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Barriers and enablers of community-based Kangaroo Mother Care (cKMC) practice: a mixed methods systematic review

Hagos T. Atalay^{1,2*}, Victoria J. Kain¹ and Amanda G. Carter¹

Abstract

Background Kangaroo Mother Care (KMC) is an essential practice that can save the lives of preterm and low birth weight neonates. However, there is limited implementation at home and in the community. This systematic review aims to identify and synthesise the barriers and enablers of KMC in home and community settings.

Methods A mixed-methods systematic review was conducted using the JBI Convergent Integrated Approach to investigate the barriers and enablers associated with the implementation of Community-based Kangaroo Mother Care (cKMC). The review included qualitative, quantitative, and mixed-methods studies, with all quantitative findings transformed into qualitative narratives through a process of data “qualitisation”, allowing for the integration of diverse forms of evidence into a cohesive thematic synthesis. A comprehensive search strategy was applied across eight electronic databases, covering literature published in English from January 2003 to July 2024. Study selection and methodological appraisal were conducted independently by two reviewers, with disagreements resolved through discussion with a third reviewer. The methodological quality of all included studies was assessed using the Mixed Methods Appraisal Tool (MMAT) (Hong et al., *Educ Info* 34:285-91, 2018).

Results Thirty-four studies met the inclusion criteria for this review. Key barriers to cKMC included environmental constraints, limited knowledge, modesty concerns, sociocultural attitudes, lack of family support, and absence of follow-up systems. Enablers included peer support, advocacy by elders, postpartum rest, and healthcare provider involvement.

Conclusion There is a limited body of high-quality evidence on the barriers and enablers of KMC in home and community settings. Tailored strategies addressing sociocultural, practical, and knowledge-related barriers are needed. Further research should focus on cKMC to develop effective and sustainable approaches that enhance KMC practices in the community and home environments, and further exploration is required on the role of healthcare workers in sustaining practice outside healthcare facility settings.

Keywords Health barriers, Community health services, Enablers, Kangaroo-Mother care method, Home care services

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Background

In 2022, approximately 2.3 million neonates died globally during the first month of life, averaging about 6,500 newborn deaths daily [1]. Most of these deaths occurred in sub-Saharan Africa, where the neonatal mortality rate (NMR) was 27 neonatal deaths per 1,000 live births, accounting for 43% of global neonatal deaths. Central and Southern Asia followed closely, with an NMR of 21 per 1000 live births, contributing to 36% of all global newborn deaths [2].

In contrast, NMR in developed countries is proportionately low, with 2.4 deaths per 1,000 live births in Australia [3], and 3.4 neonatal deaths per 1,000 live births in the United States [4]. A child born in sub-Saharan Africa is 11 times more likely to die in the first month of life than a child born in a high-income country. These figures highlight the significant disparity in neonatal survival based on geographical location and access to quality healthcare services.

Preterm and low birthweight (LBW) neonates significantly contribute to the rates of neonatal morbidity and mortality, representing a major challenge in neonatal care [5]. Preterm neonates are defined as being born at less than 37 weeks' gestational age, and LBW neonates are defined as being born with a birthweight below 2.5 kg, regardless of gestational age [6]. An estimated 15 million newborns are born preterm, and more than 20 million are born at LBW each year around the globe [5]. Prematurity and LBW remain the leading causes of death in newborns and children under-five years of age [7]. Premature and LBW neonates are at a higher risk of developmental disabilities, including cerebral palsy [8]. The consequences of prematurity and LBW may continue into adulthood, increasing the risk of adult-onset chronic conditions such as obesity and diabetes [9, 10].

The World Health Organisation (WHO) has progressively developed strategies to improve the care of premature and LBW neonates, advancing both the operational and strategic policy dimensions of KMC to facilitate its global adoption and scale-up. The earlier 2003 WHO publication, *Kangaroo Mother Care: A Practical Guide*, functions primarily as a technical manual, offering detailed step-by-step instructions for healthcare providers on the initiation and maintenance of KMC, with a focus on its implementation in clinical and facility-based settings [11]. In contrast, the more recent 2023 WHO Global Position Paper, *Kangaroo Mother Care: A Transformative Innovation in Health Care*, represents a strategic policy document that articulates a comprehensive vision for health system integration of KMC. This document situates KMC not merely as a clinical intervention but as a keystone of maternal and newborn care within universal health coverage, emphasising the need for system-wide reforms, such as the removal of institutional

barriers to mother-infant proximity and the promotion of family-centred care [12].

This distinction highlights the evolution in WHO's approach: from the operational implementation of KMC at the provider level to a strategic commitment aimed at embedding KMC within national health systems. The transition reflects a growing global consensus that KMC is not only an effective clinical practice but also a transformative model for reconfiguring maternal and newborn care services to be more equitable, respectful, and family-centred. The 2023 position paper thus broadens the scope of KMC from facility-based care to include home and community settings, aligning with global efforts to enhance accessibility and sustainability of care for preterm and low birthweight infants across all contexts [12].

KMC practice is recognised as a safe, cost-effective, and feasible intervention across various settings, especially in those with limited resources [13–15]. Furthermore, when implemented effectively, KMC significantly reduces both mortality and morbidity rates [16].

The advantages of KMC for premature and LBW neonates are widely recognised. However, in areas with limited or cost-restricted access to healthcare facilities, it is essential to encourage mothers to practice KMC at home [17]. By extending KMC into the community, barriers faced within facilities, such as space restrictions, understaffing, and inadequate support from families, can be eliminated. The added benefits of community-based KMC (cKMC) are that it allows families and communities to take an active role in caring for vulnerable newborns, provides an opportunity for community members to support one another, and promotes a sense of collective responsibility [12, 18]. Additionally, cKMC can potentially improve the survival and neurodevelopment of premature or LBW neonates, particularly in resource-limited settings [19].

Most systematic reviews examining the barriers and enablers of KMC have predominantly focused on facility-based implementation, particularly within hospital settings [13, 17, 20, 21], with limited attention to community or home-based contexts. A study conducted a comprehensive umbrella review, synthesising evidence from multiple systematic and scoping reviews that analysed data from primary studies on KMC implementation across diverse settings [17]. Although their work identified significant knowledge gaps and explicitly called for further research on KMC in community and home environments, it did not directly examine the specific barriers and enablers associated with cKMC. This stresses the need for focused investigation into non-facility settings—an area this review aims to address.

By focusing explicitly on community and home environments, the present review addresses a critical gap in the literature and builds upon the broader evidence

landscape, offering a range of insights into the contextual, cultural, and practical barriers and enablers of KMC outside hospital settings. Thus, this systematic review aims to identify and synthesise the barriers and enablers of KMC in home and community settings.

