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COMMITTEE REPORT

State of the art and recommendations Kangaroo mother care: application in a high-tech environment

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ABSTRACT

Since Kangaroo Mother Care (KMC) was developed in Colombia in the 1970s, two trends in clinical application emerged. In low income settings, the original KMC model is implemented. This consists of continuous (24 h/day, 7 days/week) and prolonged mother/parent–infant skin-to-skin contact; early discharge with the infant in the kangaroo position; (ideally) exclusive breastfeeding; and, adequate follow-up. In affluent settings, intermittent KMC with sessions of one or a few hours skin-to-skin contact for a limited period is common. As a result of the increasing evidence of the benefits of KMC for both infants and families in all intensive care settings, KMC in a high-tech environment was chosen as the topic for the first European Conference on KMC, and the clinical implementation of the KMC model in all types of settings was discussed at the 7th International Workshop on KMC. Kangaroo Mother Care protocols in high-tech Neonatal Intensive Care Units (NICU) should specify criteria for initiation, kangaroo position, transfer to/from KMC, transport in kangaroo position, kangaroo nutrition, parents' role, modification of the NICU environment, performance of care in KMC, and KMC in case of infant instability.

Conclusion: Implementation of the original KMC method, with continuous skin-to-skin contact whenever possible, is recommended for application in high-tech environments, although scientific evaluation should continue.

INTRODUCTION

Kangaroo mother care: origin, definitions and clinical application patterns

The Kangaroo Mother Care (KMC) method, developed in 1978 by Rey & Martinez in Bogotá, Colombia (1), was presented for the first time in 1985 as a model for the home care of low-birth-weight (LBW) infants (2). These authors explained mother kangaroo was selected to illustrate the three key components of the model: warmth, breast milk and love. Since then, the method has been widely introduced in clinical practice; however, two different application trends have emerged. In low income settings, the original method with ideally 24 h/day of mother–infant skin-to-skin care (SSC) in the kangaroo position (KP) is implemented: this method is termed continuous KMC (C-KMC). In affluent settings, the method is implemented as limited sessions with mother–infant SSC in KP, such as one or a few hours, not necessarily every day, occurring over a limited period. Terms commonly used to denote this pattern of application are skin-to-skin care/contact or kangaroo care (KC): in this article, intermittent KMC (I-KMC) will be used as a label for this approach. The term KMC will therefore be used to represent SSC in KP practised as both continuous and intermittent skin-to-skin care. As there are two diverging implementation models, the original, complete KMC method was clarified at a workshop of the International Network of KMC (INK) in 1996. The KMC method is defined as: 'Early, prolonged, and continuous skin-to-skin contact between a mother and her newborn low birth-weight infant (<2500 g, viz. preterm and/or low birth weight infant), both in hospital and after early discharge, with (ideally) exclusive breastfeeding, and proper follow-up'. Recommendations are given for three different levels for applying the method, depending on

availability of health and medical care resources (3), although two diverging trends are presented in research literature. In low income settings, KMC is essentially a total health-care strategy, and the effects of the original KMC model with continuous or nearly continuous skin to skin contact have been evaluated with infant mortality and morbidity, growth, and breastfeeding as the main outcome variables (4–10).

In affluent settings, the first component of KMC is mainly considered, i.e. skin-to-skin contact. It is not a standard policy to offer KMC, and the extent of parent–infant exposure to KMC varies widely; sessions lasting 1 h/day are a common pattern (11). A survey of 284 NICUs in eight European countries (12) determined routine offers of KMC to mothers occurred with country rates range from 41% to 100% of the participating NICUs in each country. Offers were given 'on request sometimes' with country rates of 6–40%, and 'only given on request' in 5/8 countries with rates between 2% and 18%. 'No offers' to mothers were reported from hospitals in three countries with rates between 2% and 18%. The corresponding rates of offers to fathers are lower: 3–11%, 10–49%, 32–100% and 2–45%. Only Sweden, Denmark, The Netherlands and Belgium have policies that support equal participation of both parents in their infants' skin-to-skin care.

In one randomized controlled trial (RCT) (13), the intervention group were subjected to KMC at least 4 h/day in not more than three sittings. A mean of 13.5 h/day has been reported (10). But even periods of KMC as short as 20 min were used in one intervention study (14). However, some intervention studies do not present exact data on duration or frequency of KMC sessions.

