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Review Article

Effectiveness of kangaroo mother care for low-birth-weight infants during neonatal care and evidence supporting continuity of care after NICU discharge: A systematic review

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Abstract

Background: The benefits of Kangaroo Mother Care (KMC) for low-birth-weight (LBW) infants have been widely reported during hospitalization; however, the continuation of KMC after discharge from the Neonatal Intensive Care Unit (NICU) remains unclear.
Objective: To synthesize evidence from primary studies on the effectiveness of KMC among LBW infants in neonatal units and assess the extent to which this evidence supports continuity of KMC after discharge.
Methods: Eligible studies included randomized controlled trials (RCTs), secondary analyses of RCTs, and quasi-experimental studies involving LBW (<2,500 g) and/or preterm infants in neonatal units who received KMC or skin-to-skin contact (SSC), published in English or Indonesian between 2020 and July 2026. ClinicalKey for Nursing, ScienceDirect, ProQuest, and SAGE Journals were searched. Risk of bias was appraised using the JBI Critical Appraisal Checklists; findings were synthesized narratively following SWiM, and certainty of evidence was assessed using GRADE.
Results: Of 953 records, five primary studies (two RCTs, one secondary analysis of an RCT, and two single-group quasi-experimental studies; 435 infants) were included. Four studies evaluated KMC/SSC during hospitalization, and one evaluated a transitional developmental intervention package in which both groups received KMC; none evaluated KMC at home. Early SSC did not reduce hypothermia (4% vs. 7%; p = 0.68) but reduced hyperthermia (26% vs. 47%; p = 0.02). SSC immediately after birth reduced maternal depressive symptoms and paternal anxiety during the first week, but these effects did not persist at 3–4 or 12 months. Physiological and growth changes in single-group studies and improvements in cognitive scores with a transitional intervention package could not be attributed to KMC.
Conclusion: The certainty of evidence was low to very low. KMC/SSC appeared safe and was associated with physiological stability during neonatal care, but its effectiveness after discharge remains undetermined. Standardized studies of home-based KMC are needed.

Background

Low birth weight (LBW), defined as a birth weight below 2,500 g, remains a major global neonatal health concern. Data from UNICEF and the World Health Organization (WHO) indicate that approximately 19.8 million infants (14.7%) worldwide were born with LBW in 2020 (UNICEF, 2023; WHO, 2023). LBW may result from preterm birth, intrauterine growth restriction, or both. It increases the risks of hypothermia, respiratory disorders, infection, impaired growth and development, and neonatal death, with mortality risk approximately 20 times higher than among infants with normal birth weight (WHO, 2023). Some LBW infants require care in a Neonatal Intensive Care Unit (NICU) for thermoregulatory, nutritional, and respiratory support and monitoring for complications.

Nevertheless, discharge from the NICU does not mean that all risks have been resolved. At home, LBW infants face challenges that differ from those encountered during hospitalization: (a) physiological instability, particularly impaired thermoregulation; (b) nutritional difficulties and challenges in sustaining breastfeeding; (c) caregiver readiness and confidence in infant care and recognition of danger signs; and (d) morbidity and hospital readmission (Deswasni et al 2025; Amalia & Siahaan, 2025; Chandra, 2026). Improvements achieved during hospitalization do not necessarily persist after discharge, as parents transition from relying on healthcare professionals and NICU equipment to becoming their infant's primary caregivers (Agustina & Angela, 2024; Wihyawati et al, 2025).

Continuity of care is therefore required to link NICU care with family-based care at home. To make this concept assessable, it is operationalized

into six components: discharge preparation, caregiver competency assessment, continuation of KMC at home, post-discharge monitoring, referral mechanisms, and follow-up communication. This framework was developed by the authors as an analytical framework and has not been formally validated. The review addresses a practical question relevant to service delivery: can the benefits achieved during hospital care be sustained after discharge?

