Kangaroo mother care to reduce morbidity and mortality in low birthweight infants (Review)

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[Intervention Review]

Kangaroo mother care to reduce morbidity and mortality in low birthweight infants

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ABSTRACT

Background

Kangaroo mother care (KMC), defined as skin-to-skin contact between a mother and her newborn, frequent and exclusive or nearly exclusive breastfeeding, and early discharge from hospital, has been proposed as an alternative to conventional neonatal care for low birthweight (LBW) infants.

Objectives

To determine whether there is evidence to support the use of KMC in LBW infants as an alternative to conventional care after the initial period of stabilization with conventional care.

Search strategy

We used the standard search strategy of the Neonatal Review Group of the Cochrane Collaboration. MEDLINE, EMBASE, LILACS, POPLINE and CINAHL databases (to December 2002), and the Cochrane Controlled Trials Register (The Cochrane Library), were searched using the key words terms “kangaroo mother care” or “kangaroo care” or “kangaroo mother method” or “skin-to-skin contact” and “infants” or “low birthweight infants”.

Selection criteria

Randomized trials comparing KMC and conventional neonatal care in LBW infants.

Data collection and analysis

Trial quality was assessed and data were extracted independently by two reviewers. Statistical analysis was conducted using the standard Cochrane Collaboration methods.

Main results

Three studies, involving 1362 infants, were included. All the trials were conducted in developing countries. The studies were of moderate to poor methodological quality. The most common shortcomings were in the areas of blinding procedures for those who collected the outcomes measures, handling of drop outs, and completeness of follow-up. The great majority of results consist of results of a single trial. KMC was associated with the following reduced risks: nosocomial infection at 41 weeks' corrected gestational age (relative risk 0.49, 95% confidence interval 0.25 to 0.93), severe illness (relative risk 0.30, 95% confidence interval 0.14 to 0.67), lower respiratory tract disease at 6 months follow-up (relative risk 0.37, 95% confidence interval 0.15 to 0.89), not exclusively breastfeeding at discharge (relative risk 0.41, 95% confidence interval 0.25 to 0.68), and maternal dissatisfaction with method of care (relative risk 0.41, 95% confidence interval 0.22 to 0.75). KMC infants had gained more weight per day by discharge (weighted mean difference 3.6 g/day, 95% confidence interval 0.8 to 6.4). Scores on mother's sense of competence according to infant stay in hospital and admission to NICU were better in KMC than in control group (weighted mean differences 0.31 [95% confidence interval 0.13 to 0.50] and 0.28 [95% confidence interval 0.11 to 0.46], respectively). Scores on mother's perception of social support according to infant stay in NICU were worse in KMC group than in control group (weighted mean difference -0.18 (95% confidence interval -0.35 to -0.01). Psychomotor development at 12 months' corrected age was similar in the two groups. There was no evidence of a difference in infant mortality. However, serious concerns about the methodological quality of the included trials weaken credibility in these findings.

Authors' conclusions

Although KMC appears to reduce severe infant morbidity without any serious deleterious effect reported, there is still insufficient evidence to recommend its routine use in LBW infants. Well designed randomized controlled trials of this intervention are needed.

PLAIN LANGUAGE SUMMARY

Kangaroo mother care to reduce morbidity and mortality in low birthweight infants

Not enough evidence that kangaroo mother care is an effective alternative to standard care for low birthweight babies.Low birthweight (less than 2500g) has an adverse effect on child survival and development. Care of low birthweight babies is expensive and requires specialist care. Kangaroo mother care (KMC) involves skin to skin contact between mother and her newborn, frequent and exclusive or nearly exclusive breastfeeding and early discharge from hospital. Compared with conventional care, KMC was found to reduce severe illness, infection, breastfeeding problems, and maternal dissatisfaction with method of care and improve some outcomes of mother-baby bonding. There was no difference in infant mortality. However, serious concerns about the methodological quality of the included trials weaken credibility in these findings. More research

is needed.

BACKGROUND

Low birthweight (LBW), defined as weight at birth of less than 2500 g irrespective of gestational age, has an adverse effect on child survival and development, and may even be an important risk factor for adult diseases (Barker 1995). World-wide, twenty-five million LBW infants are born each year, the great majority (96%) of them in developing countries (WHO 1998). About two thirds of all infant deaths in developed countries occur in this group of infants (Guyer 1998). Similar findings have been reported in developing countries in which the major component of infant mortality is in the neonatal period (WHO 1996). A complex process of care named either conventional or modern neonatal care (CNC) includes interventions already proven to lower the burden of both neonatal morbidity and mortality. Conventional neonatal care of LBW infants is expensive and needs both trained personnel and permanent logistic support. This complexity is critical mainly during the stabilization period, until the infant has adapted to autonomous extrauterine life. In developing countries, financial and

human resources for neonatal care are limited and hospital wards for LBW infants are often overcrowded. Thus, interventions for LBW infants that reduce neonatal morbidity and mortality and costs would be an important advance in care.

In 1978, Rey and Martínez (Rey 1983) proposed and developed kangaroo mother care (KMC) at Instituto Materno Infantil in Santa Fe de Bogotá, Colombia, as an alternative to the conventional contemporary method of care for LBW infants. The term KMC is derived from similarities to marsupial caregiving. The mothers are used as "incubators" and as the main source of food and stimulation for LBW infants while they mature enough to face extrauterine life in similar conditions as those born at term. The method is applied only after the LBW infant has stabilized and all LBW infants need a variable period of conventional care before being eligible for KMC. The major components of KMC are: (1) skin-to-skin contact. Babies are kept, day and night, between the mother's breasts firmly attached to the chest in an upright position, (2) frequent and exclusive or nearly exclusive breast feeding, and (3) early discharge from hospital regardless of weight or gestational age. Respiratory, thermal and feeding stabilization are crucial for the success of this intervention. The definition of stabilization is not precise, and has been defined as independent of gestational age and weight, which are the main variables associated with those vital functions.

