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Determinants of Kangaroo Mother Care Implementation in Low-and Middle-Income Countries: An Implementation Science-Informed Systematic Review and Meta-Analysis

Nicolas Kinamboli Kangoyangala^{1*}, Dieu-Merci Amuda Baba², Gloire MBAYABO³ and Jean-Pierre Alworonga Opara³

¹Doctoral School, Higher Institute of Medical Techniques of Kinshasa, Kinshasa, Democratic Republic of the Congo

²Department of Public Health, University of Bunia, Democratic Republic of the Congo

³Department of Pediatrics, Faculty of Medicine, University of Kinshasa and Kisangani, Kisangani, Democratic Republic of the Congo

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***Corresponding author:** Nicolas Kinamboli Kangoyangala, Doctoral School, Higher Institute of Medical Techniques of Kinshasa (ISTM-Kinshasa), Kinshasa, Democratic Republic of the Congo, E-mail : nicokinamboli@gmail.com

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ABSTRACT

Background: Kangaroo Mother Care (KMC) is an evidence-based intervention for preterm and Low-Birth-Weight (LBW) infants that combines prolonged skin-to-skin contact, breast-milk feeding, family participation and continuity of care. Although substantial evidence demonstrates reductions in mortality and important neonatal morbidities, implementation remains heterogeneous across Low-and Middle-Income Countries (LMICs). This evidence-to-practice gap suggests that population-level impact depends not only on clinical efficacy, but also on implementation context organizational readiness, workforce capacity, fidelity, reach and sustainability.

Objective: To systematically synthesize evidence on the effectiveness and implementation of KMC in LMICs, with emphasis on implementation determinants, strategies, implementation outcomes and contextual characteristics that may modify clinical and programme outcomes.

Methods: The review is structured in accordance with PRISMA 2020 and PRISMA-S principles. The definitive search strategy includes MEDLINE/PubMed, Embase, Scopus, Web of Science Core Collection, CINAHL, Cochrane CENTRAL, Global Index Medicus and relevant citation-tracking sources. Clinical effectiveness and implementation evidence are treated as distinct but complementary evidence streams. Randomized and eligible comparative studies contribute to clinical meta-analysis, whereas quantitative, qualitative, process-evaluation and mixed-methods studies contribute to implementation synthesis. Determinants are mapped to the updated Consolidated Framework for Implementation Research (CFIR), while implementation outcomes are classified according to Proctor's framework. Random-effects meta-analysis with restricted maximum likelihood estimation is

prespecified for sufficiently comparable clinical studies. Heterogeneity is assessed using Cochran's Q, I^2 , τ^2 and 95% prediction intervals where appropriate.

Results: Verified published evidence consistently supports clinically important benefits of KMC. A 2023 systematic review identified 31 randomized trials involving 15,559 preterm or LBW infants and found that KMC reduced mortality compared with conventional care. The multicountry WHO Immediate KMC randomized trial further demonstrated lower 28-day mortality when KMC was initiated immediately after birth rather than after conventional stabilization. A 2026 meta-analysis of KMC initiated within the first 24 hours included 13 studies and 4,162 infants; early KMC was associated with lower neonatal mortality (RR = 0.78, 95% CI [0.66-0.92]) and greater breastfeeding at discharge (RR = 1.23, 95% CI [1.04-1.46]). Implementation evidence identifies inadequate staffing, insufficient space and supplies, limited supportive supervision, weak organizational readiness and policy gaps as recurrent barriers, while local leadership, provider training, family engagement, supervision and adaptation to context are recurrent facilitators.

Conclusion: KMC has established clinical effectiveness, but sustainable population-level impact depends on how effectively health systems implement it. Implementation should therefore be conceptualized as a multilevel process involving policy organizational readiness, provider competencies, infrastructure, family participation, supervision, fidelity, continuity and monitoring. Rigorous synthesis requires explicit separation of KMC versus conventional care from immediate or early versus delayed KMC and requires complete study-level traceability before original pooled estimates are reported.

Keywords: Kangaroo mother care, Low birth weight, Preterm infant, Neonatal mortality, Implementation science, CFIR, Implementation outcomes, Systematic review, Meta-analysis, LMICs

1. Introduction

Preterm birth and Low Birth Weight (LBW) remain major contributors to neonatal morbidity and mortality, with a disproportionate burden in Low- and Middle-Income Countries (LMICs). Kangaroo Mother Care (KMC), based on prolonged skin-to-skin contact, breast-milk feeding and family-centred care, has emerged as a core intervention for improving outcomes among preterm and LBW infants^{1,2}. Importantly, definitions and delivery modalities of KMC have varied substantially across studies, emphasizing the need for explicit characterization of intervention components when synthesizing evidence¹.