One intervention that may help bridge this continuum is Kangaroo Mother Care (KMC), which involves early, continuous, and prolonged skin-to-skin contact between a preterm or LBW infant and the mother or another caregiver, accompanied by exclusive breastfeeding or breastfeeding to the greatest extent possible. WHO recommends KMC as routine care for preterm or LBW infants. It may be initiated in healthcare facilities or at home and provided for 8–24 hours per day, or for as long as possible (WHO, 2023). The terms Kangaroo Mother Care, kangaroo care, and skin-to-skin contact (SSC) are frequently used interchangeably in the literature, although they may differ in duration, timing of initiation, breastfeeding support, and continuity of care. This review distinguishes comprehensive KMC, intermittent KMC, and brief or early SSC to avoid interpreting the benefits of brief SSC as evidence for sustained KMC. Several reviews have reported benefits of KMC, primarily during hospitalization. Anjani et al. (2024) reported that KMC helps increase body temperature and stabilize respiratory rate, heart rate, and oxygen saturation. In a meta-analysis of 31 RCTs involving 8,561 preterm and/or LBW infants, Li et al. (2026) reported that KMC during hospitalization reduced mortality and length of stay, improved gains in body weight, length, and head circumference, and reduced the risks of hypothermia, apnea, sepsis, and necrotizing enterocolitis. Oleti and Murki (2022) reviewed evidence linking KMC initiated immediately after birth with survival of LBW infants up to 28 days of age. From the parental perspective, Pathak et al. (2023), in a systematic review and meta-analysis of 30 studies involving 7,719 preterm or LBW infants, reported that KMC reduced the risk of moderate-to-severe postpartum depressive symptoms, maternal stress, and anxiety while improving mother–infant bonding. These findings are derived from secondary reviews and are presented as background, not as findings of the present review.

However, previous findings have not been entirely consistent. García-Valdivieso et al. (2023) found that nonpharmacological interventions, including KMC, did not significantly reduce neonatal pain as assessed by heart rate, Premature Infant Pain Profile scores, and oxygen saturation, although trends toward lower pain scores and faster stabilization of vital signs were observed. Oleti and Murki (2022) also noted that the mortality benefit of KMC was not uniform across study settings. This variation may reflect infant characteristics and clinical stability, the timing of KMC initiation, duration of skin-to-skin contact, caregiver involvement, the type of comparator care, and the timing of outcome assessments. Moreover, some studies used only short observation periods and therefore could not establish whether benefits were sustained after discharge. A gap also exists between efficacy and implementation. Lawal et al. (2023) reported that KMC coverage among LBW infants across 34 low- and middle-income countries ranged from 11.04% to 84.36%, influenced by place and mode of delivery, breastfeeding initiation, antenatal visits, maternal education, access to information, and social and geographical conditions. After discharge, continued KMC may be affected by parental readiness, family support, access to healthcare professionals, availability of follow-up services, and knowledge of danger signs. Thus, the benefits of KMC depend not only on clinical efficacy but also on the capacity of families and healthcare systems to sustain it at home.

Although KMC has been extensively studied, most previous research has focused on KMC initiated immediately after birth or provided during hospitalization. Moore et al. (2025) examined early skin-to-skin contact among healthy newborns, whereas Li et al. (2026) focused on the efficacy and safety of KMC during hospitalization. Other reviews have emphasized physiological responses (Anjani et al., 2024), parental psychological health (Pathak et al., 2023), neonatal pain (García-Valdivieso et al., 2023), or factors affecting KMC implementation (Lawal et al., 2023). The research gap addressed here is the lack of a synthesis of primary studies explicitly mapping evidence on KMC as a continuum of care from the NICU to the home. This review differs in five respects: (1) population, focusing on LBW infants in neonatal units with consideration of gestational age and birth-weight strata; (2) care setting, distinguishing hospital-based, transitional, and home-based KMC; (3) intervention timing and intensity, distinguishing early SSC, intermittent KMC, and comprehensive KMC; (4) post-discharge outcomes, including caregiver readiness, home KMC practices, growth, breastfeeding, readmission, and morbidity; and

(5) follow-up duration (≤3 months, 3–<12 months, and ≥12 months).

This review aims to synthesize evidence from primary studies on the effectiveness of KMC among LBW infants in neonatal units and to evaluate the extent to which this evidence supports continuity of KMC after NICU discharge. The specific objectives are to: (1) map studies by KMC setting (hospital, transitional, and home); (2) synthesize the effects of KMC/SSC during hospitalization on physiological outcomes, growth, breastfeeding, and parental psychological health; (3) determine whether evidence is available on transitional and home-based KMC and their post-discharge outcomes; and (4) assess certainty of evidence and formulate implications for practice and research. The principal finding is that evidence from eligible primary studies is largely restricted to hospitalization, with no study evaluating home-based KMC.

Methods

Study Design

This systematic review was conducted to identify, appraise, and synthesize scientific evidence regarding the effectiveness of Kangaroo Mother Care (KMC) on outcomes among low-birth-weight (LBW) infants during care in a Neonatal Intensive Care Unit (NICU) and, where available, after discharge. The review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. Search strategy reporting followed PRISMA-S (Rethlefsen et al., 2021), synthesis without meta-analysis followed SWiM (Campbell et al., 2020), intervention descriptions were guided by TIDieR (Hoffmann et al., 2014), and certainty of evidence was assessed using GRADE (Guyatt et al., 2008). The review was limited to studies published between January 2020 and July 2026.

