TITLE

OPERATIONAL RESEARCH ON THE UPTAKE OF KANGAROO MOTHER CARE FOR SMALL BABIES ALONG THE HEALTH FACILITY–COMMUNITY CONTINUUM IN A SELECTED SUB-DISTRICT OF NORTHERN KARNATAKA, INDIA

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Submitted to

SCHOOL OF HEALTH SCIENCES & SPORT

UNIVERSITY OF STIRLING

In fulfillment of requirements for

DOCTOR OF PHILOSOPHY

June 2021

DECLARATION

I HEREBY DECLARE THAT THIS THESIS ENTITLED

Operational research on the uptake of kangaroo mother care (KMC) for small babies along the health facility–community continuum in a selected sub-district of northern Karnataka, India

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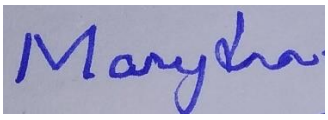

SIGNATURE

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June 2021

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ACKNOWLEDGEMENT

I am above all grateful to all the mothers with small babies and their family members who consented to participate in the study. I am indebted to them for their willingness to open their homes to my research assistants and myself, and for the time they voluntarily spared to complete the questionnaires or examine their babies. I acknowledge the commitment of my research assistant – Ms Pavitra Josit and the local WHO project staff (Ms Uma, Ms Shivaleela and Ms Anu) who travelled several kilometres with me to reach the homes of mothers with small babies, to access to these mothers. I am also grateful to all the nurses, doctors, health assistants and counsellors who participated in the study.

I would like to thank my supervisors and mentors, Dr Leah Macaden, Prof. Annetta Smith both from the Department of Nursing & Midwifery, University of the Highlands and Islands; Dr Prem K Mony, Vice Dean and Head- Division of Epidemiology and Population Health, St Johns Research Institute (SJRI), Bengaluru. Their constant support and guidance through the last four years, is deeply appreciated. The time they have taken and patience they had, through the iterative process of writing my chapters has been a source of inspiration through this journey and am grateful they were part of this journey! I would also like to thank my current employers (Dean, SJRI, Bengaluru, Karnataka, India) for their support, and for permitting me to undertake the study within the WHO project, thus providing me access to the mothers with small babies located in Koppal district, Karnataka. I am grateful for the University of Stirling Impact Studentship award and all the support staff of the University.

I would like to thank all the other project team members: firstly those that formed the team from SJRI office (Dr Suman Rao, Ms Virgin, Dr Tinku Thomas, Dr Kusum Mooray, Ms Purnavi Sundaram, Ms. Sonam McClay, Dr Kavya R., Ms. Sunitha Pinto, Ms. Kavya N., Ms. Jeeva Chinnaraj, Mr. Diwakar); secondly I would like to acknowledge those who worked at Karnataka Health Promotion Trust both in Bengaluru (Mr. Arin Katkar, Dr Swaroop, Ms. Prathiba Rai and Dr Krishnamurthy Jayanna) and Koppal Office (Mr. Pundalik, & Mr. Veeresh), for their constant support – technical, logistic or psychological support through this period. I would also like to place on record my gratitude to Ms. Sumithra Selvam who walked with me through the data analysis several times before it reached the final state. I also wish to thank Ms Gila Pereira for helping me with the final edits. Finally, I would like to thank my family, especially my husband Robert who constantly told me “I could do this”, my children Abigail and Jonathan; my siblings, extended family and friends for their encouragement through this journey, but specifically the last year of the Covid 19 pandemic when my faith in God helped me persevere through this journey to its end!

ABBREVIATIONS

APGAR	: Appearance, Pulse, Grimace, Activity, Respiration
aRR	: Adjusted Relative Risk
AYUSH	: Ayurveda, Unani, Siddha, Homeopathy (Alternative medicine)
CHC	: Community Health Centre
CHW	: Community Health Worker
CI	: Confidence Interval
CTRI	: Clinical Trials Registry of India
DH	: District Hospital
DHO	: District Health Official
ENAP	: Every Newborn Action Plan
ENC	: Essential Newborn Care
FI	: Field Investigator
fKMC	: Foster KMC
GUEP	: General University Ethics Panel
Gm	: Gram
IEC	: Institutional Ethics Committee
IQR	: Interquartile Range
INAP	: India Neonatal Action Plan
HCW	: Health Care Worker
KMC	: Kangaroo Mother Care
LBW	: Low Birth Weight
LMIC	: Low-and Middle-Income Countries
MoHFW	: Ministry of Health and Family Welfare
NBCC	: Newborn Care Corner
NBSU	: Newborn Stabilising Unit
NHFS	: National Health Family Survey
NHS	: National Health Service
NICR	: NHS Institute of Clinical Research
NICU	: Neonatal Intensive Care Unit
PHC	: Primary Health Centre
PhD	: Doctor of Philosophy
RCT	: Randomised Controlled Trial
RR	: Relative Risk
SD	: Standard Deviation
SDG	: Sustainable Development Goals

SDH : Sub-district Hospital
SGA : Small for Gestational Age
SNCU : Special Newborn Care Unit
SOP : Standard Operational Procedures
SSC : Skin-to-Skin Contact
DH : District Hospital
U5 : Under five years age group
UNICEF : United Nations International Children's Fund
UN-IGME : United Nations Inter-agency Group for Child Mortality Estimates
uRR : Unadjusted Relative Risk
WHO : World Health Organization

Symbols used:
> : More than
< : Less than

ABSTRACT

Introduction: Kangaroo Mother Care (KMC) scale-up is a proposed game changer for accelerating reduction in neonatal mortality rate. This operational research study aimed to identify determinants of KMC practice for small babies with birth weight less than 2000 gms (<2000 gms) irrespective of gestational age along the health facility-community continuum in Gangawati Sub-district and was nested within the district-wide WHO implementation research study. The latter aimed to identify a model for KMC scale-up in Koppal district of Northern Karnataka, India.

Methods: Following ethical and administrative approvals data on health facility preparedness, competence (knowledge, attitude, and skills) of health care workers (HCWs) from eight purposively selected health facilities in Gangawati were assessed at two time-points. Knowledge, attitude, and support mothers (n=209) received for KMC practice were assessed between 4-8 weeks of the small baby's life. Determinants of KMC practice (initiation day and duration) were analysed using multivariate log-binomial analysis.

Results: 227 (55.6%) from 408 small babies born between Dec 2017-Sept 2018, with a mean unadjusted age of 35.6 (±7.5) days; and 1693.9 (+263.1) gms birth weight were recruited to this study. KMC was initiated for 216/227 (95.2%) babies at the health facility, at ≤3days of life for 173/226 (59.6%) and was continued >4weeks at home [30.2 (±8.4) days]. Early KMC initiation (≤3days of life), effective KMC (≥8hours skin-to-skin contact and exclusive breastfeeding) 24hours before discharge and ≥8hours KMC a week after discharge were observed for those hospitalised in public health facilities. Knowledge, attitude, and skills of HCWs were found to be key determinants of KMC practice. Support for KMC at the health facility was associated with early KMC initiation and ≥8 hours KMC before discharge.

Conclusion: Findings from this study concluded that the support mothers received from HCWs who were competent are key determinants for KMC practice along the health facility-community continuum. Context specific implications for policy, practice, education, and further research have been identified as appropriate.

CHAPTER 1. INTRODUCTION

All children have the right to grow and develop in a healthy environment to reach their full potential as citizens of the world. It is the responsibility of adults – the Health Care Workers (HCWs) in the healthcare system, the first contacts for life to identify vulnerabilities or obstacles to and conditions that would impair children's ability to grow to their full potential and maintain a healthy life. Of all children, neonates particularly, preterm and Low Birth Weight (LBW) are the most fragile and vulnerable, considering their contribution to neonatal mortality is the highest (Liu, et al., 2019). Evidence suggests that preterm birth is associated with increased risk for adverse cognitive development and academic achievement, social relationship problems and poorer quality of life that could affect their overall potential as adults (Wolke, 2018). Additionally, the fact that LBW babies who are so tiny and fragile are unable to regulate their own body temperature (Lunze & Hamer, 2012) is crucial to consider since LBW and hypothermia could be a double vulnerability for multiple morbidities and increased mortality (Datta, et al., 2017). This vulnerability of hypothermia risk could be modified *by HCWs* at birth through facilitation of the best environment: Skin-to-Skin Contact (SSC) with the mother, if spontaneous breathing were established (Lunze & Hamer, 2012). Plethora of evidence exists from several research studies (Abdulghani, Edvardsson, Amir, 2018; Arivabene & Tyrrell 2010; Bera, et al., 2014; Boundy, et al., 2015; Bulfone, Nazzi,& Tenore, 2011; Charpak, et al., 2017; Cleveland, et al., 2017; Conde-Aguedelo & Díaz-Rossello, 2016; Feldman, et al., 2014; Gabriels, et al., 2015; Ludington-Hoe, et al., 2006; Rao, et al., 2008; Rasaily, et al., 2017; Sharma, et al., 2018; Sharma, et al., 2016; Smith, et al., 2017; Tessier, et al., 1998) in India and globally that have been conducted over the last two decades, on both the short- and long-term benefits of SSC along with the initiation of early breastfeeding, the two key components of Kangaroo Mother Care (KMC). Short-term benefits of KMC include increased warmth, stable physiological parameters, better growth parameters, and reduction in mortality and morbidity (Rao, et al., 2008; Bera, et al., 2014; Conde-Agudelo & Díaz-Rossello, 2016). Long-term benefits of KMC include enhanced neuro-psycho-cognition and social benefits for the baby (Head, 2014; Charpak, et al., 2017; Doddabasappa, et al., 2018; Namazzi, et al., 2020). KMC has been around for >40 years and has been strongly recommended by the World Health Organization (WHO) as part of Essential Neonatal Care (ENC) for all stable small babies weighing less than 2000 gms (<2000 gms) at birth irrespective of gestational age, (WHO, 2015). KMC is known to facilitate healthier development and attainment of high adult potential in later years, in these vulnerable neonates (Charpak et al., 2017). But efforts for KMC scale-up and to reach all stable small babies globally, have not yet been successful, despite it having the potential

to reduce mortality in small babies <2000 gms by 40% (Conde-Agudelo & Díaz-Rossello, 2016).

Chapter 1, is divided into five sections where the background for the present study and how the research idea was developed is detailed, followed by the aim, objectives, and hypotheses for the study.

1.1 Background

1.1.1 Scale of prematurity and LBW globally and in India

The worldwide average preterm birth rate in 2010 was 11.1% (Blencowe et al., 2012). Variations in the preterm birth rate are evident with average rates being the highest in low-income countries at 11.8%, followed by Lower Middle-Income Countries (LMICs) at 11.3% and the lowest in the upper middle- and high-income countries at 9.4% and 9.3% respectively. In 2010, India ranked the highest with an estimated 3.5 million preterm births amongst the top ten countries globally that accounted for 60% of all preterm births. The preterm birth rate of India in 2014 was 13.6% (Uncertainty Interval: 11.1-16.1%) (Blencowe, et al., 2012; Chawanpaiboon, et al., 2019).

India also had the highest number of under-5 (U5) deaths, of all countries in 2015 (Liu, et al., 2019). This was despite its progress in reduction of the U5 mortality rate by half between 2000 and 2015, due to efforts of the National Rural Health Mission instituted in 2005 by the Government of India, to improve maternal and child survival in rural areas. The decrease in U5 mortality during this period was largely attributed to scale-up of immunisations to prevent communicable diseases and infections, yet, with no concomitant decline in infant as well as neonatal mortality in the country. In fact, the neonatal mortality accounted for nearly 60% of all U5 mortality during this period (Liu et al., 2019). This warranted India to focus on the causes of neonatal mortality, develop strategies to scale-up recommended evidence-based interventions such as the use of corticosteroids for preterm labour, KMC, exclusive breastfeeding, and prevention of infection (Moore, et al., 2016; Bhutta, et al., 2014), to accelerate reduction in the U5 mortality. India demonstrated its commitment to accelerate reduction in neonatal mortality through the ratification of the United Nations' 17 Sustainable Development Goals (SDGs) of 2015, with SDG-3 (WHO, 2016) in particular. The targets set by SDG-3 was the reduction of U5 mortality rate to <25 per 1000 live births, and neonatal mortality rate to be <12 per 1000 live births by 2030 (Liu, et al., 2019).

Three clusters of causes were attributed to 80% of neonatal mortality globally and to nearly 77% in India. The three causes included complications due to prematurity and LBW,

infections, and intra-partum related events. Complications due to prematurity and LBW was identified as the main contributor to neonatal mortality - 36% globally and 44% in India (Lawn, et al., 2014; Liu, et al., 2019). Thus, the call for scaled-up action towards neonatal health, with a specific focus on these three clusters to substantially impact on global and Indian neonatal mortality rates was well justified (Hug, et al., 2019; Lawn, et al., 2014). Considering that complications related to preterm and LBW births is the biggest contributor to neonatal mortality, it was befitting to accelerate efforts focused on LBW neonates towards achieving SDG -3.

Globally, preterm and LBW neonates have the greatest risk for health problems such as unstable body temperature, feeding difficulties, infections, low blood sugar, and breathing difficulties all of which increase their risk of mortality (Blencowe, et al., 2013). Of all preterm births, approximately 84% occur between 32 to 36 completed weeks of gestation (moderate to late preterm), globally (March of Dimes, et al., 2012; Blencowe, et al., 2012). Most of these babies are likely to survive with just supportive and essential neonatal care without intensive therapy (Blencowe, et al., 2012). Approximately, 15% of preterm babies born before 28 weeks of gestation worldwide are known to require intensive neonatal care due to serious and complex health problems for example, severe respiratory distress with inability to directly breast feed, risk of hypothermia and infections (March of Dimes, et al., 2012; Blencowe et al., 2013). But the equity gap between the high-income and the LMICs is evident in that >90% of preterm neonates born before 28 completed weeks of gestation had higher survival rates in high-income countries in comparison to 10% in LMICs, a 90:10 survival gap (Blencowe, et al., 2012). This gap exists till date, primarily, due to availability of intensive care, and investments made by high-income countries on high-tech environments and trained workforce that is rationed in LMICs (Blencowe, et al., 2013). Given the constraints of finance, infrastructure, and human resources in LMICs including India, investments directed towards scaling-up of neonatal intensive care units (NICUs) alone for reduction in neonatal mortality would probably be unjustifiable (Cheah, 2019). Instead, investments in scaling-up of cost-effective ENC packages for stable babies with birth weight <2000 gms, irrespective of gestational age would probably be a more sustainable option for LMICs to reach SDG-3 targets of neonatal mortality rates <12 per 1000 live births by 2030 (Liu, et al., 2019).

Three evidence-based cost-effective ENC packages were recommended for scaling-up globally towards accelerated reduction in neonatal mortality (March of Dimes, et al., 2012). The first package targeted all neonates irrespective of gestational age or birth weight. It included ENC encompassing thermal care, hygienic cord and skin care, early initiation of

and exclusive breastfeeding. Package two was focused towards approximately 5-10% neonates, who did not breathe spontaneously at birth and included basic neonatal resuscitation that comprised of immediate assessment of the neonate at birth, stimulation, and positioning, including bag and mask ventilation if needed. Effective bag and mask ventilation was known to avert 30% of term neonatal deaths and 5-10% of preterm deaths (Enweronu-Laryea, et al., 2015; Niermeyer, et al., 2000; Wall, et al., 2009). Experts claim that bag and mask ventilation can reduce preterm mortality by about 10% in health facilities and by about 5% if community based basic resuscitation is implemented (Lee, et al., 2011).

The third package was recommended for care of all LBW babies and included Kangaroo Mother Care (KMC) with breastfeeding support for their mothers (March of Dimes, et al., 2012; WHO, 2015). The practice of KMC, essentially placing the LBW baby on direct skin-to-skin contact (SSC) with the mother as early as possible after birth was first introduced in 1978, at Bogota, Columbia, as an alternative to conventional care of these babies in an incubator. KMC was strongly advocated by the WHO since 2003. Findings from a meta-analysis that included 21 randomised controlled trials (RCTs) and 3042 infants (Conde-Agudelo & Díaz-Rossello, 2016) concluded that KMC reduced mortality by 51% for stable neonates weighing <2000 gms if started in the first week of life (Lawn et al., 2010; Conde-Agudelo & Díaz-Rossello, 2016). Reductions in morbidity from severe infections, nosocomial infections, hypothermia, and lower respiratory tract infections were documented in the follow-up of LBW babies when discharged from the health facility compared to those babies who received conventional neonatal care. The risk for prolonged hospitalisation was reduced with KMC, also known for resulting in improved growth, breastfeeding and maternal-infant attachment as well as increased parental confidence to care for a LBW baby (Bhutta et al., 2014; Boundy et al., 2015;Conde-Agudelo & Díaz-Rossello, 2016; Uwaezuoke, et al., 2017). Thus, efforts to scale-up KMC could have triple dividends namely, reduction in neonatal mortality and morbidity; reduced costs for the healthcare system through reduced use of warmers, early discharge and close follow-up (Broughton, et al., 2013; Sharma, et al., 2018); and long-term benefits to the community at large through its impact on parental engagement with care of the neonate and fostering better neuro-cognition developmental outcomes in LBW babies (Charpak, et al., 2017; Doddabasappa, et al., 2018; Head, 2014; Namazzi, et al., 2020).

Despite guidelines for KMC implementation at health facilities in 2014 (Ministry of Health and Family Welfare - MoHFW, 2014a), by the Government of India, KMC was not yet scaled-up in India in 2016. There was limited or no evidence of its usage in primary and secondary level health facilities, regardless of it being a cost-effective, evidence-based

intervention for LBW neonates (Sharma, et al., 2018; Taneja, et al., 2020). It was therefore imperative to find ways to overcome barriers to implement this third neonatal care package, inclusive of KMC with extra support for breastfeeding, firstly of stable LBW babies at scale to achieve the SDG-3 targets (Bhutta, et al., 2014; Liu, et al., 2019; March of Dimes, et al., 2012; Moore, et al., 2011).

1.2. Development of the research idea

Adoption and implementation of KMC practice as part of ENC was limited both globally and in India despite the plethora of evidence on the benefits of KMC and its endorsement by the WHO, several global and country level initiatives (Chan, et al., 2016b; March of Dimes, et al., 2012; MoHFW, 2014a). At the policy level, India's commitment towards neonatal health was undoubtedly sound. The India Newborn Action Plan (INAP) had the following national targets set in 2014, to integrate KMC as part of ENC in at least 50% of LBW babies by 2020; 75% by 2025 and 90% by 2030 (MoHFW & INAP, 2014). An understanding of the public healthcare system organisation and the co-existence of the private healthcare system in India is essential to comprehend the challenge of achieving these proposed national targets for KMC.

1.2.1 Present status of reaching set national neonatal targets

The healthcare system in India is pluralistic, in which both the public and private health facilities co-exist, with disproportionate distribution of private health facilities in rural and urban areas. The public health system is organised at three levels. The primary healthcare level consisting of Sub-Centres, Primary Health Centres (PHCs) and Community Health Centres (CHCs) (Appendix-A). Based on the guidelines of the MoHFW (2014a), these health facilities except for sub-centres are expected to be equipped with workforce and infra-structure to implement the ENC package one and possess capabilities for care of LBW babies between 1800-2500 gms at birth, provided they were without any health problems (MoHFW, 2011a).

The secondary healthcare level consists of Sub-District hospitals (SDHs) that are also referred to as first referral units and the district hospitals. The SDHs, as per the MoHFW guidelines are required to have a four-bedded Newborn Stabilising Unit (NBSUs) equivalent to a Level I neonatal care unit (MoHFW, 2011a).The NBSUs are expected to be resourced with radiant warmers and phototherapy units; possibly a paediatric specialist, and with capabilities to manage babies with birth weight >1800 gms, including those with neonatal sepsis, hyperbilirubinemia on phototherapy; or to stabilize and refer sick or LBW babies

<1800 gms (MoHFW, 2011a) to the tertiary healthcare level facilities. One would infer that KMC could be provided for these LBW babies (1800-2500 gms) especially since most of them would be stable (MoHFW, 2014a) at both primary and secondary level health facilities. The district hospitals on the other hand are expected to have a 12-bedded Special Newborn Care Unit (SNCU) equivalent to a Level II neonatal care unit and are required to be equipped with facilities and workforce to manage LBW babies <1800 gms, all sick babies except those requiring mechanical ventilation or major surgical intervention, and facilitate referral services (MoHFW, 2011a). The tertiary level healthcare in the public health system consists of hospitals that are attached to a medical college. These health facilities are expected to have a Level III neonatal care unit, typically called the Neonatal Intensive Care Unit (NICU). Alongside the public healthcare system, is a vibrant private healthcare system that could have a Level I, II or III neonatal care unit, the latter of which provides services for sick neonates requiring mechanical ventilation or intensive care.

Thus, secondary, and tertiary health facilities including the private neonatal care units must typically have the capability to implement KMC for stable LBW babies. But data on KMC implementation from 20 states of India in 2014 indicated only 0-20% of LBW babies admitted in public Level II neonatal care units (SNCUs) in 12 of the states had received KMC, suggesting possible low coverage of LBW babies with KMC (Save the Children, n.d.). Extrapolating from this information, one would assume that KMC is not yet the norm for ENC of LBW babies across all levels of health facilities. These findings on KMC coverage were relevant only for those LBW babies admitted in SNCUs. It was not relevant for those babies born across a range of health facilities from PHCs, CHCs to high-tech private health facilities and neither those who were born at home, the latter of which is approximately 8.7% in Karnataka according to the NFHS-4, 2015-16 (IIPS & ICF, 2017) and who are likely to also be LBW. This clearly demonstrated that KMC implementation was far from reaching a fraction of the INAP target of 50% coverage of LBW babies with KMC by 2020. Given the strong evidence-base on the benefits of KMC especially for its ability to reduce neonatal mortality and morbidity rates in LBW neonates (Conde-Agudelo & Díaz-Rossello, 2016), the growing evidence on the facilitators and barriers for its implementation, it was an opportune time to scale-up KMC, especially in LMICs (Chan, et al., 2016b & 2017; Moxon, et al., 2015; Seidman, et al., 2015; Smith, et al., 2017) to meet the target of INAP and the SDG-3 on neonatal mortality. It thus would be critical to reach at least all stable LBW babies with KMC irrespective of the place of birth in a country like India known to have a health system that is diverse and pluralistic.

1.2.2. Nesting the PhD study within a district-wide project

My first experience with KMC was in 2004, as a research supervisor for a postgraduate student specialising in Child Health Nursing. The study explored perceptions of Health Care Workers (HCWs) on KMC and the effect of KMC on the physiological parameters of LBW babies in a Level III neonatal care unit of a private tertiary hospital in Bengaluru (Nirmala, Rekha, Washington, 2006). I was intrigued by KMC, since it seemed to be such a simple procedure, and so humane to keep the mother and LBW baby in contact, unlike the visitation restrictions when a baby was admitted into a newborn care unit such as an NICU or SNCU or NBSU. I was then keen for KMC to reach LBW babies who needed it most, particularly in rural and remote areas of India which primarily, had higher neonatal and U5 mortality rates (Liu, et al., 2019).

In 2016, three states in India (Uttar Pradesh, Haryana, and Karnataka) were identified for an implementation research project to explore context specific barriers for the low coverage of KMC and to test a model for KMC scale-up within two years. Three institutions were selected to lead the projects in each state. The St John's Research Institute from Karnataka where I am employed was one of the three institutions funded by WHO to lead this project. The project entitled "Implementation research in India (Karnataka State) towards accelerating scale-up of Kangaroo Mother Care (KMC)" (Clinical Trials Registry-India [CTRI] REF/2017.02/013469) began in June 2016 (Appendix B). The overall aim of this project henceforth referred to as WHO project, was to obtain coverage for 80% of LBW babies (birth weight <2000 gms, henceforth referred to as "small babies") who would be physiologically stable at birth with effective KMC (a minimum of 8 hours of SSC and exclusive breastmilk feeds) within the Koppal district in the state of Karnataka, India. This meant that KMC would have to be scaled-up rapidly within that district to reach almost all stable small babies irrespective of the place of childbirth. Reports on scale-up of KMC in other countries for example, Sub-Saharan African countries had evolved through three stages and over several years. The first stage included setting up a centre of excellence with focus on in-patient health facility care. The second stage included building technical capacity and expanding coverage to district level and primary level health facilities. The third stage included comprehensive follow-up and family support at the community level (Foote & Tamburlini, 2017). The WHO project's aim was formidable, firstly for its short implementation time span (June 2016-December 2018), the first six months of which were spent on identification of barriers through qualitative research and piloting of strategies (Appendix B). Secondly, at its initiation in June 2016, KMC was initiated for <2% of small neonates in Koppal district. The daunting aim of the WHO project, could thus be possible through an accelerated, concerted and coordinated engagement of all stakeholders

including the users (mothers and the community) all occurring concurrently, instead of a staged process as happened in other countries, given the short duration of the WHO project.

There are additional complexities to be considered for the scale-up of KMC in India. These include co-existence of the public and private healthcare system; childbirth occurring in a range of settings from the public healthcare system at the primary, secondary, or tertiary levels as well as at homes or in the private health facility; and early voluntary discharge from health facilities after childbirth (Devasenapathy, et al., 2014; Kumar & Dhillon, 2020). Small babies can be born in any of these health / home settings demanding focussed expansive effort to achieve the 80% coverage target set for the purposes of the WHO project. Therefore, for KMC scale-up, it was essential to understand the complexities of how these systems coordinated and functioned together as a whole and what role mothers, families and the community at large had in utilising the services.

This WHO project came at an opportune time when I was considering undertaking a PhD Although there were existing guidelines for KMC implementation applicable for childbirths occurring in health facilities (MoHFW, 2014a), they might not be relevant in those facilities where self-discharge within 6-8 hours after childbirth is practised (Varma, et al., 2010; Devasenapathy, et al., 2014) contrary to the recommendation of 24-48 hours stay in the health facility after childbirth (WHO, 2013). Further, KMC initiation and maintenance was not an acceptable strategy for home deliveries (WHO, 2010), primary level public health facilities (CHCs, and PHCs). Private health facilities who also provided neonatal services had minimal engagement with public health officials and thus adhering to government guidelines for care of small neonates (MoHFW, 2014a) was a challenge. The health system was also not equipped sufficiently in terms of resources such as infrastructure, supplies, health workforce that have capabilities, motivation, or supportive environment to manage care of LBW babies (Mony, et al., 2015). As a team member on the WHO project, the more I pondered on the contextual complexities and challenges involved in scaling-up KMC, the idea to nest my PhD study within the WHO project emerged to study specific operational issues for KMC practice along the health facility-community continuum within one sub-district. It thus helped me crystallise my thesis topic as “Operational Research on Kangaroo Mother Care (KMC) practice for small babies along the health facility–Community Continuum in a selected sub-district of Northern Karnataka, India”.

1.2.3. Rationale and conceptualisation of the PhD study

Although seemingly simple as a procedure, implementation of KMC is known to be riddled with barriers related to HCWs and with the health system as a whole (Ahmed, et al., 2011;

Cattaneo, et al., 1998a & 1998b; Chan, et al., 2016b; Moxon, et al., 2015; Seidman, et al., 2015; Smith, et al., 2017; Vesel et al., 2015) or with the community at large (Chan, et al., 2016b; Seidman et al., 2015) thus making it presumably a complex intervention. If KMC was to be implemented, ensuring 80% coverage of all small babies as proposed by the WHO project, a multi-layered stakeholder involvement was imperative. This calls for engagement and collaboration of district and state level health officials with managers of health facilities; implementers such as HCWs, Community Health Workers (CHWs), and more importantly the mother and family members, known to be fraught with challenges. Cognizance of these barriers from a review of the literature along with findings from the qualitative research of the WHO project, helped identify key areas of concern that needed to be addressed whilst considering KMC scale-up. Five challenges were identified towards the scale-up of KMC as outlined below from which research questions stemmed.

