


# BMJ Open Quality Sustaining prolonged kangaroo mother care in stable low birthweight babies over 2 years in a predominant outborn unit: a quality improvement approach

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## ABSTRACT

**Background** Kangaroo mother care (KMC) is a proven intervention for improving intact survival in low birthweight babies. Despite the evidence, its adoption and implementation have been low. Availability of mothers for the first few days of life is a specific challenge at outborn units. We used a quality improvement (QI) approach to implement and sustain KMC in stable low birthweight babies (<2000 g) from a baseline of 2.7 hours/baby/day to 6 hours/baby/day (prolonged KMC) over a period of 2 years in our unit through a series of Plan-Do-Study-Act (PDSA) cycles.

**Methods** All babies with birth weight <2000 g not on any respiratory support or jaundice were eligible. The key quantitative outcome was KMC hours/baby/day. A QI team consisting of nurses, nursing in charge and consultants of the unit was formed. The potential barriers for prolonged KMC were evaluated using fishbone analysis. A variety of parent-centric measures (provision of bed to mothers apart from KMC chairs, foster KMC, structured KMC counselling through a video, making KMC an integral part of treatment order) were introduced and subsequently tested by multiple PDSA cycles. Data on the duration of KMC per day were measured by bedside nurses on a daily basis.

**Results** A total of 134 mother–baby dyads were enrolled over 2 years. The mean gestation (SD) and mean birth weight (SD) were 33 (2) weeks and 1557 (295) g, respectively. 78 (58%) babies were outborns. We implemented prolonged KMC over 9 months and sustained it over the next 18 months. KMC duration increased from a median of 2.7 hours/baby/day from baseline to a median of 7.4 hours/baby/day after implementation.

**Conclusions** Prolonged KMC could be implemented and sustained over 2 years by implementing parent-centric best practices even in a predominant outborn unit.

## INTRODUCTION

### Problem description

India contributes to 42% of low birthweight (LBW) babies and about 25% of preterm births globally. Nearly 30% of neonates are born with birth weight <2500 g in India.<sup>1</sup> Prematurity-related deaths are the main contributor to neonatal mortality rate and it accounts for nearly 43%.<sup>2</sup> There has been

variation in the outcomes of prematurity in terms of both survival and morbidities. Kangaroo mother care (KMC) is one of the simple interventions to enhance both short-term and long-term outcomes in preterm and LBW babies. The WHO defines KMC as ‘care of preterm infants carried skin to skin with the mother and the main features include continuous and prolonged skin to skin contact between the mother and the baby, and exclusive breastfeeding (ideally) or feeding with breast milk’. WHO recommends newborns weighing less than 2000 g receive continuous KMC when possible; and that when continuous KMC is not feasible, intermittent KMC should be provided based on evidence of decreased morbidity when compared with conventional routine care.<sup>3,4</sup>

Despite guidelines and strong evidence of the benefits of KMC,<sup>5,6</sup> the implementation of KMC in many units is poor.<sup>7</sup> The average duration of KMC in previous Indian studies varies between 3 and 5 hours/baby/day.<sup>8,9</sup> The common barriers for KMC implementation are issues with the facility environment/resources, negative impressions of staff attitudes, the anxiety of hurting the baby, lack of help with KMC practice or other obligations, pain and low awareness of KMC. The availability of mothers is a major and unique challenge in outborn units.<sup>7,10</sup>

### Setting

The Ovum Woman & Child Speciality Hospital is a tertiary care centre in rural Bangalore, India. This centre caters to close to 400–500 outborn admissions per year and an area close to a 100 km radius. The unit has 12 intensive care beds, with an average occupancy of 80%. The unit has eight ventilated beds including high-frequency ventilation. There were a total of 12 nurses with an attrition of 20% per year. The average nursing



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strength was three per shift with a nurse to patient ratio of 1:2–3. There are two consultant doctors (6 hours on-site followed by on call) supported by three resident doctors (one per day) round the clock. The weight and corrected gestation cut-off for discharge are 1500 g and 35 weeks as per the unit policy. The unit did not have a written policy for KMC in the unit. There were only two special KMC chairs in the unit for providing KMC. There was no separate KMC ward or step-down nursery for the stay of stable LBW babies with mothers in the unit.

