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Skin-To-Skin Care: Focusing On the Maternal–Infant Dyad

In This Issue...

The effectiveness of Skin-To-Skin Care (SSC, aka Kangaroo Care) for infants at risk is supported by strong research and advocated by respected organizations, including the World Health Organization. Despite a growing body of evidence detailing the benefits of this intervention, SSC has yet to be adopted as standard practice within Neonatal Intensive Care Units (NICUs) across the nation and the world.

In this issue, we review the most recent literature related to the practice of SSC, including specific research on maternal and infant outcomes as well as barriers to implementation. It is hoped that this information will assist clinicians in evaluating the readiness of their NICUs to implement SSC, allowing them to develop plans that are responsive to the needs of patients, caregivers, and families, and to select measures to use in monitoring implementation progress.

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LEARNING OBJECTIVES

At the conclusion of this activity, participants should be able to:

- Describe the influence of Kangaroo Care on both the neonate and the mother
- Explain the effects of Kangaroo Care on pain in the neonate
- Discuss common barriers to the implementation of Skin-to-Skin Care in Neonatal Intensive Care Units

COMMENTARY

The separation of mother and infant, while often necessary for the survival of the pre-term infant in the NICU, is unnatural and stressful for parents and infants alike. Just as the neonatal team employs the most advanced technology and pharmacology available to improve outcomes, so too should they investigate available environmental improvement and support strategies to minimize the impact of separation and maximize mutually beneficial interaction between mother and infant (and father and infant).

SSC is a practice that holds much promise for neonates in the NICUs of developed countries as well as in other care settings in developing countries. SSC has been shown to enhance gas exchange,¹ increase restive sleep time,² improve the quality of sleep,³ decrease birth-related fatigue,⁴ provide pain relief for term infants during heel-stick procedures,^{5,6} conserve energy,⁷ decrease time to full enteral feeds, reduce the impact of separation, promote parental involvement and bonding, and improve transition to home following discharge.⁸ Most importantly, SSC has been shown to reduce overall morbidity and mortality among low-birthweight infants and to promote adaptive development.

There is a saying: "The only person who likes change is an infant in wet diapers!" SSC represents significant change for clinicians in the NICU. Perhaps that is why

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SSC meets such resistance in practice; some believe it to be substandard care, while others find it too time consuming, too risky for a fragile neonate, or simply "fluff" in the context of real medical care. Addressing each of these concerns requires a thoughtful, evidence-based response, as well as a careful strategy to reduce risk. With such forethought, SSC can be successfully added to the many varied approaches we can use to individualize care, implementation of SSC can proceed in a far greater number of institutions, and caregivers will become more competent and confident in its application.

Offering opportunities for a mother to positively interact with her child very early in life requires support from accessible bedside clinicians who are committed to implementing SSC and who need not be drawn away for other unit activities. Attending to the concerns of those clinicians requires involved administrators who have responsibility for both staffing and the environment in which care is provided. These are the key elements essential to the success of any SSC program and to improving the well-being of the neonates and the families in our care.

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STRESS, MOOD, AND PAIN PROFILES OF MOTHERS AND INFANTS DYAD DURING KANGAROO CARE AS MEASURED BY CORTISOL LEVELS

Morelius E, Theodorsson E, Nelson N. [Salivary cortisol and mood and pain profiles during skin-to-skin care for an unselected group of mothers and infants in neonatal intensive care](#). *Pediatrics*. 2005;116:1105-1113.



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This 2005 prospective study by Morelius et al investigated the relationship between SSC and stress among 17 mother-infant dyads in the NICU of The University Hospital in Linköping, Sweden. Infants were between 25 and 32 weeks' gestational age; free from congenital anomalies, neurological deficit or intraventricular hemorrhage; minimally 2 days of age; and were entered into the study before their first SSC experience. Stress was measured using salivary cortisol levels and heart rate measures in both mothers and infants. The researchers controlled for the established lack of diurnal cortisol rhythm in infants



by conducting SSC sessions at the same time each day. In addition, Mood Scale (MS) and Visual Analog Scale (VAS) data were collected from mothers, and Premature Infant Pain Profile (PIPP) and Neonatal Infant Pain Scale (NIPS) data were collected from the infants. Saliva samples and heart rate were obtained prior to, during, and after the first and fourth skin-to-skin care episodes.

