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Facilitators and barriers to developmentally supportive care for preterm infants in low and middle-income countries: A scoping review☆

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ABSTRACT

Background: Preterm birth and its associated complications are a major cause of neonatal mortality worldwide. Approximately 15 million preterm infants are born annually, most births occurring in Sub-Saharan Africa and South Asia. However, Developmentally Supportive Care—an evidence-based intervention reported to improve the survival of preterm infants, is under utilized in Low and Middle-Income Countries. This review focuses on examining the barriers to, and facilitators of, Kangaroo Mother Care, positioning (nesting and swaddling), and control of the external neonatal intensive care environment in low- and middle-income countries.

Methods: Six databases were systematically searched between January 2000 to April 2020. A search of the grey literature was also conducted. Two independent reviewers screened the citations of the retrieved papers and abstracted data for included studies based on predetermined inclusion/exclusion criteria.

Results: A total of 15853 articles were retrieved from the search. A full-text review was conducted on 155 articles. Thirty-two papers were identified and included in the review. Thirty papers focussed on KMC, two papers focused on noise control. No studies were identified on positioning and light control in the NICU. Barriers identified included lack of knowledge of DSC practices in both health care workers and family caregivers, existing cultural norms, and the absence of protocols and guidelines for practice. Facilitators included; healthcare worker training, leadership and support from health care facility managers to family caregivers, and available infrastructure.

Conclusion: Further studies that comprehensively examine DSC implementation in Low-Middle-Income countries are required in order to improve sustained DSC practices.

1. Background

The significant progress made globally between 1990 and 2015 in reducing the deaths of children under the age of five years; from 12.6 million deaths per year in 1990 to 5.4 million in 2015, has been described as 'unprecedented' (Darmstadt et al., 2014; Lawn et al., 2013b, p. 189; Mejía-Guevara et al., 2019). However, the percentage of neonatal deaths (in the first 28 days of life) that contribute to the mortality of children under five years of age has consistently remained high; between 40% and 47% within the same period (Chou et al., 2015; Lawn et al., 2010; UNICEF, 2019). The global neonatal mortality rate (NMR) as of 2018 was approximately 18 per 1000 live births, with an estimated 2.5 million neonatal deaths annually equating to almost 7000 newborn deaths daily around the world (Mejía-Guevara et al., 2019; UNICEF, 2019). Low and middle-income countries (LMICs) such as those in Sub-Saharan Africa and South Asia conversely have NMRs of 28 and 26 per 1000 live births, respectively (UNICEF, 2018; World Health Organization, [WHO] 2019). These rates make the chances of survival within the first 28 days of life in Sub-Saharan Africa and South Asia ten times less likely than in high-income countries (UNICEF, 2019; WHO, 2019).

Neonatal deaths are caused by complications of prematurity, intrapartum-related conditions, and infections such as sepsis, pneumonia, and meningitis (UNICEF, 2018; WHO, 2019). Preterm birth or prematurity is defined as" any live baby born before 37 completed weeks of pregnancy or births earlier than 259 days from the first date of a woman's last menstrual period" (American College of Obstetrics and Gynecology [ACOG], 2020; Stavis, 2019). Prematurity is a major cause of newborn deaths worldwide. Approximately 15 million preterm infants are born worldwide every year (UNICEF et al., 2018; WHO, 2019)

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with twelve million (81.1%) of these preterm infants delivered in Sub-Sahara Africa and Asia. (Chawanpaiboon et al., 2019; UNICEF, 2017). More than one million deaths each year in the neonatal period are estimated to be due to complications associated with preterm birth, most of which occur in LMICs (Griffin et al., 2019; Lawn et al., 2013b). Preterm infants who survive may live with life-long motor and cognitive impairments (BlencoweCousens et al., 2013; Medvedev et al., 2020).

The physical and neurological development of a term infant occurs entirely in utero; an environment with constant nutrients, maternal protection from excessive light and continuous temperature control (Allotey et al., 2018; Als and Gilkerson, 1997; Altimier et al., 2015). In contrast, preterm infants experience a disruption in the developmental process due to the early transition into the extra-uterine environment, which is psychologically distressing and physically stressful. External factors such as lighting, noise, and excessive handling, common in most Neonatal Intensive Care Units (NICUs), elevate infant stress and decrease oxygenation, thereby impacting negatively on the development of the preterm infant (Byers, 2003a; Montirosso et al., 2012; Sathish et al., 2019). It has been estimated that with the implementation of existing cost-effective and feasible developmentally supportive care interventions, preterm survival could be enhanced, and neonatal mortality reduced by 41–72% worldwide (BlencoweCousens et al., 2012; Darmstadt et al., 2005; VictoraBahl et al., 2016a).

Developmentally supportive care (DSC) comprises a broad range of interventions to reduce the stress of the extra-uterine environment on the preterm infant and promote survival and improve long-term outcomes (Burke, 2018; Byers, 2003b; Sathish et al., 2019; Soleimani et al., 2020). DSC includes; Kangaroo Mother Care (KMC), family-centered care, positioning of the infant (nesting, swaddling) as well as the control of light and noise in the environment (Benzies et al., 2013; Symington and Pinelli, 2006; Wiley et al., 2020). KMC is the practice whereby an infant is held closely through continuous, direct skin-to-skin contact on the bare chest of the mother or other caregivers (Bayo et al., 2019; Chan et al., 2016; WHO, 2015). The key features of KMC as described by the WHO are; initiation in hospital and continuation at home, early continuous and prolonged skin-to-skin contact, exclusive breastfeeding (ideally), and early discharge from hospital with adequate support and follow-up (WHO, 2003).

Environmental factors, such as noise and light, in the NICU, have been reported to increase physiological stress among preterm infants (Aita et al., 2019). High levels of noise and light above 45 decibels and 600 lux (American Academy of Pediatrics, 1997; White, 2007), respectively, cause an alteration in the physiological state of the preterm infant, such as apnoea, sleep disruption, and increased oxygen consumption, thereby increasing the required calories for the preterm infant to grow (Almadhoob and Ohlsson, 2020; Brown, 2009).

Correct positioning (Karp, 2015; Van Sleuwen et al., 2007) and comfortable close wrapping of infants, termed 'swaddling' (Meyer and Erler, 2011; Pease et al., 2016), has been noted to control excessive crying. With proper positioning and swaddling, extra energy expended from abnormal movements and excessive crying of the preterm infant is conserved to promote growth and enhance survival (Picheansathian et al., 2009; Shepherd et al., 2018).

Family-centered care involves parents and other family caregivers as collaborators in infants' caregiving (Lavallée et al., 2019; Vetcho et al., 2020). The engagement of family caregivers in the daily care of their infants shortens the length of hospitalization, promotes bonding and breastfeeding, and increases their confidence to care for their infants, particularly after discharge from the NICU (Soni and Tscherning, 2021; Vetcho et al., 2020).

Research has shown that DSC interventions are not widely used in LMICs despite the high incidence of preterm births and neonatal deaths (Boerma et al., 2018; Lawn et al., 2010; Morgan et al., 2018). A possible reason for the under-utilization of DSC interventions in LMICs is that there are barriers to the effective implementation of DSC specific to the context of LMICs.