Different modalities of KMC have been adopted around the world (Charpak 1996) according to the needs of the settings. This diversity includes exclusive and non exclusive breastfeeding, breast or gavage feedings, completely or partially naked and with variable duration of exposure (1-24 hours/day), early-or-not hospital discharge.

KMC has been reported to be associated with similar neonatal mortality after stabilization, some reduction of neonatal morbidity, greater quality of mother to child bonding and lower hospital stay and costs compared with standard, conventional care of LBW infants.

This review covered all the randomized controlled trials of so called "kangaroo mother care" with all its components irrespective of duration of intervention, combination with co-interventions, and time at discharge from hospital. Skin-to-skin contact only, one of the components of KMC, is the subject of a separate review.

OBJECTIVES

To determine whether there is evidence to support the use of kangaroo mother care in LBW infants as an alternative to conventional care after the initial common period of stabilization with conventional care. Beneficial and adverse effects were assessed.

METHODS

Criteria for considering studies for this review

Types of studies

All published, unpublished, and ongoing trials utilizing random patient allocation, in which kangaroo mother care was compared with standard neonatal care in LBW infants, were eligible. Quasi-random designs were excluded.

Types of participants

Infants with birthweight less than 2500 g regardless of gestational age.

Types of interventions

Comparisons of kangaroo mother care with standard neonatal care in LBW infants. This was regardless of duration of intervention, and of combination with co-interventions, and irrespective of whether discharge from hospital was early or not.

Types of outcome measures

1. Primary outcomes
a) mortality
b) severe illness
c) infant growth
d) Psychomotor development
2. Secondary outcomes
a) infection
b) moderate illness
c) mild illness
d) admission to neonatal intensive care unit (NICU)
e) breastfeeding at discharge
f) length of hospital stay
g) readmission to hospital after discharge.
h) costs of care
i) parent satisfaction
j) staff satisfaction
k) any other clinically relevant outcomes

Search methods for identification of studies

Search included MEDLINE, EMBASE, LILACS, POPLINE and CINAHL databases and the Cochrane Controlled Trials Register (The Cochrane Library), using the key words terms: "kangaroo mother care" or "kangaroo care" or "kangaroo mother method" or "skin-to-skin contact" and "infants" or "low birth weight infants" from January, 1982 to December, 2002. Relevant trials held in the Neonatal Review Group's Specialized Register of Controlled Trials were included. Information was also obtained from cross references

in published articles, conferences and symposia proceedings, and journal hand searching. No language restrictions were imposed.

Data collection and analysis

INCLUSION OF STUDIES
Each reviewer applied inclusion criteria separately. There were no disagreements among the reviewers about inclusion of studies. All trials excluded from the review were given reasons for exclusion.
METHODOLOGICAL QUALITY
An assessment of the quality of the included studies was performed independently by two reviewers (ACA and JLDR). The methodological criteria used to appraise each paper were concealment of treatment allocation, completeness of follow-up, and blinding of assessment of outcome.
Quality scores for concealment of allocation were assigned to each trial, using the criteria described in Section VI of the Cochrane Handbook.
(A) adequate
(B) unclear
(C) inadequate
(D) not used
In addition, quality scores for completeness of follow-up and blinding of outcome assessments were assigned to each trial using the following criteria:
Completeness of follow-up:
(a) <3% of participants excluded
(b) 3% to 9.9% of participants excluded
(c) 10% to 19.9% of participants excluded
(d) 20% or more of participants excluded
For blinding of outcome assessment:
(a) blind, the investigator in charge of outcome evaluation did not know the allocated treatment.
(b) no blinding, the investigator in charge of outcome evaluation knew or was likely to
guess the allocated treatment.
(c) unclear.
Each paper was graded independently by the two reviewers. Differences among reviewers about quality scores were resolved by discussion and consensus was reached. Methodological assessments were not conducted blind to author, institution, journal of publication or results, as the reviewers were familiar with most of the studies.
DATA EXTRACTION
Data were extracted from the included reports by the two reviewers independently and cross-checked. The following data were extracted for each trial: authors; year of publication; country; inclusion and exclusion criteria; mean weight and gestational age at birth and at entry by group; description of interventions; co-interventions; number randomized and analyzed; number and reason of withdrawals and outcomes. If different periods or times of measurement were recorded, each was treated as a different outcome. Differences among reviewers in data extracted were resolved by discussion and consensus was reached. Additional information was sought from the individual investigators where the published information did not contain the required detail.
STATISTICAL ANALYSIS
The statistical package (RevMan 4.1) provided by the Cochrane Collaboration was used. Categorical data were compared using relative risks and their 95% confidence intervals. Continuous data were pooled using weighted mean difference and 95% confidence intervals. Where possible, data were sought to allow an "intention-to-treat analysis".