Research Question

The research question was developed using the PICO framework. Because interventions delivered during NICU care and after discharge occur in different clinical settings, the framework was specified separately for three contexts: hospital-based KMC, transitional KMC, and home-based KMC. In all three contexts, the population comprised LBW infants with a birth weight below 2,500 g, including preterm infants, who were receiving care in a NICU or neonatal unit (hospital context), preparing for or having undergone discharge (transitional context), or living at home after discharge (home context). The interventions included KMC or skin-to-skin contact (SSC) provided during NICU care, initiated in the NICU and continued at home with transitional components such as education, competency assessment, and home visits, or provided at home. Comparators included conventional care, incubator care, standard neonatal services, no KMC, KMC of different durations, standard discharge and follow-up, or usual home care. Pre-intervention measurements were considered a weak comparator because they lacked a control group.

Secondary outcomes in the hospital context included physiological stability, growth, breastfeeding, mortality, infection, length of stay, and parental psychological health, assessed up to discharge or 28 days of age. Primary outcomes in the transitional context were caregiver competency and KMC practices at home, whereas primary outcomes in the home context included KMC duration and adherence, breastfeeding, growth, readmission, and morbidity. Secondary outcomes in the latter two contexts included neurodevelopment, sleep regulation, and mother–infant bonding. Outcomes in these two contexts were evaluated at ≤3 months, 3–<12 months, and ≥12 months after discharge. Based on this framework, the research question was: 'To what extent do eligible primary studies support the effectiveness of Kangaroo Mother Care compared with conventional care in improving outcomes among LBW infants in neonatal units, and is there evidence that KMC continued after NICU discharge is effective?'

Inclusion and Exclusion Criteria

The inclusion criteria comprised primary research articles involving infants with a birth weight below 2,500 g, including preterm infants with a birth weight below 2,500 g, who were cared for in a NICU, neonatal unit, or perinatology ward. The intervention had to involve KMC, kangaroo care, or skin-to-skin contact during hospitalization and/or after discharge. Studies were required to report at least one relevant outcome, such as mortality, morbidity, body temperature, respiratory rate, heart rate, oxygen saturation, weight gain, growth, breastfeeding, infection, length of stay, readmission, neurodevelopment, sleep regulation,

or mother–infant bonding. Eligible designs were randomized controlled trials (RCTs), secondary analyses of RCTs that preserved randomized comparisons, and quasi-experimental studies. Single-group pretest–posttest studies were included to map all available primary evidence but were regarded as providing the lowest certainty of evidence and were not used to support causal conclusions. Studies published in English or Indonesian between January 2020 and July 2026 were eligible.

Exclusion criteria included studies involving term infants with normal birth weight and no history of intensive neonatal care, as well as preterm infants weighing 2,500 g or more at birth, because they differ physiologically from LBW infants and fall outside the focus of this review. Studies of preterm infants without a specified birth-weight threshold were included only if the reported mean or range of birth weight was below 2,500 g. Studies that did not deliver KMC or skin-to-skin contact or did not report relevant outcomes were also excluded. Systematic reviews, meta-analyses, scoping reviews, narrative reviews, cohort studies, cross-sectional studies, qualitative studies, case reports, case series, protocols, editorials, letters to the editor, conference abstracts, undergraduate theses, master's theses, and doctoral dissertations were excluded. Full-text availability was not an eligibility criterion; reports that could not be retrieved were documented, rather than classified as excluded on that basis. Each intervention was categorized from the full-text description as comprehensive KMC, intermittent KMC, brief or early SSC, or a multicomponent intervention package. When descriptions were insufficient, studies were conservatively categorized as SSC to avoid treating evidence of brief SSC as evidence of sustained KMC.

Search Strategy

The literature search covered four electronic databases—ClinicalKey for Nursing, ScienceDirect, ProQuest, and SAGE Journals—for articles published between January 2020 and July 2026. The search strategy incorporated three principal concepts: KMC, LBW or preterm infants, and care during and after NICU hospitalization. Synonyms within each concept were combined using the Boolean operator OR, while concept groups were combined using AND.

