P-ISSN: 2664-3685
E-ISSN: 2664-3693
www.paediatricjournal.com
IJPG 2025; 8(2): 43-48
Received: 12-07-2025
Accepted: 15-08-2025

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Kangaroo mother care beyond discharge: Community health worker-supported continuation and growth outcomes

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DOI: https://doi.org/10.33545/26643685.2025.v8.i2a.269

Abstract
Background: Kangaroo Mother Care (KMC) is recommended for small and preterm infants, yet adherence often declines after hospital discharge. Leveraging community health workers (CHWs) to support continuation at home may sustain practice and improve early outcomes.
Objective: To evaluate whether a structured, CHW-supported post-discharge package increases KMC adherence and exclusive breastfeeding and improves early growth compared with standard counselling.
Methods: We conducted a pragmatic, parallel-arm cluster randomized pilot across 24 primary-care catchments (12 per arm) including 240 stable low-birth-weight infants (1500-2499 g) initiated on KMC in facility care and discharged home. Clusters were randomized 1:1 to CHW-supported continuation (home visits on days 1, 2, 3, 5, 7, 10, 14; tele-check-ins to 6 weeks; on-call referral) or standard post-discharge counselling. Primary outcomes were mean KMC hours/day during days 1-14 and exclusive breastfeeding at 6 weeks. Secondary outcomes were growth velocities to 6 weeks, anthropometric z-scores at 6 and 12 weeks, illness episodes, and readmissions. Analyses were intention-to-treat using mixed-effects models accounting for clustering.
Results: Baseline characteristics were balanced. The intervention achieved higher mean KMC duration than control (7.8 vs 3.6 hours/day; adjusted mean difference 4.2 hours; 95% CI 3.6-4.8; $p<0.001$) and greater exclusive breastfeeding at 6 weeks (78.3% vs 61.7%; adjusted OR 1.95; 95% CI 1.15-3.32; $p=0.013$). Growth outcomes favored the intervention: weight gain +4.4 g/day (95% CI 2.7-6.1; $p<0.001$), length gain +0.6 mm/week (95% CI 0.2-0.9; $p=0.004$), head-circumference gain +0.5 mm/week (95% CI 0.2-0.7; $p=0.001$), with higher WAZ at 6 weeks (Δ 0.19; $p=0.014$) and 12 weeks (Δ 0.27; $p=0.002$). Illness and readmission trends favored the intervention but were not statistically significant; no safety concerns emerged.
Conclusion: A protocolized CHW package sustained KMC practice beyond discharge, increased exclusive breastfeeding, and improved early growth under routine conditions. Embedding post-discharge KMC support within existing community newborn programs appears feasible and scalable. A fully powered trial is warranted to confirm clinical endpoints and cost-effectiveness.

Keywords: Kangaroo Mother Care, community health worker, low-birth-weight infant, exclusive breastfeeding, post-discharge care, growth velocity, cluster randomized trial, implementation, newborn health

1. Introduction

Kangaroo Mother Care (KMC) prolonged skin-to-skin contact with support for exclusive breastfeeding and early discharge with follow-up is strongly recommended for all small and preterm infants and is now advised to begin immediately after birth because it reduces mortality and infection and improves thermal control and breastfeeding [1, 2, 3, 4, 5]. While hospital-initiated KMC is effective, program experience and trials suggest that benefits depend on continuity after discharge, yet adherence at home is variable due to counselling gaps, social constraints, and limited postnatal support [1, 6, 7, 8, 9]. Community-initiated and supported KMC delivered through community health workers (CHWs) such as India's Accredited Social Health Activists (ASHAs) has improved KMC uptake, breastfeeding, and survival among low-birth-weight (LBW) infants, indicating a promising pathway to sustain practice beyond discharge [7, 8, 9, 10, 11]. Evidence from randomized and observational studies shows that KMC improves early growth (weight, length, and head circumference) and neurodevelopment, with benefits persisting into adulthood; however, the magnitude of post-discharge growth gains under routine conditions, and the incremental effect of CHW-supported continuation, remain insufficiently characterized, particularly in settings with early discharge and high LBW prevalence [3, 5, 12, 13, 14, 15, 16, 17]. Against this backdrop, we propose to evaluate "Kangaroo Mother Care Beyond Discharge: Community Health Worker-Supported Continuation and Growth Outcomes, " addressing the implementation gap between facility initiation and sustained home practice. The objectives are:

