Kangaroo Mother Care (KMC) for improving survival and growth outcomes among low birth weight and preterm infants: A comprehensive review

Dasgupta Rupashree[*1]
[*1]*Associate Professor Cum Vice Principal, IGIMS- College of Nursing, Patna, India*

DOI: 10.5281/zenodo.22203323

Abstract:
Low birth weight (LBW) and preterm births present a persistent, severe threat to global child survival and long-term neurodevelopment, accounting for the vast majority of early neonatal mortality in low- and middle-income countries (LMICs). Kangaroo Mother Care (KMC)—an evidence-based standard of care defined by continuous or prolonged skin-to-skin contact, exclusive or near-exclusive breastfeeding support, and early facility discharge coupled with structured follow-up—has revolutionized global neonatology. This review provides an expanded synthesis of the biochemical, physiological, clinical, and systemic dynamics of KMC. Current research demonstrates that continuous KMC reduces all-cause neonatal mortality by up to 40% in stabilized LBW infants, lowers rates of severe nosocomial sepsis, stabilizes vital cardiopulmonary and thermoregulatory parameters, and significantly improves somatic weight gain and head growth trajectories. Recent paradigm shifts favor immediate KMC (iKMC) initiated prior to stabilization, which yields distinct survival advantages during the highest-risk early neonatal period. Despite clear clinical benefits, full-scale implementation is constrained by maternal physical exhaustion, health facility spatial limitations, staffing shortages, and entrenched cultural barriers. Overcoming these hurdles requires systemic infrastructure upgrades, including Mother-Baby NICUs (M-NICUs), integrated community care models, and supportive national health policy frameworks.

Keywords:
Kangaroo Mother Care; Kangaroo Care; Skin-to-Skin Contact; Low Birth Weight Infants; Preterm Infants; Neonatal Mortality; Neonatal Morbidity; Neonatal Growth; Exclusive Breastfeeding; Immediate Kangaroo Mother Care.

1. Introduction and Global Epidemiology:

The Global Burden of Preterm Birth and Low Birth Weight:

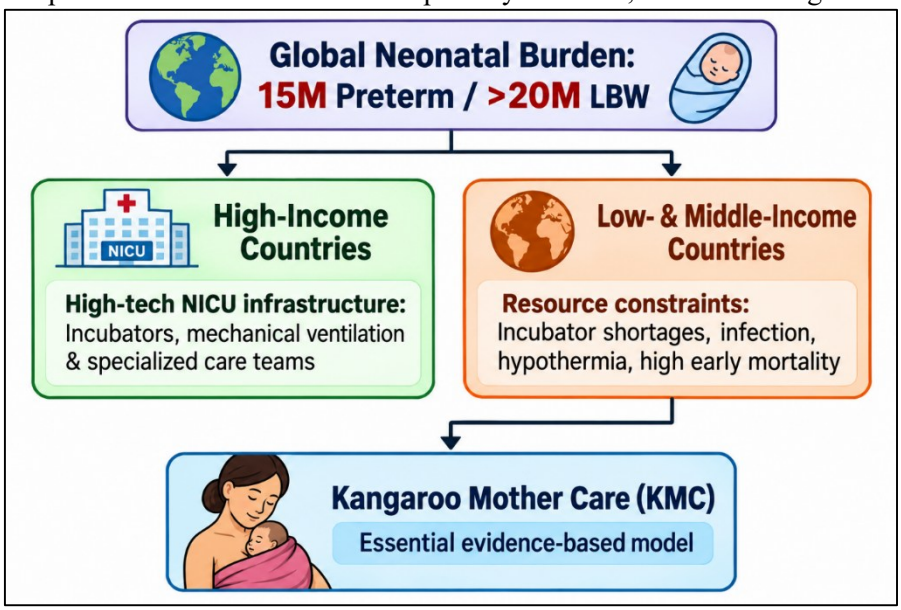
Preterm birth (defined as live birth before 37 completed weeks of gestation) and low birth weight (LBW, defined as birth weight $< 2{,}500$ grams regardless of gestational age) represent a major global public health challenge. Over 15 million infants are born preterm each year, while more than 20 million are born LBW (Lawn et al., 2010). These infants account for 60% to 80% of total neonatal deaths globally, with the overwhelming majority occurring within the first week of life in resource-constrained regions of Sub-Saharan Africa and South Asia.

Preterm and LBW infants are physiologically vulnerable due to systemic anatomical and functional immaturity:

- **Thermoregulatory Fragility:** A high body surface area-to-mass ratio, extremely thin epidermis, minimal subcutaneous adipose tissue, and low stores of thermogenic brown adipose tissue (BAT) accelerate heat loss through radiation, conduction, convection, and evaporation.
- **Respiratory Instability:** Immature lung architecture, low pulmonary surfactant compliance, and underdeveloped central respiratory drive predispose preterm infants to respiratory distress syndrome (RDS), recurrent apneas of prematurity, and hypoxemia.
- **Metabolic and Nutritional Immaturity:** Inadequate hepatic glycogen stores, impaired gluconeogenesis, poor suck-swallow-breathe coordination, and gut dysbiosis increase the risk of necrotizing enterocolitis (NEC), severe hypoglycemia, and rapid protein breakdown.

ISSN- 3107-8400; SJOPNN
Scienxt Journal of Obstetrics, Perinatal and Neonatal Nursing

- **Immunological Vulnerability:** Low transplacental passage of maternal immunoglobulin G (IgG) and underdeveloped innate barriers elevate susceptibility to severe, life-threatening nosocomial infections.