The search string was: ("Kangaroo Mother Care" OR "Kangaroo Care" OR "skin-to-skin contact") AND ("low birth weight" OR "preterm infant" OR "premature infant") AND (NICU OR hospitalization OR discharge OR "post-discharge" OR "home care" OR follow-up). The search string was adapted to the search syntax of each database. Filters included publication years 2020–2026, human studies, and journal articles. Additional searches involved screening the reference lists of eligible articles to identify other relevant studies.

Study Selection Process

Study selection followed the PRISMA 2020 stages of identification, screening, eligibility assessment, and inclusion. The initial search yielded 953 records: 257 from ClinicalKey for Nursing, 312 from ScienceDirect, 212 from ProQuest, and 172 from SAGE Journals. A total of 542 records were removed before screening because they were duplicates, were marked as ineligible by automated tools, or met other removal criteria, leaving 411 records. The titles and abstracts of these 411 records were screened, and 369 were excluded because the population, intervention, design, or outcomes did not meet the criteria. Full texts were sought for 42 reports, but 30 could not be retrieved. Consequently, 12 reports underwent full eligibility assessment. Following full-text assessment, seven reports were excluded; the reasons were described as four reports, including one cohort study and two systematic reviews/meta-analyses, leaving five studies included in the systematic review. Two reviewers performed selection independently, and discrepancies were resolved through discussion until consensus was reached.

Quality Appraisal

The methodological quality of included articles was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists appropriate to each study design. RCTs and secondary analyses of RCTs were assessed using the JBI Critical Appraisal Checklist for Randomized Controlled Trials (Barker et al., 2023), while quasi-experimental studies were assessed using the JBI Critical Appraisal Checklist for Quasi-Experimental Studies (Tufanaru et al., 2020). Appraisal of RCTs covered randomization methods, allocation concealment, baseline comparability, blinding, similarity of treatment aside from the intervention, completeness of follow-up,

consistency of outcome measurement, and appropriateness of statistical analysis. Appraisal of quasi-experimental studies examined the clarity of cause-and-effect relationships, group comparability, presence of a comparison group, pre-intervention and post-intervention assessments, completeness of follow-up, measurement reliability, and appropriateness of statistical analysis. Each item was rated yes, no, unclear, or not applicable. Two reviewers assessed studies independently and resolved differences through discussion. Quality appraisal findings were not used to exclude studies but informed interpretation of individual findings and downgrading of certainty in the GRADE assessment.

Data Extraction and Synthesis

Data from eligible articles were extracted using a structured form by two independent reviewers; the form was pilot-tested. Extracted study characteristics included author, publication year, country, study objective, design, setting, population characteristics, sample size, sampling method, gestational age, birth weight, and infant clinical condition. Intervention data included timing of KMC initiation, duration per session, frequency, overall intervention period, location, KMC provider, breastfeeding support, post-discharge continuation, adherence monitoring, co-interventions, comparator type, data collection instruments, and follow-up period. Extracted outcomes included mortality, morbidity, physiological stability, growth, breastfeeding, infection, length of stay, readmission, neurodevelopment, sleep regulation, and mother–infant bonding. Means, proportions, effect sizes, confidence intervals, and p-values were also recorded where available.

Data were synthesized narratively because of variation in participant characteristics, the type and duration of KMC, timing of intervention initiation, comparators, follow-up periods, and reported outcomes. Meta-analysis was not performed because heterogeneity was substantial and very few studies reported each outcome. Studies were grouped as KMC during NICU care, KMC initiated in the NICU and continued after discharge, and KMC delivered at home, with studies assessing KMC directly distinguished from multicomponent intervention packages. Findings were further organized by outcome type and follow-up period. The direction and magnitude of KMC effects were compared across studies with consideration of study design, sample size, intervention characteristics, follow-up duration, and methodological quality. Effect estimates were reported as presented in the primary studies, and heterogeneity was explored qualitatively according to gestational age, birth weight, KMC dose, comparator, and design. Certainty of evidence was assessed for each outcome using GRADE principles; reporting bias could not be formally assessed because fewer than 10 studies were available. Systematic reviews and cohort studies excluded from the primary synthesis were not combined with primary-study findings and were discussed only as contextual evidence.

Results

This systematic review was conducted to identify, appraise, and synthesize scientific evidence regarding the effectiveness of Kangaroo Mother Care (KMC) on outcomes among low-birth-weight (LBW) infants during care in a Neonatal Intensive Care Unit (NICU) and, where available, after discharge.