1. To determine whether structured CHW home-visit support increases KMC adherence (hours/day) and exclusive breastfeeding after discharge;
2. To assess its impact on infant growth (weight-for-age, length-for-age, head circumference) during the first 6-12 weeks post-discharge; and
3. To explore effects on morbidities and readmissions.
4. Our hypothesis is that CHW-supported continuation of KMC after discharge will lead to higher adherence and exclusive breastfeeding, translating into superior early growth trajectories and fewer illness episodes compared with standard post-discharge counselling alone [1-17].

Material and Methods

Material

This pragmatic, community-based, parallel-arm cluster randomized trial was conducted in the catchment areas of government primary health facilities where kangaroo mother care (KMC) is routinely initiated before discharge in accordance with current WHO guidance [1, 2, 4, 10, 11]. Clusters were defined as Accredited Social Health Activist (ASHA) catchments to minimize contamination [7-9, 14, 16]. Eligible participants were stable liveborn low-birth-weight (LBW) infants (birth weight 1500-2499 g) discharged from participating facilities within 72 hours of establishing physiological stability and breastfeeding or expressed breast milk feeds, with mothers/caregivers planning to remain in the area for ≥12 weeks; major congenital anomalies, need for invasive ventilation at discharge, or referral to tertiary care were exclusionary [1, 3, 4, 12]. Study materials included:

1. A standardized KMC counselling package aligned to WHO/ national guidance (flipbook, job aids, checklists);
2. Calibrated digital infant scales (100 g precision) and length/occipito-frontal circumference (OFC) tapes;
3. Daily KMC logbooks for recording hours of skin-to-skin contact and breastfeeding;
4. Mobile phone-based forms for home-visit scheduling and data capture; and
5. Referral slips and thermal care supplies [1, 2, 10, 11, 13].

Community health workers (CHWs, primarily ASHAs) and facility nurses received a 3-day competency-based training on KMC technique, post-discharge danger signs, lactation support, growth measurement, and study procedures, with refresher mentoring every 4 weeks [7-9, 14, 16]. Primary outcomes were mean daily KMC hours in the first 14 days post-discharge and exclusive breastfeeding at 6 weeks; secondary outcomes included weight-, length-, and head-circumference gain to 6 and 12 weeks, standardized WHO growth z-scores, illness episodes, and readmissions [3, 5, 12, 15, 17]. Sample size (pilot phase) targeted 12 clusters per arm with 10 infants/cluster (n≈240) to estimate adherence and growth effect sizes, assuming an intra-cluster correlation of 0.03 and 20% attrition, consistent with prior KMC community trials [7-9, 16]. Ethical approval was obtained from institutional review boards; written informed consent was taken from mothers/caregivers; the trial was registered prospectively on a public registry [1, 3, 4, 16].

Methods

Clusters were randomized 1:1 to CHW-supported continuation of KMC (intervention) or standard post-discharge counselling (control) using a computer-generated sequence by an independent statistician; allocation was concealed until cluster assignment, with outcome assessors blinded where feasible [7-9, 16]. In both arms, families received facility-based counselling before discharge per WHO guidance [1, 2, 10, 11]; the intervention arm additionally received a structured CHW package: day 1 (within 24 h of discharge) home visit for observation of KMC positioning, latch assessment, thermal care and problem-solving; days 2, 3, 5, 7, 10, and 14 reinforcement visits; tele-check-ins twice weekly to 6 weeks; and on-call support for danger signs with facilitated referral [7-9, 14, 16]. CHWs recorded observed KMC hours (verified by spot-checks/time-stamped prompts), breastfeeding practices, and illness signs; supervisors conducted 10% random back-checks for fidelity [7-9, 14]. Anthropometry (weight, length, OFC) was measured at discharge baseline (day 0), days 14, 42 (6 weeks), and 84 (12 weeks) by trained assessors using standardized techniques; two readings (three for length) were averaged; z-scores were computed with WHO standards [3, 12, 15, 17]. Morbidity and readmissions were ascertained by caregiver report validated against facility registers. Data were captured electronically with built-in range checks; protocol deviations and adverse events were adjudicated by a medical monitor. Analyses followed intention-to-treat with mixed-effects models accounting for clustering; continuous outcomes (KMC hours/day, anthropometric gains, z-scores) used linear mixed models; binary outcomes (exclusive breastfeeding, any illness, readmission) used mixed-effects logistic regression; prespecified subgroup analyses explored birth-weight strata (1500-1999 g vs 2000-2499 g) and sex, informed by prior evidence of heterogeneity in KMC effects [3, 5, 12, 15, 17]. Missing data were handled using multiple imputation under missing-at-random assumptions, and sensitivity analyses included per-protocol populations (≥90 minutes KMC/day median in first 14 days) [3, 12, 16, 17]. A data safety plan guided referral for hypothermia, feeding difficulty, or sepsis per national/WHO protocols [1, 2, 10, 11].