Integrating research into practice has been identified as essential in every country's health care delivery system (Kent, 2019). The success or failure of any evidence-based implementation process relies on identifying the facilitators and barriers to the intervention being adopted into practice (Geerligs et al., 2018). According to Dogherty et al. (2010), the collective responsibilities of individuals or groups, along with efficient and effective leadership at the organizational level, are essential in integrating evidence-based practice into a setting (Dogherty et al., 2010). Barriers encountered at the individual or organizational level may hamper the implementation process (Ubbink et al., 2013; Warren et al., 2016). Given this, for an evidence-based practice like DSC to be implemented effectively, the barriers, as well as the facilitators, must be explored (Duncombe, 2018). Therefore, it is relevant to conduct a scoping review to identify the facilitators of, as well as the barriers to, implementation and provision of DSC in LMICs. As a broad bundle of interventions, the DSC interventions for this scoping review were limited to KMC, positioning (nesting/swaddling), and lighting and noise control in the NICU.

2. Methods

Ovid-Medline, Psych-Info, EMBASE, Latin American and Caribbean Health Sciences Literature (LILACS), Africa-Wide Information and CINAHL were searched between the years 2000 and 2020. Approaches used in the search included; database-specific subject heading searches, text word searches, Boolean operators and truncations, a search of individual concepts, and a combination of concepts. Searches were conducted for relevant studies in consultation with an information specialist and research team.

To supplement the database searches, reference tracking of retrieved papers was done to identify papers that were missed through the database search (University of Toronto Libraries & Gerstein Science Information Centre, 2020). Additionally, to avoid bias and ensure comprehensiveness of the search, grey literature was accessed using Advanced Google through targeted website browsing of relevant international organizations and professional associations for reports and policies (Mahood et al., 2014). Websites of international organizations and Non-Governmental Organizations (NGOs) included WHO, UNICEF, USAID, March of Dimes Foundation, and professional associations such as the American Academy of Pediatrics and the Association of Women's Health, Obstetric and Neonatal Nurses. ProQuest Dissertations & Theses Global were also searched for unpublished doctoral dissertations on DSC pertaining to LMICs.

Retrieved papers were imported into a reference management software (Endnote X 9) for de-duplication (Bramer et al., 2016). Following de-duplication, the remaining articles were imported into Covidence; web-based software for screening and data extraction (Covidence, 2020)

Table 1
Inclusion and exclusion criteria.

Criterion	Inclusion	Exclusion
Population	Preterm Infants; < 37 completed weeks gestation	Term infants
Concept	DSC, KMC (facility-initiated), skin-to-skin contact, swaddling/nesting, positioning, light, and noise	Family-centered care Community-initiated KMC
Context	LMICs (Low and Lower-Middle Income countries) based on GNI per capita Neonatal Intensive Care Units (NICUs)	Upper-Middle Income Countries High-Income Countries
Study Design	Quantitative, Qualitative, Mixed Methods	
Language	English	Any language other than English
Sources	Primary Studies, Secondary Studies	Editorials, Commentaries and Case Studies
Year	January 2000–April 2020	Before the year 2000

based on pre-determined inclusion and exclusion criteria (Table 1). The World Bank country grouping was used to classify low and middle-income countries (WorldBank, 2020). Editorials, commentaries, case studies, and studies not published in English were excluded. Two independent reviewers (KK and LJ) screened titles, abstracts, and full texts in Covidence. However, an appraisal of the quality of included studies was not undertaken by the reviewers given this study is a scoping review (Arksey and O'Malley, 2005). The research team resolved conflicts encountered during the process.

3. Results

A total of 15853 articles were identified. De-duplication resulted in the removal of 8347 articles, and 7528 articles were imported into Covidence and screened against the title and abstract and the a priori inclusion and exclusion criteria (Covidence, 2020). The two independent reviewers excluded 7373 articles, and a full-text review was carried out on the remaining 155 articles. One hundred and twenty-three (123) articles were further excluded, with 32 studies included in the review as shown in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses; Scoping Review Guideline (PRISMA-ScR) (Moher et al., 2009; Tricco et al., 2018) (Fig. 1).

The papers included 20 primary studies (Appendix A-Table 2) and 12 secondary studies (Appendix B-Table 3). The studies were carried out in various LMICs, including; Ghana, Indonesia, Malawi, Pakistan, Zimbabwe, Uganda, India, Rwanda, Mali, and Tanzania. Thirty of the included studies focused primarily on the KMC component of DSC. Two studies focused on noise reduction in the NICU, and no studies were identified on positioning/swaddling or light control in the NICU.

3.1. Themes

An analysis of the extracted data generated three themes; knowledge, cultural norms, and health systems, as both barriers to, and facilitators of, DSC implementation.

3.2. Knowledge

The theme 'knowledge' is attributed to both health care workers (HCWs) and family caregivers. It was apparent that the lack of training for HCWs regarding KMC and the resultant apathy towards the practice among HCWs was identified as a challenge to KMC practice (Chan et al., 2017; Jamali et al., 2019; Yawson et al., 2016). Some studies reported that few HCWs had any knowledge of KMC (Bergh et al., 2012c, 2013; Seidman et al., 2015; Utami and Huang, 2019). Though HCWs may have known the components of KMC, they had no knowledge of the benefits, and most importantly, on when to start KMC as well as the eligibility criteria for KMC; such as the gestational age and weight at which a preterm infant should commence KMC (LawnDavidge et al., 2013; Seidman et al., 2015; Utami and Huang, 2019). This lack of knowledge

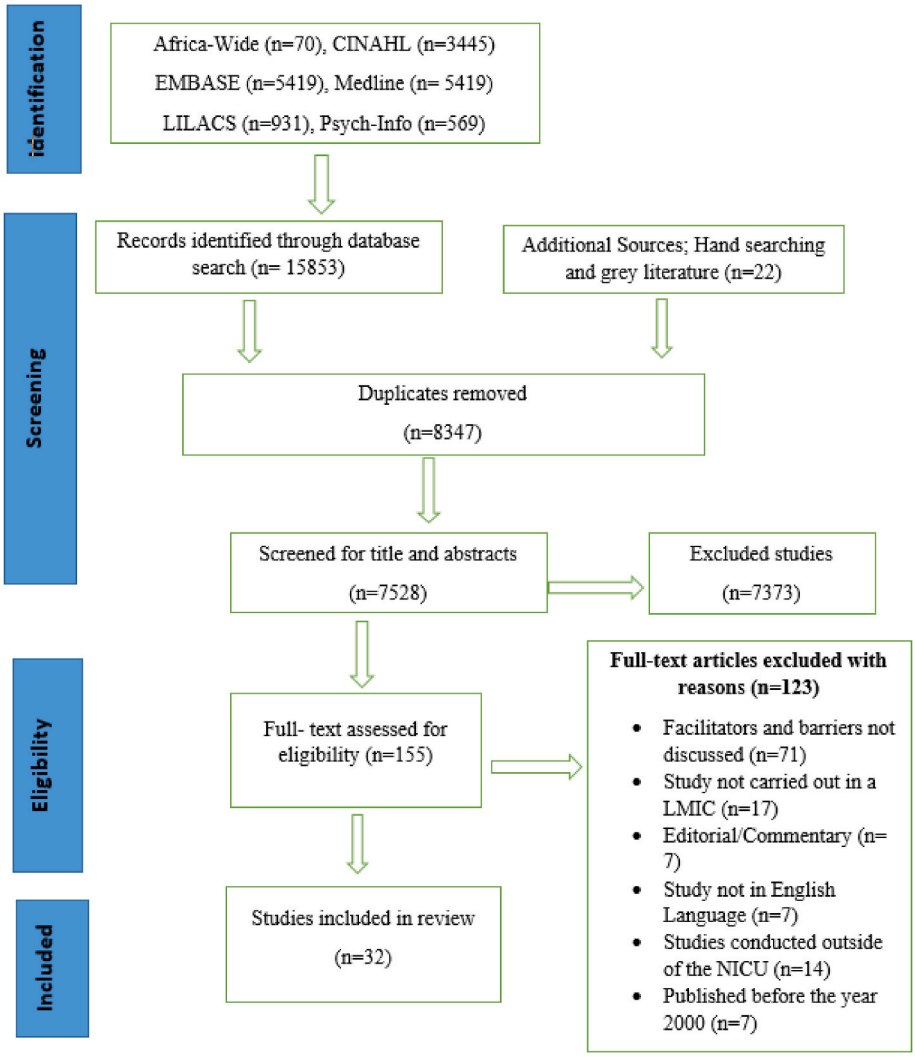

Fig. 1. PRISMA-flow diagram of included studies.