Randomized trials and meta-analyses consistently demonstrate that KMC reduces neonatal mortality and important morbidities compared with conventional care³⁻⁵. Contemporary evidence further suggests that timing and intensity of KMC are clinically relevant: immediate or early initiation may provide additional survival benefits, reinforcing the importance of implementation fidelity rather than simple programme availability^{5,6}.

Despite established effectiveness, implementation remains heterogeneous. A global systematic review identified 112 studies with qualitative implementation data, demonstrating barriers related to time requirements, social support, family acceptance, healthcare organization, financing, service delivery and cultural norms¹. A complementary caregiver-focused review included **98 studies** and highlighted social support, competing demands, medical concerns, stigma, traditional practices and gender roles⁷. In sub-Saharan Africa, a systematic review of **30 studies** additionally identified inadequate staffing, limited infrastructure and supplies, weak policies, insufficient supervision and leadership constraints⁸.

These findings indicate that the principal evidence gap concerns not merely whether KMC works, but how and under which contextual conditions it can be implemented effectively and sustainably at scale. Accordingly, this systematic review aims to synthesize determinants, strategies and implementation outcomes of KMC in LMICs and to examine whether imple-

mentation characteristics contribute to heterogeneity in clinical outcomes.

2. Methods

2.1. Study design and reporting

This systematic review and meta-analysis was designed to integrate evidence on the clinical effectiveness and implementation of Kangaroo Mother Care (KMC) in Low- And Middle-Income Countries (LMICs). Clinical-effectiveness and implementation evidence were treated as distinct analytical streams and subsequently integrated using an implementation-science perspective. Reporting followed the PRISMA 2020 statement and PRISMA-S recommendations for literature searches^{9,10}.

2.2. Search strategy and eligibility

The literature search was updated through August 13, 2026. The prespecified information sources were MEDLINE/PubMed, Embase, Scopus, Web of Science Core Collection, CINAHL, Cochrane CENTRAL and Global Index Medicus, supplemented by backward and forward citation tracking. The final database-specific search strings, platforms, dates and numbers retrieved will be reported in Supplementary Table S1; only databases for which searches can be documented will be reported as searched.

Eligible studies involved preterm (<37 weeks) or low-birth-weight (<2,500 g) infants, caregivers, healthcare providers, facilities or health systems implementing KMC in LMICs. KMC was defined consistently with contemporary WHO guidance as prolonged skin-to-skin contact combined with breast-milk feeding. WHO recommends KMC as routine care for all preterm or LBW infants, for 8 hours to 24 hours/day whenever possible.

2.3. Study selection, outcomes and implementation constructs

Randomized, cluster-randomized, quasi-experimental, observational, qualitative and mixed-methods primary studies were eligible according to the relevant synthesis. Reviews were used exclusively for citation tracking and contextual comparison

and were not counted as primary studies. Multiple publications arising from the same underlying study were linked to prevent double counting.

The primary clinical outcome was all-cause neonatal mortality through 28 days. Secondary outcomes included severe infection/sepsis, hypothermia, exclusive breastfeeding, growth, hospitalization, readmission and neurodevelopment. Implementation outcomes were classified as acceptability, adoption, appropriateness, feasibility, fidelity, cost, penetration and sustainability¹¹. Determinants were mapped to the updated CFIR domains-innovation, outer setting, inner setting, individuals and implementation Process¹².

2.4. Risk of bias and statistical analysis

Risk of bias was assessed using design-specific instruments: RoB 2 for randomized trials, the cluster-RCT extension where applicable, ROBINS-I for non-randomized intervention studies and appropriate JBI/MMAT tools for observational, qualitative and mixed-methods evidence.

KMC versus conventional care and immediate/early versus delayed KMC were analyzed separately to preserve estimand compatibility. Dichotomous outcomes were expressed as risk

ratios (RRs) with 95% confidence intervals. Random-effects models with restricted maximum likelihood (REML) estimation were prespecified when pooling was clinically and methodologically justified. Heterogeneity was characterized using Cochran's Q, I² and τ^2 , supplemented by 95% prediction intervals where estimable. Cluster-adjusted estimates were prioritized. Prespecified subgroup and sensitivity analyses examined KMC initiation, duration, birth weight, gestational age, setting, region, implementation fidelity and risk of bias. Meta-regression was restricted to sufficiently populated analyses and certainty of evidence was evaluated outcome by outcome using GRADE.