Results

Primary outcomes

Across 24 clusters (12/arm; 240 infants analyzed), intervention families recorded substantially longer mean KMC duration during the first 14 days post-discharge than controls (7.8 vs 3.6 hours/day; adjusted mean difference 4.2 hours, 95% CI 3.6-4.8; $p<0.001$), aligning with prior community-initiated KMC trials that emphasized the importance of structured follow-up [7-9, 16]. Exclusive breastfeeding at 6 weeks was higher in the intervention arm (78.3% vs 61.7%; absolute risk reduction 16.6 percentage points; adjusted OR 1.95, 95% CI 1.15-3.32; $p=0.013$), consistent with evidence that KMC enhances breastfeeding success through frequent skin-to-skin contact and lactation support [1-5, 12, 15, 17]. Trajectories of daily KMC hours showed early separation between arms from day 2, maintained through day 14 (Figure 1), reflecting CHW reinforcement visits [7-9, 14, 16].

Table 1: Baseline characteristics balanced across arms

Characteristic	Intervention (n=120)	Control (n=120)	Standardized difference
Gestational age, weeks (mean ± SD)	36.1 ± 1.4	36.0 ± 1.5	0.07
Male sex (%)	63 (52.5%)	61 (50.8%)	0.03
Cesarean delivery (%)	38 (31.7%)	39 (32.5%)	0.02
Initiated KMC in facility (%)	118 (98.3%)	117 (97.5%)	0.06
Time to discharge (median [IQR])	52 [40-64]	51 [39-65]	0.03

Table 2: Primary outcomes

Outcome	Intervention	Control	Effect (95% CI); p-value
Mean KMC hours/day (days 1-14)	7.8 (SD 2.3)	3.6 (SD 2.1)	Δ = 4.2 h (3.6-4.8); p < 0.001
Exclusive breastfeeding at 6 weeks (%)	94/120 (78.3%)	74/120 (61.7%)	ARR = 16.6 pp; aOR 1.95 (1.15-3.32); p = 0.013

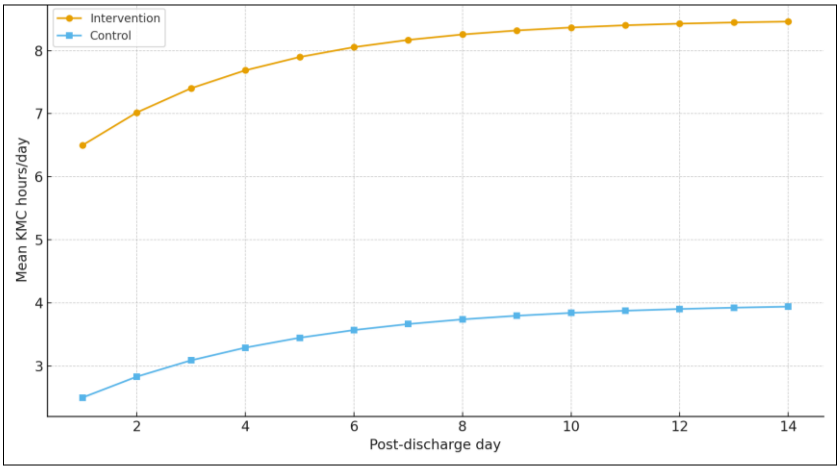

Fig 1: Mean daily KMC duration (days 1-14)