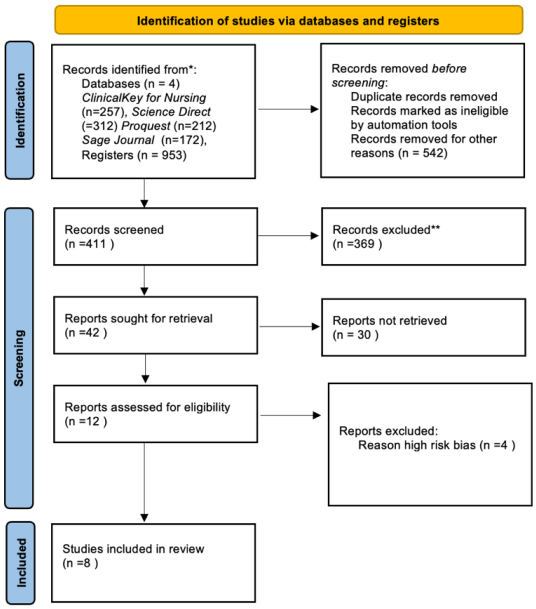


Figure 1. PRISMA Flow Instagram

The five included studies were published between 2023 and 2025 and were conducted in Pakistan, Indonesia, Norway, Sweden–Norway, and Brazil (Mateen et al., 2023; Kristoffersen et al., 2023; Silveira et al., 2024; Lilliesköld et al., 2025; Muliani et al., 2025). Across these studies, the reported enrollment totaled 435 infants, although the

number of participants contributing to individual outcomes varied.

Considerable variation was observed in study populations, intervention characteristics, comparators, and follow-up durations. The studies involved low-birth-weight or preterm infants receiving neonatal care, including very preterm and very-low-birth-weight infants. Interventions ranged from brief skin-to-skin contact immediately after birth to structured Kangaroo Mother Care (KMC) sessions and multicomponent developmental interventions.

Four studies evaluated KMC or skin-to-skin contact (SSC) initiated during hospitalization. Mateen et al. (2023) investigated physiological changes following a three-hour KMC session among 60 low-birth-weight infants, whereas Muliani et al. (2025) assessed a KMC backpack intervention administered for four hours daily over four days among 38 infants.

Kristoffersen et al. (2023) compared immediate SSC with conventional incubator care among 108 very preterm infants, while Lilliesköld et al. (2025) examined parental psychological outcomes following immediate SSC initiated at birth among 91 infants.

The remaining study, conducted by Silveira et al. (2024), evaluated a parent-guided developmental intervention initiated during NICU hospitalization and continued after discharge. Although KMC formed part of routine care, it was provided to both intervention and control groups. Therefore, the observed between-group differences represented the additional effects of the developmental intervention package rather than the independent effects of KMC.

The characteristics of the included studies are summarized in Table 1.

Table 1. Characteristics and Key Findings of the Included Studies

Author (Year), Country	Study Design and Sample	Intervention / Exposure	Key Findings
Mateen et al. (2023), Pakistan	Quasi-experimental; 60 LBW infants	KMC for 3 hours; pre–post assessment	Increased temperature (35.9–37.0°C), heart rate (135.7–142.8 bpm), and SpO_2 (87.1–95.4%; all $p<0.001$). Respiratory rate was not significantly changed ($p=0.17$).
Muliani et al. (2025), Indonesia	Quasi-experimental; 38 LBW infants	KMC Backpack, 4 h/day for 4 days	Improved weight gain ($p=0.011$), body length ($p=0.049$), breastfeeding ($p=0.013$), and physiological parameters ($p<0.001$).
Kristoffersen et al. (2023), Norway	RCT; 108 very preterm infants	Immediate SSC/KMC (up to 2 h) vs. incubator care	Hyperthermia was lower in the SSC group (26% vs. 47%; $p=0.02$). No significant differences were found in hypothermia, heart rate, respiratory rate, or oxygen saturation.
Lilliesköld et al. (2025), Sweden–Norway	Secondary analysis of RCT; 91 infants	Immediate SSC for 6 h vs. incubator care	Reduced maternal depressive symptoms and paternal anxiety in the early period; no sustained effects at 3–12 months.
Silveira et al. (2024), Brazil	RCT; 138 randomized, 100 assessed	KMC in both groups; intervention group also received developmental stimulation	Higher cognitive scores at 18 months in the intervention group (101.8 vs. 97.3; mean difference 4.5, 95% CI 0.1–8.9). Effects could not be attributed to KMC alone.
Cristóbal Cañadas et al. (2022), Spain	Prospective cohort; 112 preterm infants	KMC >90 vs. <90 min/day for 12 days	Longer KMC duration was associated with lower infant cortisol ($p=0.02$), lower maternal cortisol ($p=0.002$), improved weight gain, and lower maternal depressive symptoms.
Sivanandan and Sankar (2023)	Systematic review and meta-analysis; 31 RCTs, 15,559 preterm/LBW infants	KMC vs. conventional care; early vs. late initiation	KMC reduced mortality (RR 0.68; 95% CI 0.53–0.86) and severe infection (RR 0.85; 95% CI 0.79–