### Available knowledge and rationale

KMC is an evidence-based and cost-effective intervention. The data from a meta-analysis involving 21 studies and 3042 infants have demonstrated KMC to increase newborn survival, exclusive breastfeeding rates even up to 1–3 months after discharge, weight gain, reduce the risk of hypothermia, apnoea and nosocomial infections.<sup>5</sup> The effects of KMC last longer up to 20 years with children receiving KMC having reduced aggressiveness, hyperactivity, school absenteeism, etc.<sup>6</sup> There is limited evidence of strategies for ensuring the sustenance of KMC.<sup>11 12</sup> With evidence of safety and benefits to mother–infant dyad, anticipating more challenges with the predominant outborn setting for KMC, we planned to implement KMC in a gradual manner using Plan-Do-Study-Act (PDSA) cycles.

### Aim

We aimed to implement KMC in eligible babies (<2000 g birth weight) in the neonatal intensive care unit (NICU) of our hospital from a baseline of 2.7–6 hours/baby/day (prolonged KMC) over 6 months (February 2019 to July 2019).

## METHODS

### Design

A multidisciplinary quality improvement (QI) team was formed consisting of three nurses, a fellow and two consultants of the unit. The nursing officers were given the responsibility of data collection and supervising implementation. The fellow assisted them in supervising the implementation. Three nursing officers, fellow and consultants led this QI initiative for the entire duration. The study was conducted in the NICU from January 2019 to April 2021. All stable babies both inborn and outborn with a birth weight below 2000 g were eligible for the study. A stable baby was defined as a baby not requiring respiratory support or phototherapy. The babies on parenteral nutrition or intravenous fluids were also included. An arbitrary 6 hours' cut-off of KMC per day was defined as prolonged KMC.<sup>11</sup> We aimed to address the barriers through a series of PDSA cycles.

### Ethical considerations

The mother was explained about the QI initiative in her own language and verbal consent was obtained. An institutional review board was not sought to review as per

hospital policy as all of the changes being tested were evidence-based and widely accepted internationally.

### Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

### Measurements

The number of hours of KMC per baby was taken as a numerator. The number of eligible babies was taken as the denominator. Twin babies were taken as two eligible babies. Audits were done by the three nurses who were project leads. KMC duration was documented in the daily monitoring sheet and the number of hours was calculated from 08:00 the previous day to 08:00 the next day. All the data were entered initially in the Excel sheet of the NICU computer daily. In the sustenance phase, daily data were updated on the dashboard of the NICU entry and transferred to an Excel sheet weekly. The data entry was done by two nurses supervised by the fellow. The data were cross-checked on a weekly basis by the consultant. Descriptive statistics were used to describe demographic variables. We obtained 4 weeks of baseline data to calculate the median. Monthly compliance rates were collected thereafter and displayed using run charts from Microsoft Excel software. We defined a shift according to evidence-based rules.<sup>13</sup> When we identified a shift, we recalculated the new median using the points that made up the shift and compared new data to this new median. We followed the Standards for Quality Improvement Reporting Excellence 2.0 guidelines for reporting.<sup>14</sup>

### Strategy

During the baseline phase (January 2019), the team tracked all the babies with birth weight less than 2 kg who were off respiratory support and phototherapy. In this period, there were four eligible babies. The nursing officers recorded the KMC duration during these 4 weeks and the KMC rate was only 2.7 hours/baby/day. The data were collected on a predesigned Excel sheet for eligible preterm infant–mother dyads. The potential barriers for prolonged KMC were evaluated using fishbone analysis. After the baseline period, we implemented prolonged KMC sequentially over a period of 9 months through a series of three PDSA cycles. In each phase, the duration of KMC per baby per day was recorded daily and displayed in the run charts every month.

### PDSA cycles

#### PDSA 1 (1 February to 10 March 2019)

The nursing officers of the QI team disseminated the existing evidence of the benefits of KMC to other nursing officers of the unit and other doctors of the unit in a discussion forum. The KMC procedure and counselling skills of nursing officers were enhanced by a half-day training session by the QI team. The sensitisation session also allayed fears on monitoring babies on KMC and improved confidence of the staff in providing KMC even

when babies were on intravenous fluids or Peripherally inserted central catheter (PICC) lines. One of the barriers for prolonged KMC for mothers was being unable to sit for a long duration on a KMC chair especially in the first 2 weeks after delivery. The NICU unit had an adjoining four-bedded paediatric high dependency unit (HDU) which had low occupancy (<50%). The team convinced the management for utilisation of these unoccupied beds for KMC (2/4 beds). The team marked two beds in HDU for KMC. The team also drafted a protocol for KMC implementation in babies with birth weight less than 2 kg with no respiratory support and phototherapy. The protocol was approved by the lead neonatologist of the hospital and the information was disseminated through posters and WhatsApp messages.