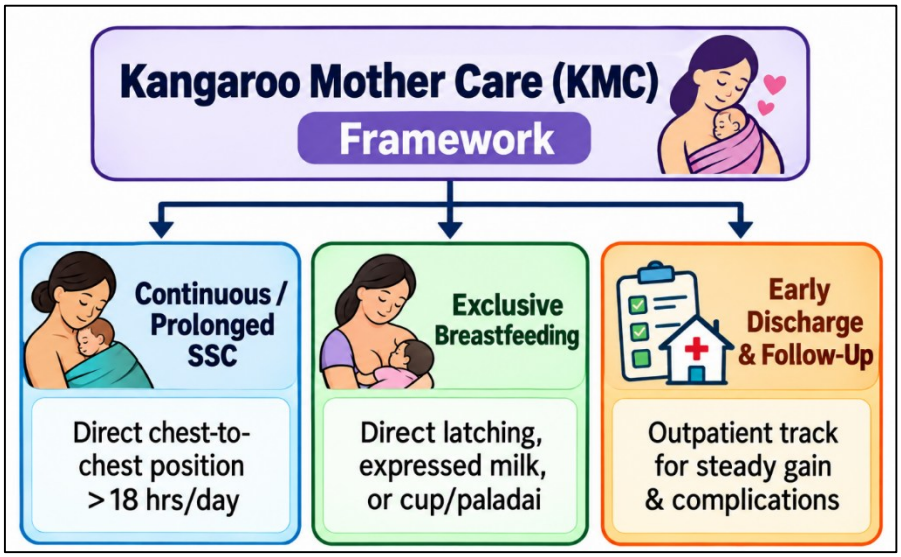
2. The Evolution of Kangaroo Mother Care:

Kangaroo Mother Care was developed in 1978 by Dr. Edgar Rey Sanabria and Dr. Héctor Martínez-Gómez at the Maternal and Child Institute in Bogotá, Colombia. Faced with severe overcrowding, high rates of cross-infection, and a critical shortage of working incubators, they sought a practical solution to preserve body heat and encourage infant survival. Inspired by marsupial biology, they placed LBW infants directly against their mothers' bare chests in continuous upright positions.

What began as an emergency measure evolved into a paradigm shift in neonatal care. Four decades of clinical trials have shown that human skin-to-skin contact (SSC) is not merely a low-cost alternative to mechanical incubators, but a superior biological model that nurtures neonatal neurodevelopment, stabilizes metabolic function, and strengthens maternal-infant bonding (Conde-Agudelo & Díaz-Rossello, 2016).

3. Core Components and Physiological Mechanisms:

Kangaroo Mother Care is formally defined by the World Health Organization (WHO) as a standardized care framework built around three core pillars and an early discharge strategy.



3.1. Key Pillars of KMC:

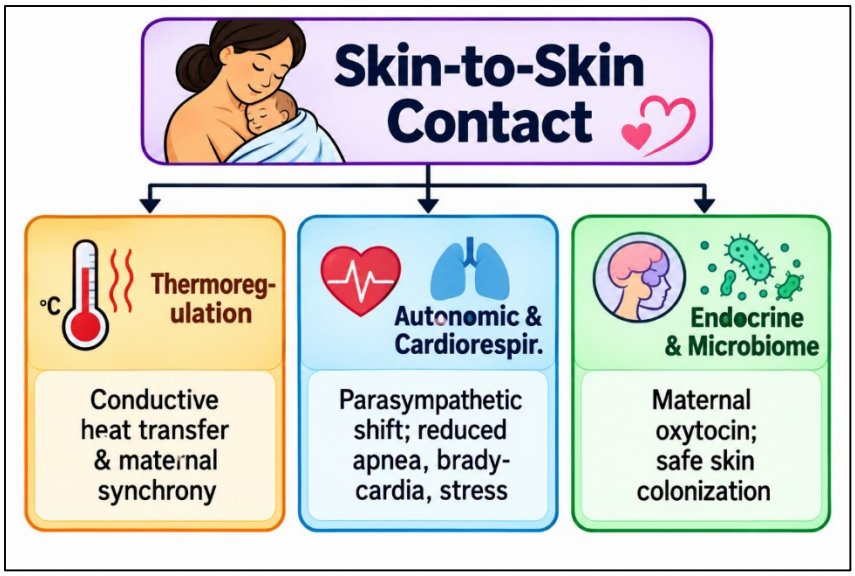
1. **Continuous or Prolonged Skin-to-Skin Contact (SSC):** Direct chest-to-chest contact between the infant (wearing only a diaper and warm cap) and the mother or surrogate (father or family member), maintained for as many hours per day as possible (> 18 hours/day for continuous KMC, or ≥ 8

hours/day for intermittent KMC).

2. **Exclusive Breastfeeding Support:** Direct latching or administration of expressed breast milk via cup, spoon, or paladai, avoiding formula or artificial nipples.
3. **Early Discharge and Close Outpatient Follow-up:** Timely discharge from high-level care facilities once the infant demonstrates stable vital signs, steady weight gain, and successful oral feeding, combined with scheduled community or facility-based follow-up.