The first challenge for scale-up of KMC was the **need for clarity on where KMC should be initiated.** According to MoHFW guidelines (MoHFW, 2011a) on Facility Based Newborn Care (FBNC), only babies born with birthweight <1800 gms were expected to be referred from primary level health facilities (PHC/CHC) to a secondary level health facility (SDH or district hospital). However, in India approximately 10-30% of deliveries occurred in PHCs and homes (Mazumdar, et al., 2019). Thus, if KMC was to be initiated only in secondary level public or high-tech private health facilities, it would mean babies born in primary health facilities or homes would have no access to KMC. Of all preterm births, approximately 84% are moderate or late preterm babies with mostly a birth weight >1800 gms but <2500 gms. These small babies would be presumably stable, not requiring intensive neonatal care (March of Dimes, et al., 2012). Therefore, if these babies were provided KMC as early as possible it was presumed that health gains could be impressive, by reduced neonatal mortality and morbidity. This assumption took cognizance of two facts. The first fact being small babies could be born anywhere along the health facility-community continuum i.e., in a District hospital / SDH / high-tech private or at a primary health facility i.e., in a CHC, PHC or even at home. The second fact was that mothers who had their childbirth in a health facility often opted for early discharge within 24-48 hours(Varma, et al., 2010; Devasenapathy, et al., 2014), and hence unlikely to respond to a referral for KMC especially if the baby was stable. The reasons for seeking early discharge were varied and included, poor infrastructural facilities as well as lack of basic amenities such as water, food, toilet; poor care experiences with staff; lack of insistence by HCWs for mandatory 48 hours stay; and socio-cultural practices such as burial of the placenta, religious rituals etc. to be performed at home after birth (Kesterton, et al., 2010; Devasenapthy, et al., 2014; Nipte, et al., 2015; Udgiri, 2020). Given this scenario, and in the context of the MoHFW, Government

of India guidelines for KMC implementation (MoHFW, 2014a), some crucial elements required consideration that led to the following question which was contemplated within the WHO project for the PhD study: "*How equipped and ready were the different levels of the public and private health facilities, the HCWs and CHWs along this health facility-community continuum (any place of childbirth till 6-8 weeks of life of the small baby) for KMC implementation?"*

Additionally, sustaining KMC at scale required coordinated efforts between health officials with health facilities and strong linkages between HCWs with CHWs since the baby would require KMC for several days after birth (WHO, 2003). The WHO project thus envisioned building competencies of HCWs and CHWs as well as strengthening linkages between them, two well established facilitators for KMC implementation (Seidman, et al., 2015; Smith et al., 2017) to support mothers to initiate and maintain KMC along the health facility-community continuum. Previous experience in the field by the project team showed that capacity building strategies of HCWs through short skill-based continuing education, onsite mentoring and supportive supervision by specialists were effective for change in intranatal, early postnatal as well as neonatal practices at the primary health level (Fischer, et al., 2015; Washington, et al., 2016; Jayanna, et al., 2016). The WHO project used the same approach to advocate for changes within the health facilities and to build competencies among HCWs and CHWs for KMC implementation. Another fact that could not be ignored was those facilitators and barriers for KMC implementation were reported primarily from the health facilities' perspective (Seidman et al., 2015; Smith et al., 2017; Vesel, et al., 2015) or of the community (Chan, et al., 2017; Seidman, et al., 2015), independently and not along the health facility-community continuum. Neither could any study be accessed on how health facility preparedness or the competency of HCWs would facilitate KMC practice along this continuum. KMC practice considered for this PhD study included place where KMC was initiated, when KMC was initiated (in terms of the baby's age in days), daily duration in hours of KMC, and number of days KMC was provided. Hence my PhD study was poised to evaluate how these gaps of health facility preparedness and competencies of HCWs for KMC implementation changed and impacted KMC practice along the health facility-community continuum.

A second challenge with KMC implementation at scale was to **identify who would require KMC**. The WHO strongly recommended that KMC be provided for small babies, with birth weight <2000 gms, which was objective and hence not of concern. The challenge lay on the recommendation "for a small baby that was *stable*" (WHO, 2015), an ambiguous concept that could be interpreted differently by HCWs of various cadres and qualification; neither

was it operationalized in the WHO or MoHFW recommendations for initiating KMC (MoHFW, 2014a; WHO, 2015). A systematic review conducted on "what is KMC?" highlighted the need to have criteria for initiation, duration and ending SSC (Chan, et al., 2016a). This review showed that "*criteria for stability were non– specific with the terms 'clinically stable,' 'adapted to extra–uterine life,' 'can tolerate handling,' and 'without serious illness;'* or more defined when it included *'satisfactory APGAR score,' 'stable weight,' and 'stable respiratory and hemodynamic parameters.' Criteria to end SSC were largely nonspecific that included 'until baby no longer accepts,' or 'until parent no longer accepts;' while more specific terms included 'until reaches satisfactory weight"* (Chan et al., 2016a, pg. 5). Hence in order that all HCWs irrespective of cadre had the same understanding of "stable", Standard Operating Protocols (SOPs) were developed as part of the WHO project. These SOPs included criteria for:

- KMC initiation: Small babies who did not require any assistance for breathing or had no breathing problem, was active, had normal colour, feeding well, appeared well, and did not require any intensive therapy. This could be at the public health facilities (PHC, CHC, SDH, DH) or at the private health facility.
- Monitoring during KMC: included the same criteria as for KMC initiation in addition to 'normal body temperature'.
- Discharge of a small baby from the health facility: KMC must be provided for a minimum of 8 hours per day for three consecutive days; the baby was feeding well and without any health problems.
- Termination of KMC: Baby had gained 2500 gms or the baby was not comfortable in KMC position.

Early initiation of KMC within the first three days of life was shown to impact on morbidity and mortality of babies (Ahmed, et al., 2011). Yet, if the small baby was not stable, KMC initiation would be necessarily delayed. Hence to understand how the public and private health facilities functioned together as a whole to meet the requirement of scale-up of KMC, I proposed to explore the following questions as part of KMC practice:

- *"Where will KMC be initiated for small babies in the sub-district?"*
- *"How soon after birth will KMC be initiated for a small baby in the sub-district?"*
- *"What would facilitate early initiation of KMC in small babies?"*

The third challenge for KMC scale-up was the **operational definition of KMC practice** (Chan, et al., 2016a). The WHO and MoHFW guidelines for KMC implementation recommended for KMC to

- Be continuous (>12 hours - 20 hours per day),

- Include SSC, exclusive breastfeeding, early discharge from the health facility including follow-up (MoHFW, 2014a; WHO, 2003;).

The feasibility of fulfilling the recommendation of KMC duration to be continuous (>12 hours/day), along the health facility-community continuum was the first concern. A mother would need to be comfortable, have support with household chores and childcare to provide KMC for such a long duration. Evidence suggested that KMC duration of >7 hours daily initiated within the first two days of life had significantly reduced neonatal mortality (Ahmed, et al., 2011). The benefits of SSC were shown to be dependent on when SSC is initiated and the duration of SSC.

The second concern was the meaning of KMC. A systematic review undertaken to answer the question "what is KMC?' showed that KMC was interpreted differently by various stakeholders with SSC being the commonest component, and other components namely exclusive breastfeeding, early discharge and follow-up being less considered; although these were crucial components of KMC (Chan, et al., 2016a). For scale-up of KMC, it was imperative that all stakeholders - the health officials, managers, HCWs, CHWs, the mothers and community had a common understanding of KMC, its components and the optimal duration for a day (Chan, et al., 2016a & 2017; Smith, et al., 2017; Solomons & Rosant, 2012). Mothers must essentially master the skill of providing KMC for optimal durations recommended, before she and the small baby were discharged from the health facility, and this often is too soon, sometimes within 48 hours of childbirth (Kumar & Dhillon, 2020). Hence to ensure clarity with implementers (HCWs and CHWs including health facility managers) and users (mothers and significant others) of KMC, SOPs were made available through the WHO project for all health facilities recommending the minimum duration of KMC to be for 2 hours per session, and for ≥8 hours over each day. KMC was defined as effective if SSC was practiced for ≥8 hours per day along with exclusive breastfeeding. Considering the paucity of information on daily duration of KMC and for how long KMC must be provided I proposed to explore these additional questions in my PhD study.

- *"What would facilitate KMC duration of >8 hours per day or effective KMC for LBW babies along the health facility-community continuum?"*

A fourth challenge for KMC uptake was to **ensure change in the way HCWs and CHWs communicated and supported the users** namely, mothers of small babies along the continuum. "Negative impressions of staff attitudes and interactions with staff", was quoted as key barriers for uptake of KMC by mothers (Seidman, et al., 2015, pg. 1). Lack of awareness about the benefits of KMC and experience by HCWs; lack of mentorship and supervision mechanisms for KMC were cited as causes for the lack of support by HCWs to

mothers (Vesel, et al., 2015). Literature highlighted the need for "social support" along the health facility-community continuum both for the mother and family members to adopt KMC (Seidman, et al., 2015; Smith, et al., 2017). Research showed that barriers for its scale-up could be addressed through high user engagement i.e., HCW and CHWs with mothers including family members (Chan, et al., 2016; Gabriels, et al., 2015; Moxon, et al., 2015; Seidman, et al., 2015; Smith, et al., 2017). Yet, there is paucity of evidence of how to make social support a viable reality along the health facility-community continuum for KMC uptake. Hence, I proposed to explore support for mothers by HCWs at the health facility for KMC practice or support at home through the CHWs and others (family members or friends) and the relationship of support with KMC practice.

The fifth challenge was to **ensure that mothers practised KMC till required**. This would include KMC duration that would benefit the baby in terms of daily hours provided and till required. KMC was estimated to be required for LBW babies for >1 month (Chan, et al., 2016b). Yet, this was dependent on the baby and could be decided if the baby had reached 2500 gms or had showed signs of discomfort in the KMC position (usually occurred at reaching approximately 2250 gms). The feasibility of providing continuous skin-to-skin contact as the WHO recommended seemed impractical in a home setting. Thus, it was essential to reach a balanced daily duration of KMC that was feasible for mothers to practise and yet not risk the full potential of KMC benefits for the baby. As cited earlier, >7 hours of KMC per day contributed to reduction of morbidity and mortality in LBW babies (Ahmed, et al., 2011). Most studies indicated KMC initiation at the health facility, except for a few studies where community initiated KMC was tested (Ahmed, et al., 2011; Mazumdar, et al., 2019). Hence to ensure that KMC practice is optimal by the mother, even after discharge from the health facility a few conditions were required to be in place. First, mothers were confident to provide KMC for this duration; second, they needed to organise their day, to ensure respite for themselves whilst providing the requisite hours of KMC each day; third, they would require support with household chores or support in the form of foster KMC (fKMC) providers (family members who also provided KMC for the baby); fourth, they would need to internalise and experience the benefits of KMC themselves (Seidman, et al., 2015; Chan, et al., 2016b; Smith et al., 2017). Crucial facilitators for KMC practice included a conducive environment both at the health facility and at home for the mother to be able to practice KMC, with adjustable beds, amenities for bathing and food, support from the HCWs and family members or significant others (Kymre, 2014; Nyqvist & Larsson, 2011; Seidman, et al., 2015). Key lessons from the first three months of the WHO project implementation showed that mothers who had not practiced ≥8 hours of KMC per day in the health facility, continued the same trend when at home. No study could be accessed from the Indian

setting that explored how health facility preparedness and HCW's competence would influence KMC practice (when and where it would be initiated, and for daily duration). Neither were studies available that reported how support for the mother along the health facility-community continuum or how her awareness on KMC itself would influence KMC practice, although these were cited as facilitators for KMC uptake. Thus, additional questions therefore asked in the PhD study were:

- *"How were mothers and family members prepared for KMC practice?"*
- *"How did support for the mother at the health facility and at home impact KMC practice?"*

Findings from the literature demonstrate that global coverage of **KMC was low due to implementation gaps at three levels: health systems, health facility and HCWs** (Chan, et al., 2016b). Even in India, as cited earlier, KMC coverage was low (Save the Children, n.d.). Further research was deemed essential to close this implementation gap in all settings to contribute to program learning and implementation efforts, thus, to improve KMC coverage of small babies, both at the national and global level (Remme, et al., 2010). The WHO project, built on this agenda with strategies (Appendix C) which were tried and tested through evidence (Fischer, et al., 2015; Washington, et al., 2016; Jayanna, et al., 2016). These strategies included:

- Building competencies of HCWs and CHWs through short skilled-based continuing education programme, onsite nurse mentoring, and supportive supervision by specialists. Onsite mentors and supportive supervision specialists also advocated for structural changes, facilitated in clinical understanding of KMC at health facilities through scheduled visits based on number of LBW babies that could be accessed at these health facilities.
- Strengthening linkages and communication between health facilities and CHWs to facilitate home follow-up of mothers with small babies who were discharged from the facility.

Regardless of clear evidence on facilitators and barriers to scale-up KMC (Chan, et al., 2016a, 2016b, 2017; Seidman, et al., 2015;) there was a dearth of information on how these influenced the practice of KMC along the health facility-community continuum. It was in this context, the PhD study was nested within the WHO project, yet distinct from it (Appendix C.1), with the following aim, and objectives of the PhD study.

1.3. Aim of the PhD study

To assess preparedness of health facilities and HCWs for initiation and maintenance of Kangaroo Mother Care (KMC) in eligible small neonates along the health facility – community continuum in the sub-district Gangawati of Karnataka state in southern India.

1.4. Objectives of the PhD study

- To appraise the change in health facility preparedness for KMC implementation.
- To evaluate the change in KMC knowledge, attitude, and skills of HCWs from the selected health facilities.
- To assess KMC knowledge, attitude and support received for KMC practice of mothers and foster KMC providers.
- To describe the characteristics of small babies in the sub-district.
- To determine association between KMC practice with characteristics of the health facility, HCWs, small babies and mothers inclusive of the community.

Known since 1978, KMC today is an evidence-based package for care of preterm and LBW babies with several benefits. Yet, it was not yet scaled-up in India, a country that could have benefited largely, for the quantum of LBW babies born each year. Chapter 2 provides the background behind the focus on preterm and LBW babies both in India and globally.

CHAPTER 2. NEONATAL MORTALITY AND INTERVENTIONS TO IMPROVE NEONATAL OUTCOMES

Introduction

The global push towards neonatal health, prompted the Ministry of Health and Family Welfare (MoHFW), Government of India to shift their focus towards implementation of evidence-based interventions for neonatal care to accelerate its reduction in neonatal mortality, since 2010. In this quest, the MoHFW published guidelines for Facility Based Newborn Care (FBNC); Home Based Newborn Care (HBNC); Implementation of KMC at health facilities for Low Birth Weight newborns; Corticosteroids for preterm labour; neonatal resuscitation (MoHFW, 2011a; 2011b; 2014a; 2014b; 2014c). Evidence suggested that medical complications due to prematurity and LBW was the largest contributor to neonatal mortality. In addition, KMC (skin-to-skin-contact {SSC} and exclusive breastfeeding) was demonstrated to be an evidence-based cost-effective intervention, yet not fully exploited for its benefits in reducing morbidity and mortality of small neonates and thus recommended for scale-up. Furthermore, both potential facilitators and barriers for KMC implementation published in systematic reviews, indicated that these barriers could possibly be overcome through concerted efforts of all stakeholders. Underpinned by evidence and motivated by the impetus to achieve the SDG-3 and India Newborn Action Plan (INAP) targets of <12 neonatal deaths per 1000 live births (Liu, et al., 2019; MoHFW & INAP, 2014), this chapter builds a case for specific focus on neonatal health and reviews interventions, known to accelerate reduction of neonatal morbidity and mortality, if scaled-up.

Chapter 2 is divided into two sections, the first of which details burden of prematurity and LBW both globally and nationally. The second section highlights the key evidence- based interventions recommended for preterm and LBW babies to accelerate reduction in neonatal mortality.

2.1. Landscape of neonatal mortality

2.1.1. Prematurity and LBW in context of neonatal mortality

Preterm babies are classified by weeks of gestation such as, extremely preterm - <28 weeks; very preterm - 28 to <32 weeks; moderately preterm - 32 to <34 weeks and late preterm - 34 to <37 weeks of gestation (Blencowe, et al., 2013). The moderate and late preterm babies constitute >80% of all preterm births (March of Dimes, et al., 2012). Globally, each year 15 million babies are born preterm (Blencowe, et al., 2013; March of Dimes, et al., 2012). In 2010, based on the data from 184 countries (Figure 1) the global average preterm rate estimated was 11.1% (a range of 5-18% among these countries) of all live

births, with India ranking first, for the number of preterm births, with 3.5 out of 27 million babies born being preterm (Blencowe, et al., 2012).

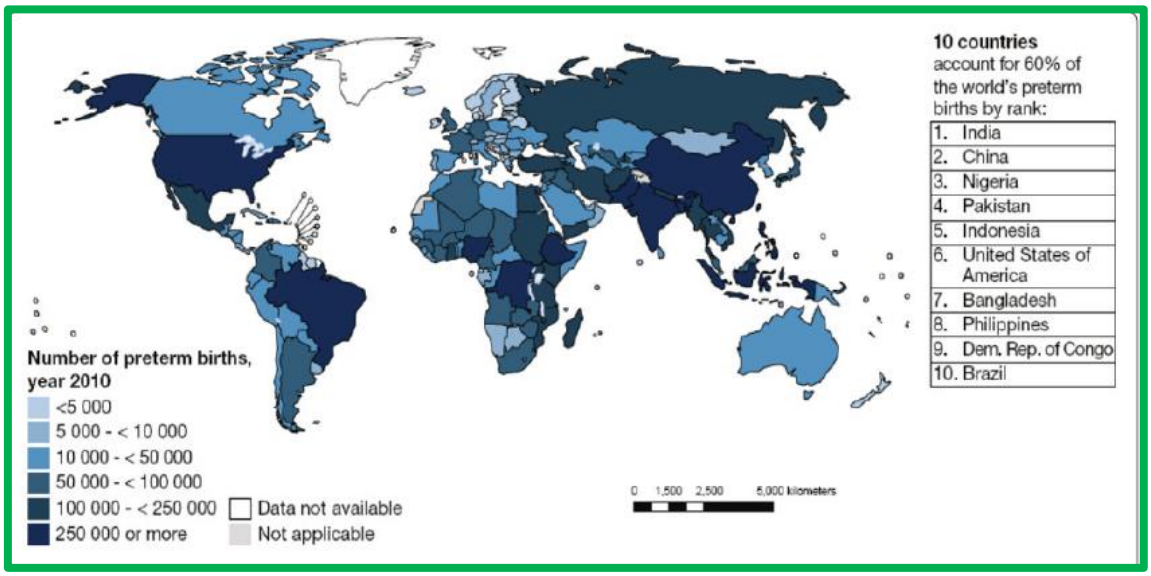


Figure 1: India ranking first globally for premature births (source: Blencowe, et al., 2013)

LBW on the other hand was defined by WHO as birth weight <2500 gms; very LBW weight as <1500 gms and extremely LBW as <1000 gms at birth (WHO, 2011). LBW is a consequence of either preterm birth or being small for gestational age when weight is <10th centile of a reference population for fetal growth as the threshold (WHO, 2011; Vogel et al., 2016). The prevalence of LBW globally was 15.5%, with 96.5% of them occurring in Low- and Middle-Income countries (LMICs) (WHO, 2018). According to two consecutive reports of the National Health Family Survey (NHFS) in India, the prevalence of LBW had decreased over a decade between 2005—2006 (NHFS-3) and 2015-2016 (NHFS-4) from 20.4% to 16.4% respectively (Khan, et al., 2019). LBW babies were classified based on the MoHFW guidelines (MoHFW, 2014a) as

- <1200 gms [corresponding to <28 weeks of gestation / extremely preterm]
- between 1200-1799 gms [corresponding to 28 to <32 weeks of gestation / very preterm]
- >1800 gms [corresponding to >32 weeks of gestation /moderately and late preterm].

This operational classification was based on the type of neonatal care services required for LBW babies concurring to their health status (MoHFW, 2014a). However, for the PhD study, the term “small babies with birth weight < 2000 gms” irrespective of gestational age, is hence forth referred to as small babies is used.

Small babies are of major concern since they have a higher risk for mortality and morbidity in comparison to all other neonates. Complications of prematurity and LBW was reported

as the single largest direct cause of neonatal deaths, counting for 1 million deaths each year, globally (Blencowe, et al., 2013). This impact cuts through high-income and LMICs, but with its highest adverse impact affecting LMICs. In high-income countries, 50% of babies born at 24 weeks of gestation (extremely preterm) were known to survive due to availability of health infrastructure, competent HCWs, appropriate equipment and medications; and standard operating procedures for management of these complications. On the contrary, in LMICs babies born at 32 weeks (moderately or late preterm) often fail to survive due to the lack of basic ENC such as providing warmth, support for breathing difficulties and breastfeeding; and measures to prevent infections (Blencowe, et al., 2013; March of Dimes, et al., 2012).

A situational analysis reported by the INAP (MoHFW &INAP, 2014), showed variations in neonatal mortality rates per 1000 live births across the different states of India (Figure 2). The neonatal mortality rate in five of the central / northern states, namely Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Orissa and Rajasthan was >30 per 1000 live births, whilst in Karnataka where the WHO project was implemented, it was 21-25 per 1000 live births (Figure 2); all still above the SDG-3 target of <12 per 1000 live births to be achieved by 2030, indicating there was a need to accelerate strategies to bring down the annual neonatal mortality rate. Kerala was the only state in the country that had already reached this target of <12 neonatal deaths per 1000 live births while Karnataka was listed as one of 17 states that required to accelerate its effort to scale-up evidence-based neonatal interventions to counter causes of preventable neonatal mortality (Liu, et al., 2019). In addition to commitment to the SDG-3 target, India was aligned with the global “Every Newborn Action Plan” (ENAP) launched in 2014 by the WHO that set clear targets to reduce preventable neonatal mortality to <12 per 1000 live births by 2030, with intermediate targets of 24, 21 and 15 per 1000 live births by 2017, 2020 and 2025 respectively (WHO & UNICEF, 2014). This commitment signalled the need to focus on ways to reduce the present neonatal mortality rate both globally and in India.

2.1.2. Causes of neonatal mortality

Three cluster causes were attributed to neonatal mortality in India and globally. These included preterm birth complications (44%), intrapartum related events previously referred to as birth asphyxia (19.1%) and neonatal sepsis or meningitis (13.7%), with regional differences across India (Liu, et al., 2019). In the southern states of India, that included Karnataka, the two leading causes of neonatal mortality were preterm birth complications and congenital abnormalities, while in all other regions it was preterm birth complications

and pneumonia (Liu, et al., 2019). Thus, targeting these mortality specific causes would help accelerate the annual reduction in neonatal mortality.

Neonatal mortality per 1000 live births						
<10	11-15	16-20	21-25	26-30	>30	Data not available
13- Kerala	24 Tamil Nadu	15 Maharashtra 21 Punjab	12 Karnataka 28 West Bengal	1 Andhra Pradesh 3 Assam 4 Bihar 7 Gujarat 8 Haryana 9 Himachal 10 Jammu Kashmir 11 Jharkhand	5 Chattisgarh 14 Madhya Pradesh 20 Odisha 22 Rajasthan 26 Uttar Pradesh	2 Arunachal Pradesh 6 Goa 16 Manipur 17 Meghalaya 18 Mizoram 19 Nagaland 23 Sikkim 25 Tripura 27 Uttaranchal

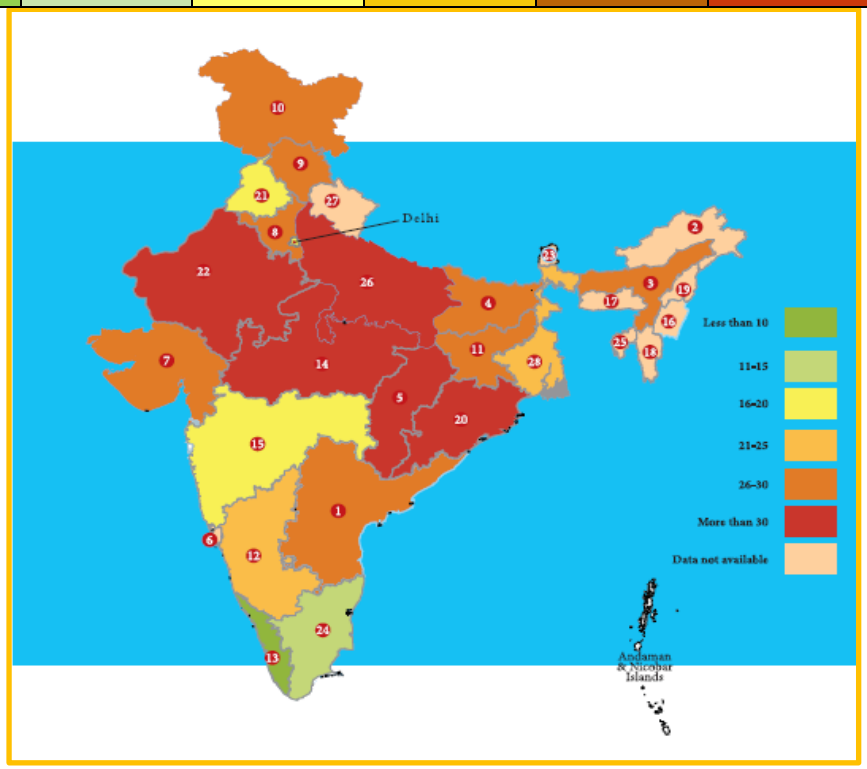


Figure 2: Neonatal mortality rates in India as per Sample Registration Survey (SRS)-2012 (Source, India Newborn Action Plan-MoHFW & INAP, 2014)

Neonatal mortality due to intrapartum related events had declined between 2000 and 2015 in India possibly due to quality improvement initiatives in labour and delivery practices (Liu, et al., 2019). These practices, launched with the introduction of the National Rural Health Mission (NRHM) in 2005 in India were part of the essential obstetric and neonatal services. Increase in health facility births by skilled birth attendants as opposed to home births; ambulance support for referral services; early identification of risk factors, and timely referral and caesarean sections were part of these essential obstetric and neonatal services. Despite such efforts, the overall reduction in neonatal mortality was slow, suggesting a critical review of investments in neonatal health, whilst maintaining a balance between

infrastructural changes and setting-up district level neonatal care units with scaling-up of evidence-based interventions. Arguably, if focus were to be directed specifically on preterm and LBW babies, it could possibly create the desired impact of reducing preventable neonatal deaths (Lawn, et al., 2014; Liu, et al., 2019). It would be logical to assume that augmentation of strategies mentioned above to reduce intrapartum related events would need to be extended to ENC for all small babies. The justification for accelerating efforts targeted specifically towards prematurity and LBW complications includes the following:

- Firstly, the rise in number of preterm births, primarily due to advanced maternal age; underlying maternal health problems such as diabetes and high blood pressure; greater access to infertility treatments with risk for multiple pregnancies, and changes in obstetric practices such as more caesarean births before term (WHO, 2018)
- Secondly, acknowledging that approximately 84% of preterm babies are born between 34 to 36 weeks of gestation thus in relatively larger numbers, and mostly not requiring intensive care; more attention to the planning and implementation at scale of cost-effective essential neonatal services along the continuum of care from community to health facility is crucial for the greatest public health impact (Blencowe, et al., 2013).

Some of the cost-effective neonatal care interventions for preterm and LBW babies suggested for scale-up include KMC and thermal control, breastfeeding support, basic management of infections and breathing difficulties at scale to decrease neonatal mortality (Blencowe, et al., 2012; Lawn, et al., 2010). However, strategies to scale-up these cost-effective interventions across the continuum of care demands a knowledge of the organisation of newborn care services in India.

2.1.3. Evolution of basic ENC in India

The care of LBW and sick newborn babies has been historically assigned to secondary or tertiary health facilities. A brief on the evolution of newborn care in the public health facilities of India over the last six decades is outlined in Figure 3. India took the cue from the global impetus towards reduction of neonatal mortality in 2014, through several initiatives and published operational guidelines that were directed towards capacity building and functioning of HCWs for improving neonatal health. These included:

- Operational Guidelines for Kangaroo Mother Care and Optimal Feeding (MoHFW, 2014a)
- India Newborn Action Plan (MoHFW &INAP, 2014)
- Facility Based Newborn Care (MoHFW, 2011a)

- Home Based Newborn Care (MoHFW, 2011b).