3. Results

3.1. Evidence of an implementation gap

Les données multicentriques africaines montrent une différence majeure entre présence de KMC, intégration dans les soins courants et durabilité. Dans 39 structures sanitaires du Malawi, du Mali, du Rwanda et de l'Ouganda, 37/39 (94.9%; IC95% approximatif 83.1-98.6) présentaient des preuves d'une pratique de KMC. Cependant, seulement 13/39 (33.3%; IC95% 20.6-49.0) avaient atteint le stade d'intégration routinière, et seulement 2/39 (5.1 %; IC95% 1.4-16.9) celui d'une pratique durable (Table 1)¹³.

Table 1: Indicateurs quantitatifs vérifiés de l'implémentation de KMC.

Context	Indicator	Result	Interpretation
Afrique, 4 pays, 39 structures	Evidence of KMC practice	94.9%	Introduction fréquente
Afrique, 4 pays	Routine/integrated KMC	33.3%	Institutionnalisation faible
Afrique, 4 pays	Sustainable KMC	5.1 %	Durabilité très faible
Oromia, Éthiopie	Effective KMC at discharge	54.4% (167/307)	Amélioration importante mais cible de 80 % non atteinte
Oromia, Éthiopie	Effective KMC, day 7	37.8% (108/286)	Perte importante après sortie
Tigray, Éthiopie	KMC initiated	83.5% (354/424)	Forte adoption après stratégie adaptée
Tigray, Éthiopie	Effective KMC at discharge	82.3%	Haute couverture obtenue
Inde du Sud	KMC initiation	87.6%	Forte pénétration institutionnelle
Inde du Sud	KMC at discharge	85.0%	Bonne continuité hospitalière
Inde du Sud	KMC at home, day 7	67.9 %	Baisse après retour au domicile

Les études d'implémentation en Éthiopie et en Inde confirment cependant que cette faiblesse n'est pas irréversible. Dans l'étude multisite, la couverture effective - définie notamment par ≥ 8 heures de peau-à-peau et l'allaitement exclusif - variait de 53.4% à 82.3% avant la sortie; la couverture combinée était de 68.1% en Éthiopie et 55.5% en Inde.

3.2. Continuity gap after hospital discharge

Le deuxième résultat majeur est la diminution de l'implémentation après la sortie.

En Oromia, la couverture effective atteignait 54.4% (167/307) avant la sortie mais seulement 37.8% (108/286) au septième jour après la sortie. Le programme avait pourtant augmenté la couverture depuis un niveau initial inférieur à 5%.

Au Tigray, 354/424 (83.5%) nouveau-nés éligibles avaient commencé KMC et la couverture effective atteignait 82.3% avant la sortie. Elle diminuait cependant à 60.2% sept jours après la sortie.

Une tendance comparable a été observée en Inde du Sud : 87.6 % des nouveau-nés éligibles avaient commencé KMC, 85.0% la recevaient à la sortie, mais seulement 67.9 % poursuivaient KMC à domicile à J7.

Ces données identifient donc un **continuity gap** distinct du simple problème d'adoption : obtenir une initiation élevée en milieu hospitalier ne garantit pas la poursuite de KMC après la sortie.

3.3. Determinants of inadequate implementation

Les données qualitatives et mixtes convergent vers une origine multiniveau et systémique du déficit d'implémentation.

Chan, et al.¹ ont dépisté 2 875 publications et retenu 112 études comportant des données qualitatives d'implémentation. Les principaux obstacles concernaient le temps nécessaire, le soutien social, l'acceptation familiale, les besoins médicaux, l'organisation du système, le financement et la prestation des services.

Kinshella, et al.⁸, dans 30 études d'Afrique subsaharienne, ont identifié comme barrières récurrentes le manque d'espace, les budgets et fournitures insuffisants, le déficit de personnel, l'absence de politiques ou directives, la supervision insuffisante, la charge de travail, les déficits de connaissances et le soutien familial insuffisant. Un leadership local fort constituait un facilitateur central.