Methods

Introduction

The systematic review followed the JBI methodology for mixed methods, using the JBI Manual for Evidence Synthesis to integrate qualitative and quantitative data in a convergent approach [22, 23]. The “qualitized” data was assembled with qualitative data, categorised, and pooled based on similarity in meaning to produce a set of integrated findings in the form of action statements [24]. This systematic review was reported using the PRISMA 2020 checklist [25] with the addition of a JBI reporting guide for mixed methods review [20, 21]. The PRISMA checklist has been included in supplementary files (Supplementary file 1). This review was registered with PROSPERO (Registration: CRD42024503309) to ensure transparency and methodological rigour throughout the process.

Eligibility criteria

The reviewed studies met the PICo (Population, Phenomena of Interest, Context) criteria, focusing on mothers or families practising KMC with preterm or LBW neonates in the community or home settings [22, 24] (See Table 1).

Information sources

The literature search for this review was conducted across eight databases: CINAHL Complete (EBSCOhost), Medline (Ovid), Scopus, Embase, ProQuest, Cochrane Library, Web of Science, and PubMed. The reference lists of the selected articles were examined to uncover any additional relevant studies. In addition, the search engine

Google Scholar was used to identify grey literature, where relevant sources were screened using the study title and considered the first 10 pages of search results or the first 100 hits. The review initiated the search process on 23 January 2024 and ended on 29 July 2024. The grey literature was used to ensure the completeness of the search, particularly for potentially relevant articles that may not be indexed in conventional academic databases.

Search strategy

The search terms for this review were derived from indexed subject headings or MeSH terms and keywords. We used Boolean operators ‘AND’ and ‘OR’ to structure and refine our search strategy. ‘AND’ narrowed results by combining key terms to retrieve only records containing all specified concepts. ‘OR’ broadened the search by including synonyms or related terms, ensuring a comprehensive and relevant literature search.

The final search terms included: ((perceptions OR barriers OR enablers OR experiences OR challenges OR facilitators OR feelings OR beliefs OR attitudes) AND (“community-based” OR “community based” OR “home based” OR community OR home OR “home-based” OR rural OR “hard to reach”) AND (“kangaroo care” OR “skin to skin” OR “kangaroo mother care” OR “skin-to-skin” OR “chest-to-chest” OR “skin contact” OR “KMC”)). These key terms were selected to capture the maximum number of relevant studies, as different researchers may use varying terminology. After refining the search strategies, they were applied to the different databases. To identify any further studies, reference lists of relevant articles were hand-searched, and the publication period spanned from January 1, 2003, to July 29, 2024.

Study selection

A PRISMA flowchart of the study selection process is presented in Fig. 1. From the initial search, this review identified 1330 articles across the databases. After removing 737 duplicates, 593 articles remained for screening. Of these, 486 articles were excluded due to their focus on factors unrelated to cKMC, leaving 107 articles for full-text retrieval. An article could not obtain the full text, resulting in 106 articles being assessed for eligibility. Among these, 73 articles were excluded, as outlined in Fig. 1, with 34 articles included in the final review. Assumptions were made regarding missing or unclear data, addressed through consensus among the reviewers.

Methodological quality assessment

We conducted the methodological quality assessment using the Mixed Methods Appraisal Tool (MMAT) [26]. It was chosen for its ability to appraise diverse study types, including mixed methods designs. The MMAT

Table 1 Eligibility criteria for systematic review on barriers and enablers of cKMC

Component	Inclusion Criteria	Exclusion Criteria
Population	Mothers, families (fathers, grandparents, surrogates) providing KMC for preterm or LBW infants	Neonates without LBW/preterm status; studies on health-care providers only
Phenomena of Interest	Barriers and enablers of KMC in home or community settings	Studies on facility-based KMC only
Context	Home and community environments globally	Hospital/facility settings
Study Types	Qualitative, quantitative, and mixed-methods primary research	Systematic reviews, abstracts, concept notes, case reports
Timeframe	Published 2003–2024	Studies prior to 2003
Language	English only	Non-English publications

Barriers and Enablers of cKMC Practice

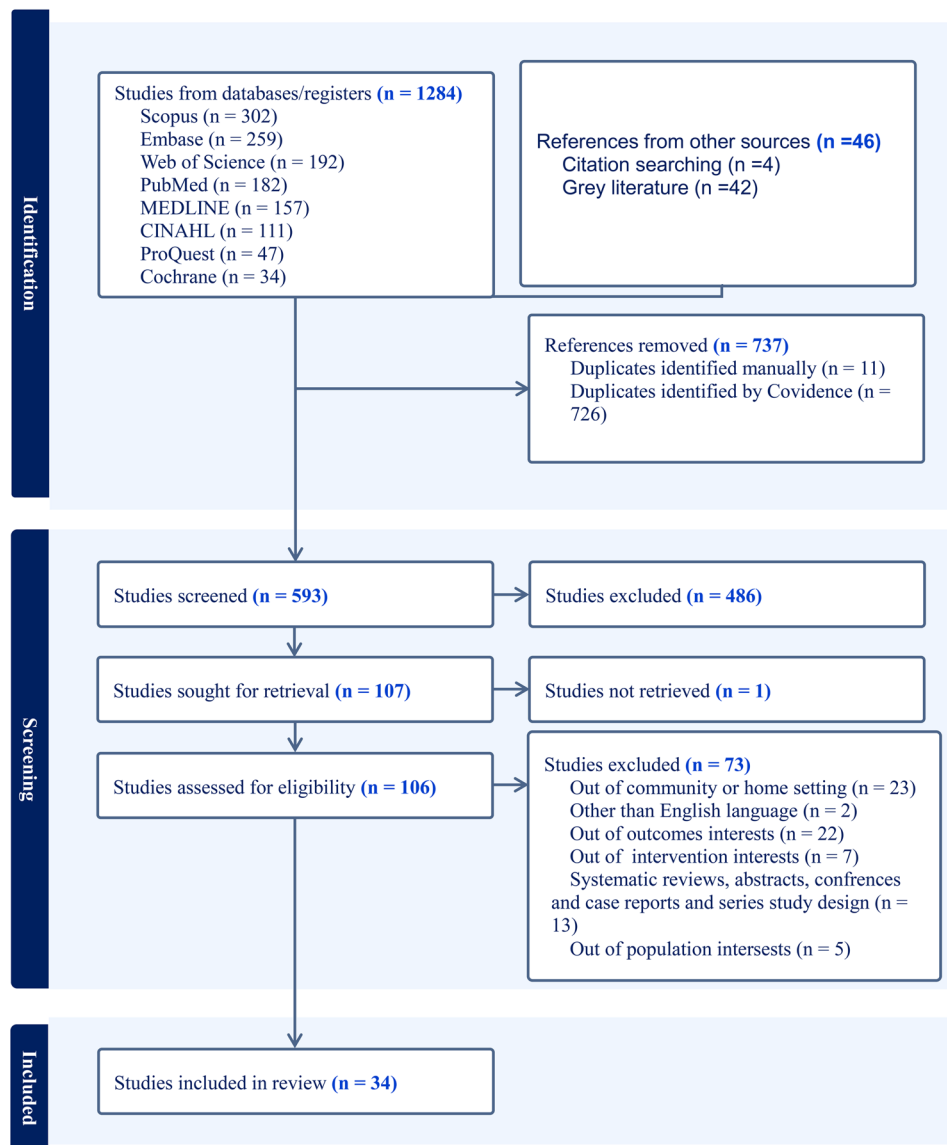


Fig. 1 PRISMA flowchart showing the selection of studies on barriers and enablers of cKMC

begins with two mandatory screening questions applicable to all study types, followed by five specific criteria tailored to each study category. Quality ratings were determined by the number of ‘yes’ responses. For example, a qualitative study receiving four out of five ‘yes’ responses would suggest that most quality criteria were met. The assessment process involved two independent reviewers (HA and VK), with discrepancies resolved through discussion and, if necessary, consultation with a third reviewer (AC).