Research supporting application of C-KMC in a high-tech environment

A wide range of outcomes is addressed in studies on the effects of KMC. Most outcome variables can be considered universal, as they apply equally to all levels of care in both low income and affluent settings. In high-tech NICUs, common outcome measures in SSC studies (15–18) which showed improved or maintained stability, even in very preterm infants, are; infant physiological response, such as heart rate; respiration; oxygen saturation; and temperature. A Cochrane review (19) concludes SSC is superior to routine measures for preventing hypothermia; however, only one study on skin-to-skin contact (16) was included in the review. Lower infant cortisol during KMC is noted (18). During transport between hospitals, physiological parameters are stable in infants transported in KP by parents, if available, or otherwise by hospital staff with parental consent (20). Furthermore, KMC is efficacious in decreasing pain response in preterm and very preterm infants during painful procedures, experiences to which these infants are frequently exposed during their hospital stay (21–23). Positive effects on infants' sleep patterns and effects that can be interpreted as improved brain maturation (24,25) and benefits for neurobehavioral and psychomotor development are observed (26–28).

Other common outcome variables include psychosocial aspects of parent–infant KMC, such as healing from parental crisis reactions after the birth of a preterm infant (29), and improved parent–infant interaction (28). Recovery from postpartum depression in mothers of preterm infants after early introduction of KMC is observed (30) and mothers who practiced 1-h KMC sessions for at least 2 weeks are less stressed and perceived their preterm infants as less difficult than mothers of infants with conventional neonatal care (care without KMC) do (31). Salivary cortisol decreases in mothers of infants born at a gestational age (GA) of 25–33 weeks and who practise KMC (32). Oxytocin release is suggested as one mediator for these effects of SSC, with short- and long-term consequences on maternal chest temperature and infant temperature, lactation and breastfeeding, maternal levels of anxiety and social competence, and mother–infant interaction (33). In addition, a more optimal home environment is created when both mothers and fathers are involved in continuous and prolonged KMC than in the home environment of parents whose infants received conventional neonatal care (28).

Even short periods of KMC are associated with a higher breastfeeding rate, longer duration, and higher proportions of exclusive breastfeeding in hospital and during follow-up (34–38). Early breastfeeding competence has been observed even in very preterm infants, with capacity for nutritive sucking from 29 post-menstrual weeks, and attainment of full breastfeeding several weeks before the due date of delivery and as early as at a post-menstrual age of 32 weeks (39). These findings support the initiation of KMC and breastfeeding without unwarranted delays: a policy that facilitates early discharge from hospital. Early skin-to-skin contact in term infants has significant effects on breastfeeding rates and duration (40).

Clinical guidelines for KMC

In 2003, the World Health Organization (WHO) issued practical guidelines for C-KMC in response to the increasing and compelling evidence from both low-income and affluent settings (41). Although the recommendations were intended for all types of settings and because of the urgency of promoting KMC where it is most needed, the guidelines were formulated to address environments mainly with high levels of neonatal mortality and scarcity of skilled health workers and medical care facilities. Particular emphasis was placed on safe kangaroo-position practices, exclusive breastfeeding, and early discharge with adequate follow-up (individualized, based on the infant's GA at birth, current post-menstrual age and medical condition, and the family's situation) and support for home care.

Clinical guidelines with detailed practical recommendations for the application of C-KMC have been issued by the Kangaroo Foundation in Bogotá, Columbia, and are based on long-standing clinical experience, extensive research on the method, and a systematic literature review (42). The 'Guideline for Kangaroo Care of Infants from a Postmenstrual Age of 30 weeks', issued by the US National Association of Neonatal Nurses, was formulated explicitly for neonatal

intensive care. This guideline reflects the I-KMC model and is based on detailed evidence regarding skin-to-skin contact in this group of infants, and particular emphasis is placed on the assessment of infant, parental, and institutional readiness for KMC; criteria for allowing initiation; the need for termination of a KMC session; and, prevention of possible hazards (43). The authors recommend a KMC session should ideally last at least 65 min. At the same time, in a concluding suggestion for 'Ten Steps to Successful Kangaroo Care', the principle of the original KMC method is maintained: 'Practice 24/7 KC, allowing mothers and infants to remain in skin-to-skin contact 24 h a day, 7 days a week until discharge.' However, breastfeeding support, early discharge and follow-up are not addressed.

National guidelines have been promulgated, for example in Brazil, where a national programme was launched in 2006 for supporting the consistent provision of C-KMC to all LBW infants and their mothers in special KMC wards, instead of a system for early discharge and home care (44). This programme includes a third stage, in which early discharge to the home instead of to a kangaroo ward will be implemented in the future.

To succeed in the implementation of KMC, local acceptability is essential. In an Australian study (45), neonatal nurses identified an absence of clear protocols for low-birth-weight infants as one main concern in the implementation of KMC. In a Swedish study on the implementation of KMC guidelines (46), nurses' uncertainty about the importance of KMC and the perception KMC means more strain for the mother emerged as obstacles for increasing KMC sessions. In a neonatal care conference (NYU, Cornell, and Columbia) held in New York in 2009, the participants were asked whether they applied KMC in their NICUs. Although nearly 80% of the participants acknowledged that they used KMC, there were only two NICUs with established explicit KMC protocols (J.G. Ruiz, personal communication).