also influenced some HCWs' beliefs concerning the appropriate clothing for infants during KMC (Chan et al., 2017; Seidman et al., 2015). Neonates, including preterm infants, should be protected from hypothermia and its potentially fatal consequences (LawnDavidge et al., 2013; SmithBergelson et al., 2017; Tahir and Fatmi, 2019). As such, clothing preterm infants with a cap and socks during KMC is sufficient to maintain an infant's temperature. However, the lack of knowledge on the part of some HCWs' regarding this requirement led to misconceptions, such as believing that dressing infants with caps or socks in warm climates made them uncomfortable, impeding correct KMC practice. (Chan et al., 2017).

Additionally, the lack of knowledge of HCWs regarding the benefits of KMC contributed to a perception of KMC as a "poor man's" alternative to technologically advanced newborn care (Chan et al., 2017; Charpak and Ruiz-Pelaez, 2006, p. 530; Victora and Gapps Review, 2010). Rather than recognizing the benefits of KMC, HCWs believed poorer countries adopted KMC because of the unavailability of incubators in low-resourced countries compared to high-income countries where preterm infants are mostly nursed in incubators (Charpak and Ruiz-Pelaez, 2006; Tahir and Fatmi, 2019; Victora and Gapps Review, 2010).

During KMC, caregivers are regularly monitored and provided with guidance from nurses to ensure their preterm infants are fed appropriately and positioned correctly. Nurses perceived these activities as additional work preventing KMC practice (Charpak and Ruiz-Pelaez, 2006; Seidman et al., 2015). In addition, follow-up care, including monitoring weight gain and sustained KMC practice, conducted by HCWs post-discharge was also considered to increase their workload leading to a reluctance to practice KMC (Charpak and Ruiz-Pelaez, 2006; Chisenga et al., 2015; Jamali et al., 2019; Seidman et al., 2015; Vesel et al., 2015)

Despite the identified barriers of lack of knowledge on the benefits of KMC by HCWs and a perception that KMC increases the workload of nurses and midwives, the evidence for positive outcomes observed by HCWs for those preterm infants receiving KMC conversely facilitated KMC practice (Aliganyira et al., 2014; Bergh et al., 2013; Victora and Gapps Review, 2010). To ensure HCWs had adequate knowledge of KMC, its principles, and its effectiveness as an alternative care method to an incubator, some health facilities provided formal training on KMC for HCWs (Bergh et al., 2013; Charpak and Ruiz-Pelaez, 2006; Parmar et al., 2009). In addition to providing this training to HCWs, some health facilities in Pakistan and Malawi also trained other types of hospital staff, such as health care assistants and community health workers (Jamali et al., 2019; Seidman et al., 2015; Vesel et al., 2015). This training empowered the community health workers to undertake follow-up care of preterm infants discharged from the hospital who required continued KMC at home. Health care assistants were also utilized, under nurses' supervision, to carry out regular checks on family caregivers practicing KMC in the NICU. These roles consequently lessened the workload of nurses and midwives, leading to improved uptake of KMC practice (Jamali et al., 2019; Seidman et al., 2015; Utami and Huang, 2019; Vesel et al., 2015). Apart from the positive impact of HCWs knowledge on KMC, some HCWs in India implemented behavioral modifications in their daily NICU practice, including speaking in a low tone during interactions to control noise after they were provided education on the importance of a quiet NICU environment required for preterm infant development (Ramesh et al., 2009).

Without knowledge of the practice and the processes involved in KMC, family caregivers were unwilling to implement the practice (Kambarami et al., 2002; SmithBergelson et al., 2017). With no knowledge of the benefits of KMC on preterm infants, family caregivers considered the practice as an imposition whenever it was suggested by healthcare workers (Kadam et al., 2005). Also, mothers reported being worried that nursing a preterm infant in the KMC position was uncomfortable, disrupting their rest period after a painful and stressful labor and delivery (Bee et al., 2018; SmithBergelson et al., 2017; Utami and Huang, 2019). Further, family caregivers were reported to be anxious about their preterm infants' safety in the KMC position, fearing injury to the fragile infant (Bee et al., 2018) and the possibility of the infant falling from the KMC position (Utami and Huang, 2019). This fear, coupled with the perception of mothers' discomfort, prevented KMC implementation (Seidman et al., 2015; SmithBergelson et al., 2017).

Although family caregivers' fears and anxieties reportedly prevented KMC practice, the provision of appropriate education by health care providers reportedly facilitated its implementation. Through education, the benefits of KMC, including weight gain, achieved by preterm infants who had completed KMC were shared with other mothers yet to start KMC (Bergh et al., 2013; Seidman et al., 2015); increasing their acceptance and willingness to practice (Chan et al., 2017; Kadam et al., 2005; Kambarami et al., 2002).

3.3. Cultural norms

As part of cultural practices in some LMICs, such as Malawi and Pakistan, mothers lack the power to make decisions concerning their infants (Chisenga et al., 2015; Jamali et al., 2019) with fathers and mothers-in-law making decisions regarding newborns' well-being, including those of preterm infants. Due to the lack of awareness of the benefits of KMC, fathers and mothers-in-law subsequently disapprove of the practice and in turn, discourage mothers from adopting the practice for their preterm infant (Tahir and Fatmi, 2019). This cultural practice adversely affects the implementation of KMC (Chisenga et al., 2015; Jamali et al., 2019; Parmar et al., 2009).

Additionally, cultural norms concerning gender roles hindered KMC practice (Tahir and Fatmi, 2019; Vesel et al., 2015). In countries like Uganda and Pakistan, childcare duties, including diaper changes, bathing of infants, and KMC practice, are considered a woman's responsibility (Seidman et al., 2015; Tahir and Fatmi, 2019). Therefore, fathers in a position to practice KMC in order to provide respite for their partners were unwilling to do so for fear of being mocked by their male peers (Seidman et al., 2015; Tahir and Fatmi, 2019). This conventional norm of exempting fathers from child care activities caused mothers to perceive KMC practice as challenging, particularly after discharge home, due to the other competing demands of household chores and family responsibilities (Chisenga et al., 2015; Seidman et al., 2015), further impeding the practice (Seidman et al., 2015; Tahir and Fatmi, 2019; Vesel et al., 2015).