Data extraction and screening procedures

Qualitative, quantitative, and mixed-methods data were extracted from all included studies by two independent

reviewers (HA and VK) using the Covidence systematic review web-based software, which facilitated both screening and data extraction [27]. Covidence’s built-in data extraction template was employed, ensuring consistency in capturing key study characteristics and outcomes relevant to the review questions.

Duplicate records were automatically removed by Covidence, with manual verification by both reviewers. Titles, abstracts, and full texts were screened independently at each stage, guided by predefined inclusion and exclusion criteria. Any disagreements were resolved through discussion, with arbitration by a third reviewer (AC) when required.

Data extraction captured detailed information on study populations, methods, settings, phenomena of interest, and contexts. Quantitative data included results from descriptive and inferential statistical analyses, while qualitative data comprised identified themes or subthemes, accompanied by supporting quotations where available. This process enabled comprehensive synthesis across diverse study designs and data types.

Data transformation

The quantitative data were transformed into 'qualitized data', which entailed converting them into textual descriptions or narrative interpretations [23]. In this study, we applied the process of qualitzing by transforming quantitative data into qualitative formats such as themes, categories, and narratives. This involved analysing the results from experimental and observational studies, including the quantitative components of mixed methods research. Through this approach, we reinterpreted numerical findings to generate deeper contextual insights that directly addressed the review questions.

For instance, in one quantitative study included in this review, 81.4% of participating mothers reported insufficient knowledge regarding cKMC. This numerical finding was subsequently transformed into a narrative statement and classified under the emergent theme "Limited Knowledge." This process allowed for the integration of quantitatively derived insights with qualitative data expressing similar concerns about maternal awareness and understanding of cKMC, thereby facilitating a coherent, thematically unified synthesis across data types in line with the convergent integrated approach.

Accordingly, quantitative findings relating to barriers and enablers of the practice of cKMC were assessed based on their reported prevalence rates and significant associations in the primary studies and were subsequently transformed into narrative form to align with the requirements of qualitative synthesis. Although there is no universally established threshold for inclusion of quantitative results in qualitative synthesis, we used a threshold of including data that was statistically significant and contextually relevant. This approach enabled the integration of meaningful quantitative insights into the thematic framework, thereby enhancing the comprehensiveness and coherence of the evidence synthesis in addressing the aim of this review.

Data synthesis and integration

The data synthesis and integration process was done manually and followed the JBI methodology for mixed methods systematic reviews, specifically employing the Convergent Integrated Approach as outlined in the JBI Manual for Evidence Synthesis [22].

Following data extraction and transformation, all findings relevant to the review question were analysed using thematic synthesis. Two reviewers (HA and VK) independently conducted inductive coding of both qualitative data and transformed quantitative findings, identifying key concepts relating to barriers and enablers of cKMC. These initial codes were then grouped into categories based on conceptual similarity and contextual relevance. Through an iterative, consensus-driven process, these categories were refined into broader thematic constructs, capturing recurring patterns across studies while accounting for regional and contextual variation.

Data synthesis relied primarily on the qualitative aspects of data, but quantitatively transformed findings were used to support, validate, or expand thematic categories and constructs. The contribution was weighted based on the relevance and consistency with qualitative insights, beyond frequency and statistical significance.

To support transparency and facilitate comparative analysis, a thematic matrix was developed, mapping each theme to its contributing studies. The final themes were synthesised and pooled based on shared meaning, finishing in a series of integrated findings presented as statements, in alignment with JBI's guidance for mixed methods synthesis [23, 24].

Discrepancies in coding or theme development were resolved through discussion, with input from a third reviewer (AC). This process ensured rigour and consistency in the interpretation and integration of findings across multiple study designs. This method ensured a systematic and transparent integration of evidence across diverse study designs, enhancing the relevance and applicability of the findings for policy and practice.

Results

Study characteristics

A total of 1,330 studies were identified from various databases, reference lists, and grey literature sources for this review. After removing 737 duplicates, 554 articles underwent title and abstract screening. Of these, 447 did not meet the inclusion criteria, leaving 106 studies for full-text review. Ultimately, 34 articles were deemed eligible for inclusion.

The primary focus of the included studies was identifying, exploring, and describing the experiences, barriers, and enablers of KMC among mothers and families in community or home settings. The studies in this review included nineteen qualitative studies (55.9%), seven quantitative descriptive studies (20.6%), three non-randomised studies (8.8%), four mixed methods studies (11.8%), and one randomised controlled trial (2.9%). The PRISMA flowchart (see Fig. 1) outlines the selection process for studies on barriers and enablers of cKMC.

Methodological quality was assessed using the mixed methods appraisal tool (MMAT). Most studies received four or more “yes” responses among the five quality assessment questions. However, two studies received only two “yes” responses, and three studies received three “yes” responses. The main reason for lower quality assessments in these studies was our judgment of unclear boundaries between qualitative and quantitative research within the mixed method approach, and issues related to data collection methods and research findings. Nonetheless, most articles’ research aims and methods were appropriate (Supplemental file 2).

The studies were geographically diverse, with nineteen studies conducted in Africa, spanning Ethiopia, Ghana, Madagascar, Malawi, Rwanda, Tanzania, and Uganda [28–42]. Thirteen were conducted in Asia, specifically in India, Bangladesh, Indonesia, and Pakistan [18, 43–45]. The studies from North and South America included work from Colombia [46] and the United States [47].

Various study designs were utilised, but data collection methods were consistent, incorporating focus group discussions, in-depth interviews, observations, and surveys. The sample comprised 3,366 mothers and families, including fathers, grandparents, and siblings. Some studies also involved healthcare providers, community health workers, traditional birth attendants, and community members (see Table 2).

This review identified several key barriers to the implementation of cKMC. The primary barriers included environmental conditions, limited knowledge or awareness, modesty and privacy concerns, practical issues, and sociocultural attitudes. Additionally, inadequate support from family, community, and partners, household responsibilities, and a lack of follow-up and referral systems were frequently reported as significant challenges.