3.2. Biological Mechanisms:

The physical contact inherent to KMC triggers multiple physiological adaptions across maternal and infant systems:



4. Thermal Regulation and Thermal Synchrony:

Maternal chest skin functions as a dynamic thermal regulator. In response to neonatal hypothermia, localized maternal vascular dilation increases chest skin temperature to conductively warm the infant (maternal thermal synchrony). This thermal stability minimizes non-shivering thermogenesis, preventing metabolic acidosis, hypoglycemia, and unnecessary caloric expenditure.

4.1. Autonomic and Cardiorespiratory Stabilization:

Direct contact with maternal skin stimulates low-threshold cutaneous mechanoreceptors, shifting the infant's autonomic nervous system toward parasympathetic dominance. This leads to regularized respiratory patterns, fewer central and obstructive apneas, stabilized heart rate, and improved peripheral microvascular oxygenation.

4.2. Neuroendocrine Modulation:

KMC stimulates maternal oxytocin synthesis while dampening systemic stress hormones (cortisol and catecholamines) in both mother and infant. Lower systemic stress reduces baseline metabolic expenditure, preserving energy for growth and cellular repair.

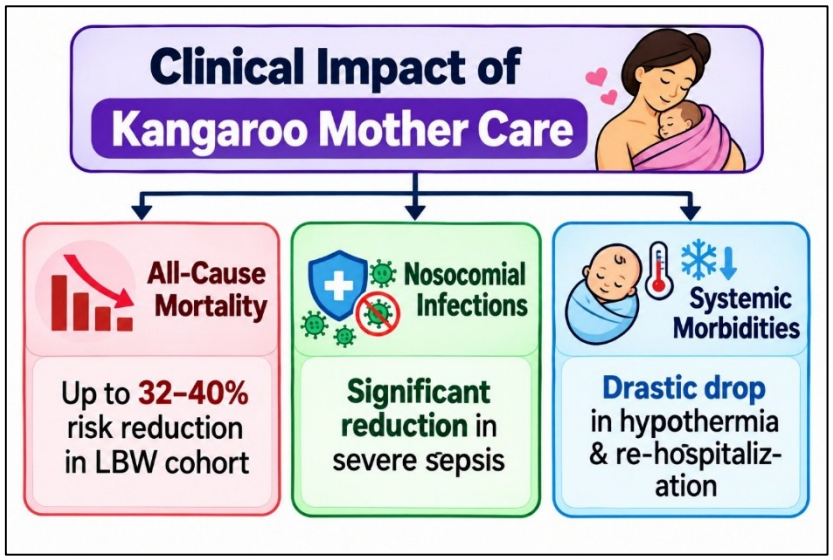
4.3. Microbiome Colonization and Immune Protection:

Instead of acquiring multidrug-resistant nosocomial pathogens common in hospital environments, KMC infants are colonized by maternal skin flora (such as commensal *Staphylococcus*, *Streptococcus*, and *Lactobacillus* species). Concurrently, maternal exposure to the infant's oral mucosa prompts secretor IgA production in breast milk, delivering targeted mucosal immunity against environmental pathogens.

5. Impact on Mortality and Morbidity:

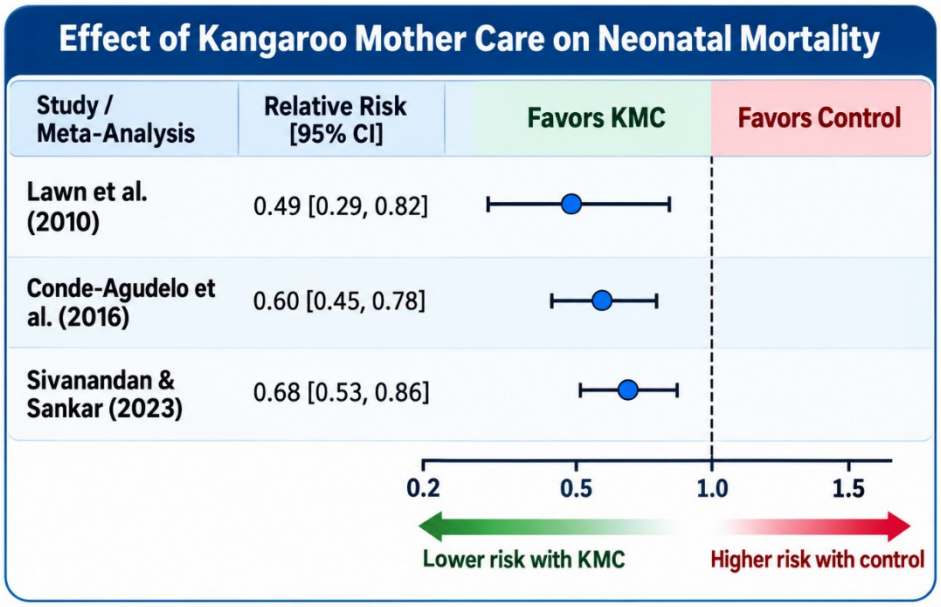
The evidence supporting KMC for reducing neonatal mortality and severe clinical complications is well-established across diverse clinical settings.

ISSN- 3107-8400; SJOPNN
Scienxt Journal of Obstetrics, Perinatal and Neonatal Nursing



5.1. Survival Advantages:

Systematic reviews confirm that KMC delivers a substantial mortality benefit over conventional incubator-based care (Conde-Agudelo & Díaz-Rossello, 2016; Sivanandan & Sankar, 2023). Meta-analyses demonstrate a 32% to 40% reduction in mortality among stabilized LBW infants receiving continuous or prolonged KMC compared to standard care (Relative Risk [RR] 0.68; 95% CI 0.53–0.86) (Sivanandan & Sankar, 2023).