#### PDSA 2 (20 March to 20 July 2019)

With sensitisation and reorganisation of resources from the first PDSA cycle, the nursing officers gained confidence. The non-availability of mothers for KMC especially in the first week of life was a barrier like any other outborn unit. The unit had visiting restrictions for the father and allowed 1 hour each in the morning and the evening. Mothers did not have any entry restrictions. Grandparents and other relatives were not allowed. The foster KMC involving either father or grandmothers was encouraged in the daily counselling sessions to the parents. The visiting restrictions were changed. The visiting restriction board outside NICU was modified to allow fathers or grandmothers at any time for doing KMC. The posters encouraging foster KMC were placed at the counselling room.

During PDSA 2, we found that mothers used to get stressed and lose motivation for KMC if there was no weight gain the next day. The KMC duration used to decrease based on the baby's weight loss or no gain.

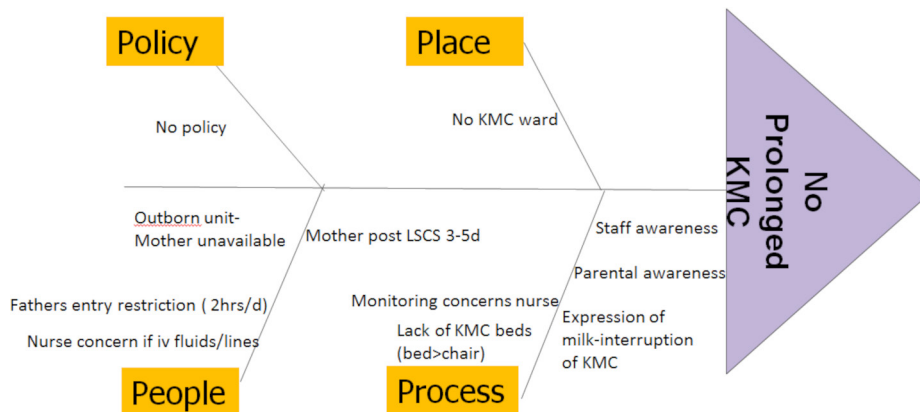
#### PDSA 3 (10 August to 15 October 2019)

The team modified the process of counselling a mother, father and grandmothers for KMC. Earlier counselling involved explaining the benefits and procedure of KMC by any of the staff nurses to the parents. There were variations in the content of counselling and undue stress on weight as the predominant benefit of KMC. The team decided to reduce variation by standardising the counselling with the help of a video. The nursing officers were asked to play a video explaining the benefits of KMC to the parents on the first visit (<https://www.youtube.com/watch?v=U0yBG59Afd>).

#### Sustenance phase (1 November 2019 to 30 April 2021)

Based on the learnings from the PDSA cycles provision of bed, foster KMC and structured counselling of mothers helped to implement prolonged KMC. In the monthly perinatal statistics meeting, the KMC rate was also presented as part of quality indicators to sustain motivation. Celebrations and incentives to QI champions led to sustained motivation within the team. The celebrations

Phase	Demographic features of enrolled neonates				
	Baseline	PDSA 1	PDSA 2	PDSA 3	Sustenance
Duration	1 January 2019 to 31 January 2019	1 February 2019 to 10 March 2019	20 March 2019 to 20 July 2019	10 August 2019 to 15 October 2019	20 October 2019 to 30 April 2021
Neonates (n)	4	5	13	16	99
Mean gestation at birth in weeks (SD)	34 (1)	34 (1)	32 (2)	33 (2)	32 (2)
Mean birth weight in grams (SD)	1577 (159)	1634 (199)	1527 (347)	1601 (203)	1548 (306)
Caesarean section, n (%)	4 (100)	5 (100)	10 (76)	15 (93)	82 (82)
Outborns, n (%)	4 (100)	5 (100)	7 (53)	10 (62)	52 (52)
PDSA, Plan-Do-Study-Act; SD, Standard deviation.					