Furthermore, in some LMICs, such as Ghana and Malawi, carrying infants on their mothers' backs is the accepted practice (Chan et al., 2017; SmithBergelson et al., 2017). Therefore, when mothers are seen with their preterm infants strapped to their chest, it is perceived as a deviation from the norm and exposes them to ridicule. This fear of being mocked prevented mothers from practicing KMC (Chan et al., 2017; Jamali et al., 2019). However, community education by HCWs through media and visual aids created an awareness of KMC practice within communities (Jamali et al., 2019; Tahir and Fatmi, 2019). This awareness led to increased community support and allayed mothers' fears; which consequently increased their confidence to carry their preterm infant in the KMC position without fear of stigmatization; enabling KMC practice (Aliganyira et al., 2014; Jamali et al., 2019; Parmar et al., 2009).

3.4. Health care system

Support of KMC at the national and health facility level was enabled by the availability of adequate health facility infrastructure (Bergh et al., 2012b, 2013; Vesel et al., 2015). For this practice to be sustained and adhered to, the comfort of both the family caregiver and the infant must be considered by health facility managers in planning and implementing KMC (Bee et al., 2018; Fronczak et al., 2019). In demonstrating commitment to the implementation of KMC, health facility managers in some countries, including Uganda, created designated KMC units

furnished with comfortable beds, chairs, and pillows for family caregivers' comfort (Aliganyira et al., 2014; Bergh et al., 2012a). In other health facilities, alterations were made to existing units by partitioning congested wards to provide privacy for family caregivers (Bergh et al., 2013; SmithBergelson et al., 2017). Furthermore, support services, such as providing food for family caregivers and the supply of KMC starter packs containing clothes, and slings, for the preterm infant, also aided KMC implementation (Bergh et al., 2012c; Jamali et al., 2019; Tahir and Fatmi, 2019). Two studies in India reported the contributions of health facility infrastructure in positively affecting the NICU environment (Ramesh et al., 2009, 2013). Health facility managers implemented hourly measurement of noise levels in a NICU in order to create a conducive environment, which enhanced the wellbeing of preterm infants and promoted DSC practice (Ramesh et al., 2009, 2013).

The absence of local and national policies on KMC implementation may adversely impact the uptake and scale-up of the practice (Aliganyira et al., 2014; Charpak et al., 2020; Fronczak et al., 2019; Lawn et al., 2013b; March of Dimes et al., 2012; Moore, 2015). Few countries, including Malawi, Mali, Pakistan, Rwanda, India, and Uganda, have prioritized KMC in their national policies (Dickson et al., 2014; Vesel et al., 2015). The failure in many LMICs to develop national policies on DSC practices, including KMC, has been attributed to financial constraints and a lack of national commitment to identifying individuals and groups to champion and advocate for the integration of these practices into health care (Charpak et al., 2020; Dickson et al., 2014; LawnDavidge et al., 2013).

Given the absence of national policies, different health facilities have employed various ad hoc policies and guidelines, which leads to varied practices such as differing weight eligibility criteria for the start of KMC (LawnDavidge et al., 2013; Utami and Huang, 2019). These diverse approaches in practice present uncertainties among some HCWs, posing a challenge to DSC implementation (Bergh et al., 2012b; LawnDavidge et al., 2013; Moore, 2015). Furthermore, most hospitals have a policy restricting family caregivers' access to the NICU. They are granted access to the NICU for only a few hours a day, usually during infants' feeding time which reduces the bonding time for the infant and their family caregivers, interrupting KMC practice (Charpak et al., 2020; Lawn et al., 2013b; Moore, 2015; SmithBergelson et al., 2017; Victora and Gapps Review, 2010).

The chronic shortage of HCWs in different health facilities in Ghana, Uganda, Tanzania, Rwanda, Pakistan, India, and Zimbabwe has been cited as a contributing factor to the lack of supervision of family caregivers during KMC practice, further inhibiting implementation (Bergh et al., 2012a; Kambarami et al., 2002; Mbalinda et al., 2018; USAID, 2019; Yawson et al., 2016). Moreover, the unequal distribution of HCWs between rural and urban health facilities leads to a disparity in HCW-patient ratios, hindering DSC implementation (Chisenga et al., 2015; Dickson et al., 2014).

4. Discussion

This scoping review aimed to assess the facilitators of, and barriers to, DSC implementation in LMICs. The majority of papers focussed on KMC, with two papers describing noise amelioration in the NICU and no identified studies reporting the other DSC interventions, namely positioning and lighting, despite their additional positive impacts on preterm infant outcomes (Legendre et al., 2011; Symington and Pinelli, 2006; Wiley et al., 2020). This finding raises concerns about the commitment of LMICs to improving preterm infant outcomes, given the high number of preterm infant deaths occurring in these countries (Arunda et al., 2017; BlencoweCousens et al., 2013). This absence of literature could be due to a lack of research undertaken on the different aspects of DSC and/or the possible failure of LMICs to recognize and prioritize the other components as essential as KMC. The barriers identified in this review were HCW and family caregiver lack of knowledge regarding KMC, the impact of cultural norms, a lack of policies on KMC at both local and national levels, and a critical shortage of appropriately trained HCWs. Conversely, social support, the establishment of designated KMC units, and the provision of education to HCW and family caregivers facilitated KMC implementation.

A lack of knowledge on the part of both HCWs and family caregivers (Mbalinda et al., 2018; Parmar et al., 2009; Seidman et al., 2015; Utami and Huang, 2019) and a chronic shortage of HCWs (Dickson et al., 2014; Fronczak et al., 2019; Mbalinda et al., 2018; Vesel et al., 2015) impeded KMC implementation in LMICs. Khawash and Banerjee (2018) documented a similar finding. They reported a lack of knowledge on early developmental care, including KMC, on the part of NICU nurses in hospitals in India, adversely affected DSC practice (Khawash and Banerjee, 2018).

An integrative review conducted by Maniago and colleagues (2020) of primarily high-income countries reported that a lack of knowledge of KMC among nurses impeded its implementation. High-income countries such as Sweden, Canada, and the United States, have also pointed to the lack of knowledge among HCWs as a barrier to developmentally supportive care practice, including KMC (Lee et al., 2012; Milette et al., 2005; Sellick et al., 2006; Strand et al., 2014). Even though these high-income countries have better preterm infant outcomes compared to LMICs (March of Dimes et al., 2012; WHO, 2019), the negative effect of this lack of knowledge of DSC among HCWs was emphasized. These related findings confirmed in different contexts, imply a significant worldwide impact of HCWs' inadequate knowledge as a barrier to effective implementation of developmentally supportive care. As described by Harvey and Kitson (2016), the successful implementation of evidence into practice depends heavily on the knowledge of the implementers of evidence (Harvey and Kitson, 2016). In other words, with regards to DSC implementation, HCWs practicing in NICUs require relevant DSC knowledge in order to facilitate practice (Altimier et al., 2015; Hendricks-Munoz et al., 2013; Peesara et al., 2017).

Studies in South Africa (Mahwasane et al., 2020) and Saudi Arabia (Abdulghani et al., 2020), both considered upper-middle and high-income countries, respectively, have indicated that a shortage of HCWs had a negative effect on KMC practice. Both studies suggested that the shortage of HCWs indirectly increased the workload of the few HCWs providing care to the many admitted babies. This situation prevented HCWs from regularly supervising and monitoring family caregivers and their preterm infants under their care, which according to some family caregivers, deprived them of the necessary supervisory support to practice KMC (Abdulghani et al., 2020).