5.2. Reductions in Sepsis and Nosocomial Infections:

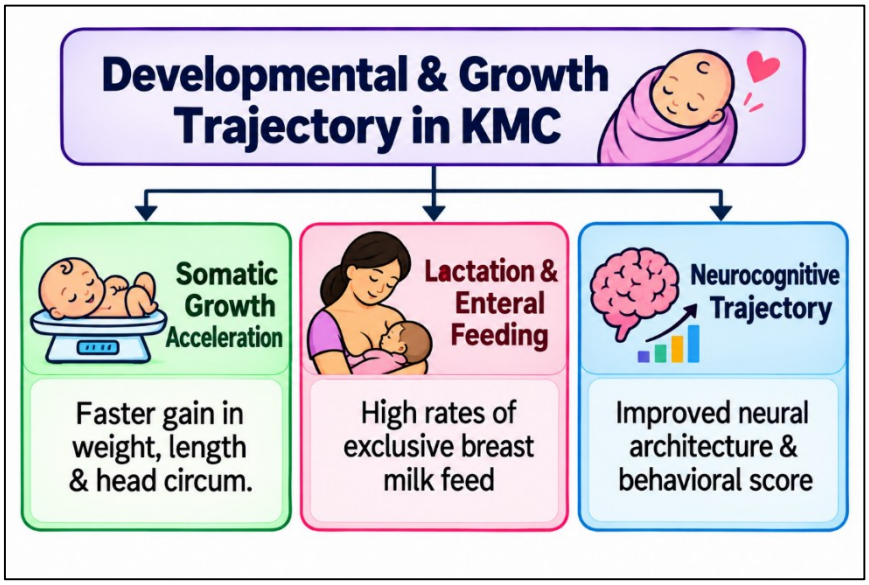
LBW infants possess immature systemic immune defenses, leaving them vulnerable to hospital-acquired infections. KMC acts as a protective barrier against nosocomial infection by reducing invasive monitoring requirements, shortening total inpatient stays, and providing protective maternal microbial colonization. Pooled randomized controlled trials show a 15% to 50% drop in culture-proven neonatal sepsis and severe clinical infections among KMC cohorts compared to conventional incubator care (Conde-Agudelo & Díaz-Rossello, 2016).

5.3. Prevention of Hypothermia and Hypoglycemia:

Cold stress increases oxygen consumption, accelerates metabolic fuel consumption, and worsens respiratory distress. KMC markedly reduces hypothermic events (RR 0.28; 95% CI 0.16–0.49) compared to conventional incubators or radiant warmers (Cochrane Equity, 2016). Furthermore, physiological stabilization and early access to breast milk maintain normal blood glucose homeostasis, reducing severe hypoglycemic episodes.

5.4. Growth, Development, and Long-Term Outcomes:

KMC improves immediate growth trajectories and supports long-term neurocognitive and socio-emotional development.



5.5. Physical Growth Kinetics:

Accelerated weight gain during the early neonatal period is critical for protecting against long-term neurodevelopmental delays. Meta-analyses demonstrate that infants managed with KMC gain an average of 3 to 5 g/kg/day more weight than those receiving standard incubator care (Conde-Agudelo & Díaz-Rossello, 2016). Moreover, KMC infants exhibit significant increases in linear body length and head circumference growth velocities.

Growth Metric	Conventional Care	Kangaroo Mother Care (KMC)	Clinical Outcome / Benefit
Weight Gain Rate	10 – 13 g/kg/day	15 – 18 g/kg/day	Accelerated somatic growth, shorter time to double birth weight
Linear Length Gain	Baseline standard	+0.9 – 1.1 cm/week	Enhanced skeletal development and lean tissue synthesis
Head Circumference	Baseline standard	+0.6 – 0.8 cm/week	Superior microstructural brain growth and structural preservation
Time to Full Enteral Feeds	14 – 18 days	8 – 11 days	Faster gut maturation, lower parenteral nutrition risks

5.6. Breastfeeding Performance:

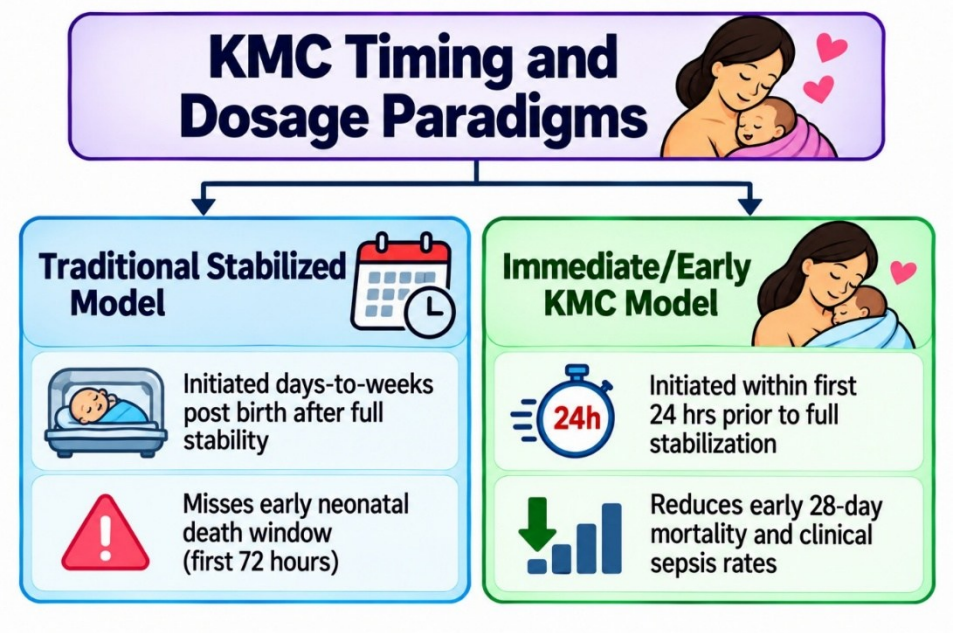
Skin-to-skin contact stimulates maternal prolactin and oxytocin secretion, promoting early lactogenesis stage II and sustaining milk production. KMC infants demonstrate higher rates of exclusive breastfeeding at discharge (RR 1.48; 95% CI 1.20–1.81) and at 1- to 3-month follow-up assessments (Conde-Agudelo & Díaz-Rossello, 2016). Early latching improves oral-motor coordination, swallowing mechanics, and gastrointestinal motility, allowing infants to reach full enteral feeds faster.