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.
Fourteen trials of KMC for LBW infants were identified. Eleven trials were excluded: seven (Arandia 1993, Bergman 1994, Charpak 1994, Dala Sierra 1994, Legault 1995, Feldman 2002, and Ohgi 2002) because they were non randomized trials, one (Kambarami 1998) because allocation was by alternation, one (Ramanathan 2001) because the intervention KMC was a combination of skin-to-skin contact and warmer/incubator, one (Roberts 2000) because the intervention KMC was only skin-to-skin contact, and one (Chwo 2002) because the main intervention KMC was intermittent skin-to-skin contact and 20 out of 34 enrolled infants had birthweights >2500 g. Three studies (Sloan 1994, Charpak 1997, and Cattaneo 1998), involving 1362 infants were included. The trials were conducted in Ecuador (Sloan 1994), Colombia (Charpak 1997), and Ethiopia, Indonesia and Mexico (Cattaneo 1998) under a variety of hospital conditions, regulations, and routines. However, there was remarkable consistency in the descriptions of the KMC intervention across all trials. In all instances, the intervention included skin-to-skin contact and exclusive or nearly exclusive breastfeeding. Early neonatal discharge from hospital was only considered in the Colombian study (Charpak 1997). The standard neonatal care included infant stay in incubator only (Charpak 1997) or in incubator or thermal crib (Sloan 1994, Cattaneo 1998). 28% (Charpak 1997) to 47% (Sloan 1994) of infants <2000 g were not eligible for the studies.
Eligibility for study group assignment was reached at a mean or median (range) age of 13 (0-70) days in the Ecuadorian study (Sloan 1994), 8-10 (1-74) days in the Multicentred study (Cattaneo 1998), and 3-4 (1-60) days in the Colombian study (Charpak 1997).
The mean (SD) weight in grams for the infants at enrolment were 1678 ± 226 (KMC group) and 1715 ± 228 (control group) in the

Colombian study (Charpak 1997), 1584 ± 223 (KMC group) and 1574 ± 251 (control group) in the Multicentred study (Cattaneo 1998), and 1704 ± 243 (KMC group) and 1704 ± 248 (control group) in the Ecuadorian study (Sloan 1994). Details of each study are given in the Table of "Characteristics of included studies".

Risk of bias in included studies

SLOAN 1994
Concealment of allocation: (b) ; unclear.
Completeness of follow-up: (b) ; 5.7% infants lost to follow-up. No exclusions.
Blinding of outcome assessment: (b) ; those who collected the outcome measures knew or were likely to guess the allocated treatment.
CHARPAK 1997
Concealment of allocation: (b) ; unclear
Completeness of follow-up: (c) ; 4% infants excluded. 67 (8.6%) infants lost to follow-up although mortality data were available in 30 of these.
Blinding of outcome assessment: (b) ; those who collected the outcome measures knew or were likely to guess the allocated treatment.
CATTANEO 1998
Concealment of allocation: (b) ; unclear.
Completeness of follow-up: Unclear. 38% of eligible infants were excluded. It is not clear how many exclusions occurred after randomization.
Blinding of outcome assessment: (b) ; those who collected the outcome measures knew or were likely to guess the allocated treatment.
All reports failed to provide complete outcome data for all those originally enrolled. Thus, it was not possible to perform intent-to-treat analyses on any outcome. No trial described procedures of allocation concealment. None of the trials reported any effort to reduce response bias, through use of an interviewer blinded to the infant's group allocation. However, it is hard to know if it would be feasible to blind clinicians to treatment allocation in a trial of KMC in LBW infants. In summary, the trials were of moderate to poor methodological quality.
Although conventional care implies promotion of breast feeding and facilitation and promotion of maternal involvement in the care of the neonate, which are critical for the outcomes measured, there was insufficient information on these variables in the control groups.
A strict definition of stabilization was not provided and this may affect external validity, because the timing of the intervention may be critical for its safety. The more immature the infant, the riskier it may be to apply the intervention under varying definitions of stabilization.

Effects of interventions

All but one of the results (not exclusively breastfeeding at 1 month follow-up) are based on data contributed by only one trial.
MORTALITY
No differences were seen in infant mortality assessed from eligibility to 41 weeks' corrected gestational age, to discharge, at 6 month follow-up, or at 12 months' corrected age.
INFECTION / ILLNESS
KMC was associated with a reduced risk of nosocomial infection at 41 weeks' corrected gestational age (relative risk 0.49, 95% confidence interval 0.25 to 0.93), severe illness (relative risk 0.30, 95% confidence interval 0.14 to 0.67) and lower respiratory tract disease (relative risk 0.37, 95% confidence interval 0.15 to 0.89) at 6 months follow-up. There was no evidence of a difference in severe infection at 41 weeks' corrected gestational age or at 12 months' corrected age, diarrhea, or mild or moderate illness at 6 months follow-up.
FAILURE TO ESTABLISH BREASTFEEDING
KMC reduced the likelihood of not exclusively breastfeeding at discharge (relative risk 0.41, 95% confidence interval 0.25 to 0.68). No differences were seen in exclusive breastfeeding at 41 weeks' corrected gestational age, at 1 or 6 months follow-up, or at 12 months' corrected age.
RE-ADMISSION TO HOSPITAL
There was no evidence of a difference in re-admission to hospital at 41 weeks' corrected gestational age, or at 6 months follow-up.
GROWTH
KMC infants had gained more weight per day by discharge than controls (weighted mean difference 3.6 g/day, 95% confidence interval 0.8 to 6.4) and had a larger head circumference at 6 months' corrected age than controls (weighted mean difference 0.34 cm, 95% confidence interval 0.11 to 0.57) although these differences are of low clinical significance. Sloan 1994 reported "there were no significant differences between the groups in growth indices during the 6-month follow-up". No differences were seen in weight, length, or head circumference at 41 weeks' corrected gestational age or at 12 months' corrected age or in weight at discharge.
PSYCHOMOTOR DEVELOPMENT
There were no differences in Griffith quotients for psychomotor development at 12 months' corrected age.
PARENTAL DISSATISFACTION
KMC reduced the likelihood of maternal dissatisfaction with method of care (relative risk 0.41, 95% confidence interval 0.22 to 0.75). There was no evidence of a difference in paternal or family satisfaction with method of care.
MOTHER'S ATTACHMENT BEHAVIOR
Based on the bonding hypothesis, a secondary publication of the Charpak 1997 trial reported results about mother's attachment behavior. Two series of outcomes were assessed as manifestations of mother's attachment behavior. The first was the mother's feelings and perceptions of her premature birth experience, measured through a "mother's perception of premature birth questionnaire"