L'umbrella review de Cai, et al.¹⁴ a identifié 531 références et retenu six revues, regroupant les déterminants en cinq domaines : environnement, professionnels, parents/familles, accessibilité et facteurs culturels. Une réserve importante doit néanmoins être rapportée : selon ROBIS, 4/6 revues présentaient un risque élevé de biais et 2/6 un risque incertain.

Une revue de 2026 identifie encore 30 catégories de barrières et 25 catégories de facilitateurs, notamment les pénuries de personnel, les connaissances insuffisantes, les préoccupations concernant la sécurité, les facteurs socioculturels et les contraintes financières dans les LMICs.

3.4. Interpretation of the implementation pathway

Les résultats ne soutiennent donc pas l'affirmation simpliste selon laquelle « KMC est absente des structures à ressources limitées ». Une formulation scientifiquement plus exacte est :

KMC may be introduced without becoming routinely integrated, effectively delivered, continuously maintained or sustainably institutionalized **Figure 1**.

The presence of KMC within a health facility does not necessarily indicate institutionalization. Although approximately 95% of the 39 assessed facilities showed some evidence of KMC practice, only 33% had achieved routine integration and 5% had reached sustainable implementation. This marked decline highlights a substantial implementation-institutionalization gap in resource-constrained health systems (**Figure 2**).

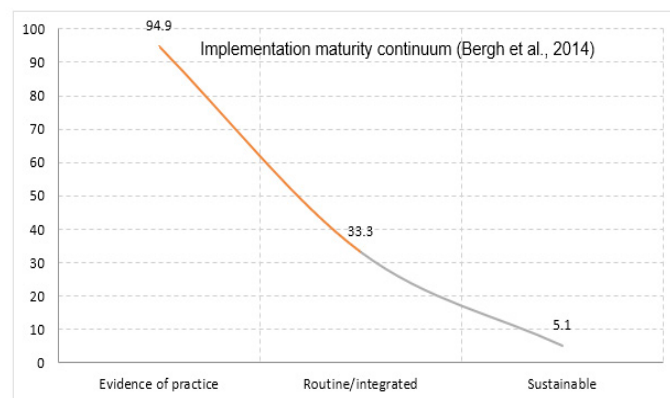


Figure 2: Effective KMC coverage before discharge.

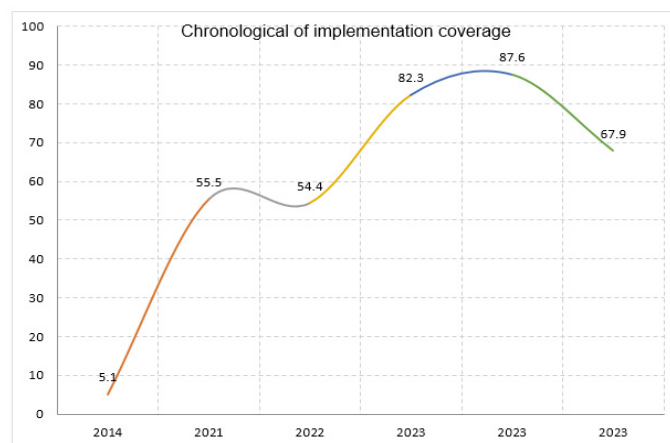


Figure 3: Continuity of KMC after hospital discharge.

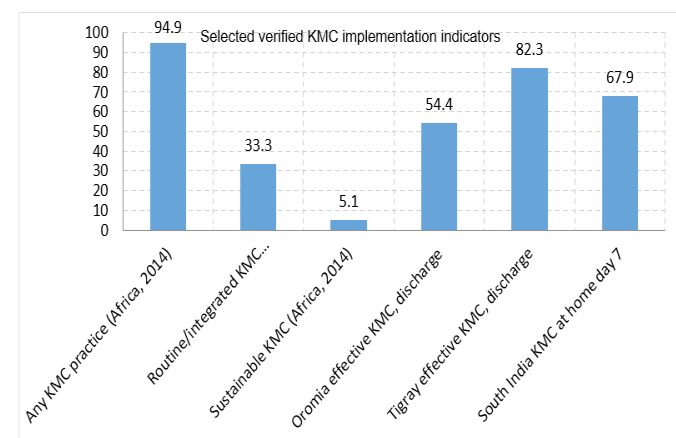


Figure 1: Level of institutional implementation of KMC.