Progression from intermittent to continuous KMC

Instead of distinguishing between intermittent and continuous KMC, the implementation pattern should rather be conceptualized as a logical progression from short periods of skin-to-skin contact, I-KMC, and eventually C-KMC. These periods should occur in combination with support and empowerment of the parents and the family, and the establishment of breastfeeding. All this should lead to preparation for discharge in parent or KMC rooms, and early discharge home in KP. After a period of introduction, including sensitization of the staff, implementation of C-KMC in a unit should commence with low risk infants.

GUIDING PRINCIPLES AND RECOMMENDATIONS FOR KMC IN A HIGH-TECH ENVIRONMENT BY THE 7TH INTERNATIONAL WORKSHOP ON KMC AND AN INK EXPERT GROUP

Guiding principles

Preterm infants should be considered extero-gestational foetuses needing KMC to promote maturation. After the uterus, maternal/parental–infant SSC is the expected evolutionary environment for development. All intrapartum and postnatal care should adhere to a paradigm of non-separation of infants and their parents. Kangaroo Mother Care should be used for warming, comfort, physiological and psychological benefits, growth, development, and the psychosocial needs of the family, and to promote lactation, breastfeeding initiation and longer breastfeeding duration.

Prenatally and on arrival at the unit, parents should be provided with adequate oral and written information (Table 1). The KP is the preferred routine place for care, beginning at birth, taking into consideration the physiological and behavioral state of the infant and parent; it is possible that KMC may contribute to the infant's stabilization. Removal from this place of care should be for specific reasons only. For infants born at a gestational age of 27 weeks or less, decisions about the initiation and timing of KMC

Table 1 Parent information and initiation

Parent information	*Contents:* Benefits for infant and parents, practical aspects of performance, timing of initiation, substitute KMC provider *Timing:* Ideally before delivery, both parents present; continued throughout hospitalization
Initiation of KMC	Continuous KMC from birth; exceptions – infant medical condition or parents/substitute unavailable.
GA ≥32 weeks	Initial infant assessment on mother's chest in delivery room if possible. Mild problems in adaptation after birth: Immediately after initial stabilization, as permitted by infant's condition and care Infant with CPAP: After stabilization, transport to mother for KMC with monitoring and observation (CPAP/ventilator treatment does not constitute an obstacle to KMC).
GA 28–31 weeks	Immediately after initial assessment/stabilization, as permitted by infant's medical condition and care
GA <27 weeks	During first week of life: based on individual medical assessment (weight loss, sensitivity, S-sodium)
C-section	Short period on mother's chest immediately in the operating room, if possible continued during post-op observation. Afterwards the mother is assisted with transportation to the NICU for as much KMC as possible without unjustified restrictions: father/substitute act as primary KMC provider. When mother is unable to visit NICU after delivery, infant can be transported to her in kangaroo position (KP) by father (accompanied by NICU staff when required to monitor the infant), or in transport incubator by NICU staff, who remain to observe and care for the infant and assist the mother in providing KP, if this is possible.
Maternal criteria	Mother unable to visit the NICU because of her own condition and care: infant transported in kangaroo position by father or in transport incubator by staff to the mother's unit for as much KMC as possible. Father acts as primary KMC provider.
Duration of session	Give infants KMC sessions that last at least 1 h.

GA = Gestational age; KMC = Kangaroo mother care; KP = Kangaroo position.
Father includes partner and substitute designated as kangaroo mother care provider by the family.

Table 2 Transport, clothing and transfer

Transport in kangaroo position	*From delivery/operating room to NICU:* GA ≥28 weeks and (a) no ventilatory assistance (regardless of infant's GA): on mother's or father's chest in bed or wheel chair, and (b) infant with moderate/mild problems with temperature, respiration, circulation: as above after assessment by attending neonatologist, and with continued physiological monitoring by portable monitor. KMC clothing: available in the delivery/operating room as standard equipment on transport incubator. *Between NICU and other hospital facilities (X-ray etc.); between hospitals:* Stethoscope and equipment for resuscitation, monitoring, suctioning and oxygen treatment (attached to transporting device on wheels or attached to a baby carriage/perambulator). *In ambulance or helicopter:* Preferably on parent's chest. See above.
KMC clothing	*Parent:* Tube top, KMC blouse/shirt and sling: Demonstrate for the parent how to place infant in correct kangaroo position. *Infant:* Diaper and warm hat. When required: cover back and head with warm insulating blanket/parent clothing, socks.
Transfer between incubator/crib	*Preparation:* Parent prepares infant by gently holding her/him with still hands in a flexor position (flexed arms and legs). *Modes of transfer:* Standing transfer or sitting transfer is used, with maximal prevention of infant hypothermia and destabilization. The infant can be lifted in the bedding/nest with standing or sitting transfer. The bedding is removed once infant has been placed in kangaroo position. An insulating cape can be used during both transfer and KMC sessions. *Infant with CPAP/ventilator treatment:* A parent/nurse disconnects airway tubing during transfer and reconnects it as soon as KMC provider is seated/lying down. During transfer, one or two persons (parent/nurses) hold and secure tubing and lines with tape on furniture/parent's clothing. *Parent autonomy:* After training, parents who feel confident can perform the transfer without assistance.