Author (Year), Country	Study Design and Sample	Intervention / Exposure	Key Findings
			0.92). Early initiation within 24 h showed greater benefit.
Narciso et al. (2022)	Systematic review and meta-analysis; 12 RCTs	KMC vs. conventional care	KMC reduced length of hospital stay (MD −1.75 days; 95% CI −3.22 to −0.28).

Thermoregulation and Physiological Stability

Three studies reported physiological outcomes associated with KMC or SSC during neonatal hospitalization (Mateen et al., 2023; Kristoffersen et al., 2023; Muliani et al., 2025).

In the randomized trial involving 108 very preterm infants, Kristoffersen et al. (2023) found no statistically significant difference in hypothermia between the immediate SSC and conventional incubator-care groups (4% vs. 7%; odds ratio [OR] = 0.50; 95% confidence interval [CI]: 0.10–3.10; p = 0.68). However, the incidence of hyperthermia was significantly lower among infants receiving immediate SSC compared with conventional care (26% vs. 47%; OR = 0.40; 95% CI: 0.20–0.90; p = 0.02). No significant between-group differences were observed in heart rate, respiratory rate, or oxygen saturation during the first 24 hours.

In contrast, Mateen et al. (2023) reported statistically significant within-group physiological changes following three hours of KMC among 60 low-birth-weight infants. Mean body temperature increased from 35.9°C to 37.0°C, mean heart rate increased from 135.7 to 142.8 beats/minute, and oxygen saturation increased from 87.1% to 95.4% (all p < 0.001). Respiratory rate did not change significantly (p = 0.17). Muliani et al. (2025) also reported statistically significant changes in physiological parameters following the KMC backpack intervention (p < 0.001).

Nevertheless, the physiological changes reported in the two uncontrolled studies represented within-group observations rather than comparative estimates of intervention effectiveness. These findings could not establish whether the observed changes were attributable to KMC or to concurrent neonatal stabilization and routine clinical care. Taken together, the available evidence indicated that immediate SSC was associated with a lower incidence of hyperthermia in one randomized comparison, while significant improvements in other physiological parameters were not consistently demonstrated in controlled studies.

Growth and Breastfeeding Outcomes

Growth and breastfeeding outcomes were reported in one included primary study (Muliani et al., 2025). In this single-group quasi-experimental study involving 38 low-birth-weight infants, KMC administered through a backpack carrier for four hours daily was associated with statistically significant within-group changes in body weight (p = 0.011), body length (p = 0.049), and breastfeeding-related measurements (p = 0.013) over the intervention period.

The study reported an average increase in body weight of approximately 15 g/day and an increase in body length of at least 0.2 cm/day. Although these findings indicated favorable short-term changes, the absence of a control group prevented differentiation between changes associated with KMC and those resulting from expected postnatal growth, nutritional intake, or other clinical factors.

Furthermore, the short intervention period did not permit evaluation of sustained growth trajectories, longer-term nutritional status, or subsequent stunting outcomes. No included controlled study directly compared KMC with conventional care for longer-term growth or breastfeeding outcomes following NICU discharge.

Parental Psychological Outcomes

Parental psychological outcomes were examined in the secondary analysis of a randomized clinical trial conducted by Lilliesköld et al. (2025). The study evaluated immediate SSC following very preterm birth and assessed maternal and paternal symptoms of depression and anxiety during the first year after birth. Compared with conventional incubator care, immediate SSC was associated with significantly lower maternal depressive symptoms and paternal anxiety during the first week after birth. Reductions in paternal depressive and anxiety symptoms were also reported at term-equivalent age.

However, the early psychological benefits were not consistently maintained at subsequent assessments conducted at 3–4 months and 12 months. These findings suggested that the psychological associations of early SSC varied according to the assessment period. The evidence supported short-term improvements in selected parental psychological outcomes but did not demonstrate sustained benefits throughout the first postpartum year.

Importantly, the study evaluated the effects of SSC initiated immediately after birth rather than the effects of continued KMC practice following discharge.