Effective KMC coverage varied considerably across implementation sites, ranging from approximately **53.4% to 82.3%**. This variability suggests substantial contextual differences in the ability of health systems to translate KMC initiation into sufficiently intensive and sustained practice. These differences should be interpreted as contextual heterogeneity rather than as causal comparisons between sites (**Figure 3**).

The decline in KMC coverage after discharge demonstrates an important continuity gap. In some settings, effective coverage fell markedly within the first week after discharge, indicating that high hospital-based uptake does not necessarily translate into sustained home-based KMC. Strengthening facility-to-community continuity and caregiver support is therefore essential (**Figure 4**).

The histogram shows that high KMC initiation rates may coexist with lower effective coverage. This finding indicates that initiation alone is an insufficient indicator of implementation quality. More meaningful measures should incorporate duration, fidelity, continuity and adherence to recommended KMC components (**Figure 5**).

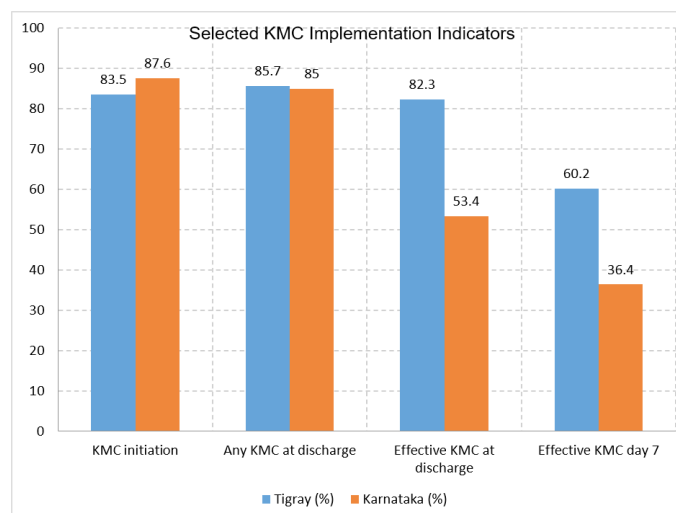


Figure 4: Histogram of KMC implementation indicators.

The cumulative implementation curve illustrates progressive attrition across the implementation pathway: availability or initiation → effective coverage → post-discharge continuation → sustainability. The main implementation challenge is therefore not merely introducing KMC, but ensuring its fidelity, continuity, institutional integration and long-term maintenance.

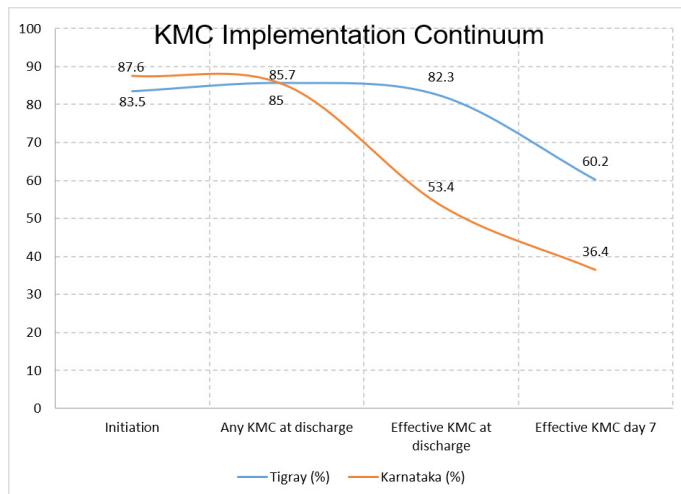


Figure 5: KMC implementation continuum.

4. Discussion

The present synthesis identifies a substantial implementation–institutionalization gap in Kangaroo Mother Care (KMC) across resource-constrained settings. The most important finding is not simply whether KMC is present within health facilities, but whether it progresses from initial adoption to routine integration, effective coverage, continuity and sustainability. In the multicountry African evidence included in our results, 94.9% of facilities showed some evidence of KMC practice, whereas only 33.3% achieved routine integration and 5.1% reached sustainable implementation. This pattern is consistent with previous implementation research demonstrating that the availability of KMC does not necessarily imply adequate penetration, fidelity or institutionalization^{1,6,7,8,13-16}. Chan, et al.¹⁵, for example, screened 2,875 records and included 112 studies with qualitative implementation evidence, identifying constraints related to time, social support, family acceptance, health-system organization, financing and service delivery.