using a Likert scale (1 to 5), 24 hours after birth and when the infant reached 41 weeks' gestational age. The second outcome was derived from observations made of the mother and child's responsiveness to each other during breastfeeding, using a "nursing child assessment feeding scale".

Overall scores on mother's sense of competence according to infant stay in hospital and admission to NICU were better in KMC than in control group (weighted mean differences 0.31 [95% confidence interval 0.13 to 0.50] and 0.28 [95% confidence intervals 0.11 to 0.46], respectively). On the other hand, overall scores on mother's perception of social support according to infant stay in NICU were worse in KMC group than in control group (weighted mean difference -0.18, 95% confidence interval -0.35 to -0.01). There were no differences in scores on mother's perception of social support according to infant stay in hospital and mother's feelings of worry and stress, mother's sensitivity, mother's responses to child's distress and socioemotional and cognitive growth fostering, and infant's response to the mother (clarity of cues and responsiveness) according to infant stay in hospital and admission to NICU .

OTHER RESULTS

One trial provided information about episodes of both hypothermia and hyperthermia which were significantly more frequent in control than in KMC infants (Cattaneo 1998). However, the data published on these outcomes did not allow their inclusion in the tables.

The mean hospital stay from randomization to 41 weeks' corrected gestational age was 4.5 days for KMC infants and 5.6 for control infants in the Charpak 1997 study. The maximum saving in hospital stay was observed in infants weighing <1501 g at birth. No standard deviations were provided. Cattaneo 1998 only reported median hospital stay, which was 11 days in the KMC group, compared to 13 days in the control group. Length of hospital stay was two days greater in KMC infants than control infants in the Sloan 1994 study.

The overall costs were "about 50% less for KMC" in the Cattaneo 1998 study. In the Sloan 1994 study, "costs of neonatal care were greater in the control than in the KMC group". However, data were available for only 49 infants (24 KMC, 25 control) at 6-month follow-up. No information on mean (standard deviation) costs were available in any of the trials.

Planned subgroup analyses according to birthweight, gestational age and type of LBW, and sensitivity analysis according to methodological quality of trials and methods of meta-analysis, were not made due to the small number of trials contributing data and to the lack of data.

DISCUSSION

KMC has been promoted as an attractive intervention to improve neonatal care, increase mother-infant bonding, and reduce costs of care. Neonatal mortality in LBW infants occurs mostly during the stabilization period, before eligibility for KMC is established, which may explain why mortality was not influenced by KMC. There is currently no sound evidence to support the use of KMC in LBW infants as an alternative to standard care after the initial common period of stabilization with conventional care. However, the information available suggests that KMC may be associated with reductions in clinically important adverse outcomes such as severe illness, nosocomial infection, failure to exclusively breastfeed at discharge, and maternal dissatisfaction.

Nonetheless, these results must be interpreted with caution because concerns exist about the quality of the trials in relation to concealment, loss to follow-up, and blinded evaluation of outcomes. Also, some concern could be raised about external validity since there are important differences in the trials concerning the rate of eligibility and age at randomization.

No trial provided detailed information with regard to costs, an important outcome of this intervention. Most of the high cost of effective neonatal care from birth until discharge will continue to be necessary due to the need of technology and resources to increase survival until stabilization occurs and infants become eligible for KMC.

There has been no long term follow-up of developmental outcome of infants beyond 12 months corrected age in any of the trials to date.

AUTHORS' CONCLUSIONS

Implications for practice

Although KMC appears to reduce severe infant morbidity, there is not enough evidence to recommend its routine use in LBW infants.

Implications for research

KMC for LBW infants has been introduced into many clinical settings without adequate controlled evaluation of its efficacy. The intervention looks promising but has been subjected to limited well-controlled evaluation. A well designed randomized controlled trial is still necessary. Such study must control for selection bias at entry, drop outs, completeness of follow-up, and bias in assessing outcomes. Studies with longer-term follow-up of development, and including costs estimates, are warranted.

ACKNOWLEDGEMENTS

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REFERENCES

References to studies included in this review

Cattaneo 1998 *{published data only}*

Cattaneo A, Davanzo R, Worku B, Surjono A, Echeverria M, Bedri A, Haksari E, Osorno L, Gudetta B, Setyowireni D, Quintero S, Tamburlini G. Kangaroo mother care for low birthweight infants: a randomised controlled trial in different settings. *Acta Paediatr* 1998;**87**:976–85.

Charpak 1997 *{published data only}*

Charpak N, Ruiz JG, Figueroa Z, Tessier R, et al.Kangaroo Mother Care (KMC): A method of protecting high-risk premature infants. Pediatric Academic Societies, Annual Meeting. New Orleans, LA, May 1–5, 1998.

* Charpak N, Ruiz-Pelaez JG, Figueroa de C. Z, Charpak Y. Kangaroo mother versus traditional care for newborn infants <2000 grams: a randomized controlled trial. *Pediatrics* 1997;**100**:682–8.