The researchers found that maternal salivary cortisol levels decreased during both the first and fourth SSC encounter. At the first encounter, salivary levels during SSC were 27% lower than pre-SSC levels, and post-SSC levels were 32% lower than the initial measurement. At the fourth encounter, salivary levels during SSC were 20% lower than pre-SSC levels, and post-SSC levels were 38% lower than the initial measurement. No significant difference was found when comparing data from the first and fourth encounter. Similarly, maternal heart rates were highest prior to SSC, decreased during SSC, and reached their lowest levels following each encounter.

VAS decreased both during and after SSC encounters, indicating reduced stress (high scores reflect high stress). Maternal mood as measured by the MS increased during and after SSC encounters as well (increased MS scores reflect elevated maternal mood). Reinforcing the validity of these findings, the mothers self-reported decreased stress and improved mood during the skin-to-skin experiences.

Infant cortisol levels showed inconsistent response to SSC: 38% of the sample had increased levels, 38% had decreased levels, and 23% remained unchanged. Changes in infant cortisol levels during and following the first SSC encounter did not reach statistical significance. Data from the fourth encounter showed 36% of the infant cortisol levels decreased during SSC, while 64% increased. Median levels were highest following SSC and lowest before the encounter.

Further, infant pain was found to decrease during SSC: the NIPS score was highest prior to SSC and decreased both during ($P=.005$, Fr/Wi) and following the first SSC encounter ($P=.04$, Fr/Wi). This finding held true for the fourth SSC encounter as well, during which the decrease in the NIPS was significant at $P=.04$ and $P=.03$, respectively.

PIPP state data indicated that infants moved into deeper sleep states during and following SSC. No difference in state was established in relation to the first SSC encounter. However, following the fourth SSC encounter, infants were more likely to be in light/active sleep with eyes closed and some facial movements before SSC, and in quiet sleep with eyes closed and no facial movements after.

The authors attributed the finding that infants experienced both increases and decreases in cortisol levels to the immaturity of the hypothalamic-pituitary-adrenal system. While this assertion is consistent with other research, further investigation of neonatal cortisol measurement is necessary.

Heart rate, cortisol, mood, and visual analog data support a conclusion that mothers had a positive experience with SSC. Further, decreased pain as measured by the NIPS and PIPP in conjunction with decreased infant heart rate may lead clinicians to believe infants experienced decreases in pain during SSC. However, there was a loss of infant data to either sample contamination or insufficient volume; therefore, the analysis has little power (although the methods and instruments used can be replicated with larger samples to assure sufficient power). For clinicians, the inconsistent infant data support a need for sustained, careful attention to the mother-infant dyad while both partners experience skin-to-skin care during the NICU stay. For researchers, these data indicate the need for further investigation.

PARENTING OUTCOMES AND PRETERM INFANT DEVELOPMENT

Feldman R, Eidelman A, Sirota L, Weller A. **Comparison of skin-to-skin (kangaroo) and traditional care: Parenting outcomes and preterm infant development.** *Pediatrics*. 2002;110(1):16-26.



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Feldman's group investigated the influence of Kangaroo Care on long-term infant development and parent-infant relationships. Participants included 73 matched pairs of infants from 2 institutions. The first institution incorporated Kangaroo Care as standard practice (treatment group), enrolling infants between 31 and 33 weeks post-conceptual age whose mothers agreed to participate in Kangaroo Care for at least 1 hour a day for 14 consecutive days; the second maintained standard NICU practices to serve as control. Total time engaged in Kangaroo Care was documented. At 37 weeks gestational age, a 10-minute mother-infant NICU interaction was videotaped and scored by blinded, trained observers using the Mother-Newborn Coding System. Mothers completed the Beck Depression Inventory (BDI) and Neonatal Parent Inventory (NPI) as measures of depressive symptoms and assumption of the parental role. Home Observation for the Measurement of the Environment (HOME) was completed by trained observers at 3 months corrected age, at which time the mother and father independently completed the Infant Characteristic Questionnaire (ICQ). The Bayley Scales of Infant Development (Bayley-II) was completed at 6 months corrected age. At each measurement point, mothers completed a self-report tool. Finally, all infants' medical risk was measured using the Clinical Risk Index for Babies (CRIB).