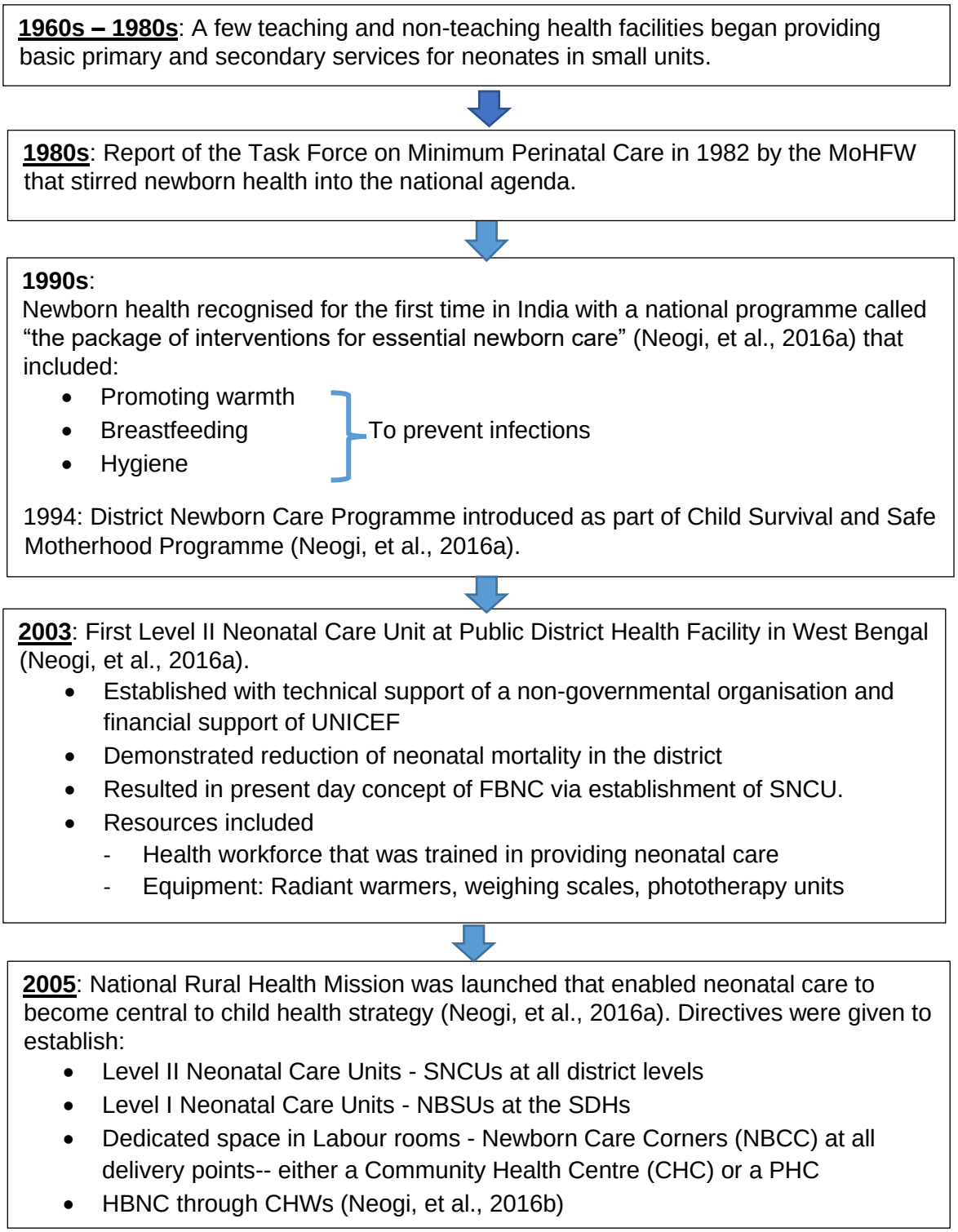


Figure 3: Brief outline of neonatal care in the public health system of India

By 2015, India had 565 SNCUs in district hospitals, 1904 NBSUs in SDHs and 14163 NBCCs in primary level health facilities such as CHCs and PHCs (Neogi, et al., 2016a). Yet the SNCUs in India were burdened with challenges such as malfunctioning equipment

coupled with poor maintenance and repair mechanisms; shortage of skilled health workforce; admission overload; overall poor quality of care; poor adherence to infection control practices; and inadequate post-discharge follow-up (Neogi, et al., 2016a). Linkages between SNCUs, NBSUs, and HBNC were poor, interrupting the health facility-community continuum of ENC and failed to establish an effective network as a coherent functional unit of neonatal care (Neogi, et al. 2016a). The 4-bedded NBSUs, equipped with radiant warmers and phototherapy units were technically the first referral units for a sick neonate from the PHCs or CHCs or the community to the district hospitals. However, they failed to function as an efficient link between the PHCs/CHCs and District health facilities, primarily due to shortage of skilled health workforce and inaccessibility of district health facilities due to distances (kilometres) that had to be covered. The district health facilities had the additional challenges of failure to follow protocols (Neogi, et al., 2016a). Most of the primary level health facilities in the country had similar health workforce and service delivery challenges (Sharma, et al., 2018). Against this backdrop, important recommendations to utilise SNCUs and NBSUs to integrate and scale-up interventions such as KMC; develop a follow-up system with HBNC services; strengthen connections between the three levels of healthcare, (Neogi, et al., 2016b) seemed unworkable. This dilemma demonstrated the need for strategies to bridge the gaps between recommended and actual practice and take advantage of the opportunities to scale-up KMC including other ENC services.

A cross-sectional epidemiological survey conducted in 2010 (Mony, et al., 2015) across eight northeast districts of Karnataka that included Koppal district to assess the neonatal services available, showed that out of 865 health facilities surveyed from the public and private sector, only 3.3% (29/865) were able to provide basic emergency neonatal care and only 11% (95/865) could provide comprehensive emergency neonatal services such as advanced resuscitation; intravenous fluids; oxygen administration; emergency treatment protocols with equipment and drugs. Additionally, most of the health facilities that provided these services belonged to the fee-for-service private sector (Mony, et al., 2015). A large proportion of the local population in this region could not afford the services whilst public health facilities were burdened with the challenges cited above. This study also reported serious gaps in knowledge and skills; workforce shortage, deficiency in the availability of essential drugs, equipment, and infrastructure for essential neonatal care (Mony, et al., 2015). Findings from a mixed methods study in 12 countries in Africa and South Asia, including India, identified that health workforce (10/12 countries); health financing (10/12 countries); community ownership and partnership (9/12 countries) as the main bottlenecks to quality neonatal care within health systems (Moxon, et al., 2015), that represented both the services at the health facilities and community. The study recommended that evidence-

based interventions for small babies must be made accessible, available at scale, provided safely and with quality through local community engagement and regional governance as well as commitment (Moxon, et al, 2015). Although KMC was recommended to be established as the norm of essential LBW neonatal care, in the above circumstances it could plausibly be challenging. Hence a comprehensive strategy involving all stakeholders – District Health Officials (DHOs), health facility managers, implementers, and the users along the health facility-community continuum would be essential to meet these challenges. Building the competency of HCWs, improving preparedness of the health facility and quality of services offered, known to impact neonatal mortality, could be one way forward to achieve scale-up of KMC.

More than three-fourths of preterm babies could be saved with feasible, essential neonatal care, such as providing antenatal corticosteroid injections for pregnant women in preterm labour; KMC, including support for early initiation and continuation of exclusive breastfeeding and antibiotics to treat neonatal infections (Bhutta, et al., 2014; Liu et al. 2019; March of Dimes, et al., 2012; WHO, 2017). Towards achieving the SDG-3 targets by 2030, India did well to set targets on these essential practices for neonates as early as 2014 (MoHFW & INAP, 2014) as given below:

- Skilled birth attendants (doctor/nurse/auxiliary nurse midwife) for all childbirths (95%)
- Immediate resuscitation for babies born with intrapartum related problems (95%)
- Initiation of breastfeeding within one of hour of birth (90%)
- LBW babies managed with KMC at the health facility (90%)
- Follow-up of babies in the community by the CHWs (95%) for both health facility and home births.

If these targets for neonatal health were to be achieved or for guidelines available to be operationalised, a multi-pronged effort of policy makers, health officials, managers, implementers, and users would be essential, to ensure that all settings of birth, be it at home or specialised health facilities, were geared towards meeting these targets (Neogi, et al., 2016b). KMC could be a starting point for implementation of evidence-based neonatal care practices. It could also be a springboard to improve the link between primary level neonatal care units (NBSUs), PHCs and the community with secondary and tertiary level neonatal care units (SNCUs and NICUs). It was thus, timely to launch the WHO implementation project that aimed to establish a model to ensure coverage of 80% of LBW babies (birth weight < 2000 gms) with effective KMC in Koppal district of Karnataka state between 2016 and 2018.

2.2. The evidence-base to manage premature and LBW babies

Quality and safe care during labour and childbirth by skilled HCWs was known to be pivotal for a good start in life for all neonates especially those premature or LBW babies (Enweronu-Laryea, et al. 2015), with resultant reduction of their vulnerability to health problems in later life. Hygienic practices during labour and childbirth to prevent newborn infections; effective resuscitation when needed; providing external sources of warmth through SSC to reduce the risk of hypothermia; early initiation of breastfeeding and breastfeeding support were listed interventions, known to reduce neonatal mortality (Bhutta, et al., 2014; Liu et al. 2019; March of Dimes, et al., 2012; Moore, et al., 2016; WHO, 2017). A critique of evidence-based interventions for all neonates listed below is presented in this Section 2.2 in the context of improving the survival rates of premature and LBW babies (Enweronu-Laryea, et al., 2015; March of Dimes, et al., 2012; Sharma, 2017):

- Immediate assessment of all newborn babies and neonatal resuscitation
- Thermal protection through warmth and early skin-to-skin contact (SSC) at birth
- Early and exclusive breastfeeding
- Cord care and prevention of infection

2.2.1. Immediate assessment of all neonates and neonatal resuscitation

Most babies (90%) are expected to cry at birth which is indicative of normal breathing (Wall, et al., 2009). Immediate SSC with the mother is recommended for these babies by placing the baby prone on the mother's chest after drying and covering the baby with a clean cloth or towel till initiation of the first breastfeed (March of Dimes, et al., 2012; Moore et al., 2016; Wall et al. 2009). Babies especially those born preterm are known to be more vulnerable for breathing problems at birth. Antenatal corticosteroid treatment for pregnant women with preterm labour or at risk for preterm labour emerged as the most effective intervention for the prevention of respiratory distress syndrome in preterm babies, and thereby in reducing early neonatal mortality and morbidity (WHO, 2015; MoHFW, 2014b). A meta-analysis of four Randomised Controlled Trials (RCTs) from middle-income countries suggested 53% mortality reduction [Relative Risk (RR)=0.47; 95% Confidence Interval (CI) 0.35–0.64] and 37% morbidity reduction (RR=0.63; 95% CI 0.49–0.81) when antenatal steroid injections were administered for preterm labour (Mwansa-Kambafwile, 2010). Management of preterm labour with antenatal corticosteroids was standard practice in high-income countries like the US and European countries (Mwansa-Kambafwile, 2010). Although recommended as standard of treatment in LMICs, it was not yet scaled-up posing a heightened risk for breathing problems at birth in premature babies (Mwansa-Kambafwile, 2010). A retrospective study on 163 premature babies admitted to a neonatal intensive care

unit of a government managed health facility in South India reported that only 13.4% (22/163) of mothers who delivered preterm received a complete course of antenatal steroid. Almost half, 44.8% (73/163) received an incomplete course of antenatal steroids and 38.6% (63/163) did not receive even a single dose of steroid (Kumar, et al., 2017), indicating low adoption of recommended standards. According to INAP, 2014 the target set for the coverage of women in preterm labour to receive at least one dose of antenatal corticosteroids was 75% by 2017, 90% by 2020, 95% by 2025, and 100% by 2030 (Kumar & Nandipati, 2016). This showed that management of preterm labour with corticosteroids is far from the expected target and probably draws attention to possible challenges in the implementation of operational guidelines.

Approximately 5-10% of neonates are known not to cry at birth, a sign that indicated initiation of the first basic steps of resuscitation (Wall, et al., 2009). These initial steps were to be performed within 30 seconds and included drying the baby, suctioning, positioning the baby and stimulating the baby to establish spontaneous breathing (MoHFW, 2014c; Wall, et al., 2009). At least 3-6% of neonates (Wall, et al., 2009) are known to require support to breathe at birth with the self-inflating bag and mask if initial steps of resuscitation failed to result in spontaneous breathing. Bag and mask ventilation, a step of basic resuscitation was strongly recommended for practice in any health facility setting by any cadre of HCWs who were trained, supervised, and retrained (March of Dimes, et al., 2012; Wall, et al., 2009), to reduce neonatal deaths. Effective bag and mask ventilation is known to avert 30% of neonatal deaths at full term and 5-10% deaths of preterm neonates (Enweronu-Laryea, et al., 2015; Niermeyer, et al., 2000; Wall, et al., 2009). Bag and mask ventilation with room air is effective in reducing mortality at week one and the first month of life compared to 100% oxygen (Rabi, Rabi, & Yee., 2007). Neonates who received basic resuscitation steps at birth with timely bag and mask ventilation (within 30 seconds of life) had similar neuro-development scores at 1 year of life compared to those who did not require resuscitation (Janet, et al., 2018). Using a structured basic neonatal resuscitation training programme for HCWs and CHWs has demonstrated reduction in mortality among neonates (Ashish, et al., 2012; Pammi, et al., 2016; Wall, et al., 2009). Further, only 1-2% of all babies at birth are known to require advanced steps of resuscitation such as chest compressions, intubation for ventilation support and medications (Wall, et al., 2009). Essential, advanced steps of neonatal resuscitation are known to be resource intensive in terms of HCWs inclusive of equipment and can often be a challenge for scale-up in all public health settings, already fraught with acute HCWs and equipment shortages in India (Mony, et al., 2015; Neogi, et al., 2016a; Wall, et al., 2009).

Knowledge of basic or advanced newborn resuscitation was relevant in the context of both the WHO project and the PhD study since it could impact on when SSC and breastfeeding would be initiated; two components of KMC. Most babies who required resuscitation were usually admitted to a Level II (SNCU) or Level III neonatal care unit (NICU), either for observation and basic neonatal care or advanced neonatal care and treatment, respectively. Currently in India, most NICUs or SNCUs have restricted visitation policies, thereby enforcing prolonged separation of the eligible neonate from the mother, with the opportunity for KMC initiation being sub-optimal. Within the context of the WHO Project, all babies < 2000 gms at birth were eligible for initiation of KMC if they were medically stable, while those requiring medical attention were reassessed for stability and excluded if they continued to require medical intervention in the first three days of life (Mony, et al., 2021). However, the approach used for the PhD study was different. All babies who were born in any health facility or at home were first identified from the WHO database. Small babies who did not survive 28 days of life or whose mothers had moved out of the sub-district were excluded. The remaining babies were eligible for recruitment to the study irrespective of health status at birth.

2.2.2. Thermal protection through warmth and early SSC for neonates at birth

Thermal protection included measures taken at birth and later to maintain the normal body temperature (36.5-37.5^{0}C) of the neonate, especially for premature and LBW babies. Generally, small babies are known to be at higher risk for developing hypothermia, primarily due to their large body surface area and lack of subcutaneous fat. Hypothermia, defined as body temperature <36.5^{0}C, was classified as mild hypothermia or cold stress when the temperature is between 36^0 to 36.5^{0}C; moderate hypothermia when the temperature ranges between 32^0 to 36^{0}C and severe when the temperature is <32^{0}C (WHO, 1997). In LMICs the prevalence of hypothermia in community settings was reported to range from 11-92% and between 8-85% in health facility settings (Lunze, et al., 2013). Findings from a cross-sectional study in Iran to assess the prevalence of hypothermia in healthy babies born at term revealed that cold stress was seen in 43.3%, 37.5%, 40.2% and 44.6% at birth, 1 hour, 2 hours, and 4 hours after birth respectively (Delavar, et al., 2014). Moderate hypothermia in the same study was prevalent in 41.2%, 47.5%, 46.4% and 37.2% (Delavar, et al., 2014). Other findings included the following: Lower body temperature of the baby was associated with lower ambient temperature of the delivery room and postpartum room (<27.5^{0}C) and lack of keeping the baby soon after birth in SSC. Babies born by vaginal delivery with episiotomy had significantly lower temperatures (Delavar et al. 2014), which could have been possibly avoided if SSC with the mother at birth was practiced (Moore, et al., 2016). Most of these studies involved babies born at term and thus by extrapolation, one could

assume that LBW babies were at higher risk for hypothermia in a healthcare setting. A study conducted in Malaysia, showed that the prevalence of admission hypothermia was 64.8% in very LBW babies admitted to NICUs (Boo & Cheah, 2013; Laptook, et al., 2018). This study reported that none of the NICUs practised complete care bundle (use of pre-warmed radiant warmer, cling wrap, ambient temperature of at least 25^0C and use of pre-warmed transport incubator) nor SSC to prevent hypothermia at admission.

SSC, a recommended evidence-based measure to prevent hypothermia and promote breastfeeding (Boo & Cheah, 2013; March of Dimes, et al., 2012; WHO, 2015), was also endorsed by the MoHFW, Government of India (MoHFW, 2014a). Yet, a systematic review that included studies from 28 countries representing WHO regions, showed that practice of SSC ranged from 1- 98%, with the practice of SSC in India being only 14.5%. There were higher rates of SSC from high-income countries than from LMICs (Abdulghani, et al., 2018). Neonatal mortality was known to increase by 28% with each degree fall in axillary temperature in the NICU. Hypothermia was also known to increase risk for late-onset sepsis, intra-ventricular haemorrhage, worsening of respiratory distress (Datta, et al., 2017) in LBW babies. The practice of SSC was recommended for all newborn babies, who cried at birth, till the first breastfeed or for an hour – the golden hour after birth (Sharma, 2017; WHO, 2015). SSC and the ambient room temperature of 26-28^0C or during transportation to an NICU or SNCU, were measures suggested to protect newborns against hypothermia (March of Dimes, et al., 2012; MoHFW, 2014a). These practices were particularly endorsed for LBW babies who had a greater susceptibility for hypothermia (Datta, et al., 2017).
The practice of early SSC at birth, was efficient in facilitating early initiation of breastfeeding as the neonate naturally latched on to the breast within 45-55 minutes of birth (Widström, et al., 2011). Babies are known to go through nine behavioural phases when on SSC to locate the breast. These included birth cry, relaxation, awakening, activity, crawling, resting, familiarization, suckling and sleeping when skin-to-skin with its mother, with resultant early optimal self-regulation (Widström, et al., 2011). Babies who had early SSC also demonstrated better self-regulation of feeding and sleeping patterns (Cleveland, et al., 2017; Widström, et al., 2011). Early SSC in a supportive environment was known to facilitate a restorative experience, with mothers becoming more self-confident in their ability to produce breastmilk and breastfeed successfully for a longer duration (Widström, et al., 2011). Although SSC was recommended for at least an hour, a systematic review on 38 trials, with 3472 women from 21 countries to study the impact of the duration of SSC at birth, showed no difference on outcomes such as initiation and maintenance of breastfeeding; heart rate, temperature and blood glucose based on initiation and duration of SSC (Moore, et al., 2016). The study, however recommended the practice of early SSC

for all babies as well as for late preterm babies without specifying its duration, given the advantages of successful breastfeeding.

But SSC practice was reported as sub-optimal (Abdulghani, et al., 2018). A qualitative phenomenological study conducted in India, highlighted the barriers to practice of SSC at birth included health workforce shortages, time constraints, ambiguous eligibility criteria for SSC, safety concerns, interference with clinical routines and lack of coordination between obstetric and neonatal departments (Alenchery, et al., 2018). Yet, antenatal counselling was demonstrated as useful for women to adopt SSC at birth, with concomitant early initiation of breastfeeding within one hour of birth; continued exclusive breastfeeding at six months (Bahairy, 2016).

Given the knowledge that SSC, one of the key components of KMC (Chan, et al., 2015), was closely linked to successful breastfeeding (Widström, et al., 2011), another key component of KMC (Chan, et al., 2016a), it could be pathway to implementation of KMC at scale.

2.2.3. Early and exclusive breastfeeding or breastmilk feeds

LMICs are known to have higher rates of women starting breastfeeding, compared to high-income countries, but the challenge is for breastfeeding to begin within one hour of birth (Balogun, et al., 2016). Both morbidity and mortality rates of neonates and infants was reduced with early and exclusive breastfeeding for 6 months (Smith, et al., 2017). Although exclusive breastfeeding was recommended for decades, the rate of initiation of breastfeeding within an hour of birth was 42% in India and only 55% of infants below 6 months of age were exclusively breast fed as per the NFHS-4 report between 2015-16 (IIPS & ICF, 2017) and 55% of babies were exclusively breast fed until 6 months of age, slightly higher than the global rates (IIPS & ICF, 2017). Globally only 44% of mothers, initiated breastfeeding in the first hour of life and 40% of all infants under 6 months of age were exclusively breastfed (UNICEF & WHO, 2018).

Early breastfeeding was efficacious in reducing morbidity and mortality risk of infants. A study in south India with >10,000 neonates showed that breastfeeding initiation between 12 and 24 hours and after 24 hours was associated with a 1.20 (95% CI =0.81, 1.78) and 4.02 (95% CI=2.73, 5.93) fold increase in mortality risk compared with infants breastfed within 12 hours of birth respectively (Garcia, et al., 2011). The WHO recommended that breastfeeds must be initiated within an hour of birth, and the baby must be exclusively breastfed for the first six months of life (WHO, 2015 & 2017). The WHO and UNICEF also

initiated the Baby-Friendly Hospital Initiative in 1991 to implement practices that promoted, protected, and supported breastfeeding (UNICEF & WHO, 2018). Yet, only 10% of the world's infants were known to be born in a health facility, designated as "Baby-friendly" in 2017 (UNICEF & WHO, 2018).

Early initiation and exclusive breastfeeding for six months improved the overall health, prevented infections, and reduced mortality especially in premature and LBW babies (Khan, et al., 2015). Yet there were challenges to premature and LBW babies being initiated early on direct breastfeeds, due to poor ability to suckle and coordinate sucking-swallowing of breastmilk. Other known benefits of exclusive breastfeeds for premature and LBW babies included decreased rates of late-onset sepsis, necrotizing entero-colitis and retinopathy of prematurity, fewer re-hospitalizations in the first year of life, improved neurodevelopmental outcomes, as well as long term benefits into adolescence (Khan, et al., 2015; Underwood, 2013). A systematic review and meta-analysis on delayed breastfeeding and infant survival, reported that babies who were breastfed within an hour of birth, had lower risk of neonatal death rates by 44% in comparison to those babies who were breastfed later – 2 to 23 hours after birth (Bhutta, et al., 2014; Smith, et al., 2017). In a longitudinal study, conducted in two hospitals in Ghana, LBW babies (with birth weight ranging from 1000-2000 gms) on KMC who had exclusive breastfeeds at discharge were more likely to continue breastfeeding at home, especially when followed-up weekly after discharge (Nguah, et al., 2011). Findings from another systematic review that included 175 mothers and babies, reported that with rooming-in, the exclusive breastfeeding rates on the 4th day of life before discharge was higher (86%) than babies who were separated (45%) from their mothers (Jaafar, et al., 2016). These reviews highlighted the importance of early initiation of breastfeeding, rooming-in and were therefore relevant to KMC implementation that required the baby to be on SSC with the mother and to receive exclusive breastfeeding.

Lack of engagement with evidence-based breastfeeding recommendations was ascribed to poor breastfeeding education and support by HCWs and CHWs for mothers (Balogun et al, 2016). Other challenges for early initiation of and exclusive breastfeeding included health workforce shortage to provide breastfeeding support to mothers with LBW babies specifically or early discharge from the health facilities with insufficient support in the community (Majra & Silan, 2016; Diji, et al., 2017). On the other hand, education, and counselling interventions, especially if focused were reported to increase exclusive breastfeeding rates by 43% at day 1 and by up to 30% when the baby was a month old (Bhutta, et al., 2014) and even at 6 months of age (Nilsson, et al., 2017). These findings emphasised that with focused interventions, SSC at birth for example could take care of

both early initiation of breastfeeding and promote increased exclusive breastfeeding rates. The evidence that SSC at birth for an hour helped in early initiation and successful maintenance of breastfeeding cannot be ignored (Moore, et al., 2016; Widström et al. 2011). Exclusive breastfeeding is an essential component of KMC (Chan, et al., 2016a). Therefore, promoting SSC at birth could be transitioned to KMC to catalyse improvement in exclusive breastfeeding rates (Heidarzadeh, et al., 2013).

2.2.4. Cord care and prevention of infection

Premature and LBW babies have higher risks for infection. Infections such as sepsis accounts for 13.7% of neonatal mortality (Liu et al, 2019). Prevention of infection is an important goal of essential neonatal care. There are time-tested essential strategies for prevention of infection in neonates. Clean birth practices and hand hygiene with soap and water for any contact with the baby is known to reduce neonatal sepsis related mortality by 15% at home, by 27% in health facilities and 40% with clean postnatal practices (Bhutta et al, 2014). Other essential measures for prevention of infection during labour include strong recommendation to abide by 4 hourly digital vaginal examination during the first stage of labour for low risk mothers; conditional recommendation of administration of antibiotics during second and third stage of labour for mothers with infection (WHO, 2015; Bhutta, et al., 2014). Critical actions recommended after birth included keeping the umbilical cord clean, dry, and free from any topical application (Gathwala, et al., 2013; Sharma & Gathwala, 2014)'. The application of chlorhexidine to the cord stump in community settings was reported to reduce infection by 27% and risk for neonatal mortality by 23% (Bhutta, et al., 2014). Additionally, initiation of antibiotics for babies born to mothers with infection or premature rupture of membranes during labour was an essential practice to prevent early onset sepsis (Bhutta, et al., 2014). SSC at birth and continued as KMC for LBW babies till required, including exclusive breastfeeding were added measures recommended to prevent infections in neonates (Conde-Agudelo & Diaz-Rossello, 2016). KMC was demonstrated to be associated with reduction in risk for nosocomial infections and sepsis (RR 0.35, 95% CI 0.22 to 0.54: five trials, 1239 infants), from the findings of a systematic review (Conde-Agudelo & Diaz-Rossello, 2016). The same review showed that early onset of continuous KMC (within 24 hours post birth) versus late onset of continuous KMC (after 24 hours) in 73 relatively stable neonates, did not have a difference in neonatal mortality, morbidity, severe infection, hypothermia, and breastfeeding rates (Conde-Agudelo & Diaz-Rossello, 2016). This clearly showed that irrespective of when KMC was initiated, the benefits were significant in terms of reduction in morbidity and mortality of preterm and LBW babies.

The review so far on the evidence-based interventions that were known to reduce neonatal morbidity and mortality, also clearly directed specific attention towards complications related to prematurity and LBW. The link between KMC to these ENC practices such as thermal protection, exclusive breastfeeding, and prevention of infection with their potential to reduce neonatal morbidity and mortality could not be more relevant, in the event of the global and national agenda to achieve SDG-3, neonatal mortality rate of <12 per 1000 live births by 2030.

2.3. Significance of evidence-based practices for accelerating reduction of neonatal mortality

The MoHFW, Government of India's commitment, resonates with the global target to reduce neonatal mortality to <12 per 1000 live births by 2030 through a resolute, multipronged strategy (Bhutta, et al., 2014). Despite a well-established and robust suite of evidence-based interventions to reduce overall neonatal mortality there is lack of access to these interventions especially for LBW babies along the health facility-community continuum in India. Findings from a systematic review suggested that 41% of all neonatal mortality could be avoided with interventions during labour and childbirth, 30% by care of LBW babies and 10% by immediate ENC (Bhutta, et al., 2014). If evidence-based interventions along the continuum of care (pre-conception to the end of the neonatal period) were scaled-up by 2025, it was estimated that mortality caused by complications of prematurity or LBW could be reduced by 58%, intrapartum related deaths by 79% and those related to serious infections by 84% (Bhutta, et al., 2014).

Cognisant of the fact that childbirths occurring in all levels of health facilities both public and private had increased over the years in India, it was imperative to seek strategies that directed focus on scaling-up of these evidence-based ENC interventions within all levels of health facilities, with focus on KMC. The need to also pay attention to sustainability of scale-up within the community was vital as it was estimated even with 90% coverage of health facility interventions to avert neonatal mortality, community interventions could contribute to a reduction of up to 20% of all neonatal mortality (Bhutta, et al., 2014). Hence sound rationale for both implementing and sustaining evidence-based neonatal care interventions at scale is available.

This Chapter 2 thus highlighted the rationale for the targeted attention on premature and LBW babies on the global and national agenda. The evidence-based ENC interventions for LBW babies was succinctly explained in this context. The targets set by India on these essential practices for neonates to be achieved by 2030 were underlined clearly. Finally,

the connection of these evidence-based interventions with KMC, the third package of neonatal care recommended for scale-up to reduce morbidity and mortality was underscored. Chapter 3 brings in context this third package of neonatal care, the gaps there-off in its implementation at scale.

CHAPTER 3. KANGAROO MOTHER CARE – CHALLENGES TO SCALE-UP AND THE WAY FORWARD

Evidence-based cost-effective neonatal care packages were recommended for scaling-up globally (March of Dimes, et al., 2012). These included firstly ENC for all neonates, secondly neonatal resuscitation for those who required it and finally Kangaroo Mother Care (KMC) with support for exclusive breastfeeding for all premature and LBW babies (Cattaneo, et al., 1998b; March of Dimes, et al., 2012). Chapter 3 strengthens the case for scale-up of the third package of neonatal care, namely KMC, introduced in Chapter 1 to accelerate reduction of neonatal mortality and for reaching the SDG - 3 goal of neonatal mortality of <12 per 1000 live births, globally by 2030. The chapter is divided into five sections. The first four sections expound on the origins, implementation, benefits of, build-up for scale-up of KMC. The final section illustrates the conceptual framework for uptake of KMC along the health facility-community continuum.