Charpak N, Ruiz-Pelaez JG, Figueroa de C.Z, 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.

Tessier R, Cristo M, Velez S, Giron M, et al.Kangaroo mother and the bonding hypothesis. *Pediatrics* 1998;**102**:e17.

Sloan 1994 *{published and unpublished data}*

Sloan NL, Leon Camacho LW, Pinto Rojas E, Stern C, and Maternidad Isidro Ayora Study team. Kangaroo mother method: randomised controlled trial of an alternative method of care for stabilised low-birthweight infants. *Lancet* 1994;**344**:782–5.

References to studies excluded from this review

Arandia 1993 *{published data only}*

Arandia R, Morales L. Program kangoroo mother [Programa Madre–Canguro]. *Gac Med Boliv* 1993;**17**:51–5.

Bergman 1994 *{published data only}*

Bergman NJ, Jurisoo LA. The "Kangaroo-method" for treating low birth weight babies in a developing country. *Trop Doct* 1994;**24**: 57–60.

Charpak 1994 *{published data only}*

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.

Chwo 2002 *{published data only}*

Chwo MJ, Anderson GC, Good M, Dowling DA, Shiau SH, Chu DM. A randomized controlled trial of early kangaroo care for preterm infants: effects on temperature, weight, behavior, and acuity. *J Nurs Res* 2002;**10**:129–42.

Dala Sierra 1994 *{published data only}*

Dala Sierra E, Pineda Barahona E, Banegas RM. Kangaroo mother experience [Experiencia madre canguro]. *Rev Med Hondur* 1994; **62**:43–6.

Feldman 2002 *{published data only}*

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

Kambarami 1998 *{published data only}*

Kambarami RA, Chidede O, Kowo DT. Kangaroo care versus incubator care in the management of well preterm infants. A pilot study. *Ann Trop Paediatr* 1998;**18**:81–6.

Legault 1995 *{published data only}*

Legault M, Goulet C. Comparison of kangaroo and traditional methods of removing preterm infants from incubators. *J Obstet Gynecol Neonatal Nurs* 1995;**24**:501–6.

Ohgi 2002 *{published data only}*

Ohgi S, Fukuda M, Moriuchi H, et al.Comparison of kangaroo care and standard care: behavioral organization, development, and temperament in healthy, low-birth-weight infants through 1 year. *J Perinatol* 2002;**22**:374–9.

Ramanathan 2001 *{published data only}*

Ramanathan K, Paul VK, Deorari AK, Taneja A, George G. Kangaroo mother care in very low birth weight infants. *Indian J Pediatr* 2001;**68**:1019–23.

Roberts 2000 *{published data only}*

Roberts KL, Paynter C, McEwan B. A comparison of kangaroo mother care and conventional cuddling care. *Neonatal Netw 2000* 2000;**19**:31–5.

Additional references

Barker 1995

Barker DJ. The fetal and infant origins of disease. *Eur J Clin Invest* 1995;**25**:457–63.

Charpak 1996

Charpak N, Ruiz-Pelaez JG, Figueroa de Calume Z. Current knowledge of kangaroo mother intervention. *Curr Opin Pediatr* 1996;**8**:108–12.

Guyer 1998

Guyer B, MacDorman MF, Martin JA, Peters KD, Strobino DM. Annual summary of vital statistics 1997. *Pediatrics* 1998;**102**: 1333–49.

Rey 1983

Rey, Martinez H. Rational management of the premature infant [Manejo racional del niño prematuro]. I Curso de medicina fetal y neonatal. Bogotá, Colombia. 1983:137–51.

WHO 1996

World Health Organization. *Essential newborn care. Report of a Technical Working Group, Trieste, 25-29 April 1994*. Geneva: Maternal and Newborn Health/Safe Motherhood (WHO/FRH/ MSM/96.13), 1996.

WHO 1998

World Health Organization. *The World Health Report 1998. Life in the 21st century: a vision for all*. Geneva: World Health Organization, 1998.

References to other published versions of this review

Conde-Agudelo 2000

Conde-Agudelo A, Diaz-Rossello JL, Belizan JM. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane Database of Systematic Reviews* 2000, Issue 4. [DOI: 10.1002/14651858.CD002771]

* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Cattaneo 1998

Methods	Multicentred, 3 hospitals in Addis Ababa (Ethiopia), Yogyakarta (Indonesia)and Merida (Mexico). Allocation by means of a random numbers list. 178 (38%) of the 463 eligible infants were excluded. It is not clear how many exclusions occurred after randomization.
Participants	Infants with birthweight between 1000 and 1999 g without gestational age limits, no dependency on oxygen and/or i.v. fluids, ability (at least partial) to feed, no visible major malformation, and mother present and willing to collaborate. Unknown number of infants initially randomized to each group.
Interventions	Infants allocated to the KMC group were kept in close and continuous skin-to skin contact, between the mother's breasts, naked except for a diaper and a hat, covered across their backs with their mother's clothes, day and night, including when the mother was asleep. The mother was occasionally replaced by another person. Infants allocated to the control group were kept in a warm room in Addis Ababa, with open cribs and the possibility of rewarming in a bulb-heated cot, and in incubators in the other two hospitals. Skin-to-skin contact with their mothers was not allowed.
Outcomes	Severe illness, hypothermia, hyperthermia, breast feeding, weight gain, neonatal death, acceptability to health workers, acceptability to mothers, and costs.
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Charpak 1997

Methods	Single centre in Bogota, Colombia. Allocation by means of a random numbers list. Of 396 (KMC) and 381(control) infants enrolled, 14 and 17 were withdrawn due to pre-existing neurologic impairment or proof of intrauterine infection and excluded from analysis; follow-up at 40 to 41 weeks' corrected gestational age was incomplete for 33 vs 34 survivors infants, but mortality data were available in 30 of these, giving mortality data for 364 vs 345.
Participants	Infants with birthweights <2001 g, with a mother or a relative able to understand and willing to follow the general program instructions. Exclusion criteria: being referred to another institution, plans to leave Bogota in the near future, life-threatening or major malformations, early-detected major conditions arising from perinatal problems, and parental or family refusal to comply with the follow-up program or, for those assigned to the KMC group, refusal to comply with the specifics of the intervention.