Environmental conditions

Nine studies identified environmental conditions as a significant barrier to the implementation of cKMC [18, 32, 42, 43, 45, 46, 51, 55]. Hot temperature presented substantial challenges, disrupting the continuity of cKMC and complicating the regulation of neonatal body temperature, particularly in preterm or LBW infants [18, 45, 51].

For instance, mothers in Pakistan and India described how excessive heat and humidity during summer made cKMC uncomfortable, with both mother and baby sweating heavily [18, 43]. Similarly, in Bangladesh, one mother explained, “*In such a [hot] season [KMC is] quite impractical... I always kept my children under the fan, so they don’t sweat and catch cold from their sweat*” [45]. Skin rashes in neonates due to profuse sweating were also reported, especially during humid weather, causing additional concern among mothers [51].

Furthermore, having sufficient space within the home is essential to ensure both the comfort and practicality of practising cKMC. Congested living environments were reported to hinder effective cKMC practice [51]. Adequate lighting and ventilation were deemed essential to support maternal-infant interactions during KMC sessions, though concerns about drafts often led to closed windows, thereby reducing ventilation and increasing the risk of suffocation [32].

Additionally, environmental protection was a concern in rural settings. For example, mothers in Colombia used insect nets and kept babies indoors to protect them from smoke, wind, and mosquitoes [46]. In Ethiopia, some mothers avoided cKMC because they felt their preterm infants were too fragile to withstand harsh environmental conditions, opting instead for layers of clothing and wraps [42].

Finally, in India, the lack of nearby toilet facilities disrupted continuous cKMC, as mothers had to travel long distances for open defecation, discouraging cKMC during certain times of day or night [51].

Modesty and privacy

Two studies reported that in both community and at-home settings, the adoption of cKMC was hindered by concerns related to maternal modesty and privacy [45, 51]. In a qualitative study in Bangladesh noted that although modesty could have been a concern, participants did not explicitly mention it, likely because KMC was practised privately within the home [45]. Similarly, in a mixed-methods study conducted in India observed that mothers were reluctant to wear front-open clothing due to cultural expectations or shyness, which limited their willingness to engage in skin-to-skin care, especially in the presence of others [51].

A cross-sectional study in India found that nearly one-fourth of mothers identified privacy and hot weather as important barriers to cKMC practice [43]. Similarly, a quantitative hospital-based survey found that mothers felt discomfort performing cKMC in joint-family households where privacy was limited [55].

Limited knowledge of cKMC

Across several studies included in this review, the lack of understanding of the benefits and techniques of practising cKMC among mothers and family members was evident [30, 31, 38, 40, 41, 54, 56–58]. A cross-sectional study in Ethiopia found that maternal knowledge was a key barrier to cKMC practice at home [28]. Similarly, another cross-sectional study in India reported that most mothers were not familiar with cKMC [50], while another in India reported that almost three-fourths of mothers practised cKMC, with the remainder citing lack of knowledge as the reason for non-adoption.

Table 2 Included studies characteristics on barriers and enablers of cKMC

First Author, year, and country	Aim	Study Design	Participants	Method of data collection	Limitations	Main findings
Anaya et al. 2022, Colombia [46]	Understand the cultural practices of premature and LBW with KMC at home	Qualitative study with an ethnographic approach	8 mothers and two key informants	Interviews	This study results were after training of KMC, difficult coverage for remote areas due to communication barriers	Environment, geographic and socio-economic conditions, cultural heritage, and family support affect the implementation of KMC for each participant
Ariff et al. 2022, Pakistan [18]	Inform the design and delivery of culturally appropriate interventions to introduce KMC in communities	Qualitative exploratory study	93 mothers, grandmothers, fathers, lady health workers, healthcare providers	Focused group discussion, key informant interview, and in-depth interview		Barriers: maternal backache, concern of suffocation, weather conditions, anxiety about household chores, Enablers: Mother's rest in 1 st 7 days, family support, elders provide KMC advocacy
Ayele et al. 2021, Ethiopia [28]	Identify factors influencing KMC practice following hospital discharge	Descriptive cross-sectional study	190 mothers	Interview	Possible recall bias	Support from the husband and health extension worker and family support
Bazzano et al. 2012, Ghana [29]	Understand the acceptance and barriers to skin-to-skin contact	Qualitative descriptive study	18 mothers	interview and observation	limited generalisability	Mothers feeling pain, fear of damaging the umbilicus, and reluctant due to the long-standing tradition of carrying neonates on the back
Bilal et al. 2021, Ethiopia [30]	Identify the barriers to KMC implementation and devise a refined model to deliver KMC practice	A formative qualitative exploratory study	144 mothers, fathers, grandmothers, healthcare providers	Focused group discussion and in-depth interview	Did not present enabling factors	Barriers: Lack of experience, awareness, and exposure to KMC, socio-economic factors, male sex preference, fathers' dominance, poor family support
Brazy-Nancy et al. 2023, Madagascar [31]	Examine the conditions for success and the obstacles facing kangaroo care in community settings	Anthropological qualitative study	32 mothers, 20 health personnel	Interview, focused group discussion		Barriers: Limited knowledge, elders' cultural practices, exposure newborn to the sun, household responsibilities, putting on KMC with wearing cloth neonates, the experience of carrying neonate with back, family support, misconception of gender roles, lack of support from the healthcare system
Dawar et al. 2019, India [43]	Identify enablers and barriers related to home KMC	Mixed methods exploratory	60 mothers	interview	Might not be clear to separate between qualitative and quantitative data	Enablers: Family support of KMC practice and household chores Barriers: Limited support on household chores, mothers being uncomfortable, lack of privacy, lack of motivation to continue, and hot weather
Degefie et al. 2014, Ethiopia [32]	Describe beliefs and practices on immediate newborn care and postnatal care practice	Qualitative Study	57 mothers, grandmothers, fathers, and traditional birth attendants	Key informant interviews and in-depth interviews	Might have a limitation on generalisability to other ethnic groups and possible recall bias, limited focus on KMC	Barrier: No skin-to-skin contact practice due to traditional beliefs of attendants focused on placental delivery and maternal wellbeing.
Devi et al. 2022, India [48]	Examine home-based newborn care practices of mothers in rural areas	Descriptive cross-sectional study	205 mothers	Interview	Might be recall bias, little focus on KMC	Barrier: Limited of knowledge
Gondwe et al. 2014, Malawi [33]	Explore the perceived causes, care practices, and challenges of preterm neonates	Qualitative study	110 mothers, fathers, grandmothers, traditional birth attendants and traditional healers	Focused group discussion and In-depth interview	Little emphasis on KMC	Barriers: Lack of awareness of KMC practice and affected by household chores

Table 2 (continued)