3.1. Origins of KMC

3.1.1. <u>The origin / history of KMC as an intervention for LBW babies</u>

KMC evolved nearly 42 years ago, in 1978 when health facilities in Bogota, Columbia, were confronted with overcrowding and limited number of incubators in the neonatal minimal care units. The concept of KMC emerged to cope with inadequate and insufficient incubator care for preterm or LBW neonates, who had overcome initial health concerns of breathing problems and required only to feed regularly without additional monitoring. The components of KMC included direct SSC between the mother and baby, exclusive breastfeeding, early discharge, and close follow-up (Charpak, et al., 2017; WHO, 2003). KMC offered promising potential for neonatal care, especially those with LBW, due to benefits of thermal control, successful breastfeeding and bonding, reduced hospitalisation costs, irrespective of setting, weight, gestational age, and clinical conditions (Cattaneo, et al, 1998b; WHO, 2003). WHO endorsed KMC as an intervention for stable LBW babies in first referral hospitals (equivalent to a district hospital or Sub-District Hospital in India) of low-resourced settings with guidelines for its adaptation and use by HCWs in these settings in 2003 (WHO, 2003). These guidelines were relevant to policy makers at the national level to develop policies, their own guidelines, and training materials according to the local context (WHO, 2003).

KMC was first introduced in India as early as 1995 in a tertiary teaching health facility at Ahmedabad, Gujarat. Yet the practice of KMC remained limited to tertiary private or public sector health facilities that were affiliated to medical colleges. A few neonatologist champions were the drivers behind the initiative as they were passionate and convinced by

its benefits (Save the Children, n.d.). However, lack of institutional or health facility support or lack of ownership for KMC by health facilities providing care, inadequate continuum of KMC after discharge were identified as bottlenecks for KMC implementation by the Ministry of Health and Family Welfare (MoHFW), Government of India (MoHFW, 2014a). As part of India's commitment towards neonatal health, the Operational Guidelines for KMC implementation (MoHFW, 2014a) was published in 2014, by the MoHFW, for use by programme officers responsible for planning and managing any health and family welfare programme (for example KMC implementation). The operational guideline was also relevant for health facility managers since it provided relevant instructions of how to implement KMC in the health facility (MoHFW, 2014a). The guidance contained explicit operational steps for KMC implementation in terms of requirements to establish a KMC unit or ward, eligibility criteria for KMC, specifications for feeding of LBW infants, institutional and monitoring plan, budget, and communication strategy, including training requirements for HCWs and CHWs (MoHFW, 2014a). But these guidelines had not been operationalised in practice. Within the recommendations for a KMC unit or ward in the guidelines, specifications for a dedicated space either near the Special Newborn Care Unit (SNCU), postnatal ward or Newborn Stabilisation Unit (NBSU) that was furnished with comfortable reclining chairs and cots along with privacy for expression of breast milk or equipped with storage facility for expressed breast milk were highlighted. Yet, as reported in a document entitled "Kangaroo Mother Care in India", only 37% (265/712), of all SNCUs in the country had an KMC unit, with a meagre 15% (106/712) of them being equipped with eight radiant warmers (Save the Children, n.d.).

The operational guideline for KMC implementation (MoHFW, 2014a) was also ambiguous, as it did not specify the type of health facility where KMC could be implemented. It was thus unclear whether KMC could be implemented in primary health level facilities like the PHCs and CHCs. The fact that the Facility Based Newborn Care guideline and procedure (MoHFW, 2011a) dictated that babies with birth weight <1800 gms required referral to an SNCU or NBSU situated in a District hospital or SDH respectively, implied that babies born in PHCs/CHCs, weighing 1800-2500 gms could be cared for there, provided did not have any health problem. This advice raised queries that needed further exploration. For example, given the resource constraints of these primary level health facilities, would they be capable of implementing KMC for such babies. Additionally, there was lack of clarity about the preparedness of the primary level health facilities and their HCWs for KMC implementation. The WHO project came at an opportune time in 2016 and partly aimed to address some of these issues and arrive at a model for scale-up of KMC with special focus on stable small babies, irrespective of gestational age.

3.2. Implementing KMC

The WHO defined KMC as early, continuous, and prolonged SSC between the mother and LBW baby; exclusive breastfeeding or breast-milk feeding; early discharge after hospital-initiated KMC with continuation at home; and adequate support and follow-up for mothers at home (Chan, et al., 2016a). This definition gave clear guidance on the components of KMC and contexts where it could be practiced. One would presume, from this definition that KMC must be initiated in the health facility and continued at home. It also provided direction on the need for support of mothers to continue KMC at home through the terms "adequate support and follow-up". However, for operationalisation and implementation at scale, it was crucial that all stakeholders had a clear understanding of the concepts "early", "continuous", "prolonged" and "adequate" in this definition. Furthermore, "hospital-initiated KMC" (Chan, et al., 2016a) required operationalisation in more concrete terms due to the pluralistic levels s of health facilities and co-existence of the public and private sectors that varied widely in terms of capacity, resources, and infrastructure in India.

3.2.1. Criteria for KMC initiation

When considering KMC scale-up, clear criteria need to be in place of when, it could be best initiated for a small baby. Findings from a systematic review on 299 studies by Chan, et al., (2016a) reported that the criteria for initiation of KMC varied particularly around SSC. Fourteen percent (43/299) reported KMC initiation happened after non-stability criteria were met and 25% (76/299) after the stability criteria were met (Chan, et al., 2016a). However, stability criteria were ambiguous and diverse in that some studies in this review referred it to be "clinically stable", "can tolerate handling", "without serious illness" whilst others mentioned more objective criteria such as "stable hemodynamic parameters" or "satisfactory APGAR score" (Chan et al., 2016a). The MoHFW guideline for KMC implementation partly specified this by indicating that KMC could be initiated immediately at birth for "stable" LBW babies weighing 1800-2500 gms (MoHFW, 2014a). Recommendations included delaying KMC for days or weeks for babies weighing 1200 to 1800 gms at birth or those weighing <1200 gms as they could have serious morbidities (MoHFW, 2014a). What was missing in this guideline was a standard definition for the concept "stable". This was crucial given the scenario that HCWs were faced with challenges of workforce shortage, work overload, time constraints, and safety concerns. A clear, standard protocol on when KMC should be initiated must be available for universal adoption by health officials, programme managers and implementers. Consideration of the APGAR scoring as a standard was a plausible option, since there is presumably universal teaching of all HCWs in India as part of their pre-registration programmes on it (Indian Nursing Council, 2015, p112; Indian Nursing Council, 2019; Medical Council of India, 2018; Deorari,

et al., 2000) for determining the health status of a neonate at 1 minute and 5 minutes of birth. The APGAR was a viable option to operationalise the concept “stable” with a good APGAR score of >7 of 10 reflecting a baby was hemodynamically stable, and thus a possible strategy to overcome the barrier of being “unsure on the eligibility for SSC at birth” itself (Alenchery, et al., 2018). Another cue for who a stable baby is could be taken from a more recent RCT conducted in India (Mazumder, et al., 2019) which tested efficacy of promoting community initiated KMC on LBW babies (1500-2250 gms) from enrolment to 180 days of life. Their exclusion criteria included difficulty in breathing, more than normal movements, inability to feed, presence of major congenital malformations, all of which were easily observable. The reverse of these criteria was normal breathing, normal movements, able to feed, and absence of major congenital malformation, all of which were criteria for defining stability. Thus, for the scale-up of KMC, it was essential there existed a universal understanding of criteria for KMC initiation, that was feasible to the KMC implementers, namely HCWs and CHWs and users, the mothers and community.

The MoHFW guideline further classified duration of KMC for a day as short (SSC for 4 hours /day), extended (SSC for 5 – 8 hours); long (SSC for 9 – 12 hours /day) and continuous (SSC was provided for 12 hours / day). This guideline on daily duration of KMC was explicit, but challenging, given the fact that mothers had to learn this procedure, be comfortable and confident that the small baby was safe. Mothers would be required to be well supported in the health facility and home (Seidman, et al., 2015; Chan, et al., 2016b) to provide the recommended duration of KMC daily.

The guideline for KMC implementation had also specified clear criteria for discharge such as the “*LBW baby who was not on parenteral medication, had maintained body temperature for three consecutive days at room temperature; had gained weight by 15-20 gms per day for three consecutive days; and was accepting feeds directly from breast or by spoon/pallada*” (MoHFW, 2014a, pg14). The MoHFW guidelines also provided details of how follow-up of an LBW baby at home by the CHW could be performed. Research had highlighted the need for support to mothers at home to continue KMC (Bajaj, et al., 2015; Chan, et al., 2016b; Seidman et al., 2015) as has been affirmed by the MoHFW guidelines, which specified that the family needed to be linked with the CHW with more frequent visits other than the recommended postnatal visit days 1, 3, 5, 7, 14 and 28 of life was required ~~by the CHW~~. Follow-up schedule for the LBW baby to the health facility was explicit in the MoHFW guideline, with the first visit recommended in the first week of discharge from the health facility (MoHFW, 2014a). Yet, feasibility of follow-up at the health facility, however, could be challenging due to geographical distance between homes and the health facility;

lack of transport and the possible perception of the family that the baby was well. The WHO provided guidance for follow-up to be at home, and this would mean that CHWs were empowered to recognise if the baby required urgent medical attention (Chan, et al., 2016a).

Given that there was some clarity in the guidelines for KMC implementation, yet with a few shortfalls, it therefore became vital that these were translated to actionable strategies for practice, in this case along the health facility-community continuum.

3.2.2. Components of KMC

KMC was the recommended third package of essential care for LBW babies; thus, it was necessary that all its components were considered by implementers and users when strategizing for its scale-up. Chan and colleagues in a systematic review on "what is KMC?" that aimed to identify a universal definition of KMC that included and reflected at least 70% of the KMC components - SSC, exclusive breastfeeding, early discharge, and close follow-up, as recommended by the WHO (Chan, et al., 2016a). SSC was the main component referred to by 71% (211/299) of the studies in the above systematic review. Other components of KMC as highlighted in the definition by WHO were minimally mentioned. Only 16% (49/299) included exclusive breastfeeding or breastmilk feeding; 12% (36/299) early discharge from the health facility, while the rest of the studies did not include these components in the definition of KMC (Chan, et al., 2016a). Studies included in this systematic review were from all six WHO world regions conducted between 1988 and 2014. Most studies reviewed by Chan et al (2016a) were conducted in countries with low neonatal mortality rates of <5 per 1000 live births indicating studies were skewed towards high-income or developed countries. Additionally, more than a third of the studies from this systematic review were conducted in urban areas (Chan, et al., 2016a). It was essential that an operational definition of KMC, with components that were measurable and feasible to implement in all settings regardless of context was available and acknowledged by all stakeholders for KMC scale-up (Chan, et al., 2016a). The MoHFW (2014a), mandated SSC and exclusive breastfeeding as the two key components of KMC along with guidance on when a baby could be discharged from the health facility, what constituted a follow-up at home and revisit back to the health facility. Hence, to scale-up KMC implementation along the health facility-community continuum in India, it was fundamental to build awareness on these four KMC components among the stakeholders namely DHOs, health facility managers and KMC implementers – HCWs and CHWs and the users – the mother and the family with an LBW baby.

3.2.3. Place where KMC can be initiated for small babies

The WHO (2015) and MoHFW (2014a) guidelines for KMC implementation stipulated that KMC must be initiated in a health facility but did not specify explicitly what type of health facility. This lack of specification could be a challenge for KMC scale-up in India, especially since childbirth could occur anywhere along the continuum from home to a primary level setting (PHC and CHC) or to secondary level facilities (SDH and district hospital) or even private health facilities. Furthermore, 15-50% childbirths in India were known to occur at home by choice or due to several constraints based on the socio-economic background and locality indicators (Devasenapthy et al, 2014; IIPS & ICF, 2017). Although the guidelines for Facility Based Newborn Care, specify that a baby with <1800gms birth weight would require referral from a primary level facility to an SDH or district hospital, where a specialist was mostly available (MoHFW, 2011a), this is challenging due to constraints of distance, lack of transport, cost, belief that the newborn would die despite referral or the mother wanting to return home as early as possible, especially when the baby was stable (Kumar & Dhillon, 2020; Teklu, et al., 2020). Thus, the need for clarity arises whether a baby with birth weight between 1800-2500 gms born in a PHC or CHC, could be initiated on KMC in these facilities.

In summary for KMC to be operationalised at scale along the health facility – community continuum, it was important to address the gaps in the delivery of KMC along this continuum and to facilitate a common understanding of how KMC could be implemented by all stakeholders (health facility managers, implementers - HCWs, CHWs and users - mothers and family members).

3.3. Benefits of KMC for small babies

3.3.1 Short-term benefits of KMC

Modest improvements in physiologic stability-respiration, heart rate, temperature, oxygen saturation in premature and LBW babies were some immediate short term benefits with KMC provision (Boundy, et al., 2015; Rao et al., 2008; Bera, et al., 2014). A systematic review on the benefits of KMC was completed on 21 RCTs that were conducted between 1998 and 2016 and included 3024 LBW babies (Conde-Agudelo & Díaz-Rossello, 2016). This review included studies from LMICs and high-income countries with 76% (16/21) of the trials being from LMICs (Conde-Agudelo & Díaz-Rossello, 2016). Most of the studies included in this review 90% (19/21) evaluated KMC after the baby was stabilised; while one study evaluated KMC outcomes before babies were stabilised and another study compared early onset versus late onset KMC in LBW babies who were stable (Conde-Agudelo & Diaz-Rossello, 2016). KMC was shown to improve exclusive breastfeeding rates (Vohra, Shah

& Mehariya, 2017), reduce risk of mortality at discharge or 40-41 weeks of gestation age by 40%; a reduction in nosocomial infections and sepsis by 75%; and hypothermia by 72% (Conde-Agudelo & Diaz-Rossello, 2016). Similar findings were found in two other reviews: a systematic review that considered 124 RCTs (Boundy, et al., 2016) and a meta-analysis that included 15 observational studies (Lawn, et al., 2010) that reported if KMC was initiated within the first week of life there was a significant reduction in neonatal mortality compared to conventional care. KMC was also shown to increase the chance of weight gain, length gain and head circumference at the latest follow-up (from randomisation to last follow-up) compared to LBW babies who had conventional care (Conde-Agudelo & Diaz-Rossello, 2016). Conventional care referred to when LBW babies were cared for in an incubator or radiant warmer. Conventional care included interventions known to reduce mortality and morbidity was resource intense requiring skilled HCWs, expensive equipment and facilities which can often be challenging for LMICs (Conde-Aguedelo & Díaz-Rossello, 2016; Bulfone, Nazzi, & Tenore, 2011).

The duration of KMC provided daily impacted mortality, with babies who received 7 hours or more of KMC daily, having better health and survival rates (Ahmed, et al., 2011). However, results from a meta-analysis, could not establish dose-response relationship between KMC and neonatal outcomes (Boundy, et al., 2016). Conde-Agudelo & Diaz-Rosello's (2016) study demonstrated that KMC for LBW babies if continuous (>20 hours in the study), was associated with a 40% lower risk of mortality at the time of discharge or at 40–41 weeks postmenstrual age compared to conventional care [Relative Risk (RR) 0.60, 95% Confidence Interval (CI) 0.39–0.92; 3 studies, 1117 babies]. Continuous KMC was also associated with a 33% (RR 0.67, 95% CI 0.46–0.98; 4 studies, 1384 babies) reduction in the risk of mortality at the latest follow-up contact, compared with conventional care (Conde-Agudelo & Diaz-Rosello, 2016), with findings that demonstrated slightly better reductions in neonatal mortality in LMICs. KMC practice was demonstrated to increase exclusive breastfeeding rates at discharge or 40-41 weeks of gestational age by 25% and by 20% during follow up at 3-months following childbirth (Conde-Agudelo & Diaz-Rosello, 2016). There was no difference in mortality and morbidity, severe infection and nutritional indicators between LBW babies started on KMC within 24 hours of birth versus those who were started after 24 hours of birth (Conde-Agudelo & Diaz-Rosello, 2016). This evidence pointed towards the benefits of KMC for LBW babies irrespective of when it was initiated. KMC was shown to have a significant protective effect against mortality over the conventional of neonatal care in a study that followed-up a cohort of participants from an RCT 20 years of KMC initiation (Charpak, et al., 2017). Based on these convincing findings,

the WHO recommended for KMC practice to be continuous (24 hours), without a break in SSC between the mother and the baby (WHO, 2015).

KMC was also reported to result in improved bonding between babies and their mothers and created a better home environment with the involvement of fathers (Tessier, et al., 2009). Mothers felt more competent in caring for their LBW babies when KMC was initiated within the first two days of life (Tessier, et al., 1998). Babies who received KMC also demonstrated better sleep organisation (Ludington-Hoe, et al., 2006).

Babies initiated with KMC, had significant reduction in length of stay in the health facility, and this was associated with cost benefits both for the health facility and the family (Broughton, et al., 2013; Sharma, Murki, Oleti, 2016). This review on short- term benefits of KMC for LBW babies over conventional care, was of relevance especially in LMICs and had high implications for scale-up of KMC in India given its large number of LBW babies (Blencowe, et al., 2013), and its contribution to global neonatal mortality rates.

In summary, based on the above evidence of KMC, recommendations were made by the WHO for use of KMC as part of ENC for small babies. These recommendations (Table 1) were based on the decision of the WHO Guideline Development Group who graded quality based on evidence profiles as “very low”, “low”, “moderate” or “high” at a Technical Consultation in May 2014 (WHO, 2015a). “The GDG qualified the direction and strength of each recommendation by considering the quality of evidence and other factors, including balance between benefits and harms, values and preferences of stakeholders, and the resource implications of the intervention” (WHO, 2015a, pp. 2)

Table 1: Recommendations by the WHO for thermal care of babies (WHO, 2015a, p. 3-4)

Theme	Recommendation	Quality of Evidence
Thermal care for preterm and LBW neonates	Kangaroo mother care is recommended for the routine care of neonates < 2000 gms at birth (small babies), and should be initiated in health facilities as soon as the baby is clinically stable	Strong recommendation based on moderate quality evidence
	Small babies should be provided with continuous KMC as early as possible	Strong recommendation

		based on moderate quality evidence
	Intermittent KMC rather than conventional care is recommended for small babies, if continuous KMC is not possible	Strong recommendation based on moderate quality evidence
	Unstable or stable small babies who cannot be given KMC should be cared for in a thermo-neutral environment under radiant warmers or in incubators	Strong recommendation based on very low-quality evidence

Source: WHO (2015) p 3-4

3.3.2. Long-term benefits of KMC

The long-term benefits of KMC were studied in a cohort of LBW babies (weighing <1800gms at birth) recruited to an RCT between 1993 and 1996 and followed up 20 years later (2012-2014). The original RCT involved comparing LBW babies who had received KMC (intervention group) with those who had received conventional care to study short- and mid-term benefits of KMC on survival, neurodevelopment, breastfeeding and the quality of mother-infant bonding (Charpak, et al., 2017; Vohra, Shah & Mehariya, 2017). The aim of the follow-up study, that re-enrolled 264 (139 in the intervention group and 125 in the conventional care group) of the original 433 (223 in the intervention group and 204 in the conventional care group) was to ascertain whether KMC intervention in the neonatal period had long-term protective effect against cognitive, social, and academic difficulties in a randomised block of participants who had weighed <1800gms at birth. Measures of comparison included health status, neurologic, cognitive, and social functioning using neuroimaging, neurophysiological and behavioural tests (Charpak, et al., 2017). The follow-up study findings revealed no overall or specific differences in IQ scores between the two groups, 20 years later. The cerebral palsy rates were the same when measured by neurologic examinations in both groups but with better motor functional ability in those who had received KMC as neonates. Additionally, there were similar rates of stunting found in both groups. Those who had received KMC as neonates had significantly more years of pre-school, less temporary absenteeism from school, and higher average hourly wages than those who had received conventional care. However, those from the conventional care group showed significantly higher scores in language and mathematics in the Columbian National examination. The HOME inventory subscales of family companionship, regulatory activity and learning material demonstrated that those who belonged to the KMC group had a more stimulating and protective environment at 12 months and 20 years. The authors

concluded that KMC families (those who provided KMC for their babies in the past) were "more dedicated to their children and the effect was permanent", with typically more father involvement in the care of the child from the neonatal period as well as increased sensitivity of mothers to the needs of the child (Charpak, et al., 2017). One could extrapolate that these parents who provided KMC were in a possibly better position to support all other childhood protective factors in the environment, due to the close bond they had developed with the child. A systematic review on 10 qualitative studies also showed that KMC increased the "feeling as parents" as they participated in the care of their babies (Gabriels, et al., 2015). Parents were known to experience ambivalent feelings initially with them wanting to desperately hold the baby yet afraid of hurting the baby. However, as parents continued to provide KMC those ambivalent feelings decreased, and they became more confident in holding their babies (Gabriels, et al., 2015). This finding was also confirmed by other studies, including a systematic review on 29 original studies that reported the mother's and family members' confidence to care for the baby before discharge from the health facility increased with KMC practice due to reduced separation time (Arivabene & Tyrrell, 2010; Anderzén-Carlsson, Lamy & Eriksson, 2014).

The study by Charpak and colleagues (2017) also demonstrated that those who received KMC as neonates had significantly larger cerebral volumes of total grey matter, cerebral cortex and left caudate nucleus than those who had received conventional care, 20 years later as measured by neuroimaging. The left caudate nucleus partly controls communication skills. The authors were also able to demonstrate lesser aggressive and hyperactivity scores as measured by the Adult Behaviour Checklist test, and less anti-social behaviour amongst those who had received KMC compared to their counterparts in the conventional care group, 20 years later (Charpak, et al., 2017). However, the findings of Charpak and colleagues (2017) were questionable since not all the findings on neurodevelopment, behaviour and cognition could be attributed to KMC alone, especially since it was challenging to quantify and qualify parent-associated and parent-delivered interventions, although KMC was a "bundled intervention" in which parental nurturing, nearly exclusive breastfeeding, and SSC could have had individual, synergistic, and overlapping contributions to the outcomes (Furman, 2017). Furman (2017) further argued that 20 years was a long duration that could have accounted for several changes in the lives of these individuals. Yet, findings from another study that compared preterm babies who had received KMC versus those who had received conventional care concluded that KMC had a significant positive impact on the perceptual–cognitive and motor development as well as parenting process when followed up over a 10-year period (Feldman, Rosenthal & Eidelman, 2014). Furman and colleagues (2017) further countered this finding suggesting

that “although there was a positive impact on executive function and mother–child reciprocity predicted by SSC, other factors may also have contributed, including maternal–child attachment and neonatal respiratory sinus arrhythmia” (Furman, 2017; pg. 2).

Thus, in summary, there is strong evidence that KMC has both short-term physiological, psychological, social as well as economic benefits alongside shorter hospital stay, better health outcomes for the baby, a justifiable rationale for its scale-up. The reported long-term benefits of KMC include better parenting, better cognitive and communication abilities in LBW babies. Importantly, there has been no evidence thus far identifying any short or long-term harmful / negative effects of KMC either on the mother or the baby. However, there have been indications from literature that more research is warranted to clarify aspects such as short-term effects of KMC on heart rate, breathing rate and oxygen saturation since these findings appear to be contradictory (Bulfone, Nazzi, & Tenore, 2011).

3.4. Build-up for KMC scale-up

At a superficial level, KMC would appear to be simple to implement as an intervention to support stable small babies, since it does not require specialised medical equipment or highly skilled HCWs (Foote & Tamburlini, 2017) yet the reality is contrary (Seidman, et al., 2015; Chan, et al., 2017). Relative to the scale of the problem, especially in LMICs, the coverage of KMC still remains insufficient – even in the countries where it was implemented most successfully (Foote & Tamburlini, 2017). For scale-up of KMC, it is essential that KMC is implemented across the health facility-community continuum. KMC can be initiated at the health facility and continued at home, provided the mother receives adequate support following discharge. Section 3.4.1 and 3.4.2 explore KMC implementation in health facilities and the community, respectively.

3.4.1. Implementation of KMC at health facilities

KMC services at individual health facilities in Asia began before being officially prioritised for scale-up. Three Asian countries - India, the Philippines and Indonesia, studied the implementation of KMC within health facilities (Bergh, et al., 2016). KMC services were first introduced in all three countries at tertiary health facilities attached to medical colleges. KMC was first introduced in the state of Gujarat, India in 1995; in Indonesia, between 1995/96, while in the Philippines a few years later in 1999. KMC services occurred in three phases or waves in these countries.

- *The first wave (1998-2006)* involved initiation of KMC through pioneers or champions, typically neonatologists or a foundation / Non-Governmental Organisations (NGO)that aimed to provide evidence of its safety and effectiveness

in their respective teaching health facilities. Since the champions lacked familiarity with advocacy strategies, they were unable to promote KMC on the policy agenda. Moreover, the focus during the first wave of these countries was on infant and child survival rather than on neonates, and thus was challenging for the champions to push the agenda of KMC scale-up.

- *The second wave (2007-2012)* involved dissemination of knowledge and skills on KMC, but with its focus on neonatal survival., “Institutional teams learning abroad” was a key initiative attempting to establish KMC services in the countries (Bergh, et al., 2016). In India, KMC implementation followed an academic path, with training and resources for building capacity being spearheaded by champions in six health facilities, again tertiary ones that formed the “KMC India initiative”. While in Indonesia and Philippines, a professional association and an NGO run by professionals, respectively, fulfilled this function of training. These approaches to KMC training had shortcomings of lack of consideration for the sustainability or scale-up. Training in these countries, India, Indonesia, and the Philippines differed in duration and ranged from a day long training to 2-5 days onsite training plus week-long fellowships for doctor-nurse teams. However, the focus of training was primarily on skills required for “applying KMC” and not on soft skills of communication and counselling that could be decisive for motivating mothers and significant others for uptake of KMC (Bergh, et al., 2016). The Philippines had a different model, based on the principle of public-private partnership with the establishment of the KMC Foundation in 2008 that focused on capacity building of HCWs to scale-up KMC, supporting health facilities and accreditation of health facilities as centres of excellence for KMC. However, as noted, during both these waves, KMC services were limited to specialist teaching and tertiary health facilities that could not support large-scale expansion of KMC beyond their own settings, possibly the reason for the low coverage of LBW babies with the KMC intervention. During this wave across all three countries, the focus of policy makers was limited to child survival and neonatal survival with resultant focus of programmes geared towards overall improvement in neonatal health, not specifically LBW and preterm infants (Bergh et al, 2016).
- *The third wave (2013 onwards)* culminated with the uptake and expansion of KMC services consistent with global trends of KMC. This wave began with the global push towards neonatal survival, with specific attention to LBW and preterm babies. The publication of the “Born too Soon” report in 2014 as well as the launch of the “Every Newborn Action Plan” (ENAP) in 2014 that was endorsed by 194 member states of the World Health Assembly and led by WHO and UNICEF, further supported a

scale-up of evidence-based interventions, one of which was KMC (WHO & UNICEF, 2014).

Simultaneously systematic initiatives were made to note implementation and monitor progress of KMC implementation within the health system in countries such as South Africa (Bergh, et al., 2005), Indonesia (Bergh, et al., 2012a); Ghana (Bergh, et al., 2012b and 2013); within Africa (Bergh, et al., 2014) and Asia (Bergh, et al., 2016). Findings from all the above initiatives showed progress of KMC implementation in health facilities was possible with availability of specialists and infrastructure and trained health workforce for the care of LBW babies (Bergh, et al., 2014). The study in Ghana, was the only exception, as it showed that KMC uptake was possible in the absence of an established centre of excellence situated in a teaching medical college tertiary health facility (Bergh, et al., 2005). However, differences in the implementation of and uptake of KMC existed between countries and regions due to contextual factors such as:

- Variances in socio-political commitment and support from all stakeholders- health officials, health facility managers, implementers-HCWs and CHWs (Bergh, et al., 2013; 2014)
- Economic policies that lacked foresight for an investment plan to scale-up KMC, with resultant high dependency on external funding (Bergh, et al., 2014)
- Lack of horizontal integration of KMC into ENC, management of basic and emergency obstetric and new-born care; infrastructural constraints within health facilities (Bergh, et al., 2014; 2016)
- Limited champions who drove KMC at all levels of the health system and human resource constraints both at managerial and implementation level (Bergh, et al., 2013, 2014, & 2016).