The investigators report that mothers participating in Kangaroo Care demonstrated significant differences in interactive behaviors, scoring higher for positive affect, touch, and visual regard for their infants. They found, however, no difference in vocalization. Infants participating in Kangaroo Care demonstrated more alert-scanning episodes and less gaze aversion during dyad interaction. Both mothers and infants showed a favorable treatment effect (Wilks' $F [df = 6, 137] = 12.47; P < .001$). Further, mothers participating in Kangaroo Care reported less depressive symptoms on the BDI and perceived their infants to be more "normal" on the NPI. Significant positive correlation between depressive symptoms and infant medical risk as measured by the CRIB score was also established (Wilks' $F [df = 2, 141] = 4.86; P < .01$).

The 3-month evaluation for families participating in Kangaroo Care showed a more optimal home environment, as reflected in higher HOME scores for both mothers (Wilks' $F [df = 7, 123] = 2.99; P < .01$) and fathers (Wilks' $F [df = 7, 110] = 2.45; P < .05$). Infant temperament at 3 months of age showed no difference between groups. Cognitive function as measured using the Bayley II MDI and PDI scales at 6 months demonstrated a significant positive effect for infants participating in the Kangaroo Care group (Wilks' $F [df = 2, 128] = 5.41; P < .01$). Using post hoc analysis, the authors reported greater differences among high-risk infants between the treatment (mean 85.14; SD: 17.88) and control groups (mean 77.91; SD: 13.68), data which are significant at the level of ($F [1,61] = 6.27; P, .01$).

These findings establish a direct connection between Kangaroo Care and favorable long-term outcomes for preterm infants (even those at greatest risk) as well as for their families. Specifically, the findings establish a positive, direct relationship between Kangaroo Care and cognitive function at 6 months, maternal perception of the infant as normal, and both maternal and paternal home environment. These findings also establish a significant inverse relationship with

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self-reported maternal depression. The finding of significant positive effects on co-morbidities among high-risk premature infants is a strong argument in favor of implementing Kangaroo Care in the NICU, which can be accomplished with attentive caregivers, willing parents, and a responsive administration.

BARRIERS TO KANGAROO CARE IN DEVELOPING COUNTRIES

Charpak N, Ruiz-Pelaez. **Resistance to implementing Kangaroo Mother Care in developing countries, and proposed solutions.** *Acta Paediatr.* 2006;95:529-534.



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This descriptive study by Charpak and Ruiz-Pelaez aimed to identify processes and strategies to support implementation of Kangaroo Mother Care (KMC) and to subsequently improve management of the program in 25 developing countries. Forty-four teams were trained in Bogotá, Columbia to initiate Kangaroo Mother Care, described as 3 phases: the first, called Kangaroo Position, involved a protocol for continuous skin-to-skin contact and continued until the pre-term infant could maintain thermal stability (at about 37 weeks); the second, called Kangaroo Feeding, involved regular breastfeeding or feeding of breast milk around the clock; the third, called Kangaroo Discharge, involved sending the infant home with the mother in the skin-to-skin position, to be continued through regular follow-up visits until the infant regained birth weight and steadily gained 15 g/kg/day.

Seventeen teams from 15 developing countries successfully implemented KMC programs – a 50% implementation success rate. The database for analysis was developed from on-site standardized field observation and interviews, as well as from a questionnaire sent to both the successful and the unsuccessful teams concerning the problems encountered during implementation and the solutions developed. By identifying the implementation barriers and understanding the circumstances and motivations leading to those barriers, the researchers sought to present solutions for the benefit of others implementing KMC.