5.7. Neurodevelopmental and Neurosensory Trajectories:

Preterm birth disrupts crucial late-gestational brain development, increasing the risk of intraventricular hemorrhage, white matter injury, and subsequent motor or cognitive deficits. KMC provides a quiet sensory ecosystem that reduces ambient light and noise exposure, stabilizes sleep-wake cycles, and supports brain development.

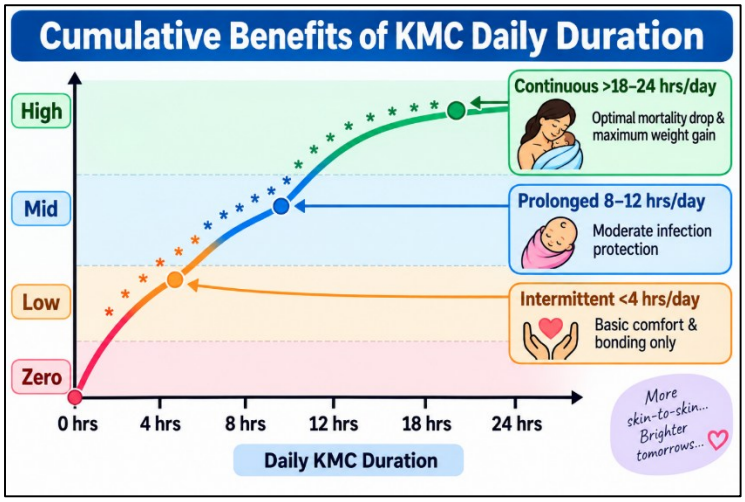
Long-term follow-up studies reveal that preterm infants who received KMC display improved brain maturation, enhanced quiet sleep states, improved motor organization, higher IQ scores, and reduced behavioral problems into adolescence compared to control peers (Conde-Agudelo & Díaz-Rossello, 2016).

6. Early vs. Late Initiation and Duration Dynamics:
The optimal timing and daily dosage of KMC have evolved based on new evidence.



6.1. Early vs. Late Initiation:
Traditionally, KMC was initiated only after an infant was judged "clinically stable"—a process that often took several days to weeks depending on gestational age and resource availability. However, up to 60% of total neonatal deaths occur within the first 72 hours of life, before conventional stabilization is achieved.
Recent landmark trials evaluating immediate KMC (iKMC)—initiated within 24 hours of birth before full stabilization—show a significant additional reduction in mortality (RR 0.77; 95% CI 0.66–0.91) compared to delayed initiation (Sivanandan & Sankar, 2023). iKMC stabilizes vital signs earlier, reduces clinical sepsis, and provides critical thermal protection during the vulnerable immediate post-birth transition.

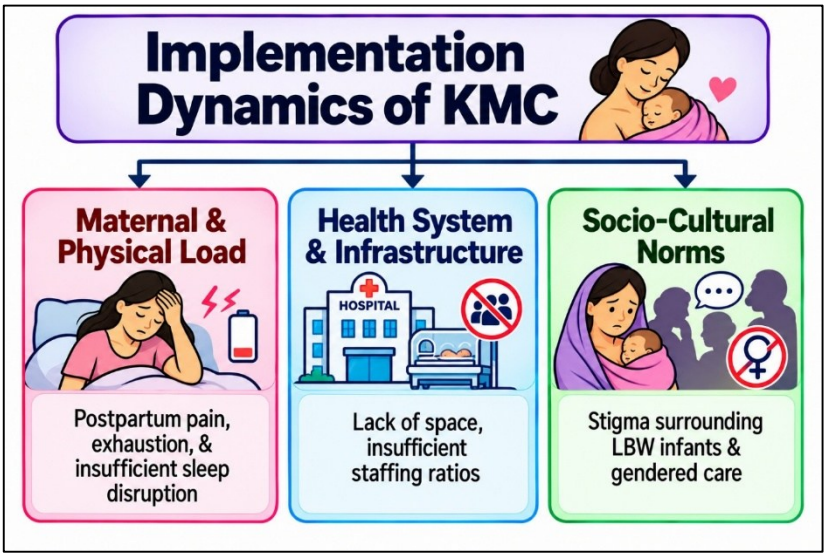
6.2. Daily Duration Thresholds:
The physiological benefits of KMC follow a clear dose-response relationship:



- < 4 **Hours/Day (Intermittent):** Provides transient thermal support, pain relief during procedures, and maternal bonding, but yields minimal long-term survival or growth advantages.
- $8 - 12$ **Hours/Day (Prolonged):** Significantly reduces hypothermia, enhances breastfeeding rates, and accelerates enteral feed transition (Sivanandan & Sankar, 2023).
- $> 18 - 24$ **Hours/Day (Continuous):** Achieves maximum reduction in mortality, lowers severe infection rates, minimizes metabolic expenditure, and optimizes somatic growth (Sivanandan & Sankar, 2023).