First Author, year, and country	Aim	Study Design	Participants	Method of data collection	Limitations	Main findings
Hadush et al. 2022, Ethiopia [34]	Explore barriers and enablers in the community implementation and continuation of KMC	Formative qualitative exploratory approach	16 focused group discussions and 46 in-depth interviews of Mothers, Fathers, grandparents, and community health workers	Focused group discussion and In-depth interview	Participant selection bias and might be limited Generalisability to remote areas	Barriers: Inadequate knowledge of practice, poor perception and socially unacceptable KMC method, concern of harm of neonates, father dominance in decision-making and unthinkable to care preterm, Enablers: Possibility of improving mother-babies bonding, facilitating frequent breastfeeding
Hariati et al. 2021, Indonesia [44]	Explore preterm mothers' experiences of caring practices at home 1 month after their neonate's discharge	Descriptive qualitative study	8 mothers	In-depth interview	Small sample size, generalisability, and lack of focus on KMC	Barriers: Myth and culture related to preterm neonate care, Limited knowledge about their neonate's needs.
Hill et al. 2010, Ghana [49]	Design a community newborn intervention	Mixed methods	260 mothers	In-depth interview	Possible recall bias, paucity of information of KMC finding	Barriers: low practised skin-to-skin contact, not prioritized over other mothering and household tasks
Hunter et al. 2014, Bangladesh [45]	Identify enablers, barriers, and recommendations for the community-level delivery of kangaroo mother care	Formative qualitative exploratory approach	40 in-depth interviews and 14 Focused group discussions with mothers, fathers, families, community members, and healthcare workers	Focused group discussion and in-depth interview	Participation response bias	Barriers: Cultural understanding of KMC, existing newborn care practices, resistance to an unfamiliar practice, decision-making dynamics, household tasks, physical discomfort, and perceived health risks Enablers: community support, family support, outcome expectations, observational learning, 45 days in the first 6 days the mother remained with neonates
Khan et al. 2022, Pakistan [50]	Gain the knowledge, and attitude of unsupervised mothers practising KMC at home and determine the most common issues	Descriptive cross-sectional study	156 mothers	interview	Possible recall bias	Barrier: Before discharge mostly unaware of KMC Enablers: Health care providers support, enhanced mother-neonate bonding, partners do KMC, mother felt relaxed
Kwesiga et al. 2022, Uganda [35]	Improve the post-discharge practice of KMC	Phenomenological qualitative study	14 mothers, 10 supporters (families), 26 community health workers and 7 community leaders	In-depth interviews, Key informants' interviews, and focused group discussion		Barriers include a lack of community follow-up, practice existing other than KMC, gender roles, inadequate knowledge follow-up, financial challenges, and pain in implementing C/S deliveries. Enabler: Peer-to-peer intervention
Lydon et al. 2018, Malawi [36]	Gain insight into community understanding, attitudes, beliefs, and practices around preterm and LBW neonates and KMC	Qualitative exploratory study	152 mothers, fathers, religious leaders' community leaders	Focused group discussion and in-depth interview	Data from the community not separated from health facilities' data	Enablers: Peer-to-peer sharing information, healthcare workers as a source of information, partners' involvement in KMC practice
Lydon et al. 2022, Malawi [37]	Understand social norms and community perceptions of preterm neonates and KMC	Qualitative exploratory study	32 mothers	Focused group discussion and in-depth interview	Possible limited generalisability	Understanding social norms context-specific for successful implementation at the individual level, household level, family level, and community level

Table 2 (continued)

First Author, year, and country	Aim	Study Design	Participants	Method of data collection	Limitations	Main findings
Mazumder et al. 2018, India [51]	Assess the feasibility, acceptability, and adoption of cKMC	A formative qualitative exploratory study	42 with mothers' families, community members, and grandmothers, 2 fathers and grandfathers	Focused group discussion and in-depth interview	Inability to test early KMC due to the high number of births conducted at health facility	Barriers: environmental conditions, lack of privacy, cultural practices, pain and discomfort, anxiety, difficulty in doing KMC with twin neonates, limited family support
Mustikawati et al. 2020, Indonesia [52]	Identify barriers and enablers to KMC implementation	Rapid qualitative study	10 mothers and 5 healthcare providers	Observations, in-depth interview	Mother response bias by the family like partner and grandmother	Barriers: buy-in and bonding, inadequate family support, household tasks, medical concerns Enablers: community health workers' empowerment and antenatal care awareness
Neu et al. 2004 US [47]	Describe factors that influence mothers of healthy preterm neonates to choose kangaroo	A qualitative study with naturalistic inquiry	24 primiparous mothers	Interviews	Lack of focus on KMC practice	Barriers: Mothers feeling frustration and fatigue after the neonate was discharged home, Enabler: Perceived benefit of close contact with the neonate
Nguah et al. 2011, Ghana [38]	Evaluate KMC in-hospital and continued practice in the community among mothers of LBW	Longitudinal cohort study	196 mothers	Interview Questionnaire	Lost follow-up may bias the study, and the interviewer may raise bias	Barriers: Limited knowledge of mothers, family support
Nimbalkar et al. 2024, India [53]	Post-discharge home kangaroo mother care follow-up study in rural Gujarat	Observational Qualitative Study	100 mothers	Interview		Lack of family support, other household responsibilities, and other children to care for were major barriers leading to pre-mature discontinuation of home KMC
Nyagasare et al. 2019, Rwanda [39]	Identify barriers to KMC in the community	Descriptive cross-sectional study	124 mothers and healthcare providers	Interview Questionnaire	It might not reveal the underlying reasons for the low adoption of KMC at home	Barriers: Difficulty working during KMC practice, difficulty getting food, having twins, difficulty sleeping, health problems like HIV, back pain, C/S, disagreement with a partner, having a disability Barrier: Limited knowledge of KMC practice
Panda SK, et al. 2021, India [54]	Implement post-discharge home-based kangaroo mother care (KMC) for LBW neonates	Prospective cohort study	29 maternal neonates' dyads	Interview	Small sample size and possible limited generalisability	
Raajashri et al. 2018, India [55]	Evaluate potential factors influencing the practice of KMC at home	Descriptive cross-sectional study	200 mothers	Interview Questionnaire	The data collection occurs at health facilities, and being descriptive wouldn't reveal any association	Enablers: Positive perceptions regarding utility, position, and persons needed for KMC and support the family, Barriers: Inadequate privacy, difficulty in holding the neonate, and hot climate
Schuler et al. 2019, Ghana [40]	Explore the knowledge and beliefs of mothers on LBW at home	Qualitative study phenomenological approach	38 mothers	Focused group discussion and in-depth interview	Participants were excluded because of not having phone and network, recall and response bias, paucity of information on KMC	Barriers: Inadequate knowledge of the practice of KMC due to unfamiliarity with practice and cultural barriers

Table 2 (continued)