The shortage of HCWs with its resultant heavy workload makes it challenging for them to attend available training programs in order to enhance their skills to practice DSC (Mahwasane et al., 2020). That notwithstanding, task-shifting programs such as delegating specific tasks from higher-to lower-skilled workers (Mijovic et al., 2016) have the potential to facilitate KMC. This evidence of task shifting was noted in Pakistan and Malawi, where community health workers undertook the follow-up visits of preterm infants discharged from health facilities to support the continuation of KMC at home. The newly assigned role to this group of workers facilitated KMC implementation (Jamali et al., 2019; Vesel et al., 2015).

A systematic review of studies conducted in high-income countries (Brouwer & Van den Hoogen, 2015) and data gathered from an international workshop to improve KMC coverage (Cattaneo et al., 2018) documented findings that concur with those of this scoping review; that the lack of knowledge of KMC by family caregivers and concerns about their preterm infants' safety in the KMC position hindered its practice (Cattaneo et al., 2018). Brouwer and Van den Hoogen (2015) indicate that the lack of knowledge of KMC by mothers while in the NICU left them dissatisfied with KMC practice. Without knowing the benefits of KMC for their infant, mothers perceived the practice as a compulsory act whenever it was recommended by HCWs, impeding its practice. However, with some knowledge acquired from HCW's counseling, family caregivers were motivated with an increased desire to practice (Brouwer

& Van den Hoogen, 2015).

With respect to cultural norms and their role as barriers to KMC practice, previous studies (Dawar et al., 2019; Rasaily et al., 2017; Yue et al., 2020) have alluded to gender roles and the interference of mothers-in-law in infant care as impeding KMC practice. In developed countries where the nuclear or immediate family system predominates (Rasaily et al., 2017), mothers, or women in general, are perceived to be independent and empowered to the extent where there may be an anticipation of lesser demanding household chores, or additional support provided, to facilitate KMC practice. However, in LMICs, where the extended family system is prevalent, mothers commonly take care of their immediate family as well as their in-laws and other family members, thus increasing their household responsibilities. Moreover, it is unusual for women to work outside the home; therefore, women who choose to do so have to maintain their traditional roles as well. These competing demands result in a lack of time to practice KMC (Dias et al., 2016; Li et al., 2019).

A recent study conducted in Malawi by Mathias et al. (2020) focused on the utilization of KMC among mothers of low-birth-weight infants and reported the interference of mothers-in-law in infant's care decision making impeded KMC practice (Mathias et al., 2020). Given their cultural norms, mothers were not permitted to decide on the most appropriate care for their infants. As such, when an infant was identified to potentially benefit from KMC, the infant's mother had to consult her mother-in-law for her consent, and in most instances, the mother-in-law did not support or approve KMC for the infant (Mathias et al., 2020). This decision not only hinders KMC implementation but also impacts the survival of the infant.

Previous studies have confirmed that the commitment of health facility managers to provide adequate training for HCWs (Ham et al., 2015), establish designated KMC wards (Cattaneo et al., 2018; Dykes et al., 2016; Lewis et al., 2019), and provide social support to family caregivers (Yue et al., 2020) has facilitated the implementation of KMC, and DSC more broadly. Formal training of HCWs provides them with a better understanding of the components and benefits of KMC (Cattaneo et al., 2018) as well as the necessary skills to monitor and supervise family caregivers during practice (Dias et al., 2016). When HCWs gain a deeper understanding of KMC, it positively influences their communication with family caregivers, particularly during caregiver education/counseling (Almutairi and Ludington-Hoe, 2016; Strand et al., 2014).

Two studies conducted in Sweden corroborate the findings that designated KMC units facilitate its practice (Dykes et al., 2016; Norén et al., 2018). Units created and designated for KMC make caregiver-infant closeness possible. (Dykes et al., 2016). Some KMC units are designed to accommodate only the family caregiver and infant (s), ensuring maximum privacy for family caregivers to undress and support the infant in the KMC position (Dykes et al., 2016). These units include comfortable reclining beds and chairs, footrests, and fridges to store breast milk. The reclining beds and chairs allow caregivers to take short periods of rest or even sleep for longer hours while infants remain comfortable in the KMC position (Norén et al., 2018). In other KMC units, a sense of community or belonging is created among family caregivers by using collapsible screens as partitions between one caregiver and the other for privacy (Norén et al., 2018). In this instance, caregivers do not feel alone as they see others strap their infants in KMC position whenever the screens are folded or removed. This setup motivates family caregivers to keep their infants in the KMC position, enhancing closeness and facilitating KMC practice (Norén et al., 2018).

A study by Yue et al. (2020) supports the suggestion that besides KMC units, additional supports that health facility managers provide to family caregivers also enables KMC practice. The study assessed the facilitators and barriers to the adoption of KMC in five hospitals in China (Yue et al., 2020). The facility managers designed clothes for infants and purchased other items, including blankets to keep the infant warm. These items were procured and made available to caregivers who could not afford to buy them due to financial constraints (Yue et al., 2020). Health facility managers have also provided support to caregivers by subsidizing staying in the KMC units (Tahir and Fatmi, 2019). This support demonstrates their commitment to an organizational culture that supports KMC; essential to successful implementation (Karlberg Traav et al., 2018; Li et al., 2018).

The lack of identified studies addressing the DSC components of control of light in the NICU environment and positioning strategies suggests they have not been widely utilized in LMICs. The failure to transfer these components of evidence-based care into clinical practice in LMICs is concerning because of their potential to improve the survival and outcomes of preterm infants (Symington and Pinelli, 2006; Victora et al., 2016). The failure to integrate this evidence into practice, particularly in LMICs as this scoping review has identified, could be attributed to a lack of knowledge on the part of health professionals and/or the inadequate assessment of the process required to translate the relevant evidence into practice by clinical managers and the health service as a whole (Kent, 2019). Understanding the barriers to implementation helps identify and develop strategies to facilitate the integration process (Duncombe, 2018; Grimshaw et al., 2012).

A limitation of this review was that studies not published in the English language were excluded; therefore, additional relevant papers may have been omitted. The definition of KMC was inconsistent across articles; therefore, not all the studies were describing the same practice, making comparisons difficult. Given this was a scoping review, an evaluation of the quality of the research methods employed in the studies included in this review was not considered.

5. Conclusion

Despite the documented evidence for DSC in improving preterm infant outcomes (Soleimani et al., 2020; Symington and Pinelli, 2006; Wiley et al., 2020), its utilization as a bundle of interventions appears limited in LMICs (Boerma et al., 2018; LawnMwansa Kambafwile et al., 2010). The identified literature focused predominantly on KMC practice in LMICs, with only two studies referencing noise levels and no studies reporting on environmental light control in the NICU or infant positioning. It is well recognized that the bundle of DSC interventions should be used in order to realize the full impact of DSC on neonatal morbidity and mortality (BlencoweCousens et al., 2012; VictoraBahl et al., 2016a). Barriers, such as the lack of knowledge among HCWs and family caregivers, cultural norms, and the absence of policies and guidelines on DSC, were reported in LMICs. However, with commitment from the leadership of health care facilities and the appropriate training of HCWs and family caregivers, the process of DSC implementation may be facilitated. Further research is required in order to identify the challenges associated with the implementation of DSC practices in low-and middle-income countries.

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Declaration of competing interest

None.