An analysis of the bottlenecks within the health systems of 12 countries in the two major continents of Africa and Asia also identified factors affecting the scale-up of maternal and ENC packages including KMC, revealed that the key obstructions were health financing (10/12 countries); community ownership and partnership (10/12); health service delivery (10/12), leadership and governance (9/12) and health workforce (9/12) (Vesel, et al., 2015). Barriers specific to KMC implementation that were highlighted included lack of designated space for KMC practice, poor monitoring systems of KMC, weak referral systems and transport, inadequate quality of KMC delivery and poor quality-improvement measures (Vesel et al., 2015). Nevertheless, KMC uptake seemed to be successful when funded externally as a project combined with the support of local authorities for its implementation within health facilities (Bergh, et al., 2016). This probably highlights the need for resources such as finance, governance and empowerment of local authorities including community

mobilisation and collaboration with local civil society or non-governmental organisations as key factors for consideration while working towards scale-up of KMC in LMICs.

A significant limitation with these studies (Bergh, et al., 2012a; 2012b; 2013; 2014; and 2016) was that they focused only on KMC practice within health facilities, despite recommendations for KMC to be continued at home. Early discharge of a small baby from the health facility, a component of KMC, implies that the mother would need to continue KMC at home. Enabling mothers and significant others to continue the practice of KMC necessitates a complex interplay between health system requirements, organisational culture, community networks, and human behaviour (Bergh, et al., 2016). These studies did not particularly identify factors that would drive the sustainability of KMC along the health facility-community continuum (Bergh, et al., 2012a; 2012b; 2013; 2014; and 2016). They only provided evidence-based approaches to assist health managers to identify meso / macro levels of support required and indicators to monitor progress of KMC implementation within health facilities. But given the fact that childbirth occurred in a range of settings from homes to primary level public health facilities to high-tech private health facilities, possibly reiterated that efforts to scale-up KMC required focus on all these limitations highlighted above including infrastructure at all levels of health facilities, health workforce capability and service provision, leadership including governance (Vesel, et al., 2015). Thus, all stakeholders could plug these limitations by taking the plausible comprehensive measures given below to enable KMC to be the "centrepiece of a package of interventions" (Furman, 2017):

- By policy makers and health officials to drive policies and advocacy around investment in setting up KMC spaces in health facilities; follow-up of KMC integrated within postnatal follow-up; health finance protection schemes; and dissemination of KMC implementation guidelines to key stakeholders (Vesel, et al., 2015).
- By implementers (health facility managers) to ensure and support the implementation of the guidelines at their respective health facilities. Reinforce competencies of HCWs and CHWs with mentoring and supervision mechanisms to facilitate implementation of KMC along the health facility community continuum (Vesel, et al., 2015).
- By implementers (HCWs and CHWs): to support mothers and family members through counselling, education, and assistance for KMC practice (Chan, et al., 2016b & 2017; Seidman, et al., 2015).
- By robust health information management systems that specify key indicators to be included in an accessible case record (for example in India the antenatal record

called the Thayi card in Karnataka) to track KMC practice (Vesel, et al., 2015) both in the health facility and at home.

- By users (mothers, family members and the larger community): through facilitation of health promotion programmes using various forms of communicative materials that are tailored to their needs, addressing their misconceptions, context specific newborn practices related to hot and humid environments and potential stigmatisation of KMC provision (Vesel, et al., 2015).

3.4.2. Implementation of KMC in the community

KMC for use in the community was not endorsed by the WHO, for the lack of evidence on its effectiveness in the community setting. An RCT performed more than a decade ago in Bangladesh, tested community initiated KMC in the immediate postnatal period against routine care for LBW babies born at home for reduction in neonatal and infant mortality (Sloan, et al., 2008). This study was set in two of eight divisions (a division is equivalent to a state in India) known for the high percentage of childbirths that occurred at homes. The study was not able to demonstrate a change in neonatal mortality between the two groups (community initiated KMC versus routine care). It recommended further research in this context with a specific focus on identification of an LBW by accurate assessment of birth weight and how KMC could be implemented to establish the effect of community initiated KMC (Sloan, et al., 2008). More recently, another RCT was conducted in India to test the effect of community initiated KMC on neonatal and infant survival (Mazumder, et al., 2019). The criteria for inclusion into the RCT were: (1) babies weighing 1500-2250 gms identified within 72 hours of birth; (2) no KMC initiated in the health facility; (3) no illness requiring hospitalisation; and (4) availability of the mother-baby dyad over a 6-month period within the area for follow up (Mazumder, et al., 2017). Mothers with LBW babies were counselled and supported to initiate and maintain KMC in the intervention group. Project staff who had qualifications and experience like CHWs made home visits on days 1, 3, 5, 7, 10, 14, 21, 28 of the baby's life. An independent team collected data on anthropometry, mortality, and morbidity from enrolment to 6 months of age. The intervention group had fewer neonatal and infant deaths compared to the control group; better health seeking behaviour for health problems; and higher exclusive breastfeeding rates in the first six months were also reported. The same study showed a "30% efficacy of the community initiated KMC to prevent neonatal deaths between birth and age 28 days" (Mazumder, et al., 2019), which implies that it has the potential to prevent about 0.24 million neonatal deaths every year, provided 90% of LBW babies were given KMC. KMC was initiated within 2 days in this study (31 hours) and thus its findings were like the previous community-based study of KMC in Bangladesh that demonstrated that when neonates had KMC for >7 hours daily in the first

two days of life, they experienced better health or survival than babies without it (Sloan et al., 2008; Ahmed, et al., 2011). This study (Mazumder, et al., 2019) conducted in India on community initiated KMC showed, contrary to the Sloan and colleagues' study (2008), that it was possible to initiate KMC in the community with close supervision. Yet it had a significant limitation as the intervention was delivered by project staff (Mazumder, et al., 2019), although they were like CHWs in terms of education and experience. In contrast, the Bangladesh community-based study on KMC used CHWs but were faced with challenges of "cascade training" of CHWs i.e., training master trainers who in turn trained local trainers who then trained the CHWs (Sloan, et al., 2008; Ahmed, et al., 2011). The authors also recommended that families choosing community based KMC had to be linked to specialist services (Ahmed, et al., 2011).

Findings from the literature reviewed clearly demonstrated that KMC could be implemented in health facilities with specialist support as well as in the community if there was adequate support by CHWs and linkage with specialist services (Ahmed, et al., 2011; Bergh, et al., 2016; Mazumder, et al., 2019; Sloan, et al., 2008). Given that KMC implementation was possible, though not without challenges both in health facilities and the community (along the health facility-community continuum), it seemed worthwhile, particularly in LMICs, to explore the factors required for successful acceptance of KMC implementation such as health facility preparedness, HCW's or CHW's competencies, or the support required by mothers (Chan, et al., 2017; Lawn et al., 2017; Seidman, et al., 2015). A crucial factor for KMC success seemed to be the long-term continuation of KMC practice by mothers who were well informed about and confident with KMC before they were discharged from the health facility and well supported to continue KMC in their homes (Chan, et al., 2017; Mazumder, et al., 2018; Rasaily, et al., 2017; Seidman et al., 2015). It also seemed that retaining the mother-baby for KMC practice in the health facility was not as feasible given its constraints in health workforce (Moxon, et al., 2015) and the circumstance of voluntary early discharge nor was it cost-effective as investing in community initiated or continued KMC at home with early discharge from the health facility (Taneja, et al., 2020).

3.4.3. ***Monitoring of KMC implementation***

As early as 2000, a progress - monitoring tool to monitor KMC implementation at health facilities (Figure 4) was developed based on individual institutional implementation strategies, qualitative interviews, and observations (Bergh, et al., 2005).

This progress monitoring tool was conceptualised around three phases, namely pre-implementation; implementation and institutionalisation under which there were six constructs as shown in Figure 4.

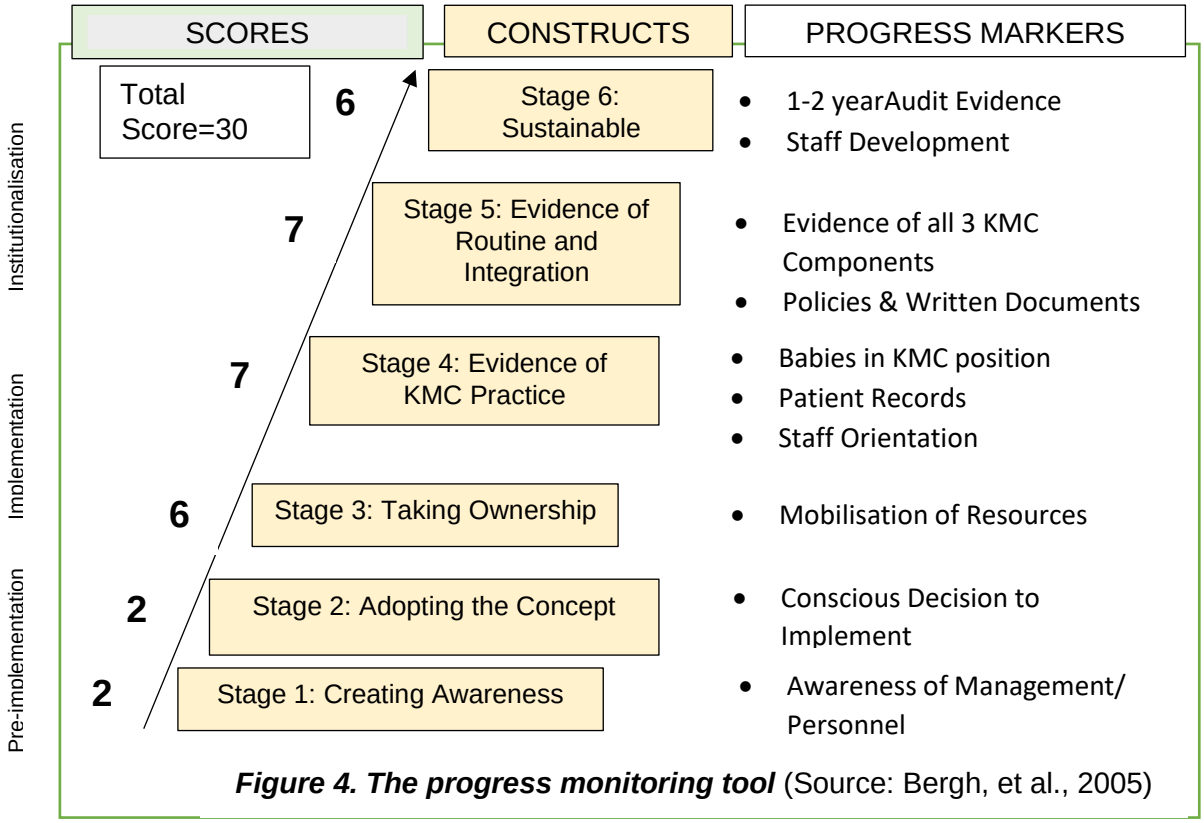


Figure 4. The progress monitoring tool (Source: Bergh, et al., 2005)

For each construct, indicators for changed behaviours were identified and scored based on the relative weight to the total maximum score of 30 (Bergh, et al., 2005). The tool was tested at 65 health facilities in South Africa and later used for assessing progress in KMC implementation at health facilities of other countries (Bergh, et al., 2012a, 2012b, 2013, and 2014). The tool was valuable in that scores obtained for individual health facilities could provide feedback to health facility managers while cumulative scores of health facilities in a locality or region could point health officials to possible areas of improvement for KMC practice. It was thus also a valuable quality improvement tool. The disadvantage of this tool was that it had indicators that were not relevant to a primary level health facility setting such as PHCs or CHCs. For example, in the construct - "evidence of practice", items such as "intermittent KMC practiced in high-care", "number of infants doing intermittent KMC in a neonatal unit" (Bergh, et al., 2016) were irrelevant to primary level health facilities. Whilst in India, for scale-up of KMC, since stable LBW babies with birth weight 1800-2000 gms would access primary level health facilities, KMC would necessarily need to be implemented in these settings. One must also be cognisant that these were challenged by infrastructural and human resource limitations and thus "high dependent care of LBW neonates" an

indicator in the monitoring tool would be irrelevant. Therefore, it was essential to modify some of the indicators in the monitoring tool for it to be relevant within primary level health facilities.

3.4.4. ***Need for KMC scale-up along the health facility-community continuum***

The key reasons for KMC scale-up along the health facility-community continuum are:

- In India, evidence suggested that all childbirths did not take place in health facilities equipped with infrastructure, requirements, and human resources for KMC implementation. Approximately 10-30% of childbirths occur in PHCs and homes (MoHFW 2014a).
- Women in India preferred early voluntary discharge after childbirth at a health facility (Campbell et al., 2016; Gilmore and McAuliffe 2013).
- The MoHFW operational guidelines (MoHFW, 2014a) mandated that only babies with birthweight <1800 gms required referral to secondary (SDH or district hospital) / tertiary (attached to a medical college) level health facilities, while those with birthweight between 1800-2500 gms presumably stable could be initiated on KMC in the postnatal ward.
- Coverage of LBW babies with KMC was reported as low in India, with many states not having data on KMC, or with data only of babies admitted to level II neonatal care units of the public health facilities (Save the Children, n.d.).

Taking the cue from evidence on the multiple benefits of KMC implementation at health facilities as well as in the community, the greatest potential for public health impact (reduced neonatal mortality, reduced infection rates, better growth parameters) would most be likely to be achieved if KMC was implemented at scale along the health facility-community continuum (March of Dimes, et al., 2012). This means, it would be opportune to implement KMC at the place of birth, if the baby was stable, rather than only in those health facilities with a specialist and designated KMC area, with adaptations to support the mother-baby dyad for breastfeeding and KMC. KMC needs to be practiced not just for a day but till the baby reached a healthy weight of 2500 gms or was no longer comfortable in the KMC position (MoHFW, 2014a). This implies several days to weeks of KMC (WHO, 2003), for a duration of not <1 hour per session (MoHFW, 2014a) and to a minimum of >7 hours per day (Ahmed, et al., 2011). In this context, it would be more viable if implementers at the health facility and community had a coordinated approach to ensure this optimal KMC duration once initiated along this health facility-community continuum.

3.5. Evidence synthesis- Facilitators and barriers for KMC uptake

If KMC had to be scaled-up along the health facility-community continuum, it was vital to address key facilitators and barriers for its uptake at these two settings – health facility and community. Over the last decade, with accumulating evidence on the benefits of KMC for accelerating reduction in neonatal morbidity and mortality (Conde-Agudelo & Diaz-Rosello, 2016), systematic reviews were conducted to identify what facilitated or hindered the uptake of KMC at scale. This section is a synthesis of evidence from the literature on facilitators and barriers for KMC implementation. This was performed through a comprehensive search using PubMed, google scholar, OVID, Web of Science, CINHAL, Cochrane Data base for scoping reviews, systematic reviews, and meta-analyses. Key words that were used in the search included “KMC”, “Kangaroo Care”, “Enablers or Facilitators”, “Barriers”, “Health facility”, “Community”. The search covered a 20-year period between 1996 and 2016 that included articles only in English or if published in other languages but with an accompanied translation. The evidence synthesis was limited to systematic reviews, meta-analyses from the literature retrieved through this search. These included systematic reviews that identified barriers faced for KMC practice from the perspective of mothers and other stakeholders (Seidman, et al., 2015); factors that facilitated the adoption of KMC in health systems (Chan, et al., 2016b; Chan, et al., 2017); barriers from the caregivers’ perspectives for adoption of KMC (Smith, et al., 2017); a scoping review of factors that influenced utilisation of KMC by parents – protocol (Mathias, Mianda & Ginindza, 2018). Additionally, two reviews and one meta-analyses respectively that included qualitative studies (Anderzén-Carlsson, Lamy & Eriksson, 2014; Anderzén-Carlsson, et al., 2014b; Gabriels, et al., 2015) were used included in this evidence synthesis on key facilitators or barriers for KMC uptake. Further, if any qualitative or quantitative studies or conceptual literature were found that were not included in the reviews or meta-analyses mentioned above, these were also reviewed. Then, these articles were reviewed, critiqued through a synopsis of key facilitators and barriers for KMC uptake for each of these studies (Tables 2-3), then themes were identified and summarised (Table 4), followed by a synthesis of key barriers and integration of facilitators as solutions for KMC uptake along the health facility-community continuum (Table 5).

Table 2: Synopsis of facilitators and barriers - KMC uptake related to the health system

Year & author	Title of study	Country and study setting	Study design & participants	Facilitators for KMC uptake	Barriers for KMC uptake	Limitation
2019 Jamali, et al.	Barriers and enablers for practicing kangaroo mother care (KMC) in rural Sindh, Pakistan	• Pakistan • Two health facilities the two districts in which these health facilities were situated	• Qualitative study • 12 in-depth interviews and 14 focus group discussions • Participants- Recently delivered women with term live birth and LBW/premature birth, and their spouses, trained birth attendants, lady health workers, decision makers- women in the household	• Support of managers and HCWs for KMC implementation • Health facility readiness – availability of equipment, supplies, water-sanitation facility, modified patient ward (curtains and separate room) • Training of HCWs	• Lack of health facility readiness • Lack of time / workload of HCWs	• Only qualitative data collected
2017 Smith, et al.	Barriers and enablers of health system adoption of kangaroo mother care: a systematic reviewer of caregiver perspectives	• 98 studies from 1960-2015 plus programmatic reports and data from Save the Children • Studies were from North and South America (33%); Africa (26.5%); Europe (16.3%); rest from SE Asia, East Mediterranean, W Pacific	• Systematic review using deductive approach of published work involving human subjects • Caregiver and HCWs who implemented KMC • NVivo software used for themes and perspectives • Themes identified: Buy-in and bonding; social support; time; medical concerns	• Training and support by HCWs for mothers • Private, quiet place available to practice KMC • Unlimited visitation hours	• Lack of time for HCWs • HCWs attitude- uncaring, loud, unsupportive • Lack of transport to health facility and distance • HCWs not informing mothers on how to perform KMC • Lack of necessary resources and privacy	• Less research done in Southeast Asia and sub-Saharan Africa where KMC has the potential for the greatest impact due to large numbers of LBW babies and poor resources • 50% of the studies were done in urban settings with low neonatal mortality rate

2017 Chan, et al.	Barriers and enablers of kangaroo mother care implementation from a health systems perspective: A systematic review	• 86 studies with qualitative data on KMC implementation • Studies were from North and South America (33%); Africa 23.3%; Europe (20.9%); Southeast Asia (11.6%); Eastern Mediterranean, Western Pacific, and Multiple regions (3.5% each); Missing (1.2%)	• Systematic review • Qualitative analytical software NVivo was used by two researchers who indexed and annotated data. • Matrix of barriers and enablers for HCWs and health facilities was thus created from the 86 studies under 6 themes. Themes included buy-in, support and empowerment, time, medical concerns, access, and cultural norms	• HCWs work experience (>5 years); experience with KMC and belief that it worked and was not time-consuming • Health facility managers being supportive by mobilising resources • Multiple cadres of HCWs involved in implementation after training • Use of technology and guidelines • Access to private space, relaxed atmosphere, and dim lighting • KMC an indicator to be included in health facility statistics	• Concerns on stability of the infants • Lack of leadership and support from managers • Poor prioritisation of LBW care in the health systems • Limited communication between HCWs • Inflexible protocols • Lack of space for KMC practice • Shortage of HCWs • Time consuming • Poor training of HCWs leading to conflicting perceptions and practices • Lack of funds for KMC implementation • No records of KMC practice	• More than half of the studies were from areas that had a neonatal mortality rate of <15 per 1000 live births and more than a third were from urban areas. • Context needs to be considered when generalising findings of the study
2016b Chan, et al.	Kangaroo mother care: A systematic review of barriers and enablers	• 112 studies mostly published from 2010-15. • Forty studies from WHO region of Americas, 29 from WHO African regions, 64 in countries with low neonatal	• Systematic review • Qualitative data – with primary data collection • Deductive approach • Population: mother-neonate dyads, HCWs, health facilities, communities, health systems	• Management support-committees to advocate KMC, policy of unlimited visiting • Space and screens – for privacy • Nurses having support from	• KMC not prioritised by management and staff • HCWs perceived parents would be a hindrance to health care activities; that it would take time away from other neonates	• May not have captured all information from the reports of projects and data available • Most of the studies were from countries with low neonatal mortality rate and thus reduces external validity of findings

		mortality (<15 per 1000 live births)	• NVivo qualitative analytical software • Themes identified- buy-in and bonding; social support; time; medical concerns; access; context	experienced nurses • Nurses experiencing the positive effects of KMC for mother-neonate dyad and selves • Data monitoring and evaluation including quality improvement initiatives used for KMC implementation progress	• Nurses did not have a strong belief on the importance of KMC • HCWs lacked knowledge, and skills in KMC application • HCW shortage • Increased leadership and HCW turnover • Resistance of HCWs to change protocols • Stability criteria not clear • Perceived as extra workload • No visitation policy for parents	
2016 Namnabati et al.	The implementation of kangaroo mother care and nurses' perspective of barriers in Iranian NICUs	• NICUs of two university hospitals in Isfahan, Iran	• Descriptive study • 96 infants and 80 nurses		• Nurses required physicians' order for KMC • Limited visitation by mothers / other family members to NICU • Lack of facilities for mother-space, water	• External validity limited since study area was only two hospitals
2016 Soni, et al.	The presence of physician champions improved kangaroo mother care in rural western India	• Tertiary hospital in rural Anand, Gujarat	• Retrospective cohort study of 648 new-borns	• Training of nurses on KMC • Peer led training of new staff nurses • KMC champions		• Retrospective study-dependent on documentation • External validity limited since it involved only one tertiary hospital.,

2015 Seidman, et al.	Barriers and enablers of Kangaroo Mother Care practice: A systematic review	• 103 studies 49 from high-income countries, 22 from sub-saharan Africa, 15 from S. Asia, 5 from north Africa and middle east, 5 from Latin America and Caribbean, 3 from Eastern Europe, 2 from East Asia/SE Asia, Pacific and 2 from LMIC from multiple settings	• Systematic review: 103 • Studies were classified as indirect (those that did not aim to study barriers); Exploratory (those that aimed to study barriers); Systematic (those that set out to identify barriers and pre-specified factors; and Prioritised (those that also prioritised barriers)	• Support from staff and other CHWs • HCWs understanding efficacy of KMC	• Issues with facility environment / resources • HCWs workload increased • Lack of clear guidelines • General lack of buy-in and belief in efficacy • Concerns about other medical conditions • Issues with the facility environment and resources	• Focused on facility implementation of KMC and not of community • Inconsistency in definition of KMC practice • Most studies excluded fathers and other family members • Difficult to determine which barriers are most critical for implementation of KMC since it involves both quantitative and qualitative analysis as well as some studies did not explicitly address barriers
2014 Anderzén-Carlsson, Lamy, Eriksson	Parental experiences of providing skin-to-skin care to their new-born infant.- Part1: A qualitative systematic review	• 29 qualitative papers from 9 countries – Brazil, Denmark, England, Japan, S.Africa, Sweden, Uganda, United States from 1995-2005	• Systematic review with meta-data analysis • Mothers and fathers whose babies were mostly from the NICU	• An environment that facilitates for holding the baby with SSC-privacy and binders, chairs, TV for parents to watch while providing KMC • HCWs who support mothers	• Attitudes of HCWs	• Limited experiences of fathers • Translation to English of some articles could possibly risk loss of nuances while interpreting data • Three studies involved mothers' experiences in the delivery room. They were selected since they had fulfilled the selection criteria.
2014 Kymre	NICU nurses' ambivalent	• Sweden, Norway, and Denmark	• Qualitative: Reflective lifeworld research based on	• Experienced nurses would	• Parental presence in NICU limited due to restrictions	• Language however was considered a limitation although

	attitudes in skin-to-skin practice	• 3 NICUs	phenomenological philosophy • Six nurses from each of the NICUs with >5 years' experience	communicate about SSC • Support to parents to provide SSC for as long as possible	imposed or voluntary • Ambivalent attitude of nurses stemming from confusion of whether it is a medical or nursing intervention and based on their beliefs, norms, evidence all influenced by multidisciplinary concerns-doctors, parents etc.	authors mention the level of understanding was adequate and all unclear expressions were clarified.
2014 Batra & Mamta	Effectiveness of a structured teaching protocol on knowledge related to kangaroo mother care among staff nurses	• Mohali district, Punjab State in India • Two hospitals	• Pre-experimental design • Nurses (n=40)	• Short teaching session (30 minutes) increases awareness on KMC of staff nurses		• Only short-term knowledge was studied • Impact of increase in knowledge on practice or attitude not studied • Limitations in external validity since only two hospitals were included
2010, Nyqvist & Larsson	Knowledge and attitudes on the practice of kangaroo mother care among staff in two neonatal units	• Sweden • Two neonatal intensive care units (23 and 17 bedded respectively) that had facilities for mothers to stay with the baby	• Descriptive explorative design using quantitative and qualitative methods • All registered nurses, physicians, and assistant nurses (n=137 and n=126 at two points of time)	• Health facilities were designed to facilitate KMC practice • Training of HCWs • Practice of KMC by HCWs • Guidelines for KMC in the unit	• Lack of knowledge and perception of KMC as an intervention	• Limitation in external validity due to selection of only two NICUs

Table 3: Synopsis of facilitators and barriers - KMC uptake related to the community

Year & author	Title of study	Country and study setting	Study design & participants	Facilitators for KMC uptake	Barriers for KMC uptake	Limitations
2019 Jamali, et al.	Barriers and enablers for practicing kangaroo mother care (KMC) in rural Sindh, Pakistan	• Pakistan • Two health facilities the two districts in which these health facilities were situated	• Qualitative study • 12 in-depth interviews and 14 focus group discussions • Participants- Recently delivered women with term live birth and LBW/premature birth, and their spouses, trained birth attendants, lady health workers, decision makers-women in the household	• Support from other family members • Awareness of family members and community of the benefits of KMC	• Nuclear families with no additional support for the mother with household chores • Expectations of decision makers in the family for the mother to contribute towards household chores • Perception of other female members of the family of increased workload • Acceptance of KMC as a practice by the other family members • Patriarchal society with the belief that spouses had no role in neonatal care or providing KMC	• Only qualitative data collected • Mothers whose LBW babies had not survived were not selected into the study. They could have provided vital information that might not have been accessed from those selected.
2017 Smith, et al.	Barriers and enablers of health system adoption of kangaroo mother care: a systematic reviewer of caregiver perspectives	• 98 studies from 1960-2015 plus programmatic reports and data from Save the Children • Studies were from America's	• Systematic review using deductive approach of published qualitative work involving human subjects • Caregiver and HCWs who implemented KMC	• Perceived and experienced benefits –baby slept longer, less anxious, happier, more willing to feed, felt useful • Perceived as calming, natural, instinctive, secure, logical, and healing	• Stigmatised about having an LBW baby or that others perceiving that something was wrong • Lack of support from grandmothers and from peers • Perceived as the role of mother only	• Less literature available from SE Asia and sub-Saharan Africa where impact of KMC would be most evident • Half the studies done in urban settings with low neonatal mortality

		(33%); Africa (26.5%); Europe (16.3%); rest from SE Asia, E Mediterranean, W Pacific	• NVivo software used for themes and perspectives • Themes identified: Buy-in and bonding; social support; time; medical concerns	• Societal acceptance of parental involvement – support from family • Preference to practice KMC at home as they could oversee other responsibilities too • Policy: unlimited visitation	• Mothers unaware of benefits of KMC • Mothers perceived that new-born did not enjoy KMC • Mothers lonely and depressed in KMC ward • Fatigue, pain, discomfort • Traditional customs	rate, so limits the generalisability to other settings
2016b Chan, et al.	Kangaroo mother care: A systematic review of barriers and enablers	• 112 studies mostly published from 2010-15. • Forty studies from WHO region of Americas, 29 from WHO African regions, 64 in countries with low newborn mortality (<15/1000 live births)	• Systematic review • Qualitative data – with primary data collection • Deductive approach • Population: mothers, new-borns, mother-new-born dyads who practiced KMC, HCWs, health facilities, communities, health systems • NVivo qualitative analytical software • Themes identified- buy-in and bonding; social support; time; medical concerns; access; context	• Perception that it was calming, natural, instinctive, healing for parents and the LBW baby • Support from spouse, HCWs, community for mothers • KMC at home allowed mothers to perform other duties • Perceived as cheaper than incubator care • Confidence to care for LBW baby built while providing KMC	• Parents and other family members feelings of shame and being stigmatised or of being forced • Lack of privacy • Mothers feel isolated in KMC ward • Mothers felt pain and tired • Traditional customs-carrying, bathing, and breastfeeding not aligned with KMC guidelines	• May not have captured all data for lack of availability of all project reports and data • Most of the studies from countries with low neonatal rate, thus challenging generalisability