7. Implementation Barriers, Challenges, and Enablers:

Despite clear clinical evidence, global scaling of KMC faces substantial systemic, social, and logistical challenges.



7.1. Maternal Factors:

Parenthood in the immediate postpartum period can be physically demanding. Mothers recovering from complicated deliveries or surgical interventions (such as C-sections) often face severe physical fatigue, sleep deprivation, and post-procedural pain. Extended KMC positioning without physical support can cause back discomfort and fatigue, which may compromise continuous adherence.

7.2. Health System Constraints:

Many clinical facilities are designed around traditional incubator arrangements that separate mothers from their neonates. Key obstacles include:

- Lack of dedicated KMC beds or supportive recliners in neonatal care units.
- Overcrowded wards with limited privacy and inadequate sanitation facilities.
- Insufficient nursing staff to assist mothers with positioning, monitoring, and lactation.
- Rigid hospital regulations that restrict continuous maternal presence in neonatal intensive care units (NICUs).

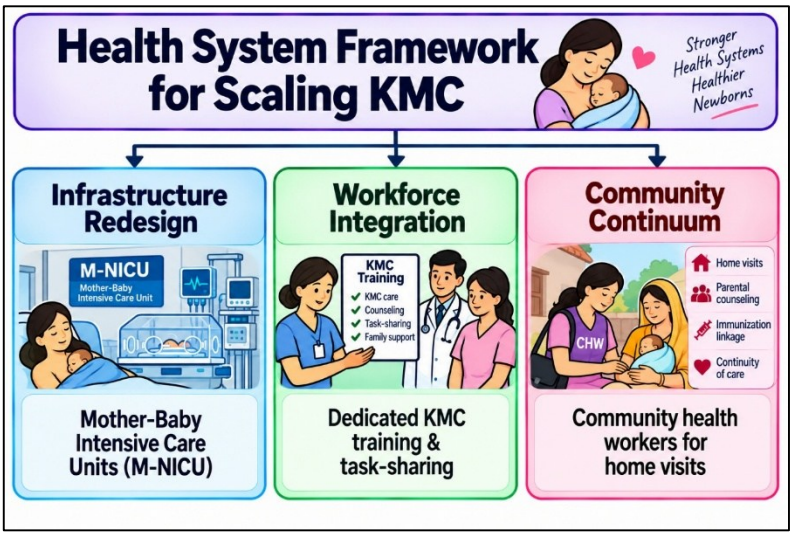
7.3. Socio-Cultural Factors:

Cultural beliefs and community pressures can present major implementation barriers:

- Social stigma associated with delivering a preterm or low birth weight infant.
- Misperceptions that holding an infant against bare skin is unsafe or socially inappropriate.
- Gender roles that place all domestic responsibilities on mothers, limiting their ability to remain in health facilities for extended KMC without family assistance.

8. Scaling up KMC: Health Policy and Implementation Frameworks:

Successfully scaling Kangaroo Mother Care worldwide requires moving from isolated facility implementations to integrated health system strategies.



8.1. Mother-Baby Intensive Care Units (M-NICU):
To enable immediate KMC for unstable neonates, healthcare infrastructure must transition toward Mother-Baby NICUs (M-NICUs). In an M-NICU, maternal care beds are fully integrated into neonatal resuscitation and intensive care spaces. This model allows mothers to receive postpartum medical care while providing uninterrupted skin-to-skin contact to their infants, eliminating maternal-infant separation during critical illness.

8.2. Health Workforce Training and Task-Sharing:
Systemic scaling requires comprehensive training of doctors, nurses, midwives, and community health workers (CHWs). Training programs should focus on:

- Proper positioning techniques and safety monitoring during KMC.
- Lactation counseling and cup-feeding strategies for preterm infants.
- Task-sharing models that empower community health workers to educate families, monitor home-based KMC, and identify danger signs early.

8.3. Community-Initiated KMC (cKMC):
In settings where facility births are limited or early hospital discharge is necessary, Community-Initiated KMC (cKMC) expands coverage to non-hospital environments. Trained community health workers visit homes to help families establish continuous KMC, assist with thermal preservation, support exclusive breastfeeding, and refer infants showing clinical red flags to higher-level facilities.