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Appendix A

Table 2
Included Studies (Primary Studies)

Author/Year/Title/Country	Objective	Study Design	Study population	Study method	Key findings
Aliganyira et al. (2014). Helping small babies survive: an evaluation of facility-based Kangaroo Mother Care implementation progress in Uganda Uganda	To measure the extent of institutional practice of KMC in Uganda	Cross-sectional	11 health care facilities	A standardized tool to assess progress of KMC implementation. Interviews with managers and staff of the health care facility and observation of facility inventory on KMC practice.	Facilities visited scored between 8.28 and 21.72 out of 30 with a median score of 14.71. Commitment from managers of a facility led to the highest score of 21.7 with evidence of institutionalized KMC practice. Documented evidence showed that family support provided to KMC mothers enabled them to practice. Shortage of staff resulted in little or no supervision of mothers practicing KMC
Bergh et al. (2012a, 2012b, 2012c). Evaluation of Kangaroo Mother Care Services in Mali Mali	To evaluate KMC practice and expansion in Mali	Cross-sectional.	7 health care facilities in Mali	Semi-structured interviews with health care workers, surveys and observation of KMC practices in facilities.	Lack of designated space for KMC practice, absence of written guidelines for KMC practice and inadequate staffing were identified as barriers to KMC implementation. All seven facilities had documentation on babies receiving KMC including the duration of KMC practice
Bergh et al. (2013).Progress with the implementation of kangaroo mother care in four regions in Ghana. Ghana	To assess the implementation of KMC in health facilities in four regions of Ghana	Action research; cross-sectional	Health care workers from 38 health facilities in four regions of Ghana	A standardized progress monitoring tool to assess KMC implementation. Self-report by health care workers, examination of available facility records on KMC practice, and observation for evidence of KMC practice on the ward.	50% of the facilities had special wards set aside for KMC practice, which facilitated KMC implementation. Twenty-six of the 38 facilities (68%) had KMC orientation and training for health care workers, this aided with significant progress in the implementation of KMC. Lack of facility support for mothers negatively affected KMC practice. Only seven facilities had written guidelines and protocols on KMC practice.
Bergh et al. (2012a, 2012b, 2012c). Progress in the implementation of kangaroo mother care in 10 hospitals in Indonesia. Indonesia	To evaluate and improve KMC intervention in 10 hospitals in Java, Indonesia	Action research; cross-sectional	10 hospitals in Java, Indonesia	Observations of activities and facility records of KMC practice. Survey with a validated tool to scrutinize the pre-implementation, implementation and institutionalization phases of KMC process in facilities. Hospital progress was measured and scored out of 100	Facility scores ranged from 28 to 85 out of 100 points with a mean score of 62.1. Five hospitals had adequate evidence of KMC practice, one facility had no evidence of KMC practice, two facilities were at the phase of implementation of KMC practice, and two were at the level of institutionalization. Lack of commitment from leadership of a facility resulted in the lowest score for KMC implementation progress
Bergh et al. (2012a, 2012b, 2012c). Evaluation of Kangaroo Mother Care Services in Malawi. Malawi	To assess the implementation and expansion of KMC in Malawi	Cross-sectional	14 health care facilities in Malawi	Semi-structured interviews with health care workers, facility observation of KMC practice, and the use of a standardized tool to evaluate implementation of KMC	11 facilities with higher scores had designated KMC wards with comfortable beds as well as posters to advertise KMC. Family support provided relief for KMC mothers to practice KMC. Shortage of staff resulted in little, or no supervision of mothers practicing KMC
Charpak and Ruiz-Pelaez (2006). Resistance to implementing Kangaroo Mother Care in developing countries, and proposed solutions. Multi-Country	To identify inhibiting factors to KMC implementation in 15 developing countries	Descriptive cross-sectional	Coordinators of 17 operational KMC programs in 15 developing countries	Open-ended questionnaires were administered to coordinators of operational KMC programmes in 15 developing countries to self-describe implementation success, followed by interviews and field observation of KMC activities	Cultural factors and the lack of privacy during KMC practice were the main cause of resistance expressed by mothers and families during implementation. The perception of KMC practice as added work and a “Poor man’s alternative" to advanced newborn care by health care workers was another source of resistance to KMC implementation.
Chisenga, J.Z., Chalanda, M., &Ngwale, M. (2015). Kangaroo Mother Care: A review of mothers’ experiences at Bwaila hospital and Zomba Central hospital (Malawi).	To describe mothers’ experiences of Kangaroo	Descriptive, cross-sectional	113 mothers of preterm or low-birth weight infants in KMC in two hospitals in Malawi	Questionnaires were administered to mothers to examine factors influencing KMC practice. Interviews were also conducted to	84% of the mothers were not aware of KMC before hospitalization. However, after counseling by health care workers, all mothers described the benefits of KMC and

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Table 2 (*continued*)

Author/Year/Title/Country	Objective	Study Design	Study population	Study method	Key findings
	Mother Care practices.			explore the experiences of the mothers	accepted the practice. Awareness creation of KMC, and counseling and support of mothers were identified as enabling factors to KMC practice. Cultural practices of husbands and mothers-in-law involvement in making decisions on the acceptability of KMC, and competing demands of mothers in relation to household chores were reported as challenges to KMC practice.
Malawi					
Dickson et al. (2014). Every Newborn: health-systems bottlenecks and strategies to accelerate scale-up in countries.	To evaluate bottle- necks for specific interventions and analyze enabling factors in countries with the highest number of neonatal deaths to improve mortality decline.	Systematic bottle-neck analysis	600 experts from 8 countries in Africa and Asia	Experts from Africa and Asia participated in collaborative workshops, identified and graded 2465 challenges in countries with high infant mortality burden using a bottle-neck analysis tool to compile, analyze and compare challenges across countries	Lack of KMC champions and political commitment were the bottle-necks identified from countries in Africa. Asian countries reported similar challenges in addition to workforce shortages and low competency of health care workers.
Multi-country					
Fronczak, N., Chitashvili, T., Opoku, E., Sagoe-Moses, I., & Kauder, S. (2019). Key findings of the Ghana situational analysis of Inpatient care of sick newborns and young Infants (Technical report).	To assess inpatient services for sick and young infants in Ghana.	Cross-sectional	Nine hospitals in Ghana	Semi-structured interviews with health care workers and facility-level managers and surveys of available facility resources for KMC practice.	Lack of space in the infant care unit was consistently reported in all facilities as a barrier to KMC practice. Acceptance of the need for increased KMC use within facilities was reported by staff as an enabler to KMC practice
Ghana					
Jamali et al. (2019). Barriers and enablers for practicing kangaroo mother care (KMC) in rural Sindh, Pakistan.	To explore the barriers and enablers to a mother's capability to practice KMC.	Exploratory	Managers, health care workers and mothers of premature babies in two hospitals in Pakistan	One-to-one in-depth interviews were conducted with health care workers and managers in selected facilities and 14 focus group discussions undertaken with mothers	Health care worker support and commitment from facility managers to provide adequate space, comfortable beds and KMC packs containing; a KMC binder to strap babies unto their mothers' chest, and clothes for the infant enabled the mothers' ability to practice KMC. Lack of training of health care workers and cultural beliefs of mothers were barriers to KMC implementation. Majority of mothers described KMC as a burden due to other household responsibilities. The use of community health workers as links between households and health facilities promoted KMC after discharge.
Pakistan					
Kadam, S., Binoy, S., Kanbur, W., Mondkar, J.A., & Fernandez, A. (2005). Feasibility of Kangaroo Mother Care in Mumbai.	To determine the feasibility and implementation of kangaroo care in a tertiary care hospital in India	Randomized controlled trial	89 neonates and their mothers	Neonates were randomized to KMC or conventional care and physiological outcomes measured. Babies in KMC group were nursed on their mother's chest for at least an hour a day and vital signs monitored hourly. This process was repeated for mother and baby until discharge from the NICU. Neonates in control group were nursed under radiant warmers. Acceptability of KMC by mothers was assessed with semi-structured interviews.	Significantly lesser episodes of hypothermia in KMC group versus control group.86% of mothers reported being happy and comfortable with KMC practice. Stress and pain of labour was documented as a barrier reported by 14% of mothers who found KMC unacceptable
India					
Kambarami, R.A., Mutambirwa, J. & Mararnba, P. P. (2002). Caregivers' perceptions and experiences of 'kangaroo care' in a developing country	To explore caregivers' experiences of KMC practice	Exploratory	48 caregivers of preterm infants	Four focus group discussions with caregivers who had completed KMC, were being taught KMC, or were practicing KMC at home.	Educating caregivers on KMC practice increased the choice for KMC over incubator care. Support from relatives of caregivers promoted KMC practice. Lack of community awareness on the benefits of KMC, coupled with the perception of KMC being unsafe by relatives of caregivers were
Zimbabwe					