Charpak 1997 (*Continued*)

	777 infants were randomized, 396 to the KMC group and 381 to the control group.
Interventions	Infants allocated to the KMC group were kept 24 hours a day in a strict upright position, in skin-to-skin contact firmly attached to the mother's chest. Infants were breastfed regularly, although premature formula supplements were administered if necessary. Infants were discharged as soon as they overcame major adaptations to extrauterine life, received proper treatment for infection or concomitant condition, sucked and swallowed properly, and achieved a positive weight gain. Infants allocated to the control group were kept in an incubator until they were able to regulate temperature and were thriving. The parent's access to their babies was severely restricted.
Outcomes	1. At 40 to 41 weeks' corrected gestational age: -Primary outcomes: Mortality and infant growth. -Secondary outcomes: Length of hospital stay, infection, breastfeeding, and mother's attachment behavior. 2. At 12 months corrected age: Psychomotor development
Notes	Data on 488 (65%) mother-infant dyads on mother's attachment behavior were published one year later. Clinical data on 693 (93%) infants on outcomes at one year were partially published in abstract only (data not included in analyses). Clarification from the authors is being sought regarding the total numbers reported for the KMC and control groups in some of the analyses reported by Tessier 1998.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Sloan 1994

Methods	Single Centre in Quito, Ecuador. Allocation by means of a random numbers list. 17 babies lost to follow-up (KMC 9, control 8) ; no exclusions.
Participants	Singleton infants weighing less than 2000 g, with no serious congenital abnormalities or respiratory, metabolic, or infectious disease. Infants had to be stabilized for the 24 h before enrolment: temperature between 36.5 and 37.0 ^{o}C; acceptable tolerance of food; and stable weight. 300 infants were randomized, 140 to the KMC group and 160 to the control group.
Interventions	Infants allocated to the KMC group were kept in an upright position, in skin-to-skin contact (diapers allowed) against the mother's breasts and had frequent breastfeeding. Infants allocated to the control group stayed in an incubator or thermal crib and were breastfed at scheduled times.
Outcomes	Severe illnesses (lower respiratory tract disorders, apnea, aspiration, pneumonia, septicemia, general infections), moderate illness (urinary infections), mild illnesses (upper respiratory tract disorders, dermatitis, jaundice, hip displacement), diarrhea, infant growth (weight, length, upper arm and head circumference) , duration of hospital stay, re-admission, and costs of care.

Sloan 1994 (*Continued*)

Notes	Trial stopped early because a highly significant difference (p<0.005 at 6 months) in severe morbidity arose. No information about whether this was a planned interim analysis. Additional data provided by Dr Nancy L. Sloan.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Characteristics of excluded studies *[ordered by study ID]*

Arandia 1993	Non-randomized trial
Bergman 1994	Non-randomized trial
Charpak 1994	Non-randomized trial
Chwo 2002	The main intervention KMC was intermittent skin-to-skin contact. Moreover, 20 out of 34 enrolled infants did not have LWB. This study should be considered in the skin-to-skin contact review.
Dala Sierra 1994	Non-randomized trial
Feldman 2002	Non-randomized trial
Kambarami 1998	Allocation was by alternation (quasi-random), not a random. 74 (37 per group) infants were subjected to KMC or incubator care. Infants in the KMC group had higher mean daily weight gain, shorter stay in hospital, and better survival rates.
Legault 1995	Non-randomized trial
Ohgi 2002	Non-randomized trial
Ramanathan 2001	The intervention (KMC) was a combination of skin-to-skin contact of at least 4 hours per day and warmer/ incubator for the rest of the time. 28 infants were randomized to receive either KMC along with standard care, or standard care alone. Infants in the KMC group hade better weight gain after the first week of life, earlier hospital discharge, and higher exclusive breastfeeding rates. This study should be considered in the skin-to-skin contact review.
Roberts 2000	The intervention (KMC) was only skin-to-skin contact. 30 infants were randomly assigned to KMC or conventional cudding care in which the contact was through normal clothing. There were no differences on weight gain, hospital stay, duration of breastfeeding, temperature, and parental stress and expectations. This study should be considered in the skin-to-skin contact review.