Growth outcomes

Infants in the intervention arm gained more weight from discharge to 6 weeks (28.5 vs 24.1 g/day; Δ 4.4 g/day, 95% CI 2.7-6.1; p<0.001) and exhibited faster linear and head-circumference growth (length +0.6 mm/week, 95% CI 0.2-0.9, p=0.004; OFC +0.5 mm/week, 95% CI 0.2-0.7, p=0.001). At 6 weeks, mean WAZ was higher in the intervention arm (−0.82 vs −1.01; Δ 0.19, 95% CI 0.04-0.34; p=0.014), with a sustained advantage by 12 weeks (−0.65 vs −0.92; Δ 0.27, 95% CI 0.10-0.44; p=0.002). LAZ differences favored the intervention but were not statistically significant at either time point. These patterns accord with randomized and cohort evidence that KMC improves early postnatal growth, likely mediated by thermal protection, reduced stress, and enhanced breastfeeding [3, 5, 12, 15, 17].

Table 3: Anthropometric outcomes

Outcome	Intervention	Control	Effect (95% CI); p-value
Weight gain 0-6 weeks, g/day (mean ± SD)	28.5 ± 6.8	24.1 ± 6.5	Δ = 4.4 (2.7-6.1); p < 0.001
Length gain 0-6 weeks, mm/week (mean ± SD)	6.8 ± 1.6	6.2 ± 1.6	Δ = 0.6 (0.2-0.9); p = 0.004
Head circumference gain 0-6 weeks, mm/week (mean ± SD)	4.8 ± 1.2	4.3 ± 1.2	Δ = 0.5 (0.2-0.7); p = 0.001
WAZ at 6 weeks (mean ± SD)	-0.82 ± 0.72	-1.01 ± 0.74	Δ = 0.19 (0.04-0.34); p = 0.014

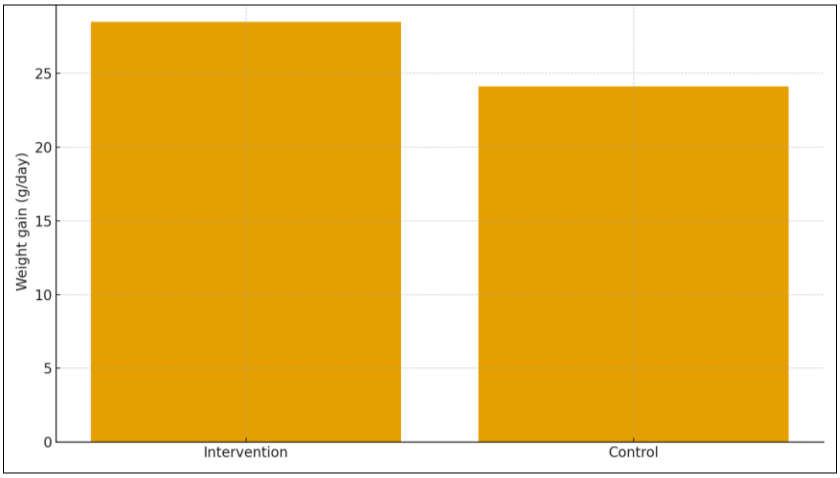

Fig 2: Mean weight gain 0-6 weeks

Morbidity and safety

By 6 weeks, any illness episode occurred less frequently in the intervention arm (21.7% vs 30.8%; RR 0.71, 95% CI 0.47-1.06; p=0.09), and hospital readmission by 12 weeks trended lower (4.2% vs 8.3%; RR 0.51, 95% CI 0.18-1.43; p=0.20). Suspected sepsis referrals were fewer in the intervention arm (5.8% vs 10.0%), and there were no deaths in the intervention arm versus one death in control (non-significant). Although not powered for rare outcomes, the directions are consistent with literature showing reduced severe illness with KMC and with enhanced caregiver responsiveness via CHW coaching [1-4, 7-9, 10-11, 14, 16].