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Table 2 (*continued*)

Author/Year/Title/Country	Objective	Study Design	Study population	Study method	Key findings
					challenges identified to successful practice
Mbalinda, S., Hjelmstedt, A., Nissen, E., Odongkara, B., Waiswa, P., & Svensson, K. (2018).Experience of perceived barriers and enablers of safe uninterrupted skin-to-skin contact during the first hour after birth in Uganda. Uganda	To identify barriers and enablers to the practice of continuous skin-to-skin contact (SSC) within the first hour after birth in a low resource health facility	Post-intervention	81 health care workers	A video of the evidence of skin-to-skin contact (SSC) was showed to health care workers. Focus group and individual interviews were carried out to elicit anticipated challenges to the implementation of SSC. After nine months of implementation, focus group discussions were conducted to explore barriers experienced during the implementation process	Barriers identified were; shortage of health care workers to implement SSC and shortage of beds due financial constraints at the facility level. Education on the benefits of SSC by health care workers to family caregivers promoted a positive attitude towards the acceptance of the practice. The commitment of health workers and their involvement was documented as a facilitator to the implementation SSC
Parmar et al. (2009). Experience with Kangaroo mother care in a neonatal intensive care unit (NICU) in Chandigarh, India. India	To examine the feasibility and acceptability of KMC in a NICU	Retrospective cohort	135 preterm infants and their family caregivers. 38 health care workers.	Preterm infants exposed to a minimum of 4 h of KMC a day. Acceptability of KMC by family caregivers was assessed using a questionnaire. Interviews with health care workers to assess attitude towards KMC practice	98% of caregivers were confident to continue KMC at home and over 80% of husbands, mothers-in-law and other family members indicated their support for KMC practice, 94% of health care workers acknowledged the importance of KMC and supported family caregivers to implement the practice
Ramesh et al. (2009). Efficacy of a Low Cost Protocol in Reducing Noise Levels in the Neonatal Intensive Care Unit. India	To investigate the efficiency of a cost-effective noise reduction protocol in a level III neonatal intensive care unit (NICU).	Prospective longitudinal	Five rooms in the NICU and 26 health care workers.	Modification of the NICU environment; alarms on monitors tuned to the lowest level and behavioural adjustment of health workers in the unit. Noise levels measured hourly for 15 days by health care workers after modifications.	Noise was reduced in all five rooms from the initial 68.96 decibels, to within 60 decibels.
Ramesh et al. (2013). Maintaining reduced noise levels in a resource-constrained neonatal intensive care unit by operant conditioning. India	To analyze the outcome of a cost-effective method of operant conditioning in maintaining reduced noise levels in the NICU	Pre-post intervention study	26 Healthcare workers of a NICU in South India	Health care workers were supported in behavioural adjustments. Noise levels in the NICU were measured hourly and reported weekly to health care workers to reinforce behaviour modification.	Behavioural modification through operant conditioning by health care workers such as speaking in low tones and having discussions away from incubators in separate rooms sustained noise reduction for 6months after operant conditioning.
USAID (2019). Situation analysis of Inpatient care of newborns and young Infants: highlights of findings for Ghana, Rwanda, Tanzania and Uganda. Multi-country	To assess service readiness and quality of care by examining health system structures, facility processes, national policies, clinical standards, and caregiver experience of inpatient care of small and sick newborns in a range of countries	Cross-sectional	5 African countries	Semi-structured interviews with health care workers and surveys of available facility resources for KMC practice.	Inadequate number of health care workers was consistently reported with 4 of the 5 countries recording approximately a 50% shortage in numbers of nursing staff, which impacted negatively on KMC practice.
Utami, S., & Huang, M. (2019). Health care providers' perception, knowledge, barriers and practice of kangaroo care for preterm babies in Indonesia. Indonesia	To explore health care workers' perspectives of KMC practice in NICUs and perinatology wards in Indonesia	Cross-sectional, descriptive, correlational study	111 health care workers from four hospitals	A modified Kangaroo Care questionnaire assessed health care workers' perception and knowledge of, and barriers to, KMC practice	82% of the health care workers had no training or experience in KMC. Inadequate knowledge of KMC by health care workers led to the unwillingness to practice KMC. Parental discomfort to practice KMC was reported by health care workers as a barrier to practice
Vesel et al. (2015). Kangaroo mother care: a multi-country analysis of health system bottlenecks and potential solutions.	To explore health systems bottle-necks to the scale up of	Bottle-neck analysis	Consultants from 12 countries in Asia and Africa	Series of consultation workshops and assessment of health systems bottle-necks using Bottle Neck Analysis Tool.	10 of 12 countries identified health financing, health service delivery and community ownership and participation as major bottle

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Table 2 (*continued*)

Author/Year/Title/Country	Objective	Study Design	Study population	Study method	Key findings
Multi-Country	KMC in 12 countries				necks.10 of 12 countries had no national policy on KMC, which negatively affected the implementation of KMC.
Yawson et al. (2016). Bottleneck analysis approach to accelerate newborn care services in two regions in Ghana: implications for national newborn care. Ghana	To accelerate newborn care interventions through bottleneck analysis in two regions of Ghana	Bottle-neck analysis	Regional reports on essential newborn care from the two regions	Desk review of regional reports on newborn care interventions including KMC within the two regions.	Less than 55% of health care facilities in the two regions had trained health care workers in essential newborn care, including KMC. This impacted negatively on KMC practice.