First Author, year, and country	Aim	Study Design	Participants	Method of data collection	Limitations	Main findings
Shamba et al. 2014, Tanzania [41]	Explore perception and experiences linked to four thermal care practices	Mixed methods	20 birth narratives, 49 of mothers, and 2 traditional birth attendants	Narratives, Focused group discussion, and in-depth interview	Might not draw generalisability to rural areas	Barriers: Limited knowledge of KMC practice, concerns that keeping the neonate skin-to-skin would injure the neonates' bones, chest problems, concerns damaging the umbilical cord, mothers too busy with other home tasks
Shibiru et al. 2024, Ethiopia [42]	Assess community perceptions and experiences on caring for premature neonates	Qualitative interpretive Husserlian phenomenological study	42 mothers and families	Focused group discussion and in-depth interview	Researcher-induced bias, the subjectivity of data	Barriers: Environmental conditions, fear of caught disease when naked neonate, sunlight exposure of the neonate
Sinha et al. 2014, India [56]	Determine risk factors for unsafe practices and describe the knowledge and skills of ASHAs during home visits	Descriptive cross-sectional study	320 mothers	Interview	Little emphasis on KMC, possible recall bias	Barrier: Lack of awareness regarding KMC
Vessel et al. 2013, Ghana [57]	Evaluate home visits and whether the intervention increased the adoption of SSC	RCT	49 mothers	observation, interview, and in-depth interview	Bias might happen by the outcome assessor	Barriers: Inadequate knowledge or information, umbilical cord problems, concerns of falls, family support, chest and back discomfort,
Waiswa et al. 2010, Uganda [58]	Perceptions and care for preterm neonates	Qualitative exploratory study	10 mothers, 6 fathers, 3 grandmothers of preterm	Focused group discussion and in-depth interview	Limited focus on KMC, only included mothers birthing at health facility due to recruitment challenges homebirths	Barrier: Limited knowledge of KMC by the community members
Wako et al. 2022, Ethiopia [59]	Assess the neonatal thermal care practices and beliefs among rural women	Mixed methods	388 mothers	Interview and Focused group discussion	Possible recall bias	Barriers: KMC has not been practised; women perceive skin-to-skin care of newborns as an odd, frightening, and potentially dangerous way of handling newborns and perceive may get injured, especially by inexperienced young mothers
Washing-ton et al. 2023, India [60]	Identify determinants of KMC uptake for small neonates	Implementation research with a descriptive study	227 mothers with their neonates	interview, observation	Possible recall bias and might have limitations on generalisability	Enablers: Hospitalization in public health facilities and higher knowledge of healthcare workers increased KMC duration at home or after discharge

A qualitative research in Madagascar revealed that some mothers misunderstood the skin-to-skin component, as one participant stated, *"They put on his clothes, and it's after that they practice this [KMC]"* [31]. Again, a qualitative study found that none of the participants practised skin-to-skin or cKMC for preterm newborns. While some had heard of it via radio, they lacked knowledge of how to implement it [33].

Confusion about the duration and method of cKMC was also prevalent. A qualitative study in Uganda reported that some mothers and support persons were

uncertain about how long cKMC should be practised, when it should be terminated, and how it should be done [35]. This lack of clarity extended to healthcare providers, as noted in Ghana, where KMC was scarcely practised at home due to inadequate information from health staff [40].

Encouragingly, peer-to-peer sharing played a vital role in promoting KMC. In a qualitative study from Malawi, women expressed a preference to learn from others who had experienced cKMC [36]. Similarly, in Uganda, mothers who had successfully practised cKMC were eager to

assist and teach others [35]. Support from healthcare providers is essential, as a study showed that mothers who received guidance from health workers were more confident and consistent in continuing cKMC after discharge [28].

Practical challenges

Mothers and families often encounter significant practical barriers when attempting to implement cKMC, particularly in home settings [31, 34, 45, 51]. A qualitative study in India found that mothers feared harming the newborn, especially due to the baby potentially slipping out of the wrap during daily activities [51]. Similarly, a community-based qualitative study in Pakistan reported that women lacked confidence in performing household chores while holding the baby in the cKMC position, fearing the baby might slip out [18]. This fear extended to concerns about injuring the umbilical stump, with mothers expressing that friction during skin-to-skin contact could cause bleeding or discomfort [51].

Household responsibilities posed a major barrier to cKMC. In Madagascar, many single mothers struggled to maintain skin-to-skin contact due to domestic chores [31]. Similarly, in Malawi, mothers found it difficult to continue cKMC after returning home because of household duties [37]. In rural Bangladesh, women were expected to perform heavy labour, such as farming and livestock care, which conflicted with the continuous nature of cKMC [45].

Some mothers perceived skin-to-skin care as unnatural or frightening, especially in communities unfamiliar with the practice. In Ethiopia, it was described as odd and frightening [59]. Psychological stress, including fears of suffocation and inability to respond to the baby while resting, added to these concerns. A mother in Ghana shared, “*I lie when performing it [SSC] because I am afraid the baby might fall*” [57]. Such anxieties, combined with post-discharge fatigue, often made sustaining KMC at home challenging [47].

Sociocultural attitudes

The sociocultural attitudes play a pivotal role in shaping the acceptance and implementation of cKMC. A qualitative study in Malawi reported that religious rhetoric portrayed preterm infants as a deviation from the norm, potentially arising as the result of punishment from God [37]. Such beliefs often result in social stigma, discouraging mothers from practising KMC due to fear of mockery or ostracism. As one mother in Ethiopia shared, “*My villages feel bad when they come to visit me while I am giving skin-to-skin care for the baby...*” [30].

In some communities, traditional warming methods are preferred over cKMC. A qualitative study in Uganda documented practices such as lighting charcoal stoves in

the room, placing hot water in plastic cans around the baby, and giving herbs to the baby, which were seen as more culturally acceptable than skin-to-skin contact [35]. Similarly, in Indonesia, researchers found that lights, flashlights, or water bottles were commonly used to warm premature infants instead of cKMC [44].

A profoundly rooted tradition of back-carrying infants also poses a barrier to cKMC. In Ghana, a qualitative study observed that women were initially reluctant to put a newborn on the chest due to the longstanding tradition of carrying babies on the back [29]. This sentiment was echoed in Madagascar, where mothers found it strange to carry their baby on the front [31]. A qualitative study in Ghana highlighted cultural barriers, with one mother explaining, “*Yes, I was taught. I always carry my baby on my back. I'm not able to carry him in front... I'm not used to it*” [40]. Similarly, in Tanzania, a participant remarked, “*This is new to us; we do not do that here*” [41], reflecting unfamiliarity with the practice. Resistance to cKMC is not merely about tradition but also about perceived safety and social norms. A qualitative study in Ethiopia noted that direct skin-to-skin contact and keeping small babies in the cKMC position were considered unusual and socially unacceptable [34].