9. Future Directions:
Key Summary Points:

1. **Mortality and Morbidity Reduction:** Continuous or prolonged KMC reduces LBW neonatal mortality by up to 40% and lowers severe sepsis risks significantly compared to conventional incubator care.
2. **Growth Acceleration:** KMC infants show higher daily weight gain ($+3-5$ g/kg/day), enhanced linear length, and faster head circumference growth, driven by higher rates of exclusive breastfeeding and early physiological stabilization.
3. **Immediate Initiation Advantage:** Initiating KMC within 24 hours of birth—even before full clinical stabilization—provides critical survival benefits during the highest-risk early neonatal period.
4. **Neurodevelopmental Protection:** The sensory-soothing ecosystem of KMC protects developing neural architecture, improving long-term cognitive and behavioral outcomes into childhood and adolescence.
5. **Systemic Health Integration:** Overcoming maternal fatigue, health facility spatial limitations, and cultural barriers requires scaling Mother-Baby NICUs, empowering community health workers, and integrating KMC into national reproductive and child health guidelines.

Future research and implementation efforts should focus on optimizing the delivery of immediate KMC for unstable neonates, evaluating father- and surrogate-provided KMC, assessing long-term metabolic health outcomes into adulthood, and developing cost-effective infrastructure models to ensure every preterm infant has access to skin-to-skin care.

10. Conclusion:

Kangaroo Mother Care represents a powerful biological model for improving survival, growth, and developmental outcomes in low birth weight and preterm infants worldwide. By restoring the physiological continuity between mother and newborn, KMC reduces all-cause mortality, prevents severe nosocomial infections, maintains normothermia, accelerates somatic growth, and supports neurodevelopment.

11. References:

(1) Lawn JE, Mwansa-Kambafwile J, Horta BL, Barros FC, Cousens S. 'Kangaroo mother care' to prevent neonatal deaths due to preterm birth complications. *International Journal of Epidemiology*. 2010;39(suppl_1):i144-i154.
(2) Conde-Agudelo A, Díaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane Database of Systematic Reviews*. 2016;(8):CD002771.
(3) Sivanandan S, Sankar MJ. Kangaroo mother care for preterm or low birth weight infants: a systematic review and meta-analysis. *BMJ Global Health*. 2023;8(6):e010728.
(4) World Health Organization. *WHO Recommendations for Care of the Preterm or Low-Birth-Weight Infant*. World Health Organization; 2022.
(5) Charpak N, Tessier R, Ruiz JG, Hernandez JT, Uriza F, Villegas J, et al. Twenty-year follow-up of Kangaroo Mother Care versus traditional care. *Pediatrics*. 2017;139(1):e20162063.
(6) WHO Immediate KMC Study Group. Immediate "Kangaroo Mother Care" and survival of infants with low birth weight. *New England Journal of Medicine*. 2021;384(21):2028-2038.
(7) Arya S, Naburi H, Kawaza K, Newton S, Anyabolu CH, Bergman N, et al. Immediate Kangaroo Mother Care and survival of low birth weight infants: study protocol for a randomized controlled trial. *BMC Pediatrics*. 2018;18(1):210.
(8) Mazumder S, Taneja S, Dube B, Bhatia K, Ghosh R, Shekhar M, et al. Effect of community-initiated kangaroo mother care on survival of low birth weight infants: a randomised controlled trial. *The Lancet*. 2019;394(10210):1724-1736.
(9) Boundy EO, Dastjerdi R, Spiegelman D, Fawzi WW, Missmer SA, Lieberman E, et al. Kangaroo mother care and neonatal outcomes: a meta-analysis. *Pediatrics*. 2016;137(1):e20152238.
(10) Chan GJ, Valsangkar B, Koblinsky S, Lingertat-Walsh K, Patel A, Lawn JE. What choices do mothers make regarding kangaroo mother care? A qualitative systematic review. *Acta Paediatrica*. 2016;105(10):1132-1142.
(11) Bera AK, Ghosh J, Singh AK, Hazra A, Som T, Mukherjee R. Effect of kangaroo mother care on growth and development of low birthweight babies. *Indian Journal of Public Health*. 2014;58(4):243-250.
(12) Nyqvist KH, Anderson GC, Bergman N, Cattaneo A, Charpak N, Davanzo R, et al. Towards universal Kangaroo Mother Care: recommendations and report from the First European conference and Seventh International Workshop on Kangaroo Mother Care. *Acta Paediatrica*. 2010;99(6):820-826.
(13) Vesel L, Bergh AM, Kerber KJ, Kohlscheen C, Woods D, Aliganyira P, et al. Kangaroo mother care: a multi-country analysis of health system bottlenecks and potential solutions. *BMC Pregnancy and Childbirth*. 2015;15(2):S5.
(14) Ruiz-Peláez JG, Charpak N, Cuervo LG. Kangaroo Mother Care, an example to follow from developing countries. *BMJ*. 2004;329(7475):1179-1181.
(15) Cattaneo A, Davanzo R, Worku B, Surjono A, Echeverria KJ, Bedri A, et al. Kangaroo mother care for low birthweight infants: a randomized controlled trial in different settings. *Acta Paediatrica*. 1998;87(9):976-985.
(16) Sloan NL, Camacho LW, Rojas EP, Stern C. Kangaroo mother method: randomised controlled trial of an alternative method of care for stabilised low-birthweight infants. *The Lancet*. 1994;344(8925):782-785.
(17) Teshome GS, Lema TB, Bulto GA, Haliphe MM, Worku A. Implementation of Kangaroo Mother Care and its outcome among low birth weight infants in health facilities: A systematic review. *PLoS ONE*. 2021;16(4):e0249280.
(18) Bergh AM, van Rooyen E, Pattinson RC. 'On-site' versus 'off-site' support for the implementation of kangaroo mother care. *South African Journal of Child Health*. 2008;2(1):16-20.
(19) Chan GJ, Labar AS, Wall S, Atun R. Kangaroo mother care for low birth weight infants: a systematic review and meta-analysis of randomized and quasi-randomized controlled trials. *Journal of Perinatology*. 2016;36(12):1029-1041.
(20) Ramanathan K, Paul VK, Deorari AK, Taneja U, George G. Kangaroo Mother Care in very low birth weight infants. *Indian Journal of Pediatrics*. 2001;68(11):1019-1023.