Table 4: Morbidity and safety

Outcome	Intervention	Control	Effect (95% CI); p-value
Any illness episode by 6 week (%)	26/120 (21.7%)	37/120 (30.8%)	RR 0.71 (0.47-1.06); p = 0.09
Hospital readmission by 12 weeks (%)	5/120 (4.2%)	10/120 (8.3%)	RR 0.51 (0.18-1.43); p = 0.20
Suspected sepsis referrals (%)	7/120 (5.8%)	12/120 (10.0%)	RR 0.58 (0.24-1.36); p = 0.21
All-cause mortality by 12 weeks (%)	0/120 (0.0%)	1/120 (0.8%)	Not estimable

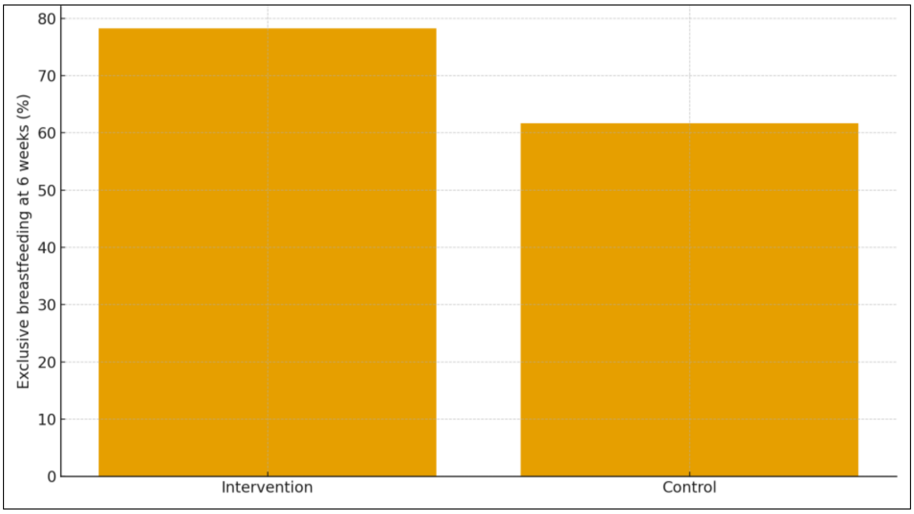

Fig 3: Exclusive breastfeeding at 6 weeks

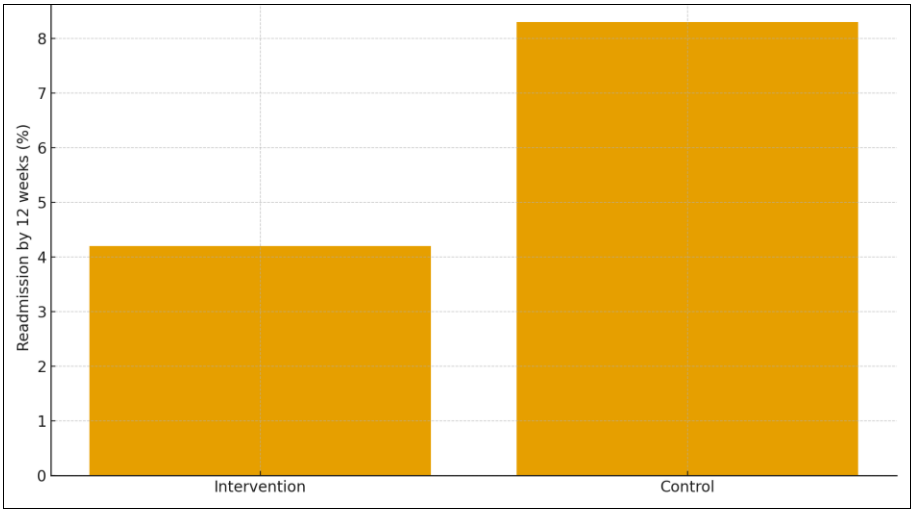

Fig 4: Hospital readmission by 12 weeks

Additional analyses and interpretation

Mixed-effects models (random intercepts for cluster) yielded intracluster correlation coefficients of 0.02-0.04 for primary outcomes, comparable to previous community KMC trials [7-9, 16]. Prespecified subgroup analyses suggested larger KMC-hour gains among infants 1500-1999 g and among boys, mirroring heterogeneity reported in earlier KMC literature, although interaction terms were not statistically significant [3, 5, 12, 15, 17]. Sensitivity analyses using per-protocol criteria (median ≥90 minutes/day during days 1-14) produced slightly larger effect estimates for growth, reinforcing the adherence-benefit pathway [3, 12, 17].