**Figure 1** Fishbone analysis depicting various barriers of kangaroo mother care (KMC) in the unit. LSCS, Lower segment cesarean section.

were in the form of cake cutting and recognising KMC champion of the month as ‘best performer of the month’ in the monthly meetings. KMC was made part of the prescription and data were entered in the monitoring sheet of the child. A simpler data collection system in the form of mentioning the number of eligible babies and KMC rate daily on a dashboard was introduced. These data were transferred to the Excel sheet of the NICU computer every week. The run charts were also updated every month and their display also helped in sustaining KMC. Providing KMC for at least 6 hours/day for two consecutive days was made part of the discharge policy of LBW babies. A standard operating procedure (SOP) was made in the unit to sustain prolonged KMC. The SOP consisted of structured counselling through video, provision of beds preferably over KMC chairs to mothers, allowing foster KMC with continued data collection on the daily dashboard and making prolonged KMC part of discharge eligibility.

## RESULTS

A total of 134 babies with a birth weight below 2 kg were part of the QI initiative for prolonged KMC. There were a total of 10 twins and 78 (58%) were outborns. The mean gestation and mean weight of these babies were 33 (2) weeks and 1557 (295) g, respectively. The demographic

features of enrolled neonates in different PDSA cycles are depicted in [table 1](#).

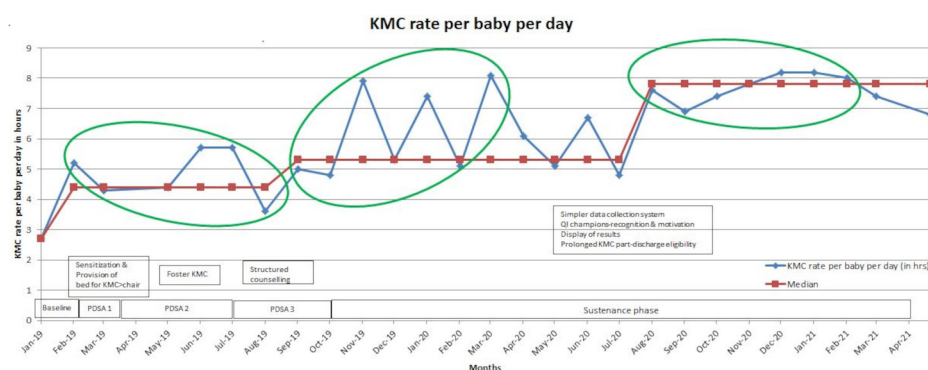
[Figure 1](#) depicts various barriers for prolonged KMC in the unit. The predominant barriers were the non-availability of mothers in the outborn unit especially for the first week, lack of awareness, lack of adequate support from other family members for baby care, absence of formal counselling on KMC, etc.

[Figure 2](#) depicts the improvement in KMC rates over time. Our baseline KMC rate was 2.7 hours/baby/day. We identified a shift of 7 data points from February to August 2019 after the baseline period. We recalculated the median based on this and found the new median of 4.4. This shift suggested improvement with PDSA 1 and PDSA 2. We identified an additional shift from October 2019 to March 2020. We recalculated the median based on this and found the new median of 5.3. This shift suggested improvement with PDSA 3. We identified an additional shift from August 2020 to February 2021. We recalculated the median based on this and found the new median to be 7.8. This shift suggested continued improvement during the sustenance phase.

The details of PDSA cycles are depicted in [table 2](#). No babies had any adverse events during KMC.

## Lessons and limitations

In predominant outborn and referral settings like ours, the challenges for the practice of KMC are unique. The



**Figure 2** Run chart depicting rate of kangaroo mother care (KMC) hours/baby/day. The oval shows a signal of shift. PDSA, Plan-Do-Study-Act; QI, quality improvement.

**Table 2** Details of the PDSA cycles

PDSA	PDSA 1	PDSA 2	PDSA 3	Sustenance
When	1 February 2019 to 10 March 2019	20 March 2019 to 20 July 2019	10 August 2019 to 15 October 2019	20 October 2019 to 30 April 2021
Plan	Training nurses, provision of bed.	Remove visiting restrictions for fathers/grandmothers for doing KMC.	Reduce variation in counselling.	Sustain KMC-QI champion and recognition, simpler data collection.
Do	Half-day KMC training session for all nurses, HDU 2/4 beds marked for KMC. Track KMC rates.	Foster KMC posters, change visiting restrictions policy, foster KMC was emphasised in daily counselling sessions.	Structured counselling of mothers for KMC using a standard video.	QI champions—cake cutting and celebrations, data collection on daily dashboard, KMC part of discharge policy, display run charts monthly.
Study	KMC increased from 2.7 to 5 hours/baby/day. Availability of mothers is a concern.	KMC increased from 5 to 5.7 hours/baby/day. Mother had concerns if there was no weight gain despite KMC and less motivation.	KMC increased beyond 6 hours/baby/day.	Prolonged KMC could be sustained for nearly 18 months despite COVID-19 pandemic.
Act	Try foster KMC with father/grandmothers.	Continue foster KMC and attempt structured counselling of mothers.	Sustain KMC.	Continued sustenance. SOP for prolonged KMC.