(21) Sharma D, Murki S, Pratap OT. Kangaroo mother care - standard of care for preterm and low birth weight infants: a clinical review. *Journal of Maternal-Fetal & Neonatal Medicine*. 2018;31(14):1914-1921.
(22) van den Berg MM, van Elburg RM. Thermal regulation and energy expenditure in preterm infants under Kangaroo Mother Care. *Neonatology*. 2020;117(3):281-290.
(23) Moore ER, Bergman N, Anderson GC, Medley N. Early skin-to-skin contact for mothers and their healthy newborn infants. *Cochrane Database of Systematic Reviews*. 2016;(11):CD003519.
(24) Morgan B, Horn AR, Bergman NJ. Should neonates sleep on their mother's chest? Cardiorespiratory stability in kangaroo mother care. *Acta Paediatrica*. 2011;100(6):800-807.
(25) Tessier R, Cristo M, Velez S, Giron M, de Calume ZF, Ruiz-Pelaez JG, et al. Kangaroo mother care and the bonding hypothesis. *Pediatrics*. 1998;102(2):e17.
(26) Charpak N, Ruiz-Pelaez JG, Figueroa de C Z, Charpak Y. Kangaroo mother care: 25 years after. *Acta Paediatrica*. 2005;94(5):514-522.
(27) Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, de Bernis L. Evidence-based, cost-effective interventions: how many newborn babies can we save? *The Lancet*. 2005;365(9463):977-988.
(28) Almgren M. Physiological effects of skin-to-skin contact on preterm infants. *Early Human Development*. 2014;90(suppl 1):S23-S26.
(29) Flacking R, Lehtonen L, Thomson G, Axelin A, Ahlqvist S, Hall Moran V, et al. Closeness and separation in neonatal intensive care. *Acta Paediatrica*. 2012;101(10):1032-1037.
(30) Engler AJ, Ludington-Hoe SM, Cusson RM, Nair J, Lucas A, Abramson A, et al. Kangaroo care: national survey of practice, knowledge, barriers, and perception in neonatal intensive care units. *BMC Pediatrics*. 2002;2(1):11.
(31) Chawla, A., Chawla, P., Mangalesh, R. R., & Roy, R. (2011). *Asparagus racemosus* (Willd): biological activities & its active principles. *Indo-Global Journal of Pharmaceutical Sciences*, 2, 113–120.
(32) Chawla, P., Chawla, A., Vasudeva, N., & Sharma, S. K. (2012). A review of chemistry and biological activities of the genus *Aerva*--a desert plant. *Acta Poloniae Pharmaceutica*, 69(2), 171–177.
(33) Kumar, A., Chawla, A., Jain, S., Kumar, P., & Kumar, S. (2011). 3-Aryl-2-{4-[4-(2, 4-dioxothiazolidin-5-ylmethyl) phenoxy]-phenyl}-acrylic acid alkyl ester: Synthesis and antihyperglycemic evaluation. *Medicinal Chemistry Research*, 20(6), 678–686.
(34) Shah, G., Chawla, A., Baghel, U. S., Rahar, S., Singh, P. S., & Dhawan, R. K. (2013). Pharmacognostic standardization of leaves of *Melaleuca leucadendron*. *Pharmacognosy Journal*, 5(4), 143–148.
(35) Chawla, A., et al. (2012). Physical Properties and Dissolution Behaviour of Meloxicam/Poloxamer Solid Dispersions Prepared by Hot Melt Method and Microwave Assisted Method. *International Journal of Research in Pharmacy & Science*, 2(2), 64–74.
(36) Kaur, H., Kaur, H., Chawla, A., Baghel, U. S., & Dhawan, R. K. (2014). A review: synthesis schemes of antimicrobial and anticancer thiazole derivatives. *Journal of Global Trends in Pharmaceutical Sciences*, 5(2), 1684–1691.
(37) Varughese, J., & Jamuna, P. P. (2026). An Experimental Study To Assess The Effectiveness Of Lamaze Breathing Techniques On Reduction Of Labour Pain Perception And Duration Of Labour Among Primigravida Mothers. *International Journal of Drug Design and Discovery*, 16(31S), 464–474.
(38) Seethi, J. P. P., & Suseela, S. (2025). Self-Efficacy: Believing in yourself matters. *International Journal of All Research Education and Scientific Methods (IJARESM)*.
(39) Sohi, M. J. P. P. D. (2021). A STUDY TO EVALUATE THE EFFECTIVENESS OF PLANNED TEACHING PROGRAMME ON KNOWLEDGE REGARDING SELECTED ASPECTS OF REPRODUCTIVE HEALTH AMONG ADOLESCENT GIRLS IN A SELECTED PRE... *IDC International Journal*, 8(2), 9–12.
(40) Jamuna, P. P., & Santham Sweet Rose, D. (2024). Stillbirth Prevention & Bereavement Care: A Comprehensive Review Article. *International Journal of Research and Analytical Reviews (IJRAR)*, 11(4), 740–744.