Transitional Care and Neurodevelopmental Outcomes

One randomized trial evaluated an intervention extending from neonatal hospitalization into the post-discharge period (Silveira et al., 2024). This study enrolled 138 infants, of whom 100 completed the study protocol and contributed to the primary developmental outcome assessment at 18 months of corrected age. The intervention incorporated parent-guided developmental activities, including sensory and motor stimulation, parental education, and continued support following hospital discharge. Both intervention and control groups received standard neonatal care that included KMC.

At 18 months of corrected age, infants receiving the enhanced developmental intervention demonstrated significantly higher mean cognitive scores than those receiving usual care (101.8 vs. 97.3). The between-group mean difference was 4.5 points (95% CI: 0.1–8.9). Although the findings demonstrated improved cognitive performance following the multicomponent developmental intervention, the independent contribution of KMC could not be determined because KMC was provided in both groups.

Therefore, this study contributed evidence regarding the effectiveness of an enhanced transitional developmental care package rather than the effectiveness of continued KMC after discharge.

Discussion

This review found that evidence from eligible primary studies was limited to five small- to medium-sized studies. Four studies evaluated KMC or SSC during hospitalization, and one assessed a transitional developmental intervention package. The most consistent findings concerned the safety and feasibility of early SSC and short-term stability of physiological parameters, whereas psychological benefits for parents emerged early but were not sustained. Most importantly, no primary study evaluated KMC continued at home. Thus, the central question of KMC effectiveness as part of post-discharge continuity of care cannot yet be answered by the available evidence. The absence of such evidence does not mean that home-based KMC is ineffective; rather, it identifies a research gap.

In the RCT by Kristoffersen et al. (2023), the incidence of hypothermia did not differ significantly between the SSC and incubator-care groups (4% vs. 7%; p = 0.68), whereas hyperthermia was less frequent in the SSC group (26% vs. 47%; p = 0.02). These findings do not support a claim that early SSC prevents hypothermia; rather, they support its thermal safety and suggest that it may reduce hyperthermia compared with incubator care during transfer. This interpretation is based on a single open-label RCT with low-certainty evidence.

An increase in oxygen saturation from 87.1% to 95.4% after three hours of KMC (Mateen et al., 2023) appears clinically meaningful but must be interpreted cautiously. The single-group pretest–posttest design had no comparator, so the observed changes cannot be distinguished from the effects of time, natural clinical stabilization, regression to the mean, or concurrent treatments such as supplemental oxygen and external warming. The baseline temperature of 35.9°C was below the WHO normothermic range (36.5–37.5°C), and the initial oxygen saturation of 87.1% indicated baseline instability. Meanwhile, the increase in heart rate (from 135.7 to 142.8 beats/minute) suggests that not all changes necessarily indicated improvement. Baseline clinical condition, respiratory support, and measurement timing were not described in detail. These findings should therefore be regarded as a description of physiological responses during one session rather than evidence of effectiveness.

As supporting observational evidence outside the primary synthesis, the cohort study by Cristóbal

Cañadas et al. (2022) found no significant differences in other physiological parameters between infants receiving more than versus less than 90 minutes of KMC per day. The systematic review by Solaz-García et al. (2022) reported stable heart rate, peripheral oxygen saturation, and tissue oxygen extraction during skin-to-skin contact. Physiological stability is an important clinical outcome in preterm infants; thus, the absence of statistically significant improvement does not necessarily indicate intervention failure. KMC is better understood as an intervention that supports physiological regulation rather than one that invariably improves every vital sign.

Only one single-group primary study (Muliani et al., 2025) reported growth and breastfeeding outcomes. Because it lacked a comparator and follow-up lasted only four days, increases in body weight and length could not be separated from natural growth, postnatal age, nutritional intake, and comorbidities. The cohort study by Cristóbal Cañadas et al. (2022) reported an association between more than 90 minutes of KMC per day and greater weight gain with reduced need for parenteral nutrition. Because exposure was determined by actual practice rather than random allocation, this relationship may have been confounded; for example, clinically more stable infants may have received KMC more frequently. A systematic review by Bueno-Pérez et al. (2025; nine studies) reported positive effects of KMC on weight gain among preterm infants, particularly when combined with breastfeeding and kinesthetic stimulation. Skin-to-skin contact may plausibly reduce energy expenditure for thermogenesis and increase breastfeeding opportunities, but these mechanisms were not measured directly in the synthesized studies.