On the other hand, cultural traditions can also support cKMC. In Bangladesh, ethnographic research described the practice of *atur*, a postpartum confinement period lasting up to 45 days, during which mothers rest and bond with their newborns [45]. This tradition aligns well with cKMC principles, allowing uninterrupted care and breastfeeding. Similarly, in Pakistan, a study noted that in the first seven days after delivery, mothers are not allowed to do any household chores, creating an ideal environment for cKMC, and community elders were willing to organise support groups to facilitate cKMC practices [18].

Sociocultural attitudes toward cKMC varied across regions. In sub-Saharan Africa (e.g., Ethiopia, Malawi, Madagascar), preterm birth was sometimes viewed as divine punishment, contributing to stigma and reluctance to practice cKMC [30, 31, 37]. Traditional back-carrying methods conflicted with chest-based KMC in countries like Ethiopia, Ghana, and Madagascar, reducing cultural acceptance [29, 31, 34, 40]. In South Asia, modesty norms and religious dress codes, especially in India and Bangladesh, discouraged open-chest skin-to-skin contact in shared living spaces [44, 45]. However, postpartum rest traditions in both African and Asian communities often facilitated KMC through family and elder support [29, 31].

Lack of support from family, partner, and/or community

The presence or absence of family support plays a decisive role in the successful implementation of cKMC [28,

30, 38, 46, 52]. A cross-sectional study in Ethiopia found that family support was critical for mothers to continue cKMC at home, especially until the baby gained normal weight [30]. Many mothers face significant challenges in practising cKMC due to the lack of assistance from family members, compounded by responsibilities such as caring for newborns, managing household chores, and attending to other children and partners [35, 51]. In India, a study observed that skin-to-skin contact was often disrupted when mothers lived in nuclear families, as no one was available to take over cKMC when mothers had personal needs [51].

In contrast, supportive family environments can significantly enhance cKMC practice. A cross-sectional study in India found that around half of mothers reported that having a husband or family member perform skin-to-skin contact enabled them to also practise cKMC [43]. A qualitative study in Indonesia described support as including encouragement, assistance with household chores, and taking over KMC during mothers' personal needs [52].

However, partner dynamics can also hinder cKMC. In patriarchal societies like Ethiopia, a study observed that male dominance may override the mother's acceptance and practice of KMC, with fathers' willingness influenced by factors such as male sex preference and the number of children already at home [30]. Mothers often defer to their partners' decisions regarding hospital stays and KMC continuation, which can limit their autonomy. Cultural beliefs further reinforce the perception that men are unlikely to participate in cKMC. As one mother in Ethiopia expressed, *"How can husbands practice KMC? They are always in the field/farm... I do not expect my husband to help me in any way. It is unthinkable"* [34].

Yet, some partners do engage in cKMC, particularly during nighttime hours when social scrutiny is reduced. A qualitative study in Madagascar suggested that some partners may feel more comfortable performing KMC during nighttime hours due to community or peer pressure during the day [31]. Unfortunately, social and cultural barriers often prevent open communication about cKMC between mothers and their partners. A study in Malawi observed that fathers were often limiting their involvement and access to information from healthcare providers [37].

Lack of follow-up and referral system

A persistent barrier to the sustained practice of cKMC is the absence of structured follow-up and referral systems. Several studies emphasised the importance of ongoing monitoring for mothers and their preterm or LBW infants [28, 31, 35, 45]. Regular follow-up not only supports mothers in addressing challenges but also facilitates the early detection of complications, enabling timely referrals to healthcare facilities [35].

However, in many settings, healthcare providers are unable to conduct follow-up visits due to overwhelming workloads and limited resources [31, 52]. As one midwife in Madagascar explained, *"We don't know if they really do it or they really don't! So that's the difficulty"* [31]. This uncertainty reflects a broader systemic gap, where community health workers are not routinely tasked with KMC follow-up, and the practice is not embedded in their standard responsibilities.

The lack of follow-up can lead to assumptions by healthcare providers that mothers have discontinued KMC, potentially resulting in missed opportunities for intervention. Furthermore, logistical and financial barriers further hinder follow-up [31, 35, 52]. Families living in remote or underserved areas often face challenges in accessing healthcare due to transportation costs or distance. These constraints can prevent mothers from attending scheduled follow-up sessions, even when they are committed to continuing KMC [31, 44, 59].

In some cases, low motivation or limited understanding of the importance of follow-up may also contribute to poor attendance. Without consistent contact with healthcare providers, mothers may feel isolated or uncertain about whether they are practising KMC correctly, which can undermine their confidence and adherence [40, 52].

Discussion

This review aimed to identify and synthesise the barriers and enablers of KMC in home and community settings, revealing a complex interplay of barriers and context-specific enablers. Although the benefits of KMC are well-established, existing research has predominantly concentrated on facility-based initiation and post-discharge continuity, with limited exploration of cKMC. This narrow focus restricts our understanding of the practical, cultural, and social realities that influence cKMC uptake and sustainability in home settings, particularly among families without reliable access to health facilities [17, 31].

The paucity of evidence on how cKMC is commenced and maintained at the community level hampers the ability of policymakers and program designers to develop comprehensive, context-sensitive strategies that support non-facility-based care. An over-reliance on facility-centred approaches risks marginalising home-birth families and neglecting opportunities to overcome sociocultural barriers through community-led interventions [19]. Bridging this research gap is critical for enhancing the inclusivity, cultural relevance, and scalability of cKMC initiatives, thereby ensuring broader and more equitable access to this life-saving intervention.

A key barrier identified in this review is the challenge of maintaining privacy during cKMC practice, which intersects with concerns around modesty, cultural

expectations, and religious values. Mothers reported discomfort exposing their bodies during cKMC, particularly in shared living spaces, which aligns with prior studies highlighting cultural and religious norms as obstacles to skin-to-skin care [53, 61, 62]. Respecting privacy is not only an ethical obligation in client care but also a practical necessity for promoting uninterrupted cKMC practice [63].

Implementing cKMC effectively requires a value-based care approach that considers privacy and modesty considerations, coupled with cultural and religious perspectives [37]. To advance value-based care, navigating ways of securing privacy during cKMC sessions and establishing a private space for cKMC sessions is imperative to safeguard the privacy of all parties involved and to promote uninterrupted cKMC practice [51, 55].

Furthermore, it is essential to recognise that the cultural, attitudinal, and belief disparities that exist across countries, nations, and regions profoundly impact the implementation of cKMC practice and influence family support for cKMC, emphasising the necessity of exploring local perspectives, cultural dynamics, and societal norms to devise and implement KMC practices within communities effectively [30, 31, 34].

