minutes)	Mean Crying (Minutes)	Total Fussing (Minutes)	Mean Fussing (Minutes)	Total Active Sleep (Minutes)	Mean Active Sleep (Minutes)	Total Quiet Sleep (Minutes)	Mean Quiet Sleep (Minutes)
1	1470	105	990	71	1050	75	10270	734
2	.	.	.	.	.	.	.	.
3	605	43	945	68	950	68	9920	709
4	.	.	.	.	.	.	.	.
5	.	.	.	.	.	.	.	.

TABLE 3

Total and Mean Time in Minutes Spent in Each State of Arousal—Kangaroo Care Stopped (2 Days)

Participant Number	Total Crying (Minutes)	Mean Crying (Minutes)	Total Fussing (Minutes)	Mean Fussing (Minutes)	Total Active Sleep (Minutes)	Mean Active Sleep (Minutes)	Total Quiet Sleep (Minutes)	Mean Quiet Sleep (Minutes)
1	30	15	60	30	75	38	1515	758
2	.	.	.	.	.	.	.	.
3	0	0	245	123	175	88	1400	700
4	.	.	.	.	.	.	.	.
5	.	.	.	.	.	.	.	.

Is kangaroo care acceptable to participants?

Kangaroo care appeared to be acceptable to a few select participants. Perhaps as more parents are exposed to kangaroo care in newborn nurseries in this country, it will seem logical to parents to continue "kangarooing" at home whenever their infant becomes irritable. Dr. Gene Cranston Anderson, who has studied the effect of kangaroo care on premature infants for years, suggested mothers could "tuck their infant down into the top of a tube top so that they can have their hands free." This may help busy mothers be able to provide kangaroo care to their colicky infant while meeting their other responsibilities.

Does the preliminary data warrant a large clinical trial of kangaroo care in colicky infants?

In the two infants who did complete the study, kangaroo care may have decreased the time spent crying. The effect of kangaroo care on the time spent fussing, in active sleep, and in quiet sleep was less apparent. In infant three, the time spent crying changed to time spent fussing, which could show maturation. Also the total time spent sleeping remained unchanged possibly because any gains resulting from kangaroo care were balanced by the infants' natural tendency to remain awake longer as they mature.

An important confounding variable was not controlled by the design of this study. Infant colic comes for no apparent reason and disappears for no apparent reason; both can occur abruptly. This could account for some of the observed decreased crying.

Conclusions

Kangaroo care is a cost-effective nursing intervention that can help with parent-infant bonding. Because kangaroo care for infants with colic is a promising intervention and because there are no other effective treatments for most of these infants, another feasibility study is warranted using different methods. This second feasibility study will need to be done locally so the researchers can meet the participants face-to-face and interact with them to offer support both initially and during study participation. Also, a larger incentive will need to be offered to encourage completion of the study. These new methods will be incorporated into the second feasibility study. Then if results are promising, a larger clinical trial should be conducted.

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