Lilliesköld et al. (2025) showed that SSC immediately after birth reduced maternal depressive symptoms and paternal anxiety during the first week, but these benefits were not maintained at assessments conducted at 3–4 and 12 months. The cohort study by Cristóbal Cañadas et al. (2022) reported an association between more than 90 minutes of KMC per day and lower maternal cortisol levels and depressive symptoms, while the review by Pathak et al. (2023) reported similar findings at the synthesis level. The loss of benefits during follow-up suggests that early contact alone may be insufficient to sustain parental psychological well-being and that post-discharge psychosocial support should be planned as part of continuity of care. Skin-to-skin contact beginning at birth may also provide a physiological and emotional foundation for parent–infant interactions at later developmental stages (Lilliesköld et al., 2025). The proposed need for post-discharge support is an interpretation consistent with the data, not a directly tested finding.

Silveira et al. (2024) reported higher cognitive scores at 18 months of corrected age following an intervention package initiated in the NICU and continued through home visits. Because KMC was provided to both groups, the observed effect reflected a combination of sensory and motor stimulation, parental education and support, and ongoing monitoring rather than KMC alone. Accordingly, this study is better interpreted as an illustration of the feasibility and potential of home-visit-based transitional programs within a family-centered care framework, rather than evidence of post-discharge KMC effectiveness. The observational study by Travis et al. (2025), which linked the duration and frequency of skin-to-skin contact with white matter microstructure in very preterm infants, was also correlational and does not support causal inference.

The biological benefits of KMC may be explained by thermal, physiological, nutritional, and neuroendocrine interactions between caregiver and infant. Skin-to-skin contact facilitates heat transfer, thereby reducing heat loss and energy expenditure for thermogenesis (Mateen et al., 2023). Positioning the infant on the mother's chest may support respiratory patterns and opportunities for breastfeeding that promote growth (Muliani et al., 2025). KMC has also been associated with reduced stress responses, as indicated by lower infant and maternal cortisol levels (Cristóbal Cañadas et al., 2022; a cohort study excluded from the primary synthesis). Tactile stimulation is thought to contribute to autonomic regulation and oxytocin release, promoting calmness, milk production, and parent–infant bonding. Because only a small proportion of studies directly measured these mechanisms, these explanations remain inferential (Priscilla et al 2026; Rahmawati et al 2026).

Implications for Continuity of Care

When mapped onto the six-component framework, none of the components was tested directly by the synthesized studies. Discharge preparation and caregiver competency assessment were not measured; continuation of KMC at home was not evaluated; post-discharge monitoring and follow-up communication were reflected only indirectly in the home-visit package described by Silveira et al. (2024); and referral mechanisms were not reported. Determinants of sustained care, such as parental readiness, family support, access to services, and recognition of danger signs, were available only as contextual evidence (Lawal et al., 2023; Cai et al., 2022). Thus, the practical recommendations in Section 6 are proposed implementation strategies aligned with guidelines and the conceptual framework, rather than conclusions directly tested in the primary studies included in this review.

Strengths and Limitations

Strengths. This review distinguishes three KMC contexts and three levels of intervention, separates primary from contextual evidence, distinguishes the effects of KMC from those of multicomponent packages, explicitly identifies the absence of post-discharge evidence, and transparently reports methodological adjustments.

Implications for Future Research

RCTs or controlled quasi-experimental studies are needed to compare home-based KMC directly with usual home care among LBW infants after NICU discharge. Such studies should use standardized protocols specifying initiation, target daily duration, breastfeeding support, and caregiver training, as well as objective adherence monitoring and follow-up at a minimum of 3, 6, and 12 months. Outcomes that should be reported consistently include growth, breastfeeding, readmission, morbidity, neurodevelopment, parental psychological health, and caregiver readiness. Analyses should be stratified by gestational age and birth weight and should clearly distinguish KMC effects from the effects of additional intervention components.

Conclusion and Recommendation

This synthesis indicates that Kangaroo Mother Care (KMC) and skin-to-skin contact (SSC) during neonatal care for low-birth-weight (LBW) infants appear safe and feasible and are associated with short-term physiological stability and reduced maternal depressive symptoms and paternal anxiety during the first week. However, these findings come from small studies with low to very low certainty of evidence, while results from single-group studies and transitional developmental intervention packages cannot be attributed to KMC. No eligible study evaluated KMC continued at home; therefore, the effectiveness of KMC following discharge from the Neonatal Intensive Care Unit (NICU) cannot yet be determined. Estimates of reduced mortality and infection reported in the literature are derived from previous systematic reviews and are not findings of the present review.

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The authors declare that they have no competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration on the Use of AI
The authors declare that no artificial intelligence (AI) or AI-assisted technologies were used in the writing, data analysis, or manuscript preparation process for this study. All work presented is original and authored solely by the researchers.

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Data sharing is not applicable to this article.

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