Several themes were identified, with caregivers expressing negative perceptions in relation to all phases of KMC practice. Some perceived KMC as a “poor man’s alternative” to proper neonatal care, specifically designed for developing countries; they also resented the additional work burden placed on health care providers due to the careful monitoring and data collection necessary to assure the stability and safety of the neonate. In some instances, respondents indicated that the skin-to-skin contact itself was inappropriate, expressing discomfort in relation to placing the infant on the bare chest, a perceived lack of privacy, difficulty maintaining thermal control, and cultural differences related to diapering. Caregivers also perceived the work of infant nutrition to be increased by the breastfeeding component of KMC, expressing the concern that breast milk is less desirable than formula feeding. Further, health care respondents responsible for discharge perceived that follow-up care was inadequate to assure infant safety. In a similar vein, mothers expressed resistance, both because of the demands KMC placed on their time and because it restricted the fathers’ participation.

Although the findings are from providers in developing countries, the themes Charpak and Ruiz-Pelaez captured can be useful to health care providers implementing skin-to-skin care programs in the NICUs across the globe because an understanding of these obstacles can aid individual units, health care organizations, and businesses to reevaluate the need for Kangaroo Mother Care, and to anticipate potential challenges during the implementation process. The

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authors offer strategies for colleagues considering similar programs, including distribution of evidence to health care professionals, administrators, and health care decision makers regarding pilot studies during early implementation; site visits or consultations with providers who have successfully implemented SSC; and family and testimonials to be shared with professionals and families alike. They also advocate the consistent use of appropriate privacy protections, education concerning newborn thermal management, and cultural training for all involved in SSC.

TRANSMISSION OF MYCOBACTERIUM TUBERCULOSIS FOLLOWING EXPOSURE TO KANGAROO CARE

Heyns L, Gie RP, Goussard P, Beyers N, Warren RM, Marais BJ. **Nosocomial transmission of *Mycobacterium tuberculosis* in kangaroo care units: A risk in tuberculosis-endemic areas.** *Acta Paediatr.* 2006;95:535-539.



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In many developing countries, Kangaroo Care is considered to be the standard of care. While KMC Units have demonstrated improved outcomes in neonates as well as significant reductions in health care costs, they are often small, poorly ventilated rooms shared by 4-8 mother-preterm infant pairs. Therefore, an endemic infectious agent such as *Mycobacterium tuberculosis* (*M. tuberculosis*), as reported in South Africa, can pose a threat of nosocomial transmission to infants, families, and clinicians. This 2006 case report by Heyns et al describes a single experience of nosocomial transmission of *M. tuberculosis* linked to a source within the Kangaroo Care Unit.

Following the admission of a 3-month old to the Pediatric Intensive Care Unit, the infant was diagnosed with pulmonary tuberculosis and an investigation was undertaken to identify the possible source. The infant had been born at 29 weeks' gestational age and spent 23 days between 2 Kangaroo Care Units. A combination of risk factors, including untreated active tuberculosis-positive pregnant women, a tuberculosis-endemic environment, and confined, poorly ventilated area, presented the opportunity for nosocomial transmission to all individuals within this setting. However, the mother of this infant was not tuberculosis-positive, nor were any contacts following hospital discharge. The investigation identified the only possible source as a contact with another mother within the Kangaroo Care Unit who had exhibited a chronic cough and illness. Through smear microscopy and subsequent restriction fragment length polymorphism testing, this mother was identified as the source case. Subsequent testing revealed that 4 of the 6 neonates that shared the Kangaroo Care Unit environment with the source case developed tuberculosis within a 6-month period.

Heyns' report reminds all clinicians of the need to be hypervigilant in proactively screening all parents, visitors, and healthcare workers in contact with any healthcare setting to decrease the possibilities of nosocomial transmission of any organism to any population.