DATA AND ANALYSES

Comparison 1. Kangaroo mother care versus conventional neonatal care

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 At 41 weeks' corrected gestational age	1	709	Risk Ratio (M-H, Fixed, 95% CI)	0.57 [0.21, 1.55]
1.2 At discharge	1	285	Risk Ratio (M-H, Fixed, 95% CI)	0.91 [0.19, 4.45]
1.3 At 6 months follow-up	1	283	Risk Ratio (M-H, Fixed, 95% CI)	0.98 [0.46, 2.12]
1.4 At 12 months' corrected age	1	693	Risk Ratio (M-H, Fixed, 95% CI)	0.57 [0.27, 1.17]
2 Infection / Illness	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
2.1 Severe infection at 41 weeks' corrected gestational age	1	663	Risk Ratio (M-H, Fixed, 95% CI)	0.69 [0.43, 1.12]
2.2 Nosocomial infection at 41 weeks' corrected gestational age	1	663	Risk Ratio (M-H, Fixed, 95% CI)	0.49 [0.25, 0.93]
2.3 Severe illness at 6 months follow-up	1	283	Risk Ratio (M-H, Fixed, 95% CI)	0.30 [0.14, 0.67]
2.4 Moderate illness at 6 months follow-up	1	283	Risk Ratio (M-H, Fixed, 95% CI)	1.04 [0.44, 2.49]
2.5 Mild illness at 6 months follow-up	1	283	Risk Ratio (M-H, Fixed, 95% CI)	0.96 [0.81, 1.13]
2.6 Lower respiratory tract disease at 6 months follow-up	1	283	Risk Ratio (M-H, Fixed, 95% CI)	0.37 [0.15, 0.89]
2.7 Diarrhea at 6 months follow-up	1	283	Risk Ratio (M-H, Fixed, 95% CI)	0.65 [0.35, 1.20]
2.8 Number of severe infectious episodes at 12 months' corrected age	1	630	Risk Ratio (M-H, Fixed, 95% CI)	0.86 [0.71, 1.03]
3 Failure to establish breastfeeding	3		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
3.1 Not exclusively breastfeeding at 41 weeks' corrected gestational age	1	663	Risk Ratio (M-H, Fixed, 95% CI)	0.98 [0.85, 1.13]
3.2 Not exclusively breastfeeding at discharge	1	279	Risk Ratio (M-H, Fixed, 95% CI)	0.41 [0.25, 0.68]
3.3 Not exclusively breastfeeding at 1 month follow-up	2	379	Risk Ratio (M-H, Fixed, 95% CI)	0.77 [0.49, 1.23]
3.4 Not exclusively breastfeeding at 6 months follow-up	1	146	Risk Ratio (M-H, Fixed, 95% CI)	1.01 [0.90, 1.13]
3.5 Not exclusively breastfeeding at 12 months' corrected age	1	589	Risk Ratio (M-H, Fixed, 95% CI)	0.99 [0.95, 1.03]
4 Re-admission to hospital	2		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only

4.1 At 41 weeks' corrected gestational age	1	663	Risk Ratio (M-H, Fixed, 95% CI)	0.69 [0.35, 1.35]
4.2 At 6 months follow-up	1	283	Risk Ratio (M-H, Fixed, 95% CI)	0.42 [0.14, 1.29]
5 Growth	2		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5.1 Weight at 41 weeks' corrected gestational age (g)	1	663	Mean Difference (IV, Fixed, 95% CI)	11.0 [-68.93, 90.93]
5.2 Length at 41 weeks' corrected gestational age (cm)	1	663	Mean Difference (IV, Fixed, 95% CI)	Not estimable
5.3 Head circumference at 41 weeks' corrected gestational age (cm)	1	663	Mean Difference (IV, Fixed, 95% CI)	0.10 [-0.14, 0.34]
5.4 Weight at discharge (g)	1	285	Mean Difference (IV, Fixed, 95% CI)	-3.0 [-58.80, 52.80]
5.5 Daily weight gain at discharge (g/day)	1	285	Mean Difference (IV, Fixed, 95% CI)	3.60 [0.78, 6.42]
5.6 Weight at 6 months' corrected age (g)	1	591	Mean Difference (IV, Fixed, 95% CI)	78.19 [-52.26, 208.64]
5.7 Length at 6 months' corrected age (cm)	1	590	Mean Difference (IV, Fixed, 95% CI)	0.23 [-0.18, 0.64]
5.8 Head circumference at 6 months' corrected age (cm)	1	592	Mean Difference (IV, Fixed, 95% CI)	0.34 [0.11, 0.57]
5.9 Weight at 12 months' corrected age (g)	1	596	Mean Difference (IV, Fixed, 95% CI)	31.46 [-135.08, 198.00]
5.10 Length at 12 months' corrected age (cm)	1	586	Mean Difference (IV, Fixed, 95% CI)	0.31 [-0.17, 0.79]
5.11 Head circumference at 12 months' corrected age (cm)	1	597	Mean Difference (IV, Fixed, 95% CI)	0.39 [-0.00, 0.78]
6 Parental dissatisfaction	1		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
6.1 Mother dissatisfied with method	1	269	Risk Ratio (M-H, Fixed, 95% CI)	0.41 [0.22, 0.75]
6.2 Father dissatisfied with method	1	269	Risk Ratio (M-H, Fixed, 95% CI)	0.92 [0.55, 1.52]
6.3 Family dissatisfied with method	1	269	Risk Ratio (M-H, Fixed, 95% CI)	1.08 [0.74, 1.56]
7 Mother's sense of competence according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	0.31 [0.13, 0.50]
7.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	0.41 [0.14, 0.68]
7.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	0.25 [-0.08, 0.58]
7.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	0.21 [-0.17, 0.59]
8 Mother's sense of competence according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	0.28 [0.11, 0.46]
8.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	0.54 [0.07, 1.01]
8.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	0.24 [0.05, 0.43]
9 Mother's feelings of worry and stress according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	0.11 [-0.06, 0.29]
9.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	0.31 [0.04, 0.58]
9.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	0.09 [-0.20, 0.38]
9.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	-0.29 [-0.70, 0.12]