HDU, high dependency unit; KMC, kangaroo mother care; PDSA, Plan-Do-Study-Act; QI, quality improvement; SOP, standard operating procedure.

challenges range from non-availability of mothers, the concern of parents only on acute care, lack of family support in a distant place from their home town and availability of hygienic places for the mother to stay near the hospital especially whom herself is recovering from delivery or sickness. Despite these challenges, prolonged KMC could be implemented in the unit over a period of 9 months, a little longer than the initially aimed duration.

The important barriers for the practice of prolonged KMC by mothers are pain or fatigue, lack of awareness or anxiety of hurting the infant. The provision of beds over KMC chairs, sharing of KMC responsibility by family members and structured counselling together could enable prolonged KMC in the study. The beds in HDU were identified for KMC as the occupancy was low. The provision of beds to mothers for KMC was met with resistance initially by the administration especially when paediatric load used to be high in a few months. But with the constant success of KMC rates and positive feedback from parents supported our policy change with the administration. The foster KMC helped us for prolonged KMC in the unit and gave a road map for continuing KMC at home. The availability of additional nurses designated for KMC logically increases KMC. Most often, the increase in staff is temporary and limited to the project. In the study, the existing nurses were trained for initiation of KMC and KMC was integrated with their nursing care. Thus, the prolonged KMC could be sustained without any need for additional resources or major infrastructure changes.

Sustaining a QI project is always a challenge. A change to be sustainable must be a new way of working rather than a new addition to routine clinical care.<sup>15</sup> In the study, strategies that helped in the sustenance of prolonged KMC were simpler data collection on the daily dashboard, continued motivation by recognition of QI champions, regular discussion of KMC metric in the perinatal

meetings, display of KMC improvement on the run charts, integrating KMC with the existing treatment order and making prolonged KMC part of discharge policy.

We did encounter unanticipated problems due to the COVID-19 pandemic. Any asymptomatic parent was not tested before KMC. Only asymptomatic parents were allowed for KMC wearing a triple-layered surgical mask. Asymptomatic COVID-19-positive mothers and babies were allowed for KMC in the isolation. If the mother was positive and the baby negative, KMC was given by another family member who had a COVID-19-negative report. Despite the challenges of the pandemic, prolonged KMC could be sustained by the active involvement of staff and cooperation by parents.

In this QI initiative, we could not formally involve either of the parents in the design and conduct of the study. Early KMC has been shown to improve survival and breastfeeding rates in randomised controlled trials (RCTs).<sup>9,16</sup> In the unit, although early KMC is provided for babies on Continuous Positive Airway Pressure (CPAP), this subset of relatively sick babies was not attempted for prolonged KMC and was not part of this QI until they were off respiratory support. There are several other perceived benefits of prolonged KMC like better breastfeeding rates, growth, fewer infections, etc. Many of these benefits have already been proven in RCTs. With our focus on addressing system factors for implementation, we restricted the measurement to limited variables.

Overall, we learnt that sustaining prolonged KMC in an outborn unit, although sounded easy, required patience, perseverance and continued active cooperation by family members without any major changes in infrastructure or additional resources. Having an SOP of patient-centric measures like a bed for KMC, foster KMC, structured counselling, integrating KMC with the treatment order, data collection on the daily dashboard and recognising QI champions helps sustain prolonged KMC. In conclusion, prolonged KMC could be implemented and sustained by

patient-centred measures over 2 years in stable preterms in a predominant outborn unit. This experience will be useful for similar scenarios across the developing world where the availability of mothers in the outborn unit is a challenge and has limited nursing and infrastructure resources.

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**Contributors** GR designed the data collection tool, collected the data, assisted in data analysis and approved the final manuscript. ASA conceptualised the study, supervised the data collection, data analysis, drafted the initial manuscript and approved the final manuscript. LM assisted in data collection, data analysis and approved the final manuscript. AK assisted in designing the data collection tool, assisted in data analysis and critical inputs to the manuscript. PV supervised the data collection, critical inputs to the manuscript and approved the final manuscript. ASA is the guarantor.

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