THE INFLUENCE OF SKIN-TO-SKIN CARE ON NEUROPHYSIOLOGIC DEVELOPMENT AND SLEEP ORGANIZATION

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Ludington-Hoe SM, Johnson MW, Morgan K, et al. **Neurophysiologic assessment of neonatal sleep organization: Preliminary results of a randomized, controlled trial of skin contact with preterm infants.** *Pediatrics*. 2006;117:e909-e923.



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Using EEG/polysomnography at 32 weeks' postmenopausal age, Ludington et al investigated the influence of SSC on sleep organization. Subjects were 28 weeks' gestational age or greater at birth, had 5-minute Apgar scores of at least 6, were free from congenital brain malformations, and weighed at least 1000g at the time of testing. All were born to mothers free of substances during pregnancy. Pre-test data collection began at the end of the 9:00 AM feeding: mothers came to the unit, pumped their breasts, got into hospital gowns, and were ready to hold infants before the subsequent feeding. Quiescence, activity, and discontinuous sleep were scored visually from the EEG data, with changes in respiratory ratio and rate also recorded.

The investigators found SSC significantly and favorably affected 3 variables related to arousal and 2 related to REM sleep, reducing both arousal while sleeping and percent of sleep epochs with more than 1 REM. Findings of regression analysis indicated that, as compared to the control group, arousal time was significantly lower in the SSC group ($B_{SSC} = -7.35$; $P = .015$), and REM counts were significantly lower in the SSC group as well ($B_{SSC} = -5.11$; $P = .013$).

The authors note that currently employed developmentally-appropriate practices tend to encourage staff to provide negative stimulation – for example, emphasizing minimal handling without making the necessary distinction between noxious handling and the comforting that parents can provide. Current practices also do not consistently reduce interruptions in sleep. The findings of this study invite caregivers to resist interruptions in sleep, and to use SSC as a method to promote quiet restive sleep as a means to healthy neurodevelopment.

THE INFLUENCE OF SKIN-TO-SKIN CARE ON PAIN

Ludington-Hoe SM, Hosseini R, Torowics DL. **Skin to skin contact (Kangaroo Care) analgesia for pre-term infant heel stick.** *AACN Clin Issues*. 2005;16:373-387.



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The researchers identified heel sticks as a common painful procedure performed on infants in the NICU, and then developed a research model to test the effects of SSC on pain response to the heel-stick procedure. Baseline heart rate, change in heart rate, time crying, and sleep state data were collected to measure pain response. Cry was defined as audible vocalization or hard cry detectable by voice-activated recorder. Length of cry was measured using a stopwatch, and calculated as the sum of the cry time from onset to cessation greater than 5 seconds.

These data were used to describe pain in response to heel sticks performed either before or after 3-hour episodes of skin-to-skin care on 24 preterm infants randomly assigned to 1 of 2 treatment groups. Caregivers performed heel sticks on infants in Group A **during** a 3-hour SSC session, while heel sticks were performed on infants in Group B **before** 3 hours of SSC.

The investigators found that infants in group A had shorter crying time elevation ($F [1,32] = 5.20$, $P = .01$) and less heart rate elevation ($F [1,32] = 3.54$, $P = .042$) as compared to infants in Group B. In addition, researchers evaluated the 2

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groups of infants for sampling bias and identified none.

While the sample size in this study is modest, it is sufficient to support a power of 0.8 and alpha of 0.05 for a medium effect size. Given that infants have the physiological capacity to experience pain from 20 weeks' gestation, interventions that can relieve that pain without compromising already fragile body systems add great value to the options for care management.

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At the conclusion of this activity, participants should be able to:

- Describe the influence of Kangaroo Care on both the neonate and the mother
- Explain the effects of Kangaroo Care on pain in the neonate
- Discuss common barriers to the implementation of Skin-to-Skin Care in Neonatal Intensive Care Units

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- **Edward E. Lawson, MD** has indicated a financial relationship of grant/research support from the National Institute of Health (NIH). He also receives financial/material support from Nature Publishing Group as the Editor of the *Journal of Perinatology*.
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- **Lawrence M. Noguee, MD** has received grant support from the NIH.
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