It can effectively address cultural and social barriers by integrating cKMC practices with existing caregiving traditions and community support systems. For example, in some rural settings, traditional postpartum practices that prioritise maternal rest and familial caregiving can be aligned with cKMC to enhance acceptance and feasibility [51]. By embedding cKMC within familiar cultural routines, such as extended family care, peer support, or locally valued child-rearing practices, community-based programs can improve uptake and sustainability in non-facility environments.

In addition, persistent knowledge gaps among mothers, families, and community health workers were evident, particularly regarding the benefits, techniques, and appropriate duration of KMC in community settings [30, 31, 40, 54]. This is consistent with a study reporting that unfamiliarity often stems from a lack of widespread awareness about the benefits of cKMC practice [64]. These gaps may stem from inadequate counselling at discharge and limited engagement of community healthcare workers in postnatal follow-up. Strengthening the capacity of community-based providers to educate and support families that practice cKMC and clarifying their roles in ongoing care is essential to ensuring the sustainability of KMC beyond facility walls.

Family involvement emerged as a critical enabler or barrier, depending on the level of support provided [28, 30, 38, 46, 52]. Mothers frequently reported that without assistance from family members, particularly in sharing household duties, they struggled to maintain continuous

cKMC practice [33]. In some contexts, male partners were identified as primary decision-makers regarding neonatal care, yet often remained uninvolved in cKMC [45].

This reflects both patriarchal family structures and cultural perceptions of childcare as a maternal responsibility [30, 45]. Conversely, in settings where family members and partners actively supported cKMC by performing household tasks or taking turns providing skin-to-skin care, mothers were better able to sustain the practice at home [50]. Some partners may feel more comfortable performing KMC during nighttime hours due to community or peer pressure during the day and work responsibilities [37]. It is essential to support both mother and neonate regardless of the time of day. These findings highlight the need for interventions that engage the broader family unit, including male caregivers, and challenge gendered caregiving norms to enable equitable participation in newborn care.

Limitations

This review has several limitations that should be acknowledged to provide a balanced interpretation of the findings. First, the majority of included studies originate from Africa and Asia, regions where preterm and LBW neonates face significant morbidity and mortality [2]. This geographic focus is likely driven by the higher prevalence and urgent need for effective neonatal care solutions in these areas, resulting in a substantial body of research from lower- and middle-income countries. Consequently, the review lacks representation from Australasia, Europe, North America, and South America—regions where preterm and LBW births might have a lesser impact due to more advanced neonatal care systems. This geographic concentration could limit the generalizability of the findings to more diverse global settings.

Another limitation is the review's broader inclusion criteria, which encompassed general newborn care practices rather than focusing exclusively on cKMC. This broader focus may restrict the applicability of the findings specifically related to cKMC, particularly in remote rural areas where unique challenges, such as communication barriers, could hinder the implementation of cKMC.

Furthermore, our review exclusively includes articles published in English, which may have led to the exclusion of relevant studies published in other languages, potentially introducing bias into the conclusions. Additionally, the enabling factors for the successful implementation of cKMC were not consistently reported across all studies, adding complexity to drawing definitive conclusions.

Methodological limitations also affected the review, including potential recall bias, small sample sizes, and participant response bias, which were prevalent across the included studies. Most studies collected data

primarily from mothers, with fewer studies incorporating perspectives from partners, other family members, traditional birth attendants, or community health workers. Even in instances where data from various participants were collected, it was often not disaggregated in the results, which could obscure important nuances and limit the depth of analysis.

Implications and recommendations

This systematic review has highlighted important factors that can be either enablers or barriers to the implementation of KMC in community and home settings. However, the studies analysed have mainly focused on the continuity of care from health facilities to homes or after hospital discharge, assuming that mothers and families are sufficiently informed to carry out KMC at home or in the community. Therefore, it is important for future research to explore KMC practices initiated by the community, including the barriers and enablers, in order to gain a deeper understanding of the fundamental challenges faced when practising KMC at home or in the community.

This review provided a limited account of the perspectives of fathers or paternal figures, as most research has only considered the views of mothers or other family members. Generally, some findings of the results from mothers, families, partners, and healthcare providers present cumulatively. Therefore, conducting separate studies for each group would be beneficial in gaining insights into developing targeted strategies for each group to address specific challenges.

Additionally, the role and impact of community health workers or health extension workers on KMC practice have not been explored, but they are important in improving community-related health. Hence, future research is of great importance in assessing the role of these workers in facilitating KMC practice and caring for preterm and LBW neonates.

The potential disparities in KMC practices between rural and urban settings have yet to be fully examined. It is important to explore and compare the barriers and enablers of KMC implementation in urban and rural communities or home settings to address any distinct differences in approach.

It is imperative to create effective interventions that address the obstacles hindering the implementation of successful KMC practices at home and in the community. Specifically, strategies must be developed that aid mothers and other family members strengthen their understanding of KMC practices, solve practical issues, overcome sociocultural barriers, and navigate family support. Additionally, designing strategies that facilitate communication between community or home settings and hospitals is important for providing prompt medical

assistance to preterm and LBW neonates in the event of danger signs; a linkage or a direct referral system is needed for this purpose. Therefore, addressing these barriers is important by acknowledging and supporting the practical issues of KMC for mothers and families, particularly those caring for preterm or LBW neonates.

The implications of implementing KMC in the community and home environments are able to significantly reduce the duration of hospitalisation for preterm and LBW neonates, alleviate the workload of nurses and involve midwives in providing KMC and other postpartum services.

Conclusion

The practice of cKMC is a highly beneficial intervention for premature and LBW neonates, but its implementation in the home and the community is complex, involving numerous obstacles. This systematic review has identified numerous barriers that can impede the implementation of KMC in the community and at-home settings, as well as potential measures to facilitate the adoption and improve the quality of care. Therefore, implementation researchers, policymakers, and government bodies need to address these challenges to reduce the burden of neonatal mortality and facilitate the adoption rate of KMC practice in the community and at-home settings.

Abbreviations

AHWI	Australian Health and Welfare Institute
CINAHL	Cumulative Index to Nursing and Allied Health Literature
cKMC	Community-based Kangaroo Mother Care
EMBASE	Excerpta Medica Database
KMC	Kangaroo Mother Care
LBW	Low Birth weight
MEDLINE	Medical Literature Analysis and Retrieval System Online
MeSH	Medical Subject Heading
MMAT	Mixed Method Appraisal tool
NMR	Neonatal Mortality Rate
PHCU	Primary Health Care Unit
UNICEF	The United Nations International Children's Emergency Fund
WHO	World Health Organisation

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

Supplementary Material 4.

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Authors' contributions

H.A. conducted research, reviewed articles, and drafted the manuscript. V.K. also reviewed the articles and provided feedback on the manuscript.

A.C. contributed as a third reviewer of the articles and participated in the manuscript review process. All authors participated in conceptualisation, study review, design and analysis, and manuscript review. Finally, all authors read and approved the final manuscript.

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Data availability

The data supporting this review's findings are available in the manuscript and supplementary files.

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