2015 Seidman et al.	Barriers and Enablers of Kangaroo Mother Care Practice: A Systematic Review	• 49 studies from high income countries, 22 from Sub-Saharan Africa, 15 from South Asia, 5 from North Africa / middle East, 5 from Latin America, 3 from Eastern Europe, 2 from East Asia / Southeast Asia/Pacific and 2 from low and middle income countries of different regions	• Systematic review: 103 • Studies were classified as indirect (those that did not aim to study barriers); Exploratory (those that aimed to study barriers); Systematic (those that set out to identify barriers and pre-specified factors; and Prioritised (those that also prioritised barriers)	• Experiential factors such as “feelings of confidence and empowerment”, “ease of practice” • Support from family, friends, and peer mothers • Mother baby attachment • Mothers can understand and enjoy KMC • Involving the grandmother from time of admission • KMC champions – experienced mothers	• Issues with the facility environment / resources • Negative impressions of staff attitudes and interactions with staff • Lack of help with KMC practice • Low awareness of KMC / baby health • Pain / fatigue especially in low- and middle- income countries	• Focused on facility implementation of KMC and not of community • Inconsistency in definition of KMC practice • Most studies included mothers, thus representation of fathers and other family members limited • Difficult to determine which barriers are most critical for implementation of KMC since it involved both quantitative and qualitative analysis as well as some studies did not explicitly address barriers
2015 Gabriels, et al.	Kangaroo care: experience and needs of parents in neonatal intensive care: A systematic review ‘parents’	• 10 Studies done before 2004 that included parents of infants in NICU, focusing on KMC, either qualitative or	• Systematic review along with meta-synthesis • Mothers and fathers of LBW babies	• KMC facilitates feelings of parent role, confidence to care for LBW baby, bonding, or attachment to baby • Support from spouse	• Negative attitudes of nurses • Inadequate knowledge, communication, as well as lack of support from HCWs • Tiredness, pain, anxiety	• All studies done in developed countries within an NICU setting, generalisability is limited.

	experience of kangaroo care	mixed methods • 5 studies from Sweden, 3 from USA, 1 from S. Africa and 1 from Denmark			• High-tech environment of the NICU	
2015 Bajaj, et al.	Knowledge, attitude, and practice of kangaroo mother care in a tertiary care centre: Does knowledge really affect attitude and practice	• KMC centre in a tertiary care teaching hospital, Mumbai	• 59 mothers providing KMC • Pre-structured open-ended questionnaire to interview mothers.	• Education of mothers on KMC along with family members • Support of HCWs for positioning, initiating KMC • Support for KMC practice at home from spouse	•	• Sample size was small, thus generalisability of findings limited
2014 Anderzén-Carlsson, Lamy, Eriksson	Parental experience of providing skin-to-skin care to their new-born infant - Part1: A qualitative systematic review	• 29 qualitative papers from 9 countries – Brazil, Denmark, England, Japan, South Africa, Sweden, Uganda, United States from 1995-2005	• Systematic review with meta-data analysis using nVivo8 • Mothers and fathers from delivery areas or NICUs	• Perceived benefit of how to parent and care for an LBW baby; bonding with the baby; facilitating breastfeeding • Support for KMC from HCWs and family as well as other relatives • Acceptability of health practice of KMC influenced by knowledge and sensation	• Need to care for other children – time constraints • Nuclear families- lack of support/help with household work and KMC • Uncomfortable and emotional burden yet considered it necessary	• Limited number of experiences of fathers • Translation to English of some articles could result in risk of loss of nuances • Experiences of mothers either from delivery area or NICUs • Most included
2014	Parental experiences of providing skin-to-skin	• 29 qualitative papers from 9 countries – Brazil,	• Meta-synthesis: meta-data analysis, analysis of meta-method	• Parents have a good feeling, and “feeling of the role of being a	• Energy draining-feeling exposed and fear of hurting the other	• Fathers’ representation might not be adequate

Anderzén-Carlsson, et al.	care to their new-born infant - Part2: A qualitative meta-synthesis	Denmark, England, Japan, S.Africa, Sweden, Uganda, United States from 1995-2005	and meta-theory through steps such as formulating a research question, selecting, and appraising primary research, meta-data analysis, meta-method, meta-theory, meta-synthesis, dissemination of findings	parent" is affirmed within		• Some studies, data was not complete limiting generalisability
2012 Blanca-Gutirérrez, et al.	The role of fathers in the postpartum period: experiences with skin to skin method	• Spain • Hospital Infanta Margarita-regional hospital, Cabra, Spain	• Qualitative description-based method for content analysis • In-depth interviews with 14 fathers 24-48 years whose spouse had caesarean section	• Support from nursing team to provide SSC • Perception that father was a participant in the care of the new-born • Feelings of satisfaction, pride, happiness, SSC being an extension of what the fathers' felt during pregnancy by fathers • Space for practice of SSC	• Baby being sick • Fathers being initially nervous, tense, frightened of this stage-being a father of a "small baby"	• Generalisability possible only to cultures and social contexts like that of this study

2009 Obeidat, Bond, & Callister	Parental experiences of having a baby in the newborn intensive care unit	• Review of 14 qualitative studies between 1998-2005 written in English conducted with mostly White middle-class families	• Systematic review of qualitative studies • Mothers, fathers, and nurses	• Parents involved in caregiving moved from passive and exclusion role to an engaged participatory parenting role • Parents felt safer, more confident, familiar, and connected with babies	• Separation of parents from babies either due to preterm birth or since the baby required extra care could have negative impact on the wellbeing of mothers, leading to alienation and lack of confidence in caring for their small babies	• Limited generalisability
2008 Erlandsson, Christensson, Fagerberg	Father's lived experiences of getting to know their baby while acting as primary caregivers immediately following birth	Two maternity clinics in Sweden where father involvement in care of baby is routine	• Phenomenological design 17 fathers included in the study	• Feelings of ambiguity and fear changing to confidence within themselves to care for the baby • Support from HCWs especially when mother cannot be available due to health issues	-	-

This synopsis of facilitators and barriers presented in Tables 2-3, highlighted the complexity of KMC implementation and the need for coordinated engagement among various stakeholders such as health officials, health facility managers, HCWs, CHWs, parents and the community at large for improving KMC uptake along the health facility-community continuum to reach its highest potential (Chan, et al., 2016b). Table 4 provides key themes inductively identified as barriers to KMC implementation through the perusal of systematic reviews cited previously.

Table 4: Themes identified as barriers to KMC uptake

Themes	**Reviewed Studies**							**Possible determinants for KMC Practice**
	A	**B**	**C**	**D**	**E**	**F**	**G**	
Health facility environment and resources	✓	✓	✓	✓	✓	✓		Health facility preparedness
Social support / lack of help with KMC practice	✓	✓	✓	✓	✓	✓	✓	
Staff attitude and interactions	✓		✓	✓				HCWs preparedness (knowledge, attitude and skills) for KMC implementation
Training and cultural norms						✓	✓	
Sufficient time to perform KMC					✓	✓	✓	
Medical concerns					✓	✓	✓	
Buy-in and bonding	✓		✓			✓	✓	Mother's and family members preparedness for KMC uptake
Low awareness of KMC/infant health				✓				
Family acceptance	✓		✓		✓			

A: Anderzén-Carlsson, et al., 2014; B: Anderzén-Carlsson, Lamy, Eriksson, 2014; C: Gabriels, et al., 2015; D: Seidman et al., 2015; E: Chan, et al., 2016b; F: Chan, et al., 2017; G: Smith, et al., 2017

The themes listed in Table 4 were relevant to KMC implementation either in the health facility or the community alone. In the context of the PhD study's objectives, the barriers to and facilitators for improving KMC uptake along the health facility-community continuum were then synthesised contextually by the investigator (Table 5).

Table 5: Synthesis of barriers and integration of facilitators- KMC uptake along the health facility-community continuum

Themes	Stakeholders and key barriers	Integration of facilitators
Health system preparedness for KMC implementation	**Health officials**: Lack of operational guidelines, lack of budget allocation for KMC implementation, or amenities – dedicated space within health facilities to support KMC (Bergh, et al., 2016; Chan et al, 2016b; Chan, et al., 2017; Foote & Tamburlini, 2017).	- Interpret and facilitate understanding of KMC operational guidelines to health officials. - Facilitate use of funds for infrastructural changes in health facilities.
	Health managers: Routine mother-baby separation shortly after birth rather than close and virtually continuous maternal-baby SSC (Chan, et al., 2017).	- Ensure a policy of no-separation at birth for stable babies. - Build competence of HCWs at the birthplace so that they acknowledge the importance of the physical mother-infant connection through practice of SSC at birth till initiation of first breastfeed (Chan, et al., 2017; Moore, et al., 2016).
	Healthcare workforce shortage and workload (Bergh, et al., 2008; Chan, et al., 2016b); Fear of infections for newborn baby (Yue, et al., 2020).	- Schedule plans to build capacity of and support HCWs, with the aim for them to internalise the benefits of implementing KMC and thus for themselves (Chan, et al., 2016b).
Support mechanisms to enhance preparedness of HCWs and CHWs for KMC implementation	**The implementers - HCWs and CHWs:** Lack of knowledge or experience, misconceptions, and negative attitudes of HCWs or CHWs could be barriers to supporting mothers and family members for KMC uptake	- Support HCWs and CHWs through skill-based training, onsite mentoring, supportive supervision, and tools to overcome these possible barriers (Avery, et al., 2017; Chan, et al.,

	(Chan, et al., 2017; Smith, et al., 2017). A need to coordinate existing community and health facility approaches to improve maternal and neonatal care.	2017; Jayanna, et al., 2016; Mamta & Batra, 2014; Smith et al., 2017). - Strengthen the linkage between HCWs and CHWs with the mothers, fathers, and family members (Mathias, Mianda, Ginindaz, 2020; Seidman, et al., 2015; Smith, et al., 2017).
Support mechanisms to enhance preparedness of mothers and community at large for KMC practice	**CHWs**, **the community, mothers, fathers, and family members with LBW babies:** Cultural practices without appreciation for privacy for the mother practicing KMC; constant flow of visitors, visitors wanting to hold the baby in the health facility (Chan, et al., 2017; Ferrarello, & Hatfield, 2014a). Traditional practices of early bathing and wrapping the neonate after birth were deep-seated behaviours in many cultures. In some places, carrying the baby on the back was common, it seemed strange to place the baby in the front (Chan et al., 2016b). Strongly ingrained cultural practices with the mother such as dietary restrictions following childbirth, body heat of mother ("Kaavu") being considered harmful for the baby, or the	- Sensitize the community on the need for KMC and increase awareness of mothers and family members on KMC during antenatal period. Practice of KMC in the community was based on the motivation for improved health and survival of the LBW baby; beliefs on KMC; value attributed to KMC (Ahmed, et al., 2011; Sloan, et al., 2008; Smith, et al., 2017). - Support and prepare mothers and family members including the general community (Anderzén-Carlsson, Lamy, Eriksson 2014a; Chan, et al., 2017) through behaviour change principles for KMC practice. This can be established through education, counselling, and assistance on how to maintain the position of the baby for KMC; the advantages of positioning the baby in front (they could observe the baby directly); benefits of rooming-in with the mother; on

	baby being placed away from the mother in a hammock (jhula) made with cloth that is suspended from the roof (based on field visit observations from the WHO project).	exclusive breastfeeding (Anderzén-Carlsson, Lamy, Eriksson 2014; Anderzén-Carlsson, et al, 2014; Chan, et al., 2016b; Blanca-Gutirérrez, et al., 2012; Gabriels, et al., 2015; Jamali, et al., 2019; Obeidat, Bond, & Callister, 2009; Seidman, et al., 2015; Smith, et al., 2017)
	Mothers and family members: Grief and loss related to early or abrupt termination of pregnancy, uncertainty of the baby's prognosis and fear to touch the fragile LBW baby could dominate over their desire to bond with the baby. Reduced internalisation and confidence of mother in practice of KMC due to early discharge from the health facility Fatigue experienced while practicing KMC and expressing breastmilk; lack of family support, poor health, sleep deprivation (Chan, et al., 2016; Seidman, et al., 2015).	- Counsel and support mothers soon after birth of an LBW baby to initiate and continue the practice of KMC (Anderzén-Carlsson, Lamy, Eriksson, 2014; Obeidat, Bond & Callister, 2009). - Encourage family members to come forward as foster KMC (fKMC) providers at the health facility itself. - Support for mothers at the birthplace by HCWs and fKMC providers and at home by CHWs and family members to initiate and maintain KMC till required (Chan, et al., 2016b; Seidman, et al., 2015).

This evidence-synthesis thus demonstrated the gaps in KMC uptake, along the health facility-community continuum. To reach the targets set by the MoHFW of 75% coverage of all LBW babies with KMC by 2025 and 90% coverage by 2030, it would be critical that all stable, "small" babies, irrespective of their birthplace be initiated on KMC as early as

possible and this is continued at home for as long as required. This essentially necessitates optimisation of those crucial facilitators for KMC practice with simultaneous reduction of the barriers to augment KMC practice along the health facility-community continuum. In this bid, a conceptual framework was developed for the PhD study that weaved the critical facilitators for KMC practice and is described in Section 3.6.

3.6. Conceptual framework - KMC uptake along the health facility-community continuum

A conceptual framework shows linkages or causal relationships that seek to explain the occurrence or non-occurrence of a desired event (Polit &Beck, 2010; Dickson, Hussein & Agyem, 2018). Such a framework within the context of this PhD study was important because it would inform understanding of the problem, specifically, low KMC practice in the health facility and its continuation at home till required. According to the social psychologist, Harry Triandis (Figure 5), behaviour in any situation was a function of (a) intention; (b) habitual responses; and (c) situational constraints and conditions or facilities (Papamikrouli, 2008). In this PhD study, the targeted "behaviour" was "KMC practice" along the health facility-community continuum. Triandis' integrated model of interpersonal behaviour argued that behaviour was neither fully automatic nor fully deliberate. An individual's intention, according to Triandis, could be influenced by social factors (norms, roles, and self-concept); affective factors; and rational deliberations. The conceptual framework for this study was thus developed based on literature reviewed on the facilitators for KMC implementation and the Triandis model (Facione, 1993; Papamikrouli, 2008), with the intention to guide and explain occurrence or non-occurrence of KMC practice along the health facility-community continuum.

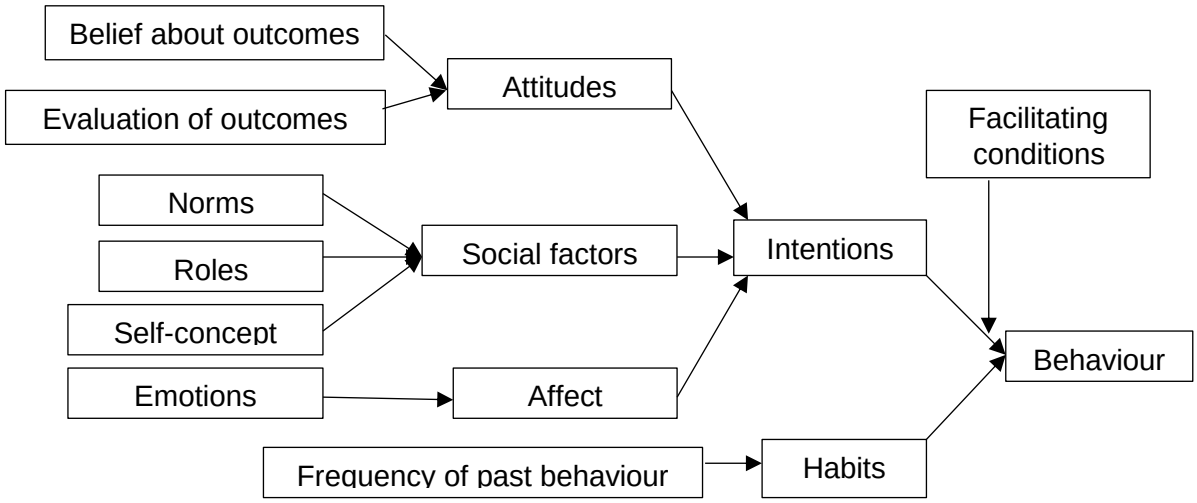


Figure 5: The Triandis' model of interpersonal behaviour (source: Facione, 1993)

Social factors included norms – “self-instructions to do what is perceived to be correct and appropriate by members of a culture in certain situations”; roles – sets of behaviours considered right based on an individual’s position in a group, society, or social system; and self-concept – the ideas that a person has of oneself, and the goals set for oneself within this social system. Another key concept of Triandis was that of social factors such as values or tendencies to prefer certain states over others; these factors are also known to influence the intention to behave in certain ways. In this study, it was assumed that KMC occurred in a social system of the health facility-community continuum (place of birth till required when the mother and LBW baby dyad went home). The key stakeholders in this system included implementers such as HCWs and CHWs; users such as mothers, family members or significant individuals. Evidence showed that practice of KMC in the health facility was based on experience and belief that KMC worked (Chan, et al., 2016b) and in the community it was based on the motivation for improved health and survival of the LBW baby; beliefs on KMC; and value attributed to KMC (Ahmed, et al., 2011; Sloan, et al., 2008; Smith, et al., 2017). Evidence also showed with improved competence of HCWs and CHWs on KMC implementation through supportive supervisors (in this instance, managers of the health facility or supervisors in the community), would enhance their ability to facilitate KMC practice as a norm. The experience thus gained could also be motivation for internalizing its value (Chan, et al., 2016b & 2017; Namnabati et al., 2016; Seidman, et al., 2015; Smith, et al., 2017; Soni, et al., 2016;). It is thus proposed that if mothers and family members were supported and sensitized to the need for KMC (Chan, et al., 2016b; Seidman, et al., 2015) they would also take on the role of providing KMC for the ~~LBW~~ small baby, while they internalized the benefits of this practice.

KMC was also known to enhance the parenting roles, self-esteem, and self-confidence of mothers (Anderzén-Carlsson, Lamy, Eriksson, 2014; Bajaj, et al., 2015; Chan, et al., 2016b; Erlandsson, Christensson, Fagerberg, 2008; Gabriels, et al., 2015; Obeidat, Bond & Callister, 2009; Seidman, et al., 2015; Smith, et al., 2017). This would facilitate the mother and the fKMC provider in continuing KMC for as long as possible, as they valued the experienced benefits for themselves and their babies.

Affective factors have an unconscious influence on decision-making and thus intention. Positive feelings would increase the intention towards a given behaviour, while negative feelings would decrease the intention. For example, in the context of this study, SSC and exclusive breastfeeding, two prime components of KMC, was required to be initiated soon after birth, provided the baby was stable. Following childbirth, if the baby

was placed in SSC with the mother, the baby would demonstrate this innate behaviour typically governed by the heightened response to odour cues in the first few hours after birth (Widström, et al., 2011), by moving towards the breast and locating the nipple. This newborn behavior was shown to facilitate the establishment of breastfeeding and the maintenance of exclusive breastfeeding for at least – 6 months (Moore, et al., 2011). The newborn behavior could be accomplished by smell and using specific behaviours such as birth cry, relaxation, awakening and opening the eyes, a resting phase, crawling towards the nipple, touching, and licking the nipple, sucking at the breast, and finally falling asleep (Moore, et al., 2011; Widström, et al., 2011). Neonates if separated from the mother at birth, are known to experience negative feelings – typically demonstrated by protest-despair behaviour and crying (Moore, et al., 2011). SSC at birth with the mother, could support the mother and neonate to develop a synchronous reciprocal interaction pattern. SSC was also known to be a strong vagal stimulant, resulting in oxytocin release, that antagonizes the flight-fight effect, thus decreasing maternal anxiety, increasing calmness and social responsiveness; enhancing parenting behaviours soon after birth (Moore, et al., 2011), hence increasing attachment to the baby. In addition, SSC could result in maternal feelings of a sense of mastery and self-confidence. Thus, if HCWs' competence were built in understanding this phenomenon, they could aid in the process of SSC and support early breastfeeding by avoiding maternal-newborn separation in the first hour of birth, two essential components of KMC.

According to Triandis, behaviours have objective consequences (that occurred in the real world) but also subjectively interpreted consequences that are based on the individual's thoughts, ideas, and beliefs. In the context of this study, it was assumed that as mothers were counselled on KMC, assisted to practice it, and experienced the benefits of KMC such as weight gain, ease in breastfeeding, and better health of the baby, without being biased by unrealistic thoughts and beliefs, they were likely to reinforce the practice of KMC. In addition, the act of holding the baby in SSC is expected to generate emotions of nurturing, love, security, comfort, in the mother (Chan, et al., 2016b; Seidman, et al., 2015; Smith, et al., 2017) all of which enhance breastfeeding success. Triandis defined habits as "situation-behaviour sequences that were or had become automatic so that they occurred without self-instruction" (Facione, 1993; Ditsa, 2013, n.p.). Habits are created from past experiences and could have a powerful influence on an individual's intentions and behaviour. For KMC practice to become a habit, it is essential for the environment of the social system (health facility-community continuum) in which HCWs and CHWs function is conducive for KMC practice, both

from their perspective and that of the users - the mothers. Thus, this conducive environment could be instituted through policies and infrastructural changes such as ensuring a safe place with privacy for the mother to practice KMC; amenities for a comfortable stay in the health facility till she is confident to practice KMC. These could include amenities such as appropriate hospital beds, and facilities to meet their hygiene and gastronomic needs. Additional factors cited in literature is having support mechanisms in place for HCWs and CHWs through mentoring and supportive supervision to ensure that KMC becomes a norm for the essential care of LBW babies (Chan, et al., 2016b). Similarly, support mechanisms for mothers along the health facility-community continuum would be crucial to enhance their awareness, promote positive attitudes and assistance through HCWs and CHWs and family members inclusive of the community at large (Anderzén-Carlsson, Lamy, Eriksson 2014a; Chan, et al., 2017) could probably enhance KMC practice.

Thus, in the PhD study, preparedness of health facilities; support mechanisms to improve awareness on KMC, attitudes and skills of HCWs that were enlisted as key enablers for KMC implementation (Chan, et al., 2016b; Seidman, et al., 2015;); and support mechanisms to improve the knowledge, attitudes and facilitate KMC practice by mothers (Chan et al., 2016b; Seidman et al., 2015;) along the health facility-community continuum -the social system (Figure 6) were considered essential for KMC uptake along the continuum.

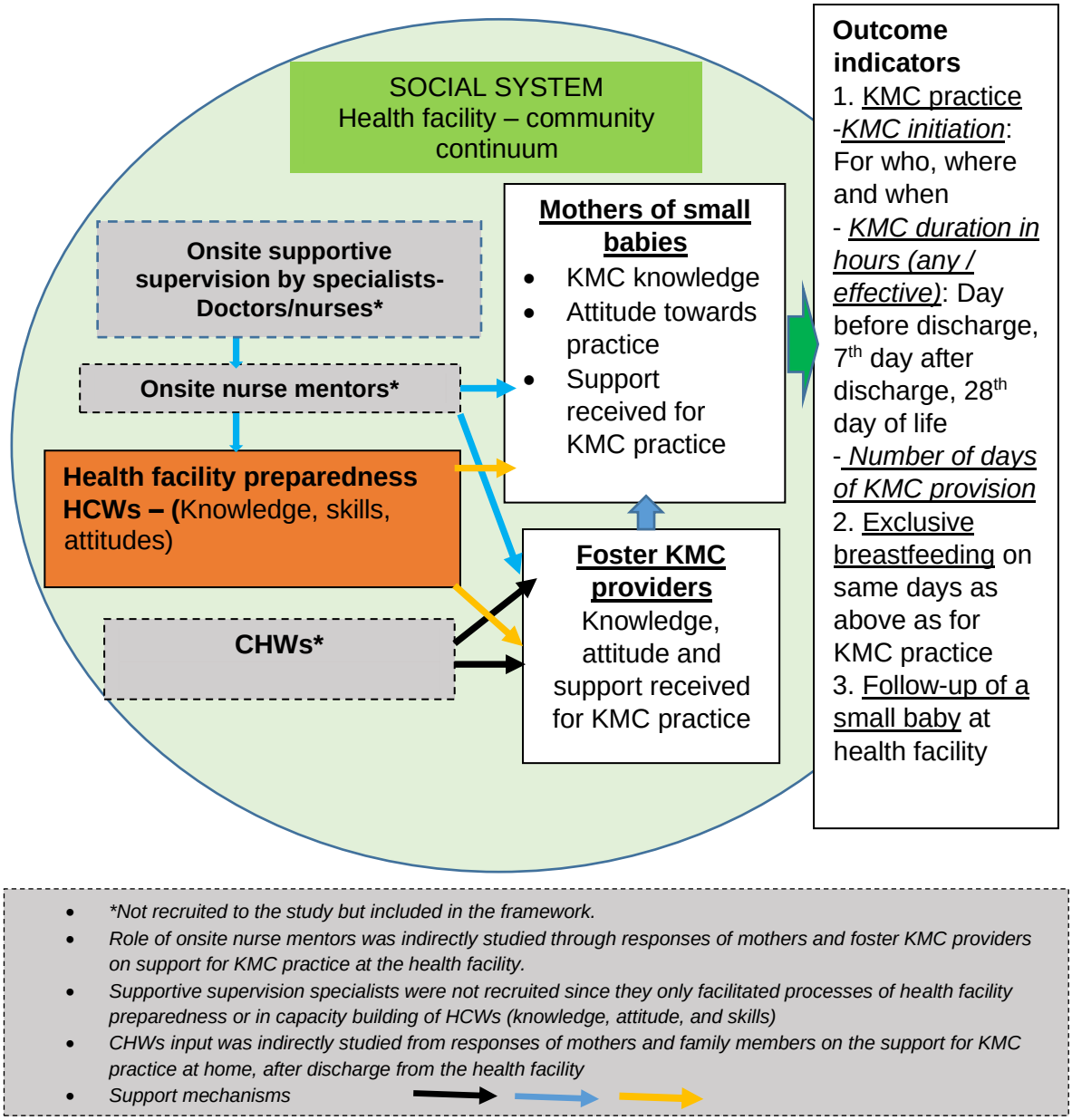


Figure 6: Conceptual framework for KMC uptake along the health facility-community continuum

This conceptual framework proposed guided the research methods (Polit & Beck, 2010) for the PhD study, which is detailed in Chapter 4, in terms of the

- Population and sampling units: Health facilities, HCWs, mothers and fKMC providers; including small babies.
- Data required – Health facility preparedness, HCWs' competencies (Knowledge + attitude + skills), mothers' and fKMC providers' knowledge, attitude and support received to practice KMC, and the characteristics of babies.
- Primary Outcome - KMC practice.

CHAPTER 4. METHODOLOGY AND METHODS

This chapter describes the research methodology used for the PhD study, based on reporting guidelines for operational research (Hales, et al., 2016). The chapter has nine sections covering all elements of the research design, including data management and ethical considerations.

4.1. Research design

The PhD study was nested within the district-wide WHO project titled "Implementation Research in India (Karnataka state) towards Accelerating Scale-up of Kangaroo Mother Care (KMC)" (TSA No: 201523195; WHO Ref No: 2016/633745-0; Appendix B-Registration at Clinical Trials Registry of India). The PhD study focused indirectly on specific operations or strategies implemented by the WHO project to increase the uptake of KMC and was confined to the sub-district of Gangawati, in Koppal district.

The research design for the PhD study was operational research using quantitative methods. Operational research primarily uses existing resources, such as data collected routinely towards monitoring public health initiatives. For example, as in this case – the number of small babies in Gangawati sub-district, the number eligible for KMC and initiated on KMC, finally the progress made with KMC implementation at health facilities. Operational research also focuses on developing solutions to problems identified towards the implementation of a specific health programme or service delivery component within the healthcare system (Bradley, et al., 2017). It thus uses a problem-solving approach to implement complex interventions with moderate costs, but with significant potential for magnifier effects involving multiple stakeholders (Hales, et al., 2016). The rationale for the use of operational research, known to be demand-driven and primarily used but not exclusively within healthcare contexts (Bradley, et al., 2017; Priyan, 2017; Remme, et al. 2010) is presented below.

