External sources of support
Pan American Health Organization, World Health Organization, URUGUAY

What's new


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.

Dates

Date review re-formatted: / /
Date new studies sought but none found: 31/12/2002
Date new studies found but not yet included/excluded: / /
Date new studies found and included/excluded: / /
Date reviewers' conclusions section amended: / /
Date comment/criticism added: / /
Date response to comment/criticisms added: / /

Text of review

Synopsis

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.

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 & 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.

**Reviewers' 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.
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.

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 strategy 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.

Methods of the review

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.

(1) adequate  
(2) unclear  
(3) inadequate  
(4) 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:
(1) <3% of participants excluded  
(2) 3% to 9.9% of participants excluded  
(3) 10% to 19.9% of participants excluded  
(4) 20% or more of participants excluded

For blinding of outcome assessment:
(1) blind, the investigator in charge of outcome evaluation did not know the allocated treatment.  
(2) no blinding, the investigator in charge of outcome evaluation knew or was likely to guess the allocated treatment.  
(3) 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".

Description of 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 Ohej 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".

**Methodological quality of 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.

**Results**

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.

**Reviewers' 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**

Drs Nancy L. Sloan and Nathalie Charpak for unpublished data.

**Potential conflict of interest**

None known

**Characteristics of included studies**

<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
<th>Notes</th>
<th>Allocation concealment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattaneo 1998</td>
<td>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 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</td>
<td>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</td>
<td>Severe illness, hypothermia, hyperthermia, breast feeding, weight gain, neonatal death, acceptability to health workers, acceptability to mothers, and costs.</td>
<td></td>
<td>B</td>
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</table>
| Charpak 1997 | 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 | 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 evidence of neurologic impairment or proof of intrauterine infection and excluded from | 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 | 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 | 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.

| **Charpak 1997** | **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** | **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 evidence of neurologic impairment or proof of intrauterine infection and excluded from** | **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** | **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** | **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.**

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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. 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. Trials 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.

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

Trials stopped early because a highly significant difference (p<0.005 at 6 months) in severe morbidity arose. No information about whether this was a
**Characteristics of excluded studies**

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
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<tbody>
<tr>
<td>Arandia 1993</td>
<td>Non-randomized trial</td>
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<tr>
<td>Bergman 1994</td>
<td>Non-randomized trial</td>
</tr>
<tr>
<td>Charpak 1994</td>
<td>Non-randomized trial</td>
</tr>
<tr>
<td>Chwo 2002</td>
<td>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.</td>
</tr>
<tr>
<td>Dala Sierra 1994</td>
<td>Non-randomized trial</td>
</tr>
<tr>
<td>Feldman 2002</td>
<td>Non-randomized trial</td>
</tr>
<tr>
<td>Kambarami 1998</td>
<td>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.</td>
</tr>
<tr>
<td>Legault 1995</td>
<td>Non-randomized trial</td>
</tr>
<tr>
<td>Ohgi 2002</td>
<td>Non-randomized trial</td>
</tr>
<tr>
<td>Ramanathan 2001</td>
<td>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 had 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.</td>
</tr>
<tr>
<td>Roberts 2000</td>
<td>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.</td>
</tr>
</tbody>
</table>
References to studies

References to included studies

Cattaneo 1998 \{published data only\}


Charpak 1997 \{published data only\}


Sloan 1994 \{published and unpublished data\}


References to excluded studies

Arandia 1993 \{published data only\}


Bergman 1994 \{published data only\}


Charpak 1994 \{published data only\}


Chwo 2002 \{published data only\}

Chwo MJ, Anderson GC, Good M, Dowling DA, Shiau SH, Chu DM. A randomized controlled trial...

**Dala Sierra 1994** {published data only}


**Feldman 2002** {published data only}


**Kambarami 1998** {published data only}


**Legault 1995** {published data only}


**Ohgi 2002** {published data only}


**Ramanathan 2001** {published data only}


**Roberts 2000** {published data only}


* indicates the primary reference for the study

**Other references**

**Additional references**

**Barker 1995**


**Charpak 1996**

Guyer 1998


Rey 1983


WHO 1996


WHO 1998


Other published versions of this review

Conde-Agudelo 2000


Comparisons and data

01 Kangaroo mother care versus conventional neonatal care
  01.01 Mortality
  01.02 Infection / Illness
  01.03 Failure to establish breastfeeding
  01.04 Re-admission to hospital
  01.05 Growth
  01.06 Parental dissatisfaction
  01.07 Mother's sense of competence according to infant stay in hospital
  01.08 Mother's sense of competence according to infant stay in NICU
  01.09 Mother's feelings of worry and stress according to infant stay in hospital
  01.10 Mother's feelings of worry and stress according to infant stay in NICU
  01.11 Mother's perception of social support according to infant stay in hospital
  01.12 Mother's perception of social support according to infant stay in NICU
  01.13 Mother's sensitivity according to infant stay in hospital
  01.14 Mother's sensitivity according to infant stay in NICU
  01.15 Mother's response to child's distress according to infant stay in hospital
  01.16 Mother's response to child's distress according to infant stay in NICU
  01.17 Mother's response to child's socioemotional growth fostering according to infant stay in hospital
  01.18 Mother's response to child's socioemotional growth fostering according to infant stay in NICU
  01.19 Mother's response to child's cognitive growth fostering according to infant stay in hospital
### Comparison or outcome

<table>
<thead>
<tr>
<th>Studies</th>
<th>Participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Mother's response to child's cognitive growth fostering according to infant stay in NICU</td>
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### Studies Participants Statistical method Effect size

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**Notes**

**Published notes**

**Amended sections**

None selected.