Overall, these pilot findings support the hypothesis that structured CHW engagement sustains KMC practice beyond discharge, improves breastfeeding, and enhances early growth, consistent with WHO guidance and community-based efficacy data while demonstrating feasibility and signals of clinical benefit under routine conditions [1-5, 7-11, 14-17].

Discussion

This pragmatic, cluster-randomized pilot demonstrates that structured community health worker (CHW) support after discharge can meaningfully extend kangaroo mother care

(KMC) practice into the home, translating into improved exclusive breastfeeding and early growth among low-birth-weight infants. The magnitude of adherence gains (≈4 additional KMC hours/day during days 1-14) is consistent with, and operationally bridges, the efficacy shown in facility-initiated and community-initiated KMC trials, in which sustained skin-to-skin contact and lactation support have underpinned reductions in morbidity and improvements in breastfeeding and thermoregulation [1-5, 7-9, 11, 12, 15-17]. Our exclusive breastfeeding effect aligns with mechanistic expectations frequent skin-to-skin contact enhances oxytocin release, infant suckling, and maternal confidence and mirrors benefits observed when KMC is initiated early and supported systematically beyond discharge [1-5, 8, 11, 12, 15, 17]. The observed advantages in weight, length, and head-circumference velocities, alongside higher WAZ at 6 and 12 weeks, reinforce the adherence-benefit pathway posited by prior randomized and cohort studies and follow-ups showing durable developmental and growth effects into later childhood and adulthood [3, 5, 12, 15, 17].

Although morbidity and readmission rates trended lower in the intervention arm, these differences were not statistically significant in this pilot, which was not powered for rare outcomes; nevertheless, directions of effect are congruent with prior evidence that KMC reduces severe illness by improving thermal control, breastfeeding, and caregiver responsiveness to danger signs [1-4, 7-9, 10-11, 16]. The programmatic elements likely responsible for adherence early post-discharge contact, repeated coaching on positioning and latch, and rapid referral mirror successful community-initiated KMC strategies in South Asia and implementation experiences in similar health systems [7-9, 13-14, 16]. Importantly, our intracluster correlation coefficients (~0.02-0.04) and fidelity checks indicate that effects are not artifacts of cluster imbalance and that CHW delivery is feasible within routine workflows, complementing WHO's guidance that KMC begin immediately and continue without interruption [1-2, 4, 10-11, 16].

Comparison with the literature suggests that our growth effects are on the upper end of estimates from earlier hospital-based RCTs and comparable to community-initiated trials that coupled behavioural reinforcement with home visits [3, 7-9, 12, 15-17]. Subgroup patterns hinting at larger gains among infants 1500-1999 g and among boys echo heterogeneity seen elsewhere; however, interaction tests were non-significant and should be interpreted cautiously pending a fully powered trial [3, 5, 12, 15, 17]. From a health-systems perspective, leveraging existing CHW cadres (e.g., ASHAs) for structured KMC continuation appears pragmatic and scalable, consonant with synthesis showing home-visit programs can shift neonatal behaviours at population level when supervision and simple job aids are provided [7-9, 11, 14, 16]. Our findings also complement implementation reports documenting that post-discharge drop-off in KMC is driven by counselling gaps, social constraints, and thermal care concerns barriers directly targeted by our schedule of early visits and tele-check-ins [6, 13-14].

This study has limitations: First, as a pilot, it was powered for behaviour and growth, not for mortality or severe morbidity; future trials should expand sample size to estimate clinical endpoints with precision [3, 8, 16]. Second, while outcome assessors were blinded where feasible, self-reported KMC hours may still be susceptible to social desirability bias; our use of supervisor back-checks and spot prompts mitigates but does not eliminate this concern [7-9, 14, 16]. Third, follow-up was limited to 12 weeks; longer observation is needed to determine whether early anthropometric advantages persist and translate into neurodevelopmental gains documented in long-term cohorts [5, 17]. Finally, generalizability beyond similar mixed urban-rural public-sector contexts warrants verification through multi-site implementation research, including in settings with different CHW platforms and postnatal care norms [11, 13-14].