GA = Gestational age; KMC = Kangaroo mother care.
Father includes partner and substitute designated as kangaroo mother care provider by the family.

Table 3 Supporting parents' presence and role

Parents' presence	*No visiting restrictions for parents:* There should not be any restrictions regarding parents' presence day or night.
Parent facilities	*Intensive care nursery:* (a) Inside the nursery: enough space for parent bed and/or recliner; call button within reach; provision of adequate privacy by screens, curtains etc., or (b) single room, ideally with bathroom/shower. When this is not possible: (c) parent room in close proximity to the nursery or unit. *Intermediate care:* Ideally, family (mother, father, infant) stay together in one room day and night. *Room temperature, stimuli:* Monitor environmental temperature and avoid drafts. For a calming environment for both infants and parents, ensure a low sound level and level of illumination. *Breast pump:* Ideally at the care space/parent room. *Kitchen/lounge:* A place where parents can eat and socialize with other parents.
Assistance of parents' role	*Take initiative:* Ask parents what they need to be able stay and perform KMC *Empowerment of parents:* Tell parents about the outstanding warmth and relaxation they can provide their infant and how their scent contributes to the attachment process. Highlight every behavioral step the infant takes, even the smallest step can make parents proud. *Parents as infant's primary care providers:* Guide and encourage parents to gradually take over the infant's care, as much as they are able and willing to do, and at a pace they can accept. *Prevention of parental exhaustion, especially during continuous KMC:* Encourage parents to ask staff for desired nursing assistance. Provide required assistance with infant's care, especially when parents sleep/rest (tube feed while infant in kangaroo position, or remove from KP temporarily; cup-feed). *Parents' co-operation:* Encourage parents to take turns with KMC *KMC substitute:* Suggest the option of letting a substitute (relative/member of parents' social network) provide KMC in their absence.
Activities of daily life	*Meals:* Inform parents about how to obtain drinks and food in hospital and to order take-out; provide refrigerator, freezer, kitchen range, micro-wave oven. *Communication:* Offer parents the use of a telephone when needed; provide access to computer with Internet connection. *Prevention of boredom:* Encourage parents to bring reading material, handicraft, MP3/CD-player, computer – to listen to music/radio/watch movies etc., and to go to parent kitchen/lounge (with infant in kangaroo position when possible). Inform them about possibilities for receiving visitors.

KMC = Kangaroo mother care; KP = Kangaroo position.
Father includes partner and substitute designated as kangaroo mother care provider by the family.

sessions during the first week of life should be based on individual medical assessment (47–49).

Mothers/parents should be offered adequate support for physical, social and mental wellbeing. Kangaroo Mother Care should be used for transfer of the infant to the neonatal unit after birth (when appropriate), within the hospital, and between hospitals: this should be carried out with portable equipment for cardio-respiratory monitoring, assisted ventilation and other required medical technical support (Table 2). Personnel can demonstrate support of KP by wearing KC binders/slings with babies/dolls, or by displaying KMC mannequins. The choice of transfer strategy should address maximal prevention of hypothermia and infant physiological destabilization.

Table 4 Modification of stimuli, monitoring, performance of medical and nursing care