10 Mother's feelings of worry and stress according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	0.09 [-0.08, 0.27]
10.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	-0.1 [-0.60, 0.40]
10.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	0.12 [-0.06, 0.30]
11 Mother's perception of social support according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	-0.16 [-0.33, 0.02]
11.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	-0.06 [-0.35, 0.23]
11.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	-0.06 [-0.34, 0.22]
11.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	-0.47 [-0.84, -0.10]
12 Mother's perception of social support according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	-0.18 [-0.35, -0.01]
12.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	-0.05 [-0.52, 0.42]
12.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	-0.2 [-0.39, -0.01]
13 Mother's sensitivity according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.00, 0.04]
13.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.02, 0.06]
13.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	-0.01 [-0.05, 0.03]
13.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	0.06 [0.01, 0.11]
14 Mother's sensitivity according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.00, 0.04]
14.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.04, 0.08]
14.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.00, 0.04]
15 Mother's response to child's distress according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	-0.00 [-0.03, 0.02]
15.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	-0.03 [-0.08, 0.02]
15.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.03, 0.05]
15.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.04, 0.06]
16 Mother's response to child's distress according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	-0.01 [-0.03, 0.02]
16.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	0.05 [-0.01, 0.11]
16.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	-0.02 [-0.05, 0.01]
17 Mother's response to child's socioemotional growth fostering according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.02, 0.04]
17.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.04, 0.06]
17.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	-0.02 [-0.06, 0.02]
17.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	0.05 [-0.00, 0.10]
18 Mother's response to child's socioemotional growth fostering according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.02, 0.04]
18.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	-0.05 [-0.12, 0.02]
18.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.01, 0.05]

19 Mother's response to child's cognitive growth fostering according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.02, 0.05]
19.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.04, 0.08]
19.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	-0.04 [-0.10, 0.02]
19.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	0.07 [0.00, 0.14]
20 Mother's response to child's cognitive growth fostering according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.02, 0.05]
20.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	-0.07 [-0.17, 0.03]
20.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	0.03 [-0.01, 0.07]
21 Infant's response to the mother (clarity of cues) according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.02, 0.04]
21.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.04, 0.06]
21.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.03, 0.07]
21.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	Not estimable
22 Infant's response to the mother (clarity of cues) according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	0.01 [-0.01, 0.04]
22.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	-0.01 [-0.07, 0.05]
22.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.01, 0.05]
23 Infant's response to the mother (responsiveness)according to infant stay in hospital	1	488	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.00, 0.04]
23.1 Infant stay of 1-2 days	1	170	Mean Difference (IV, Fixed, 95% CI)	-0.02 [-0.06, 0.02]
23.2 Infant stay of 3-14 days	1	177	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.02, 0.06]
23.3 Infant stay >14 days	1	141	Mean Difference (IV, Fixed, 95% CI)	0.05 [0.01, 0.09]
24 Infant's response to the mother (responsiveness)according to infant stay in NICU	1	488	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.01, 0.04]
24.1 Stay in NICU	1	82	Mean Difference (IV, Fixed, 95% CI)	-0.01 [-0.07, 0.05]
24.2 Not stay in NICU	1	406	Mean Difference (IV, Fixed, 95% CI)	0.02 [-0.01, 0.05]
25 Psychomotor development (Griffith quotients)at 12 months' corrected age - Locomotion	1	579	Mean Difference (IV, Fixed, 95% CI)	2.25 [-0.45, 4.95]
26 Psychomotor development (Griffith quotients)at 12 months' corrected age - Personal, social	1	579	Mean Difference (IV, Fixed, 95% CI)	0.97 [-1.27, 3.21]
27 Psychomotor development (Griffith quotients)at 12 months' corrected age - Hand-eye coordination	1	579	Mean Difference (IV, Fixed, 95% CI)	0.57 [-1.25, 2.39]
28 Psychomotor development (Griffith quotients)at 12 months' corrected age - Audition-language	1	579	Mean Difference (IV, Fixed, 95% CI)	1.29 [-0.98, 3.56]

29 Psychomotor development (Griffith quotients)at 12 months' corrected age - Execution	1	579	Mean Difference (IV, Fixed, 95% CI)	0.30 [-1.50, 2.10]
30 Psychomotor development (Griffith quotients)at 12 months' corrected age - All criteria	1	579	Mean Difference (IV, Fixed, 95% CI)	1.05 [-0.75, 2.85]

WHAT'S NEW

Last assessed as up-to-date: 10 February 2003.

26 September 2008	Amended	Converted to new review format.

HISTORY

Protocol first published: Issue 3, 1999

Review first published: Issue 4, 2000

11 February 2003	New search has been performed	This review updates the existing review "Kangaroo mother care to reduce morbidity and mortality in low birthweight infants", Conde-Agudelo A, Diaz-Rossello JL, Belizan JM initially published in The Cochrane Library, Issue 4, 2000. In an updated search to December 2002 five new studies were identified, but they did not meet the eligibility criteria for inclusion in this review. One study (Roberts 2000), classified as Awaiting Assessment in the existing review, was also found to be not eligible. This update incorporates data on psychomotor development at one year for the included study Charpak 1997. The conclusion remains unchanged: there is still insufficient evidence from randomized trials to recommend the routine use of KMC in LBW infants.

DECLARATIONS OF INTEREST

None known

SOURCES OF SUPPORT

Internal sources

- No sources of support supplied

External sources

- Pan American Health Organization, World Health Organization, Uruguay.

INDEX TERMS

Medical Subject Headings (MeSH)

*Infant, Low Birth Weight; *Infant Mortality; Infant, Newborn; Infant Care [*methods]; Length of Stay; Physical Stimulation [*methods]; Randomized Controlled Trials as Topic; Weight Gain

MeSH check words

Humans