A second major finding concerns **effective coverage**. Across the implementation sites represented in our synthesis, effective KMC coverage before discharge ranged from 53.4% to 82.3%, while combined coverage differed between Ethiopia and India. These variations should not be interpreted as direct comparative effectiveness estimates because populations, contexts, implementation packages and measurement procedures differed. Rather, they illustrate substantial contextual heterogeneity. This interpretation is consistent with implementation-science evidence showing that successful scale-up depends on locally adapted combinations of facility access, initiation and maintenance of KMC and post-discharge support^{1,7,8,13,15,16}. The multisite Ethiopia-India implementation study involving 3,804 eligible infants specifically used iterative, context-adapted models addressing facility access, initiation and maintenance and home continuation.

Particularly concerning is the continuity gap after discharge. Effective coverage decreased from 54.4% at discharge to 37.8% at day 7 in Oromia and from 82.3% to 60.2% in Tigray; similarly, 87.6% of eligible infants initiated KMC in southern India, 85.0% received it at discharge, but only 67.9% continued at home by day 7. Thus, facility-based initiation is an insufficient marker of successful implementation. Sustainable KMC requires continuity across the facility-home-community interface, caregiver preparedness, social support, follow-

up systems, referral linkages and community health-worker engagement^{1,2,6,7,16}. Caregiver evidence is particularly relevant: Smith, et al.⁷ synthesized 98 studies and identified social support, available time, medical concerns, family acceptance and contextual influences as major determinants.

Our findings further demonstrate that inadequate implementation is multilevel rather than attributable to a single barrier. Recurrent constraints include shortages of trained personnel, workload, inadequate space and supplies, weak supervision, limited financing, deficient protocols, insufficient monitoring and sociocultural barriers. These findings converge with health-system analyses emphasizing leadership, financing, workforce, information, technologies, communication, training and service delivery^{1,7,8,14}. Chan, et al.¹ specifically identified training, communication, support, time, medical concerns and cultural norms as interacting determinants among providers and facilities. Kinshella, et al.⁸ similarly documented inadequate space, staffing, supplies, policies, supervision and family support in sub-Saharan Africa, while highlighting local leadership as an important facilitator.

These findings support conceptualizing KMC implementation as a pathway of organizational readiness → adoption → fidelity → effective coverage → continuity → institutionalization → sustainability, rather than as a binary “implemented/not implemented” variable^{6,7,11-13,15-17}. This interpretation aligns closely with WHO’s current strategy, which positions KMC as an integral component of care for preterm and low-birth-weight infants across facility and community levels and explicitly requires adaptation to health-system, cultural and social contexts.

Overall, the evidence argues against relying on isolated provider training or the nominal availability of a KMC unit as indicators of implementation success. Scale-up requires multicomponent, context-sensitive strategies combining leadership and policy commitment, adequate workforce and infrastructure, competency-based training, supportive supervision, family engagement, reliable monitoring, audit and feedback and facility-to-community continuity^{1,2,6-8,12-16,18}. The WHO implementation strategy similarly emphasizes that KMC should be embedded within routine small and sick newborn care rather than operated as an isolated vertical programme. Future studies should therefore measure not merely initiation, but reach, adoption, appropriateness, fidelity, effective coverage, equity, cost, post-discharge continuation, penetration and sustainability, using standardized implementation outcomes and sufficiently comparable definitions to permit robust meta-analysis and meta-regression.

5. Conclusion

This review highlights a persistent gap between the availability of Kangaroo Mother Care (KMC) and its effective institutionalization in resource-constrained health systems. Although KMC is frequently introduced, routine integration, fidelity, effective coverage, post-discharge continuity and long-term sustainability remain inconsistent across Low- And Middle-Income Countries (LMICs). The findings indicate that implementation is shaped by interacting determinants at caregiver, provider organizational, community and health-system levels. Sustainable implementation therefore requires more than training or clinical guidelines; it depends on leadership organizational readiness, adequate staffing and

infrastructure, provider competency, supportive supervision, family engagement, reliable monitoring systems and continuity between facilities and communities. Accordingly, KMC scale-up should be approached as a context-sensitive, multicomponent health-system intervention. Future implementation research should use standardized measures of reach, adoption, fidelity, effective coverage, equity, penetration, cost, continuity and sustainability to identify which implementation strategies work, for whom, under which conditions and how they can be sustainably integrated into routine neonatal care in LMICs.

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