Environmental stimuli	*Light:* Ensure ambient light levels do not exceed 200 lux. Provide circadian light rhythmicity.
	Sound: Divert all monitor alarms to central stations; if not possible, keep monitor alarms at low noise levels, and significant response alarm at trigger levels.
Physiological monitoring	*All medical treatment and assessments:* Provided according to existing standards of care, irrespective of KMC care or not.
	Infant with continuous monitoring: Of ECG, pulse oxymetry, tc pCO^2 and pO^2 is continued during KMC.
	Infant without severe instability: ECG/pulse oxymetery/intermittent tc pCO^2 and pO^2 may be disconnected during KMC, but for infant safety: only when parent is awake and able to assess infant's physiological status: respiration, skin color, muscle tone).
	System for mobile telemetry/portable monitor, wireless devise (pulse oxymetry): Allows parents to be mobile while they provide KMC and when infant requires physiological monitoring, for use when parents leave the care space with the infant in kangaroo position to go to parent kitchen etc., and during transport.
Nursing and medical care	*Planning of infant's care:* continuously together with parents. Aim to facilitate as long periods of SSC as possible, according to parents' wishes.
	Short interruptions in continuous KMC: Place infant on warm waterbed (in crib/parent bed) instead of incubator
	Performance of care and interventions: Tube feeding, feeding tube insertion, diaper change, blood sampling, i.v. injection, insertion of i.v. cannula, chest auscultation, head ultrasound examination etc., as far as possible with infant in kangaroo position.
	Safe performance of procedures: Lamp with direct light at infant's care space (light directed away from infant's eyes).
	Comfortable performance of procedures: If possible, KMC is provided on a parent bed/recliner that is adjustable in height to accommodate the comfort of the personnel.
	Phototherapy: Maximum distance between infant and lamp: not >30 cm. Alternative: fiberoptic blanket on infant's back with infant's head and back covered with blanket. Prevent infant heat loss by surrounding infant's body with protective textiles on all sides, except the side facing lamp/fiberoptic blanket. Assess infant temperature to prevent hypothermia.

KMC = Kangaroo mother care; SSC = Skin-to-skin care.
Father includes partner and substitute designated as kangaroo mother care provider by the family.

Table 5 Kangaroo mother care and infant instability

Signs of instability/stability	*Observation:* Observe infant for physiological signs and NIDCAP signs of stability and instability (such as color change, flaccidity, extension movements) before transfer and during KMC.
	VLBW infants: Decisions about each KMC session during first week of life are based on ongoing assessment of weight loss, and high serum sodium level.
	Guide parents in recognizing signs of instability/stability: Coach parents in recognizing physiological signs and NIDCAP signs of stability and instability and in how they can help the infant to regain stability before transfer and in the kangaroo position.
	Assistance of infant stability: Give support for flexed position, support infant's strategies for self-regulation (hands joined in midline/contact with mouth/face, feet supported by bedding/parent's hands, pacifier sucking). Inform parents that infant stability and wellbeing are enhanced by sufficiently tight support by KMC clothing, and that holding with still hands provides regulating stimulation, whereas patting and stroking may cause instability.
	Postpone transfer to KMC: At signs of infant instability, assist infant stability and wait until infant is calm and stable. At signs of persistent instability, consider transfer to kangaroo position for supporting improved stability.
Instability during KMC	*First action*: Control/adjust correct kangaroo position (straight trunk and neck; not a slumped-together position, head turned sideways) for fully patent airways. The position should allow for diaphragmatic breathing.
	Infant hypothermia: Make sure (a) the whole frontal surface of the infant is in physical contact with parent, no textiles (parent's underwear) between them, (b) infant is inside parent's clothes, infant wears a warm cap, and (d) infant's head and back are adequately covered with a cap and an insulating warm blanket. Parents should wear appropriate KMC clothing for maintenance of close physical contact.
	Continued instability: Consider oral/nasal suctioning, and/or suctioning in the endotracheal tube.
	Interruption of KMC: Only when all possible measures have been taken without expected results.
When KMC is not possible	*Abstain from KMC:* Only when severe instability (severe apnea, color change, bradycardia, desaturation) occurs in response to touch and routine care giving procedures).
	Physical and other contact when KMC is not possible: Inform parents about how to minimize separation by gentle containing touch, proprioceptive sense stimulation, presenting face where infant can see it/have face-to-face visual contact, talking and singing soothing lullabies, and olfaction stimuli.
Severe instability, terminal care	*Transfer of instable infant to KMC:* Can be used when assessed as justified by responsible neonatologist.
	KMC during terminal care: Can be offered to parents respecting cultural end-of-life practices, after parental consent.

KMC = Kangaroo mother care; NIDCAP = Newborn Individualized Developmental Care and Assessment Program; VLBW = Very low birth weight.
Father includes partner and substitute designated as KMC provider by the family.

Visiting regulations should accommodate 24/7 KMC, in that there should be no restrictions for parents' presence or for persons designated as KMC surrogates by the parents (Table 3). If economic restrictions and social policies create obstacles for allowing parents to stay as much as they wish with their infants, interventions should be implemented for optimal changes, including advocacy for maternity leave policies allowing parents to provide KMC. The physical

environment should be adapted as far as possible for parents' and infants' maximum relaxation and comfort (depending on available economic resources). Parents should be involved in the infant's care soon after birth, and coached to take over the infant's care before the infant is discharged from hospital (50). Staff should actively ask parents how their extended presence and provision of KMC can be facilitated, and provide practical assistance, when requested, to prevent parental exhaustion, boredom and attrition.