USAID- United States Agency for International Development
KMC——— Kangaroo mother care
NICU——— Neonatal Intensive
SSC————————Skin-to-Skin-Contact

Appendix B

Table 3
Secondary Studies

Author/Year/Title/Country	Objective	Study design	**Study population**	Study method	Key findings
Bee, M., Shiroor, A. & Hill, Z. (2018). Neonatal care practices in sub-Saharan Africa: a systematic review of quantitative and qualitative data. Multi-country	To identify factors that influence immediate newborn care practices in sub-Saharan Africa	Systematic review	42 studies	Literature search, review and critical appraisal	Physical state of mothers (pain, fatigue) after delivery hindered the practice of skin-to-skin contact while willingness of mothers to accept the practice of skin-to-skin contact enabled utilization of the practice.
Chan, G., Bergelson, I., Smith, E., Skotnes, T., &Wall, S. (2017). Barriers and enablers of kangaroo mother care implementation from a health systems perspective: a systematic review. Multi-country	To explore health workers and health facilities perspectives on the enablers and barriers to KMC practice.	Systematic review	86 papers	Literature search, review and critical appraisal	Barriers identified were lack of training of health care workers in KMC, cultural norms of the health care workers, poor documentation of KMC practice, limited space, and absence of leadership support. Enablers identified were acceptance of KMC practice by mothers and training of other health care workers in addition to nurses, provision of a KMC unit, which grants unlimited access to mothers to be with their infants.
Charpak et al. (2020). Strategies discussed at the XIIth international conference on Kangaroo mother care for implementation on a countrywide scale. Multi-country	To identify strategies at the country level to scale-up KMC practice	Semi-systematic review with consensus report	172 KMC professionals from 33 countries	Experts' discussion on strategies for KMC scale-up	Availability of standardized guidelines and institutional support enhances KMC uptake by health care workers and caregivers.
Lawn et al. (2013). Born too soon: accelerating actions for prevention and care of 15 million newborns born too soon. Multi-country	To provide detailed strategies on preterm infant care	Review of evidence on maternal and newborn care	Not applicable	Review of interventions and action plans on newborn care, analysis of data of demographic and health surveys of different countries and systematic assessment of challenges in newborn and maternal care conducted by over 55 global health experts, researchers and policy makers, from 29 institutions in 18 countries	National policies and guidelines on KMC as well as family support facilitates implementation and scale-up to KMC practice
Lawn et al. (2013). Born too soon: care for the preterm baby.	To describe interventions for preterm care.	Review of evidence on maternal and newborn care	Not applicable	Review of interventions on newborn care, analysis of data of demographic and health surveys of different countries and systematic assessment of challenges in newborn and	Inadequate knowledge on KMC by health care workers impedes the scale- up of KMC. Available national policies and guidelines on KMC facilitates the uptake of KMC practice

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Table 3 (*continued*)

Author/Year/Title/Country	Objective	Study design	Study population	Study method	Key findings
Multi-country				maternal care conducted by over 55 global health experts, researchers and policy makers from 29 institutions in 18 countries.	
March of Dimes, PMNCH, Save the Children &WHO. (2012). Born too soon the global action report on preterm birth. Multi-country	To identify evidence -based interventions such as KMC in preterm care	Semi-systematic review	Not applicable	Review of evidenced-based interventions by 45 international multi-disciplinary experts from 11 countries, with 50 organizations in support.	Availability of policies and guidelines, and the training of health care workers are essential for the implementation of newborn care interventions including KMC.
Moore, H. (2015). Improving kangaroo care policy and implementation in the neonatal intensive care. Multi-country	To examine the barriers to KMC policy implementation	Narrative review	12 papers	Discussions on searched literature	Insufficient knowledge about KMC by nursing staff, Lack of parental education on KMC and absence of KMC policies were identified as barriers to KMC implementation.
Seidman et al. (2015). Barriers and enablers of kangaroo mother care practice: a systematic review. Multi-country	To identify maternal enabling factors that influence the practice of KMC	Systematic review	103 studies	Literature search, review and critical appraisal	Barriers identified include; the lack of awareness by mothers on KMC practice and its benefits. Shortage of nurses and their perception of KMC practice as additional work was also a barrier. Family and community support were reported to be of higher importance in enabling mothers to practice KMC compared to health care worker support.
SmithBergelson et al. (2017). Barriers and enablers of health system adoption of kangaroo mother care: a systematic review of caregiver perspective. Multi-country	To identify caregivers' perspective of enablers and barriers to implementation of KMC	Systematic review	98 studies	Literature search, review and critical appraisal	Parental acceptance and family support of KMC enabled caregivers to adopt KMC practice. Barriers: Mothers perceived the practice of KMC as an imposition by health care workers when the benefits of KMC were not explained to them, impacting negatively on the implementation of KMC. Poor interactions between health care workers and families negatively affected KMC practice, lack of space and privacy.
Tahir and Fatmi (2019). Kangaroo mother care: opportunities and implications for rural Pakistan. Pakistan	To identify factors that influence KMC implementation in rural Pakistan	Narrative review	Not reported	Discussions on searched literature	Awareness creation on the benefits of KMC, and maternal acceptance to practice facilitated KMC implementation. Cultural norms, such as men not required to carry out household chores, negatively influenced implementation of KMC practice.
USAID (2019). Nurturing care for small and sick newborns: Evidence review and country case studies. Multi-country	To provide evidence on nurturing care approaches including developmentally supportive care for small and sick newborns	Review of evidence-based interventions	Not applicable	Evidence synthesis	"Parental Engagement", institutional preparedness, adequate knowledge on DSC by nurses including its impact on infant outcomes were identified as facilitators to the implementation of DSC.
Victora, G., & Rubens, C. (2010). Global report on preterm birth and stillbirth (4 of 7): delivery of interventions. Multi-country	To discuss the challenges with the scale-up of preterm and still birth interventions	Semi-systematic review and consensus report	Not reported	Review of searched literature and experts' discussion	Barriers identified include; perceptions of health care workers about the concept of KMC being 'poor man's alternative' to advanced newborn care, cultural practices, lack of policies and also practices of health care workers not granting mothers 24hr access to the NICU.Enablers identified were: Caregivers sharing their successful KMC experiences with others undergoing KMC and awareness creation on the benefits of KMC practice to mothers

KMC-Kangaroo Mother Care
NICU-Neonatal Intensive care unit

USAID-United States Agency for International Development.

Appendix C

Table 4
Medline Search Strategy

Ovid MEDLINE: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE® <1946-Present>		
#	Searches	Results
1	exp infant, premature/or infant, extremely premature/	54939
2	((preterm* or pre-term* or pre-matur* or prematur*) adj3 (baby or babies or infant* or birth* or deliver* or newborn* or neonat*)).tw,kf.	94469
3	preemie*.tw,kf.	133
4	infant prematurity.tw,kf.	23
5	(Born too small or Born too soon).tw,kf.	60
6	((low or extreme or very low) adj3 (birthweight* or preterm* or preemie* or infant* or baby or babies or newborn* or neonate*)).tw,kf.	26922
7	1 or 2 or 3 or 4 or 5 or 6	125426
8	Development* Supportive care.tw,kf.	48
9	(Developmental adj2 (care or care approach* or intervention*)).tw,kf.	861
10	8 or 9	890
11	exp Environment/	1265825
12	(Noise or sound or ambient noise or hearing protection or auditory stimulat* or acoustic stimulat*).tw,kf.	210228
13	(light* adj3 (NICU or Dim* or sleep or cycled or isolette cover* or incubator cover* or visual stimulat* or infant stimulat*)).tw,kf.	5854
14	11 or 12 or 13	1454425
15	position*.tw,kf.	587488
16	((swadd* or nest*) adj3 (babies or baby or preterm* or pre-term* or neonate* or infant*)).tw,kf.	185
17	((kangaroo mother or kangaroo-mother or kangaroo) adj3 (care or method* or approach*)).tw,kf.	786
18	(skin-to-skin adj2 (care or contact or infant)).tw,kf.	1050
19	17 or 18	1620
20	10 or 14 or 15 or 16 or 19	2013777
21	7 and 20	5419

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