4.1.1. ***Rationale for operational research***

Healthcare systems in Low and Middle-Income Countries (LMICs), have had to contend with resource-constraints across several vital areas including workforce, finance, leadership, and governance (Remme, et al., 2010; Moxon, et al., 2015). These resource-constraints are known to negatively impact services, and the effective implementation of evidence-based interventions at scale (Remme, et al., 2010; Moxon, et al., 2015). Health systems research emerged when several research initiatives were conducted in LMICs since 2004. Research to improve healthcare systems comprises operational,

implementation, and health systems research (Bradley, et al., 2017; Hales, et al., 2016; Remme, et al., 2010). Health systems research has a wider focus on the population to improve the functioning of the healthcare system or one of healthcare systems building blocks (Moxon, et al., 2015; Remme, et al., 2010). The focus, the users, and the utility of the research outputs of health systems, implementation, and operational research are given in Figure 7 (Remme, et al., 2010).

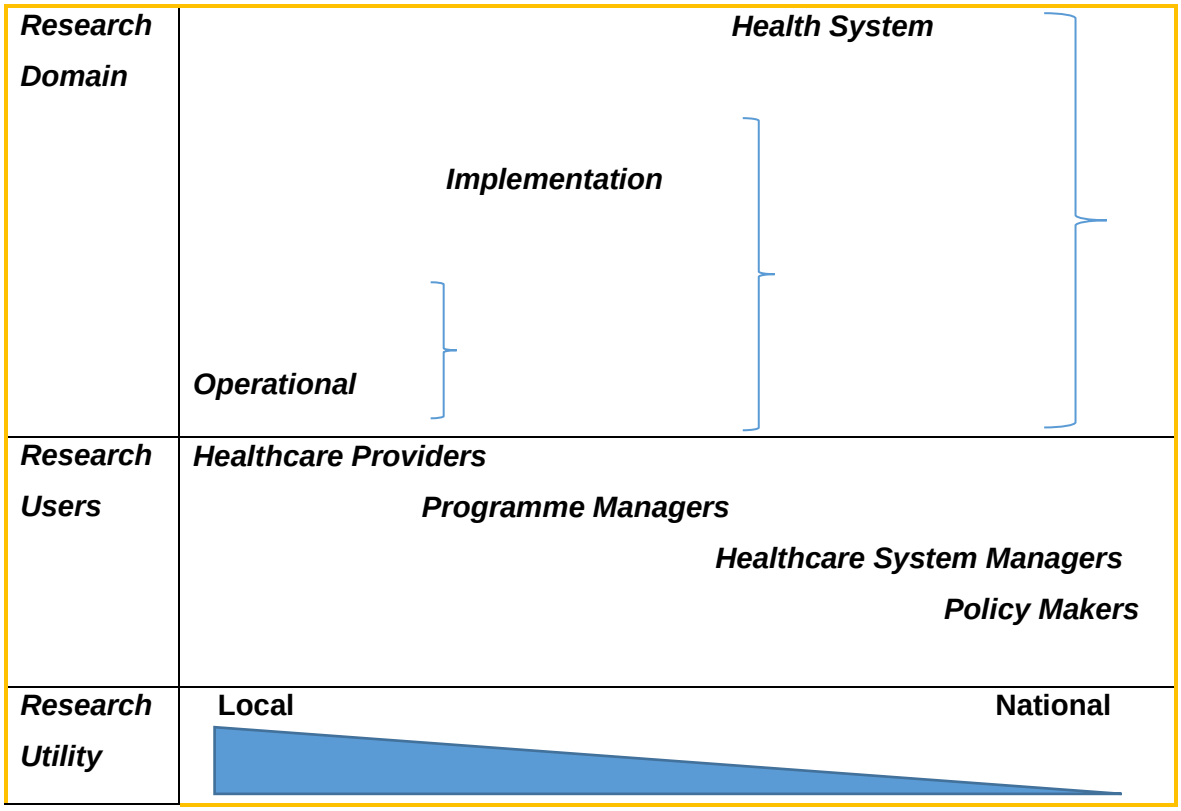


Figure 7: Scope - Operational, implementation & health systems research (Source: Remme, et al., 2010)

A key difference of these research designs (Figure 7) is that outputs of health systems research is of use to policy makers for policy development. While implementation research is predominantly of use to managers in charge of scaling-up of programmes or evidence-based interventions. Operational research on the other hand is of use to Health Care Workers (HCWs) and managers (Bradley, et al., 2017; Remme, et al., 2010). Operational research is increasingly identified as an approach to address problems within the context in which they occur. Each LMIC's healthcare system has its unique challenges in operations, design, planning, and control that are context specific. Therefore, the outputs from operational research become more transferable to specific local contexts, rather than the wider general context. Hence, if outputs from operational research were to be extrapolated to other contexts, adaptation of outputs to the local context might be necessitated (Bradley, et al., 2017; Remme, et al., 2010).

KMC scalability is projected as a game-changer, to reduce neonatal mortality (Lawn, et al., 2016). Two national initiatives in cognisance of this fact included:

- Endorsement of KMC through the publication of guidelines on KMC implementation, in health facilities by the Government of India (MoHFW, 2014a)
- The targets set by the INAP, to achieve 50% coverage of eligible LBW babies with KMC, by 2020, 75% by 2025, 90% by 2030 (MoHFW & INAP, 2014).

Despite this, KMC coverage in India is a long way from reaching a fraction of eligible neonates. Systematic reviews conducted between 2015 and 2017 on facilitators and barriers for KMC implementation (Seidman et al., 2015; Chan et al., 2016b & 2017; Smith, et al., 2017), identified specific focus areas, to ensure the scaling-up of KMC within the healthcare system, health facility, and community. Thus, capacity building strategies (Appendix C) of the WHO project were identified as focus areas and studied indirectly for the PhD study through assessment of health facility preparedness, competence of HCWs for KMC implementation, both of which were listed as facilitators from literature reviewed for KMC implementation in health facilities (Chan, et al., 2016b; Chan, et al., 2017; Seidman, et al., 2015; Vesel, et al., 2015). At a global meeting in Geneva in 2008, operational research was defined as follows within the context of public health:

> "*Any research producing practically usable knowledge (evidence, findings, information, etc.) which can improve program implementation (e.g., effectiveness, efficiency, quality, access, and scale-up, sustainability) regardless of the type of research (design, methodology, approach) falls within the boundaries of operations research"* (Malhotra & Zodpey, 2010, p146).

Other designs like implementation research, RCTs did not befit the purpose of this PhD study for reasons given below:

- Firstly, the WHO project used implementation research to arrive at a model for the scale-up of KMC. Its target group was the Child Health program managers. Implementation research was justified, given the strong evidence base on KMC and the capacity building strategies (Appendix C) adopted by the WHO project for scale-up of KMC.
- Secondly an RCT was not considered for the PhD study, since the research question in this instance, was not directed towards establishing the efficacy and effectiveness of KMC that was already established through several RCTs (Ahmed, et al., 2011; Bera, et al., 2014; Cattaneo, et al., 1998b; Charpak, et al., 2001; Doddabasappa, et al., 2018; Mazumder, et al., 2019; Rao, et al., 2008; Sloan, et al., 2008). The research question, however, was directed towards the requirements to operationalise KMC by healthcare providers, both HCWs at the health facility and

Community Health Workers (CHWs) at the community level for its uptake along the health facility-community continuum through an observational study.

Operational research involves identifying problems in the execution of routine care activities within a system, for which practically useful answers or solutions are urgently needed to allow operations to proceed more effectively (Lyeme & Seleman, 2012; Remme, 2010). The problem in this case was the low uptake of KMC. Thus, operational research was adopted to identify factors that would increase uptake of KMC practice by mothers and family members, along the health facility-community continuum of care. Both health facility preparedness and KMC competence of HCWs were operational issues that could be modified to context. Additionally, preparedness (KMC knowledge and attitudes) of mothers and foster KMC (fKMC) providers, as well as KMC specific support for them within this continuum were considered as key towards KMC practice. Hence operational research was the design of choice since the PhD study was concerned with identifying what and how the uptake of KMC practice could be improved and sustained (Malhotra & Zodpey, 2010) along the health facility-community continuum with the following study hypotheses.

4.1.2. ***Research questions and hypotheses***

A research question identifies the concepts or variables under investigation and asks how these may be related (Bouchrika, 2012; Farrugia, et al., 2010; Polit & Beck, 2010). The research questions that were stated in section 1.2.3 of Chapter 1 are given below:

- *How equipped and ready were the different levels of the public and private health facilities, the HCWs and CHWs along this health facility-community continuum (any place of childbirth till 6-8 weeks of life of the small baby) for KMC implementation?"*
- *"Where will KMC be initiated for small babies in the sub-district?"*
- *"How soon after birth will KMC be initiated for a small baby in the sub-district?"*
- *"What would facilitate early initiation of KMC in small babies?"*
- *"What would facilitate KMC duration of >8 hours per day or effective KMC for small babies along the health facility-community continuum?"*
- *"How were mothers and family members prepared for KMC practice?"*
- *"How did support for the mother at the health facility and at home impact KMC practice?"*

A hypothesis is a statement that predicts or determines a relationship between two or more variables (Farrugia, et al., 2010; Polit & Beck, 2010). The hypotheses that were developed for this PhD study was based on its objectives (Chapter 1, Section 1.4).

The hypotheses (H1-H4) tested in this study were:

H1: Health facility preparedness will be associated with early initiation and duration of KMC.

H2: HCWs who are competent in knowledge, attitude, and skills related to KMC are likely to impact the uptake of KMC by mothers.

- H2.1: Knowledge of HCWs will be associated with early KMC initiation, duration of KMC.
- H2.2: There will be an association between attitude of HCWs related to KMC with early initiation, duration of KMC.
- H2.3: KMC related skills of HCWs will be significantly related to early initiation and duration of KMC.

H3: Mothers who are supported by HCWs at the health facility, and at home by family members and the CHWs, are more likely to practise KMC for a longer duration and exclusively breastfeed their babies.

- H3.1: Support for KMC initiation at the health facility will be related to early initiation and duration of KMC.
- H3.2: Support for KMC maintenance at the health facility will be related to early initiation and duration of KMC.
- H3.3: Support for KMC maintenance at home will be significantly related to early initiation and duration of KMC.

H4: Health status at birth of a small baby will determine the early initiation and duration of KMC.

Operational research addresses a local problem, while considering the context in which it occurs. Section 4.2 describes the local context of the study setting.

4.2. The study setting

The southern state of Karnataka, with 30 districts, one of which was Koppal, had an estimated population of 1.53 million in 2017 (Population in 2011 Census: 1.39 million https://www.census2011.co.in/census/district/261-koppal.html). Situated in northern Karnataka, approximately 350 kilometres from Bengaluru, where St John's Research Institute is located, Koppal district has an 18% urbanisation rate and is divided into four sub-districts (Figure 8) or *taluks* (as known in India) namely Koppal, Gangawati, Kushtagi, and Yalburgi.

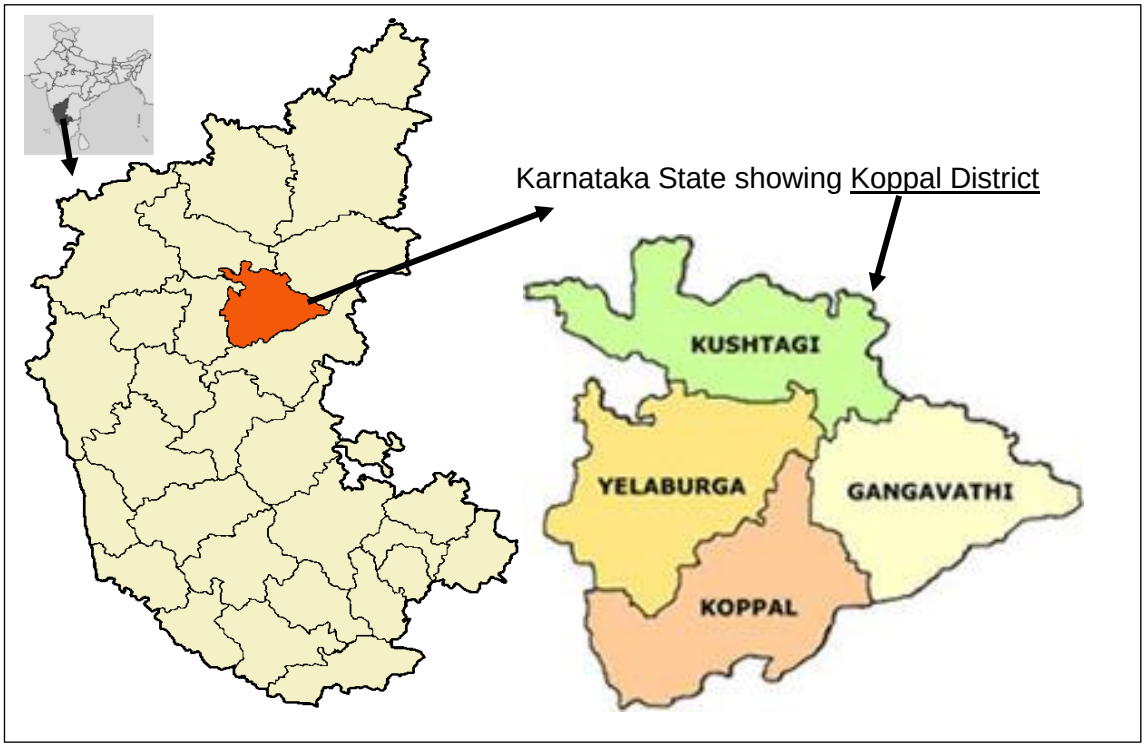


Figure 8: Map of Koppal district and sub-districts within Karnataka and India (source: https://commons.wikimedia.org/wiki/File:Karnataka-districts-Koppal.png)

The infant and neonatal mortality rate (NMR) were 28/1000 and 22/1000 live births, respectively (Office of Registrar General India, 2015) in Karnataka state. The WHO project was conducted in the Koppal district known to have LBW prevalence of about 25% and NMR of 42/1000 live births and identified as a high priority district by the government. It is an under-served region in northern Karnataka, with about 80% of childbirths being institutional. These facts justified the choice of this district by the State health officials for the WHO project.

The Koppal district has a three-tier public healthcare delivery system (Choksi et al., 2016) like the rest of India (Table A.1, Appendix A). This includes:

- Primary level: with 31 sub-centres, 46 Primary Health Centres (PHCs), and nine Community Health Centres (CHCs)
- Secondary level: includes one Sub-district Hospital (SDH) and a district hospital. The district hospital has a medical college managed by the government of Karnataka since 2015 with plans to upgrade to a tertiary level health facility in the future.
- Tertiary level: This currently is not present in the Koppal district.

In the private healthcare sector, there are 21 maternity homes and 10 neonatal care units (Level I or Level II) in Koppal district (Table A.1, Appendix A). The private health facilities are concentrated in two sub-districts namely, Koppal and Gangawati.

The Gangawati sub-district was the setting for the PhD study. Situated 52 kilometres east of district headquarters – Koppal, it comprises of 145 villages. The number of health facilities excluding subcentres in the sub-district is as follows:

- Public health facilities
    - Primary health facilities - Three CHCs and 11 PHCs
    - Secondary health facilities - One SDH
- Private health facilities
    - Maternity homes with obstetric services – 12
    - Level I or II neonatal care units – 6

4.3. Population and sampling plan

The population in a research study is defined as "all the individuals or objects with common defining characteristics" (Polit & Beck, 2010, p75). It is important to know the characteristics of the study population to include optimal numbers that would facilitate generalisation of results of the study to the entire population (Banerjee & Chaudhury, 2010; LoBiondo-Wood & Haber, 2017). The population identified for this study is given below:

4.3.1. Population:

The population in this study consisted of all:

- Public and private health facilities with capabilities for providing ENC,
- HCWs from these health facilities,
- Small babies,
- Mothers and fKMC providers of small babies.

The sampling plan specifies in advance how the sample or sampling units, a subset of the population, will be selected for a given study (Polit & Beck, 2010). Being a quantitative study, it was vital to assess the adequacy of the sample size as well as its representativeness of the population.

4.3.2. Sampling plan

4.3.2.1. Sampling method:

Purposive sampling was used for the selection of health facilities. Purposive or judgemental sampling is known to be a nonprobability sampling technique that relied on the judgement of the investigator to select the sampling units from the targeted population (e.g., Health

facilities), with a chance of increasing generalisability (Banerjee & Chaudhury, 2010; Polit & Beck, 2010; Taherdoost, 2016). The health facilities were thus selected purposively so that they represented both public and private health facilities from where 80% of the small babies could be accessed in the sub-district.

Consecutive non-probability sampling was used for the selection of small babies. This meant recruiting all small babies, defined for this study as birth weight < 2000 gms irrespective of gestational age from the available population who met the criteria for selection over a specific time interval or for a specified sample size (Figure 9). This method is the best possible choice when there is "rolling enrolment" into an accessible population (Polit & Beck, 2010, p.311-312). Mothers and family members were automatically selected if their small babies fulfilled inclusion criteria (Table 6).

4.3.2.2. Sample size

Data collected from a sample, improves feasibility, and reduces cost of data collection, but it is important to ensure the sample is representative of the population. This can be achieved by choosing an appropriate sampling method and by the calculation of an adequate sample size. The sample size adequacy is important for any study to obtain scientifically valid results (Polit & Beck, 2010; Vishwakarma, 2016). The sample size for the PhD study is described below and given in Figure 9.

- *Health facilities* (n=8) were based on the number that could provide access to 80% of small babies and represented both public and private health facilities.
- *HCWs* (n=79) all those who were available from the selected health facilities based on the assumption that they would represent the HCWs of the Gangawati sub-district.
- *Small babies* (n=210) sample size was computed based on the following:
    - KMC practice in the Koppal sub-district had improved from <2 to 5 percent within 3 months (August-October 2016) of the WHO project implementation.
    - Based on the evidence of barriers from the literature review, and findings of a previous study that showed a sustained increase in knowledge and skills of nurses over a year on neonatal care, through on-site mentoring and specialist supportive supervision visits (Jayanna, et al., 2016; Washington, et al., 2016), predictions were made that effective KMC (provision of 8 hours of KMC per day along with exclusive breastfeeds) was likely to improve to at least 40% at the end of a year.
    - Thus, to estimate 40% uptake of effective KMC by the end of a year, with a relative precision of 15% and 95% confidence interval (CI), a sample size of 175 small babies was required. After accounting for 20% attrition, the revised sample size was fixed at 210 small babies.

- *Mothers of small babies:* All mothers of selected small babies.
- *fKMC providers*: All fKMC providers of selected small babies.

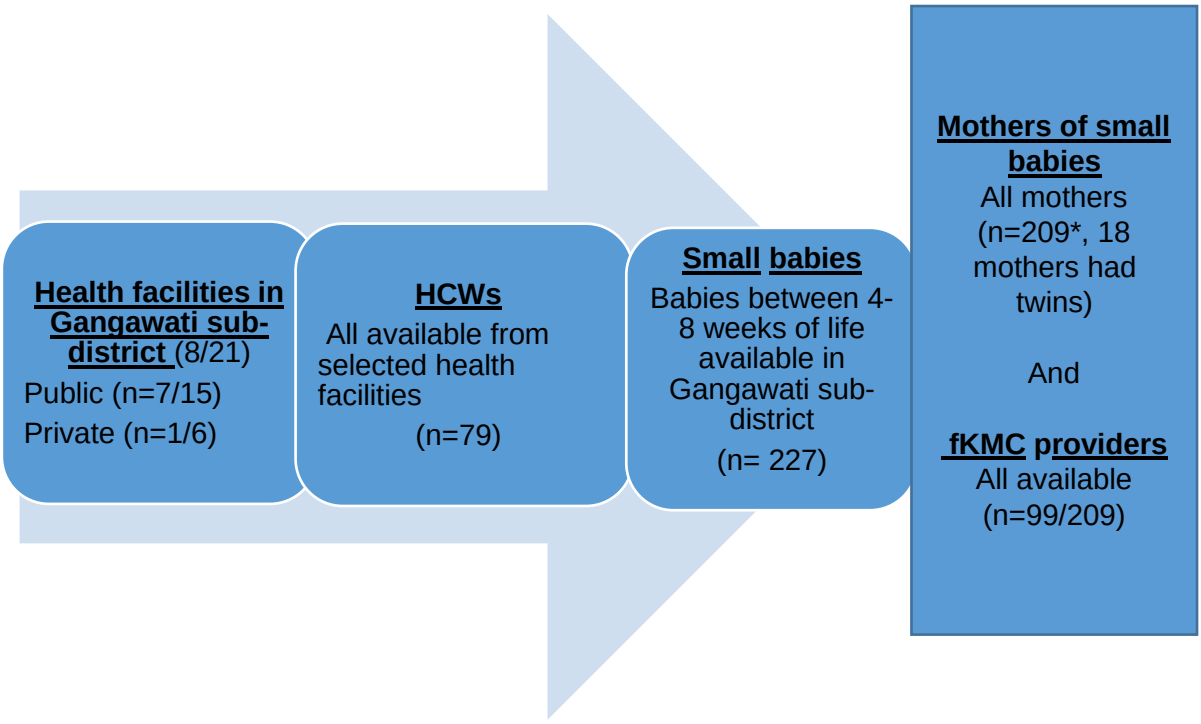


Figure 9: Number of sampling units recruited to the PhD study

4.3.2.3. Criteria for selection of sampling units

Table 6 provides the inclusion criteria for the selection of sampling units. The sampling units included health facilities, HCWs, mothers, and fKMC providers with their small babies.

Table 6: Criteria for selection of sampling units

Sampling unit	Inclusion criteria for selection
Health facilities	**Inclusion criteria:** Health facilities (public and private) from where at least 80% of ~~LBWs~~ small babies could be accessed to ensure attainment of the required sample size (Table D.1, Annexure D).
All HCWs from selected health facilities	All doctors, nurses, counsellors, and health assistants from the selected health facilities (Table D.2, Appendix D), in the Gangawati sub-district. **Inclusion criteria:** HCWs who: - Worked in the neonatal unit, postnatal ward, labour room or KMC ward in all the selected health facilities, - Provided Informed Consent (Annexure E).

Small babies	Small babies were chosen from a list of all those born in the district Koppal between December 2017 and September 2018 (taken from the WHO project database). **Inclusion criteria:** Small babies who: - Had birth weight < 2000 gms, - Were born in the Koppal district in any health facility or at home, - Had survived 4-8 weeks of life, irrespective of health status at birth [categorised as "well" (medically stable) or "sick" (requiring active or intensive therapy for health problems) as documented in the KMC case record by HCWs]. - Lived with their mothers in the Gangawati sub-district during this period. Babies who did not survive 4 weeks of life were excluded since determinants of KMC practice from initiation to 4-6 weeks of life along health facility-continuum was the focus of this study.
Mothers with small babies	**Inclusion criteria:** Mothers of small babies as above who: - Did not have any serious medical illness, postpartum depression, - Provided Informed Consent (Annexure E).
Foster KMC (fKMC) providers	**Inclusion criteria for selection:** The fKMC provider of small babies were identified by the mother as someone who assisted her with providing KMC. If there were >1 fKMC provider in a family, the male fKMC provider was preferentially selected with the mother's consent, to increase male representation in this study.

The next step in operational research is to specify methods to measure variables. It was important to first understand the conceptual definition of the variables, then operationalise them, and finally select the methods to measure these variables.

4.4. Variables, operational definitions, and data collection tools

4.4.1. Variables and operational definitions

A variable is any entity or characteristic that can take up different forms (Polit & Beck, 2010). The operational definition specifies how a variable will be measured in the study (Polit & Beck, 2010). Variables could be:

- Independent: A variable that varies naturally but cannot be modified (e.g., age) or can be modified (e.g., different persons who inform a mother about KMC – nurse, doctor,

health assistant, or counsellor) [Polit & Beck, 2010; Plichta & Garzon, 2009]. The independent variables (Table 7) in this study included:

  - Health facility preparedness,
  - KMC competence of HCWs, measured through their knowledge, attitude, and skills,
  - Mothers and fKMC preparedness for KMC practice measured through their knowledge, attitude, and support they received,
  - Small baby characteristics.

- Dependent: A variable that changes based on certain factors (Polit & Beck, 2010; Plichta & Garzon, 2009). In this study, an example would be KMC practice. The dependent variables identified were KMC practice and exclusive breastfeeding, details of which are provided in Table 7 provides details of variables, their source of data, operational definitions, and tools used to measure the variables.

4.4.2. *Data collection tools*

The commonest data collection tools used with quantitative methods are self-reports, observations, and bio-physiologic measures (Polit & Beck, 2010; Bastos, et al., 2014). Self-reports involve directly questioning study participants and can be in the form of a questionnaire or interview schedule that may contain open-ended or close-ended items (Polit & Beck, 2010, p 366; Thomas, Oenning, & Goulart, 2018). Likert scale is a common method used to quantitatively measure attitudes, personality traits or perceptions where the participant responds to items that are either favourably or unfavourably stated on a scale, to indicate level of agreement or disagreement (Jamieson, 2004; Polit & Beck, 2010, p 366). Observation checklists facilitate structured observations of an event, behaviour, or condition (Polit & Beck, 2010, p367; Thomas, Oenning, & Goulart, 2018). All the data collection tools (Appendices E-H) used in this study were developed by the investigator and informed by evidence from the literature review. The items covered different aspects of KMC such as meaning, positioning a baby, requirements, duration of KMC, its benefits, monitoring a baby receiving KMC. The face and content validity of the tools was sought and affirmed by eight experts in relation to the objectives of the study, in May 2017. The experts included: two neonatologists, five nurse specialists and one public health specialist. The tools were then pre-tested between May and November 2017. Criterion referenced validity was not established since no standard tool could be accessed, although items of the questionnaire for HCWs were comparable to those from a questionnaire used to assess knowledge of 40 nurses from two hospitals in Punjab, India (Batra & Mamta, 2014), while items of the questionnaire for mothers had items comparable to what was used in a study to assess

knowledge, attitude, and practice of mothers on KMC in a tertiary center (Bajaj, et al., 2015). Construct validity was partly ascertained and described in chapter 6.

4.4.2.1. Pre-testing of questionnaire for HCWs

The pre-testing of the questionnaire for HCWs to measure their knowledge and attitude was carried out with 10 HCWs in May 2017, using the test-retest method. This investigator-constructed tool adapted from literature reviewed (Bajaj, et al., 2015; Shah, Sainju & Joshi, 2018) consisted of 30 multiple choice questions for knowledge and 15 items on a five-point Likert scale for attitude. The reliability tested by using test-retest method was low (r=0.56). The knowledge questionnaire items were then modified to true or false items (Appendix E.1), based on feedback from experts and the participants who found it difficult to respond to multiple-choice questions. The internal consistency a measure to assess that the tool is measuring what it must be measuring was established through the Spearman Brown formula (Chakrabartty, 2013) for the split-half method, was 0.8 ($p<0.05$). Reliability responses to the attitude scale were well dispersed with the reliability of the tool established as 0.81($p<0.05$). This tool was then translated into Kannada, the local language, and back translated to check for accuracy of the translation by two independent research assistants. The final format of the questionnaire had both the English and Kannada versions to help HCWs understand the tool better. This tool was pre-tested in November 2017. Later construct validity of the questionnaire was established partly by performing correlation coefficients between knowledge and attitude, attitude and skills, skills and attitude scores at time-point 1, that showed a significant correlation indicating possible construct validity (Table I.12). Additionally correlation coefficients were performed for time-point 1 and time-point 2 assessments of these three variables (Table I.12) that were also significant. Other methods such as using content analysis, factor analysis, ANOVA studies demonstrating differences between differential groups, factor analysis, multi-trait/multi-method studies, etc. for establishing construct validity was beyond the scope of this study.

4.4.2.2. Pre-testing of questionnaire for mothers of small babies and fKMC providers:

Pre-testing of questionnaires will help in identifying problems either for participants or the investigator. Problems include confusion over the meaning of the items or misinterpretation of the concepts used (Polit & Beck, 2010; Thomas, Oenning & Goulart, 2018). The questionnaire for mothers and fKMC providers was designed with items on baby characteristics; various aspects of KMC such as meaning, positioning a baby, requirement, duration, including its benefits and monitoring; socio-demographic characteristics of mothers and fKMC providers (Appendix H). Initially, responses for items on KMC were expected on a 5-point Likert scale: Strongly agree, agree, undecided, disagree, and strongly

disagree. Pre-testing of the questionnaire was undertaken with 20 mothers from the Koppal sub-district in September 2017, to determine whether they comprehended the items and responded to them appropriately. However, they were not able to do so, hence this part of the questionnaire was then modified to open-ended items accompanied by a key with scores, to mark possible responses (Appendix F.1). This questionnaire was translated into the local language Kannada, then translated back to English by another independent research assistant and finalised between November and December 2017 (Appendix F.1). Table 7 provides information on variables included in this study, source of data, operational definitions and tools used for measurement.