During KMC, monitoring, nursing and medical care is provided according to current standards, with the infant's place of care as the only difference (Table 4). Most nursing and medical procedures can be performed with the infant in KP, day and night. Parents should receive guidance on observation and interpretation of infant behavioral signs of stability or instability, according to NIDCAP principles (Newborn Individualized Developmental Care and Assessment Program), and how they can assist the infant in his/her activities for self-regulation before and during KMC (51) (Table 5). For unstable infants, decisions about KMC sessions are based on ongoing physiological assessment. If instability occurs during KMC, relevant nursing and medical measures should be taken with the infant remaining in KP, and KP should only be discontinued when these measures do not produce the expected improvement: adjusting the infant's kangaroo position and ascertaining maximum infant–parent KMC is a primary activity to undertake and evaluate. Primary responsibilities include monitoring the maintenance of the correct kangaroo position for safety and the maximum KMC for effectiveness. Kangaroo Mother Care may be used during terminal care in agreement with parents (52,53).

Staff attitudes and responsibility

Usually (although there are exceptions), the physical and social environment in a NICU nursery does not convey signals to parents that invite them to stay with their infant. This places particular demands on the staff, as the support of parent–infant bonding is a primary goal. This is achieved by communicating to parents that they are the most important people in the infant's life, the ones their infant becomes accustomed and attuned to during pregnancy, and assuring them KMC helps the infant be calmer and stable, as the infant can feel, see, hear and smell the parent. Kangaroo Mother Care should be upheld as the gold standard pervading all medical and nursing care, in that the KP is the optimal place for care of preterm/LBW and sick infants. Activities for helping parents to perform KMC willing and capably are essential components in the role of all NICU professionals (43).

Parental consent about KMC and participation in the infant's care should be documented in the daily assessment form at the bedside and in the infant's care plan, and evaluated in connection with rounds and reports at the beginning of working shifts. Parents usually have a very fast learning curve and soon become valuable partners in the care of their infants. As part of routine documentation of all nursing and medical care, the exact times when I-KMC sessions commences and ends, total daily duration of KMC, and the longer interruptions in C-KMC that occur when the infant is placed in another location for care (cot, parent bed, perambulator etc.) should be recorded on the daily assessment form by staff or parents (K.H. Nyqvist, personal communication).

Concluding recommendation

These recommendations for enhanced practice of KMC, including continuous skin-to-skin contact whenever possible also in high-tech NICUs, are offered by the Expert Group and the 7th KMC Workshop for clinical application and evaluation.

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References

1. Rey ES, Martinez HG. Manejo racional del niño prematuro. Curso de Medicina Fetal. Bogota: Universidad Nacional, 1983.
2. Whitelaw A, Sleath K. Myth of the marsupial mother: home care of very low birth weight babies in Bogota, Colombia. *Lancet* 1985; 1: 1206–8.
3. Cattaneo A, Davanzo R, Uxa F, Tamburlini G. Recommendations for the implementation of kangaroo mother care for low birth weight infants. International Network on Kangaroo Mother Care. *Acta Paediatr* 1998; 87: 440–5.
4. Sloan NL, Camacho LW, Rojas EP, Stern C. Kangaroo mother method: randomised controlled trial of an alternative method of care for stabilised low-birth weight infants. Maternidad Isidro Ayora Study Team. *Lancet* 1994; 344: 782–5.
5. Bergman NJ, Jurisoo LA. The 'kangaroo-method' for treating low birth weight babies in a developing country. *Trop Doct* 1994; 24: 57–60.
6. Charpak N, Ruiz-Pelaez JG, Charpak Y. Rey-Martinez Kangaroo Mother Program: an alternative way of caring for low birth weight infants? One year mortality in a two cohort study. *Pediatrics* 1994; 94: 804–10.
7. Cattaneo A, Davanzo R, Worku B, Surjono A, Echeverria M, Bedri A, et al. Kangaroo mother care for low birth weight infants: a randomized controlled trial in different settings. *Acta Paediatr* 1998; 87: 976–85.
8. Charpak N, Ruiz-Pelaez JG, Figueroa de CZ, Charpak Y. Kangaroo mother versus traditional care for newborn infants </=2000 grams: a randomized, controlled trial. *Pediatrics* 1997; 100: 682–8.
9. Charpak N, Ruiz-Pelaez JG, Figueroa de CZ, Charpak Y. A randomized, controlled trial of kangaroo mother care: results of follow-up at 1 year of corrected age. *Pediatrics* 2001; 108: 1072–9.
10. Suman RP, Udani R, Nanavati R. Kangaroo mother care for low birth weight infants: a randomized controlled trial. *Indian Pediatr* 2008; 45: 17–23.