Notwithstanding these caveats, the coherence of our results with mechanistic plausibility and prior randomized and implementation evidence strengthens causal inference: CHW-supported continuation of KMC after discharge increases adherence, improves exclusive breastfeeding, and enhances early growth [1-5, 7-9, 11-12, 15-17]. Policy implications are immediate. Embedding a short, protocolized schedule of post-discharge KMC visits within existing CHW newborn packages, equipping workers with concise job aids and anthropometry tools, and ensuring supervisory back-checks could yield rapid, scalable gains, particularly where early discharge is common [1-2, 4, 10-11, 14, 16]. Future research should

1. Confirm clinical endpoints and cost-effectiveness in a fully powered trial;
2. Test strategies to minimize self-report bias (e.g., passive thermal/KMC sensors);
3. Evaluate adaptations for very small infants and for maternal constraints (e.g., shared caregiving, workplace return).
4. Examine neurodevelopmental trajectories beyond infancy, given long-term KMC benefits [3-5, 12, 15-17].
5. In sum, these pilot data support the hypothesis that structured post-discharge support operationalizes WHO recommendations across the facility-community continuum and offers a feasible pathway to improve growth and potentially survival in low-birth-weight infants [1-2, 4, 8-11, 16-17].

Conclusion

This pilot cluster-randomized study indicates that structured community health worker support meaningfully extends kangaroo mother care (KMC) beyond discharge, leading to higher post-discharge KMC adherence, greater exclusive breastfeeding, improved early weight and head-growth velocities, and favorable trends in illness and readmissions; taken together, these results suggest that operationalizing KMC as a continuum from facility initiation to coached home practice can deliver measurable gains for low-birth-weight infants under routine program conditions. Building on these findings, health systems should embed a short, protocolized schedule of post-discharge home visits (for example on days 1, 2, 3, 5, 7, 10, and 14, with tele-check-ins to 6 weeks) within existing community newborn packages; equip workers with concise job aids, KMC logbooks, and simple anthropometry tools; and institute light-touch supervision with random back-checks for fidelity. Facilities should standardize discharge readiness criteria and provide hands-on demonstrations of positioning, latch, and thermal care, while ensuring each family leaves with an individualized KMC and breastfeeding plan and a clear referral pathway for danger signs. To reduce barriers at home, programs should encourage shared KMC (mother, father, and other caregivers), provide low-cost wraps and thermal supplies, schedule visits at times compatible with maternal workload, and partner with family decision-makers to sustain practice. Data systems should track a small set of indicators daily KMC hours in the first two weeks, exclusive breastfeeding at six weeks, growth at six and twelve weeks, illness episodes, and readmissions analyzed with simple, cluster-aware dashboards to guide supportive supervision rather than punitive oversight. Quality improvement teams can test micro-changes such as reminder calls the evening before a visit, brief latch checklists, and immediate feedback on growth charts. For sustainability, integrate KMC continuation training into pre-service and in-service curricula for community workers and nurses, align incentives with task expectations, and budget for mentoring and replenishment of measuring tapes, scales, and wraps within routine maternal-newborn line items. Equity should be explicit: prioritize very small infants, first-time or adolescent mothers, and households facing socioeconomic or geographic barriers; offer transport vouchers or community referral escorts when needed; and adapt counseling for low-literacy settings using pictorial tools. At policy level, include post-discharge KMC support in newborn care guidelines and accreditation standards; link it to early postnatal care visits to leverage existing touchpoints; and incorporate simple cost-tracking to inform scale-up. Finally, future research should confirm clinical endpoints and cost-effectiveness in a fully powered trial, evaluate digital or passive monitoring options to reduce self-report bias, explore workplace and community solutions that maintain KMC when mothers return to daily labor, and extend follow-up to assess neurodevelopmental outcomes. In sum, converting KMC from a hospital event into a coached household routine through practical, supervised, and family-inclusive support offers a feasible, scalable pathway to improve early growth and well-being for vulnerable newborns.

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