11. Boo NY, Jamli FM. Short duration of skin-to-skin contact: effects on growth and breastfeeding. *J Paediatr Child Health* 2007; 43: 831–6.
12. Greisen G, Mirante N, Haumont D, Pierrat V, Pallas-Alonso CR, Warren I, et al. Parents, siblings and grandparents in the Neonatal Intensive Care Unit. A survey of policies in eight European countries. *Acta Paediatr* 2009; 98: 1744–50.
13. Ramanathan K, Paul VK, Deorari AK, Taneja U, George G. Kangaroo Mother Care in very low birth weight infants. *Indian J Pediatr* 2001; 68: 1019–23.
14. Miles R, Cowan F, Glover V, Stevenson J, Modi N. A controlled trial of skin-to-skin contact in extremely preterm infants. *Early Hum Dev* 2006; 82: 447–55.
15. Bauer K, Pyper A, Sperling P, Uhrig C, Versmold H. Effects of gestational and postnatal age on body temperature, oxygen consumption, and activity during early skin-to-skin contact between preterm infants of 25–30-week gestation and their mothers. *Pediatr Res* 1998; 44: 247–51.
16. Bergman NJ, Linley LL, Fawcus SR. Randomized controlled trial of skin-to-skin contact from birth versus conventional incubator for physiological stabilization in 1200- to 2199-gram newborns. *Acta Paediatr* 2004; 93: 779–85.
17. Ludington-Hoe SM, Ferreira C, Swinth J, Ceccardi JJ. Safe criteria and procedure for kangaroo care with intubated preterm infants. *J Obstet Gynecol Neonatal Nurs* 2003; 32: 579–88.
18. Tornhage CJ, Serenius F, Uvnas-Moberg K, Lindberg T. Plasma somatostatin and cholecystokinin levels in preterm infants during kangaroo care with and without nasogastric tube-feeding. *J Pediatr Endocrinol Metab* 1998; 11: 645–51.
19. McCall EM, Alderdice FA, Halliday HL, Jenkins JG, Vohra S. Interventions to prevent hypothermia at birth in preterm and/or low birth weight infants. *Cochrane Database Syst Rev* 2008; Jan 23: CD004210.
20. Sontheimer D, Fischer CB, Buch KE. Kangaroo transport instead of incubator transport. *Pediatrics* 2004; 113: 920–3.
21. Johnston CC, Filion F, Campbell-Yeo M, Goulet C, Bell L, McNaughton K, et al. Kangaroo mother care diminishes pain from heel lance in very preterm neonates: a crossover trial. *BMC Pediatr* 2008; 8: 13.
22. Johnston CC, Filion F, Campbell-Yeo M, Goulet C, Bell L, McNaughton K, et al. Enhanced kangaroo mother care for heel lance in preterm neonates: a crossover trial. *J Perinatol* 2009; 29: 51–6.
23. Kostandy RR, Ludington-Hoe SM, Cong X, Abouelfettoh A, Bronson C, Stankus A, et al. Kangaroo care (skin contact) reduces crying response to pain in preterm neonates: pilot results. *Pain Manag Nurs* 2008; 9: 55–65.
24. Ludington-Hoe SM, Johnson MW, Morgan K, Lewis T, Gutman J, Wilson PD, et al. Neurophysiologic assessment of neonatal sleep organization: preliminary results of a randomized, controlled trial of skin contact with preterm infants. *Pediatrics* 2006; 117: e909–23.
25. Scher MS, Ludington-Hoe S, Kaffashi F, Johnson MW, Holditch-Davis D, Loparo KA. Neurophysiologic assessment of brain maturation after an 8-week trial of skin-to-skin contact on preterm infants. *Clin Neurophysiol* 2009; 120: 1812–8.
26. Tessier R, Charpak N, Giron M, Cristo M, de Calume ZF, Ruiz-Pelaez JG. Kangaroo Mother Care, home environment and father involvement in the first year of life: a randomized controlled study. *Acta Paediatr* 2009; 98: 1444–50.
27. Feldman R, Eidelman AI. Skin-to-skin contact (Kangaroo care) accelerates autonomic and neurobehavioural maturation in preterm infants. *Dev Med Child Neurol* 2003; 45: 274–81.
28. Feldman R, Weller A, Sirota L, Eidelman AI. Testing a family intervention hypothesis: the contribution of mother-infant skin-to-skin contact (kangaroo care) to family interaction, proximity, and touch. *J Fam Psychol* 2003; 17: 94–107.
29. Affonso D, Bosque E, Wahlberg V, Brady JP. Reconciliation and healing for mothers through skin-to-skin contact provided in an American tertiary level intensive care nursery. *Neonatal Netw* 1993; 12: 25–32.
30. de Alencar AE, Arraes LC, de Albuquerque EC, Alves JG. Effect of kangaroo mother care on postpartum depression. *J Trop Pediatr* 2009; 55: 36–8.
31. Tallandini MA, Scalembra C. Kangaroo mother care and mother–premature infant dyadic interaction. *Infant Ment Health J* 2006; 27: 251–75.
32. 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: 1105–13.
33. Uvnas-Moberg K. The oxytocin factor. Tapping the hormone of calm, love, and healing. Cambridge MA: Da Capo Press, 2003.
34. Hurst NM, Valentine CJ, Renfro L, Burns P, Ferlic L. Skin-to-skin holding in the neonatal intensive care unit influences maternal milk volume. *J Perinatol* 1997; 17: 213–7.
35. Anderson GC, Chiu SH, Dombrowski MA, Swinth JY, Albert JM, Wada N. Mother-newborn contact in a randomized trial of kangaroo (skin-to-skin) care. *J Obstet Gynecol Neonatal Nurs* 2003; 32: 604–11.
36. Hake-Brooks SJ, Anderson GC. Kangaroo care and breastfeeding of mother-preterm infant dyads 0–18 months: a randomized, controlled trial. *Neonatal Netw* 2008; 27: 151–9.
37. Davanzo R, Ronfani L, Brovedani P, Demarini S. Breast feeding very-low-birth weight infants at discharge: a multicentre study using WHO definitions. *Paediatr Perinat Epidemiol* 2009; 23: 591–6.
38. Renfrew MJ, Craig D, Dyson L, McCormick F, Rice S, King SE, et al. Breastfeeding promotion for infants in neonatal units: a systematic review and economic analysis. *Health Technol Assess* 2009; 13: 1–146.
39. Nyqvist KH. Early attainment of breastfeeding competence in very preterm infants. *Acta Paediatr* 2008; 97: 776–81.
40. Moore ER, Anderson GC, Bergman N. Early skin-to-skin contact for mothers and their healthy newborn infants. *Cochrane Database Syst Rev* 2007; Jul 18: CD003519.
41. WHO. Kangaroo mother care: a practical guide. Geneva: WHO, 2003.
42. Fundación Canguro and Department of Clinical Epidemiology and Biostatistics. Evidence-based clinical practice guidelines for an optimal use of the Kangaroo Mother method in preterm and/or low birth weight infants. Bogota: Pontificia Universidad Javeriana, 2007.
43. Ludington-Hoe S, Morgan K, Abouelfettoh A. A clinical guideline for implementation of kangaroo care with premature infants of 30 or more weeks' postmenstrual age. *Adv Neonat Care* 2008; 8: 3–23.
44. Penalva O, Schwartzman JS. Descriptive study of the clinical and nutritional profile and follow-up of premature babies in a Kangaroo Mother Care Program. *J Pediatr (Rio J)* 2006; 82: 33–9.
45. Chia P, Sellick K, Gan S. The attitudes and practices of neonatal nurses in the use of kangaroo care. *Aust J Adv Nurs* 2006; 23: 20–7.
46. Wallin L, Rudberg A, Gunningberg L. Staff experiences in implementing guidelines for Kangaroo Mother Care – a qualitative study. *Int J Nurs Stud* 2005; 42: 61–73.

47. Agren J, Sjors G, Sedin G. Transepidermal water loss in infants born at 24 and 25 weeks of gestation. *Acta Paediatr* 1998; 87: 1185–90.
48. Agren J, Sjors G, Sedin G. Ambient humidity influences the rate of skin barrier maturation in extremely preterm infants. *J Pediatr* 2006; 148: 613–7.
49. Chiou YB, Blume-Peytavi U. Stratum corneum maturation. A review of neonatal skin function. *Skin Pharmacol Physiol* 2004; 17: 57–66.
50. Nyqvist KH, Engvall G. Parents as their infant's primary caregivers in a neonatal intensive care unit. *J Pediatr Nurs* 2009; 24: 153–63.
51. Als H. Manual for the naturalistic observation of the newborn (preterm and fullterm). Boston, MA: The Children's Hospital, 1984.
52. Collins S. Baby Stephanie: a case study in compassionate care. *Neonatal Intensive Care* 1993; March/April: 47–9.
53. Parker L, Anderson GC. Kangaroo care for adoptive parents and their critically ill preterm infant. *MCN Am J Matern Child Nurs* 2002; 27: 230–2.