Table 7: Variables-Source of data, operational definitions and tools used for measurement

Variables & source of data	Operational definitions	Tool used to collect data
Variable Health facility preparedness  **Source of data** 8 Health facilities	Defined as the ability of a health facility to cover all eligible small babies < 2000 gms with KMC services. It was measured using an observation checklist (Appendix G)	***Observation checklist (Appendix G)***: This checklist was developed from - the KMC progress monitoring tool (Bergh et al, 2005); evidence from the literature on KMC facilitators and practice (Chan, et al., 2016b; Chan, et al., 2017; Guenther, et al., 2017; Seidman, et al., 2015; Smith, et al., 2017) and the WHO building blocks for a healthcare system (Moxon, et al., 2015). To improve feasibility of the checklist's use, three of the seven WHO building blocks for a healthcare system, namely, health financing, essential medical products and technologies and community ownership & partnership were not included in the checklist. The checklist prepared composed of only 10 key items relevant to KMC implementation, obtained through observation or record review by the research assistant. These were categorised under the remaining four building blocks and included: ● Health workforce: Three items ● Health information systems: Two items ● Health service delivery: Four items ● Leadership and governance: One item.

		Each item was allocated 10 points and thus a health facility could obtain a maximum possible score of 100.
Variable KMC Competence of HCWs in terms of knowledge, attitude, and skills  **Source of data** HCWs from the 8 health facilities	Defined as having adequate knowledge, attitude, and skills to initiate and maintain KMC for eligible small babies at the health facility. It was measured by the composite score obtained by HCWs on KMC knowledge, attitudes, and skills assessments. - *Knowledge on KMC:* This was defined as HCW's awareness on KMC and was measured by their responses to items on a structured questionnaire (Annexure E.1) - *Attitudes on KMC:* This was defined as HCWs' feelings and perceptions towards KMC, its implementation and practice as measured by their responses to items on an attitude scale (Appendix E.1). - *Skills related to KMC practice:* This was defined as HCW's performance on specific KMC related tasks assessed	***Questionnaire for HCWs (Appendix E.1):*** This questionnaire had three parts. **Section A:** that provided socio-demographic information of HCWs such as place of employment, work experience, designation, previous training, age, and sex. **Section B**: Had items to measure knowledge organised under four themes. Items were allocated scores between one and three, based on judgement of how important this knowledge was for HCWs: ● Identification of a small neonate for KMC: Had 8 items, with a maximum score of 12. ● Components of, and requirements for KMC: Had 10 items, with a maximum score of 16. ● Provision of and monitoring of a baby on KMC: Had 6 items, with a maximum score of 12. ● Maintenance of KMC: Had 11 items, with a maximum score of 20. Thus, the maximum score possible for the KMC knowledge assessment was 60.

	by an Objective Structured Clinical Examination (OSCE) (Annexure E.2).  Pallada	**<u>Section C</u>**: The attitude scale had 15 items organised under three themes. HCWs had to rate each item on a Likert scale of 0-4, where 0 was strongly disagree and 4 was strongly agree. The maximum possible score was 60, with the higher score indicating more positive attitude. The items were categorised as follows: ● <u>Benefits of KMC:</u> Had 6 items, carrying a maximum score of 24. ● <u>Implementation of KMC:</u> Had three items, a maximum score of 12. ● <u>KMC practice</u>: Had 6 negatively stated items that were reverse scored, a maximum score of 24. ***<u>Objective Structured Clinical Examination (OSCE) for HCWs (Appendix E.2):</u>*** Skills of HCWs were assessed using OSCE, which "is an assessment of competence carried out in a well-planned, structured and objective way" (Liddle, 2014, pp:2). There were five stations as given below: ● Checking weight and swaddling a small baby. ● Counselling for KMC benefits and position. ● Expressing breastmilk and *pallada* (a mini sauce boat or a small bowl with a long tip) feeding.

		● Inserting an oro-gastric tube and calculating quantity of feed. ● Counselling at discharge of a small baby. Each skill station had a maximum score of 10. Thus, the maximum possible score for skills evaluation was 50.
Variables Mothers' knowledge, attitude and support received  **Source of data** Mothers of the selected ~~LBW~~small babies	Knowledge, attitude and support of mothers and fKMC providers was defined as given below: ● *Knowledge:* This was defined as the awareness of mothers or fKMC providers on KMC. It was measured by their response to items on the questionnaire (Annexure F.1). ● *Attitude towards KMC practice:* This was defined as perception and feelings towards KMC. It was measured by the mother's or fKMC provider's response to items on the questionnaire (Annexure F.1). ● *KMC Support:* Support for KMC practice was defined as aid or assistance provided at the health	***Questionnaire for mothers and fKMC providers*** (Appendix F.1): **Section A**: Contained items to collect socio-demographic details of the mother such as age (years), education, occupation, and number of children. **Section B**: contained items that measured: ● Knowledge: with 11 items and a maximum score of 30 points. ● Attitude: with 4 items and a maximum score of 4 points. ● Support for KMC practice: Details of the scoring system are provided in Section 4.8.3. ○ *Initiation at the health facility*: With 2 items, a total score of 14. ○ *Maintenance at the health facility*: With 3 items, a total score of 15. ○ *Maintenance at home*: With 7 items, a total score of 38.

Variables fKMC providers' KMC knowledge, attitude and support received  **Source of Data** fKMC providers ~~of LBWsmall babies~~	facility or at home. It was measured by the mother's responses to items in the semi-structured questionnaire (Annexure F.1). KMC knowledge, attitude and support received by fKMC providers were components of KMC support received by mothers.	***Questionnaire for mothers and fKMC providers:*** (Appendix F.1) **Section C**: Contained items to elicit the age, education, occupation of the fKMC provider including whether he / she had provided KMC for the small baby at the health facility and duration of KMC provided. It also contained items that measured: ● Knowledge: With 11 items and a maximum score of 30 points. ● Attitude: With four items and a maximum score of 4 points. ● Support for KMC practice: with three items for support at the health facility or by CHW at home, and a total score of 18 points.
Variables Small babies' characteristics  **Source of data** Mothers of small babies	● The characteristics of the small baby in this study included sex, birth weight, place of birth, place and duration of hospitalisation, and status at birth,	***Questionnaire for mothers and fKMC providers (Appendix F.1):*** Section A was also used to collect data on characteristics of the baby.

4.5. Data collection

Data collection describes the gathering of data to answer the research questions or meet the research objectives (Polit & Beck, 2010; Thomas, Oenning, Goulart, 2018). Data collection occurred at different time-points as shown in Figure 10.

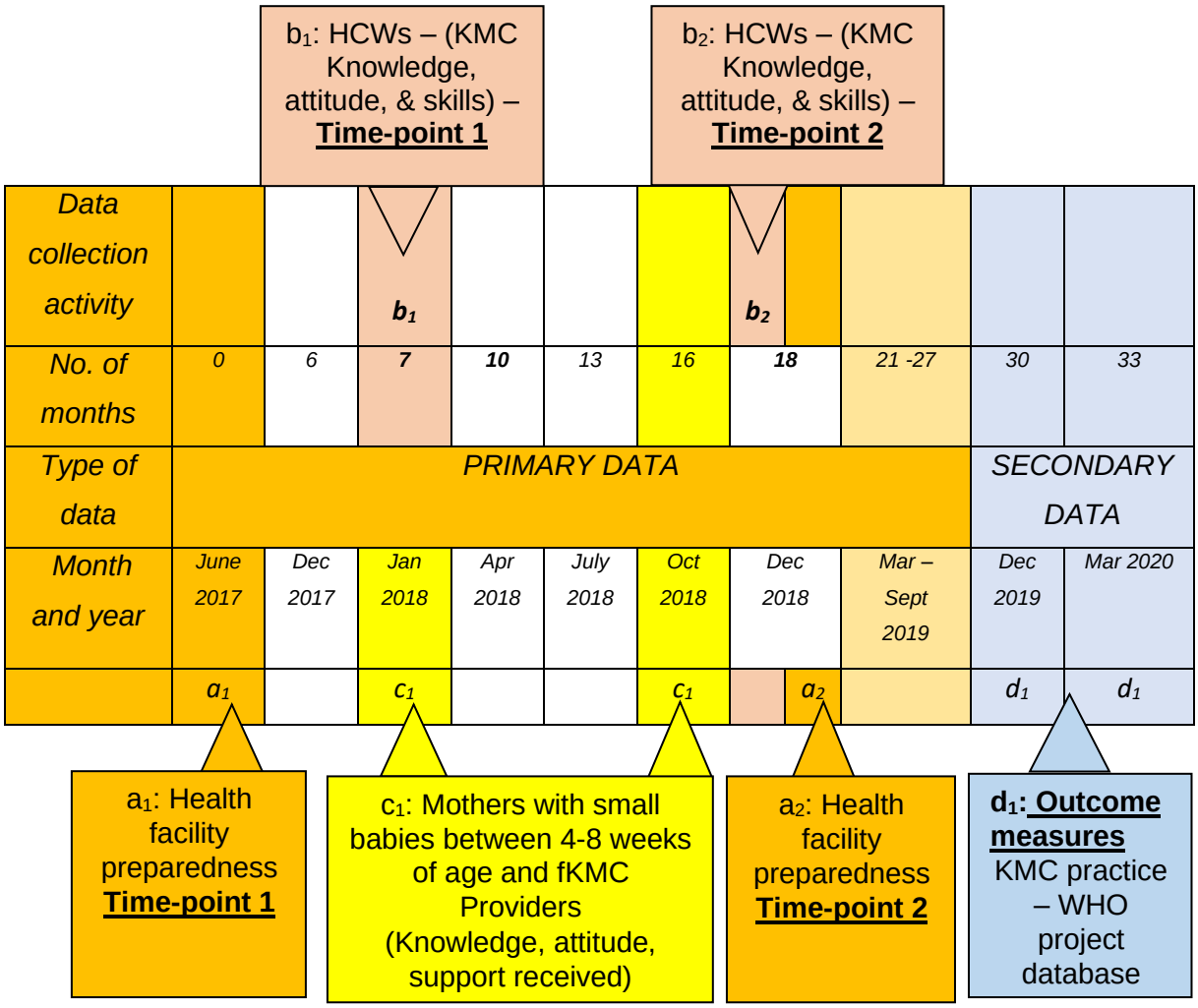


Figure 10: Data collection points for the period from June 2017-March 2020

Sources of data in this study were both primary (Thomas, Oenning, & Goulart, 2018) and secondary (Polit & Beck, 2010). The primary data included data collected on health facility preparedness and competence of HCWs for KMC implementation; characteristics (duration and place of hospitalisation) of babies recruited, and preparedness of mothers including fKMC providers for KMC practice. Secondary data included baby characteristics (birth date, weight and health status including sex) and KMC outcome measures (Section 4.6).

4.5.1. Health facility preparedness

Data collected on health facility preparedness occurred at two time-points (Figure 10) to evaluate probable change in scores due to the capacity building strategies of the WHO project

(Appendix C) that occurred between these two time-points. The observation checklist (Appendix G) was completed by a research assistant.

4.5.2. Competence of HCWs for KMC implementation

Assessment of the competence of HCWS for KMC implementation was also completed at two time-points (Figure 10). Time-point 1 assessment helped to identify which capacity building strategies for HCWs of the WHO project (Appendix C) required more focus. Time-point 2 assessment aided in evaluating the impact of these strategies implemented. For assessment of knowledge, attitude, and skills, the investigator had no control over who would be available, since HCWs were deputed by the sub-DHOs, for both the continuing education program and assessments. This avoided any selection bias of the participants (Polit & Beck, 2010;) by the researcher. HCWs were deputed in two batches on two consecutive days for time-point 1 and time-point 2 assessments. The HCWs self-completed the questionnaire which took approximately 20 minutes.

Each skill station of the OSCE was manned by an observer (nurse mentor) who was previously trained and certified as competent for conducting OSCEs (Liddle, 2014). An observation checklist (Appendix E.2) was used by the observer, to assess the HCW while he /she performed the assigned task within the specified time limit of 4 minutes. The skills evaluation took approximately 25 minutes per HCW to complete the five stations. Each session of the OSCE included five HCWs completing all five skill stations in rotation. At least 20-25 HCWs were assessed each day. It took two half-days to complete assessments of HCWs for each time-point.

4.5.3. Preparedness for KMC practice of mothers and foster KMC providers

Two research assistants assisted the investigator with data collection, one from the Bengaluru office, and the other, from Gangawati sub-district. Both were trained to collect information using the questionnaire (Appendix F.1). Data collection from mothers and fKMC providers began in Jan 2018 (Table 8). The researcher along with the Bengaluru research assistant travelled between 30-100 kilometres within the Gangawati sub-district to access mothers of small babies with the help of the local research assistant, every month for 2-3 days. A list of small babies who would be between 4-8 weeks of age (not adjusted for gestational age), irrespective of health status at birth was obtained a fortnight before a scheduled visit. This list was sent to the local office at Koppal to identify mothers with small babies who were available in the Gangawati sub-district. Those babies who did not survive 4 weeks (51/408, 12.8%), or who had moved out of the Gangawati sub-district (90/408, 22.1%) were excluded (Figure 11), since the intention was identify determinants of KMC practice along the health facility-

community continuum. A target was set to reach eight mothers with small babies per day, thus a total of 16-24 questionnaires were administered during each monthly visit.

Data on the mother's socio-demographic characteristics, KMC knowledge, attitude, and support received were collected after obtaining information on baby characteristics using the questionnaire (Appendix F.1, Section A and Section B) directly from the mothers in their own homes, to prevent any unnecessary costs or inconvenience of travel for them. This also provided an opportunity to follow-up both the mother and the baby. The questionnaire was then administered to the foster KMC (fKMC) provider, if available (Appendix F.1, Section C). The investigator along with the research assistant from Bengaluru administered the questionnaire to most of the mothers (159/209, 76%) and the remaining were completed by the local research assistant, in between scheduled visits (50/209, 24%). There were 18 pairs of twins in the study sample (Figure 11). Data was thus collected from a total of 209 mothers, as the calculated sample size of small babies (n = 227) was reached (Table 6).

4.5.4. Characteristics of babies

Characteristics (date of birth, birth weight, sex, health status at birth, place of hospitalisation) of babies recruited and not recruited (did not survive 4 weeks of life or had moved out of the study area) to the study were obtained from the WHO project database, to ascertain if there was any systematic difference between these two groups in terms of these characteristics. Additional information such as duration of hospitalisation after birth for babies recruited to the study was obtained directly from the mother using the questionnaire (Appendix F.1, Section A). Table 8 shows the total number of small babies who were available monthly, from January to October 2018, in the Gangawati sub-district, the number that did not survive 4-8 weeks of life, and the number that were out of the study area. and the number recruited to the study.

Table 8: Number of babies recruited monthly

Month of visit	Month of birth	Small babies in Gangawati Sub-district					
		[a]	[b]	[c]	[a-(b +c)]=d	[e]	[d-e]=f
Jan '18	10-31 Dec '17	24	4	2	18	4	14
Feb '18	1-31 Jan '18	40	3	10	27	5	22
Mar '18	1-28 Feb '18	30	4	10	16	0	16
Apr '18	1-31 Mar '18	39	4	18	17	1	16
May '18	1-30 Apr '18	41	5	10	26	2	24
June '18	1-31 May '18	31	6	4	21	3	18
July '18	1-30 Jun '18	39	2	8	29	1	28

Aug '18	1-31 Jul '18	56	7	8	41	11	30
Sept '18	1-31 Aug '18	55	9	11	35	9	26
Oct '18	1-26 Sept '18	53	7	9	37	4	33
	TOTAL	**408**	**51**	**90**	**267**	**40**	**227**

[a]*: Total small babies in Gangawati sub-district; [b]: Did not survive; [c]: Out of study area; [d]: Available for recruitment; [e]: Not accessible at home despite two successive visits within a week; [f]: Recruited for the study*

Steps for Data Collection

Step 1: List of small babies between 4-8 weeks of age obtained from project office in Bengaluru 2 weeks before scheduled visit.

Step 2: List sent to project office at Koppal, to determine the number available for recruitment to the study.

Step 3: Investigator and research assistant visited homes along with assistance of a local research assistant

Step 4: Performed examination of the baby - investigator

Step 5: Administered questionnaire to mother and then fKMC provider if available

Step 6: Referred a baby to the nearest health facility, based on their choice, if there was a health problem requiring medical attention (2/227=0.8%) one each – feeding & breathing problem

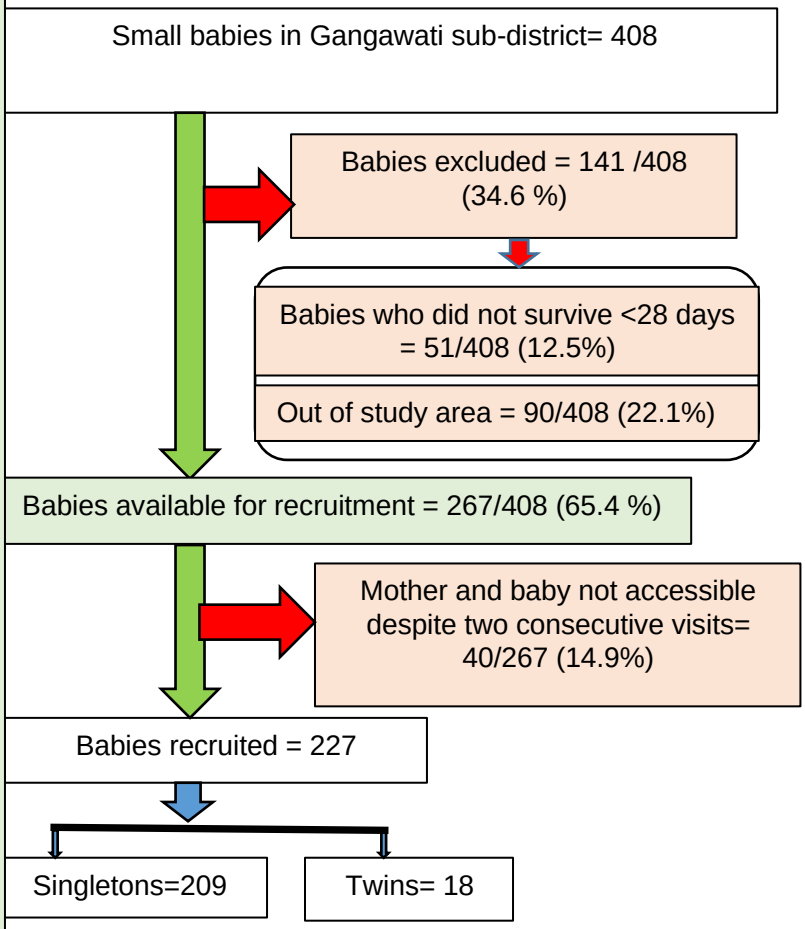


Figure 11. Algorithm of recruitment and steps to collect data from mothers with small babies

Thus, only small babies, who fulfilled the inclusion criteria (Table 6) were recruited to the study, to identify key determinants of KMC practice along the health facility-community continuum.

4.6. Outcome Measures

Operational research is action-oriented and responds to operational problems to work towards developing targeted solutions (Remme, et al., 2018; Kumar, 2019). In this study, the aim was

to assess how health facility preparedness and HCWs' competence affected KMC practice by mothers. The outcome measures in this study included KMC practice, exclusive breastfeeding practice, and return to the health facility for a follow-up. The operational definition and data sources are presented for these measures in Table 9.

The data sources for outcome measures were both primary and secondary data sources. The primary data sources included the day of life when KMC was initiated, which was obtained from the mother. Secondary sources on the other hand included data extracted from the WHO project database as given in Table 9, shows primary outcome measures collected for babies recruited and not recruited to the study, to determine if there was any systematic difference between the two groups.

Table 9: Outcome measures - Operational definitions and data sources

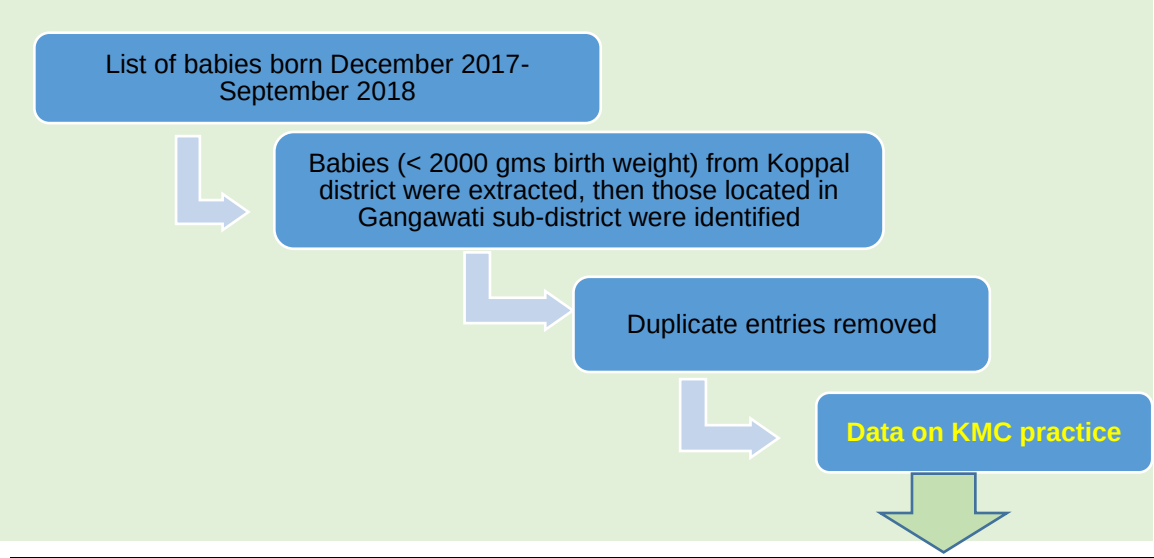
Outcome measures	Operational definition	Data sources
Primary outcome measures		
KMC practice	KMC practice in this study included the following components: ● KMC initiation at the health facility, ● Day of life (without adjusting for gestational age) when KMC was initiated, ● Duration of KMC hours - day before discharge, 7th day after discharge, 28th day of life (without adjusting for gestational age), ● Effective KMC provision: Defined as practice of KMC for ≥8 hours over a 24-hour period and exclusive breastmilk feeds (either direct or expressed breastmilk through *pallada*/spoon), ● Number of days KMC was provided.	➢ WHO project database[a,b] ➢ Mother of the baby[a] ➢ WHO project database[a,b] ➢ WHO project database[a,b] ➢ Mother of the baby[a]
Exclusive breastfeeding	Defined as whether the baby received only direct breast feeds or expressed breast milk using a *pallada* /spoon on the:	

	● Day of discharge, ● 7th day after discharge, ● 28th day of life.	➢ WHO project database[a,b] ➢ WHO project database[a,b] ➢ Mother of the baby[a] or WHO project database[a,b]
➢ ***Secondary outcome measure***		
Follow-up at the health facility:	Defined as whether a mother returned to the health facility with the baby for review and follow-up by the doctor after discharge.	➢ Mother of the baby[a]
➢ *a-babies recruited to study; b-babies not recruited to the study*		

4.6.1. <u>Data collection on outcomes of the study</u>

Primary outcomes (KMC initiation, daily duration of KMC, exclusive breastfeeding) were collected from the WHO project database. This data was entered in the database by the project Field Investigator (FI) from the KMC case record, which was filled by HCWs on duty, based, partly on direct observation and partly by mother's self-report, thus reducing possible recall bias. While data on KMC practice at home (duration on the 7th day after discharge and 28th day of life) was input in the WHO database collected by mothers' self-reporting to the FIs. The data team had merged the data from different sources, after cleaning (removal of duplicate entries or checking for incomplete forms) and completing quality checks. This data was stored in the WHO project database. The following steps were used to extract data from the WHO project database (Figure 12):

- Data on all babies born between December 2017 and September 2018 were first extracted from the WHO project database.
- Babies with a birth weight < 2000 gms were then extracted from the list provided.
- Small babies located in the Gangawati sub-district were identified.
- Duplicate entries were highlighted so that their unique identification number could be obtained. Duplicate entries occurred either because:
    - a baby was born in one health facility and was hospitalised in another health facility.
    - a project staff entered data twice for the baby by mistake.
- Data on KMC duration on day of KMC initiation, day before discharge, 7th day after discharge, and 28th day of life were then extracted where available for both babies recruited and not recruited to the study. Similarly, data on breastfeeding was extracted for the day of discharge, 7th day after discharge, and 28th day of life, where available for both groups of babies (Figure 12).



Data extracted	No. of small babies recruited (n=227)			
	Day of KMC initiation	**Day before discharge**	**7th day after discharge**	**28th day of life**
KMC duration	n_a =216/227	n_a =216/227	n_c =219/227	n_d =169/227
Exclusive breastfeed	-	n_b =218/227	n_c =219/227	n_e =223/227
	No. of small babies not recruited (n-=181)			
KMC duration	n_f=116/181	n_g= 111/132	n_h = 91/115	n_i =72/107
Exclusive breastfeed		n_g = 98/132	n_h = 53/115	n_i = 34/107
n_{a-e}: Subset of n (227); n_{f-i}:subset of n(181) for whom data was available in the WHO project database				

Figure 12: Process of data extraction from WHO project database

Data on KMC practice that was collected from the mother included date of KMC initiation and whether she had continued or discontinued KMC. The total days for which KMC was provided was thus calculated based on the start-date and date when KMC was discontinued, or the date when the mother completed the questionnaire, if KMC was continued. The latter is demonstrated in Exercise 4.1.

Example 4.1

Start-date of KMC : 05-03-2018 = (a)

Continuing KMC : 10-04-2018 (date of visit -completed the questionnaire) = (b)

Total days KMC provided: (b) – (a) = 37 days +

OR

Start-date of KMC : 05-03-2018 = (a)

Discontinued KMC : 08-04-2018 = (c)

Total days KMC provided: (c) – (a) = 35 days

Other outcome measures collected from the mother included whether she was providing exclusive breastfeeds, and if she had returned to the health facility with the ~~LBW~~ small baby for a follow-up health check after discharge.

4.7. Data management:

4.7.1 Data entry and quality checks of independent variables

A study must be able to ensure the quality of the data it obtains, to be able to contribute useful findings (Polit & Beck, 2010; Thomas, Oenning & Goulart, 2018). Data entry was completed initially in separate Microsoft (MS) Excel sheets by the investigator, or a research assistant. These included the following independent variables: health facility preparedness, competence of HCWs, baby characteristics, socio-demographic information of mothers and fKMC providers, including their knowledge, attitude, and support received for KMC.

Quality check of all data was carried out by an independent research assistant. For example, if the investigator completed the data entry for mothers, then the research assistant checked the quality of that data entry. Table 10 depicts how quality of data on health facility preparedness, competence (knowledge, attitude, and skills) of HCWs for KMC implementation and preparedness (knowledge, attitude and support received) of mothers for KMC practice was ensured in this study.

Table 10: Data entry and method of quality checks

Independent variables and tools	Data entry	Quality check and action taken
Independent variable Health facility preparedness ⇩ *Tool* Observation checklist (Appendix G)	In Microsoft (MS) Excel by a research assistant	Nil

Independent Variable KMC competence of HCWs in terms of their knowledge, attitude, and skills  *Tool* Questionnaire for HCWs (Appendix E.1) OSCE for skills (Appendix E.2)	In three separate MS Excel sheets for knowledge, attitude, and skills by the investigator after removing personal identifiers and anonymising data.	10% of questionnaires (Appendix E.1, and F.1) were selected for quality check. All items of these questionnaires were checked by a research assistant who marked the errors in another colour on the respective excel sheet. This was reviewed by the statistician who confirmed the errors were <2% of all data entered. The errors were corrected.
Independent Variable Preparedness of mothers for KMC practice including socio-demographic characteristics of mothers, fKMC providers and babies  *Tool* Questionnaire for mothers and fKMC providers (Appendix F.1)	Data entered by the investigator. Babies' data were entered in MS Excel sheet. Each baby had a Unique ID that was computer generated. Alongside with this Unique ID, other identifiers such as the mother's antenatal record unique ID, telephone number, baby's date of birth, sex, birth weight were entered. These key identifiers aided in obtaining and merging the outcome measures from the WHO project database with babies, mothers' and fKMC providers' data.	All variables of HCWs (socio-demographic characteristics, knowledge, attitude, and skills) were merged to a single sheet. Similar procedure was used for babies, mothers and fKMC providers. The total was then computed for each variable on the MS excel sheet after quality check. The statistician then exported and merged data of babies, mothers and fKMC providers using SPSS version 24. Data on health facility preparedness and HCWs knowledge, attitude, skills, and competence were then entered on this master sheet by the

	Additionally, place of birth and hospitalisation, duration of hospitalisation and date of KMC initiation were entered (Section A of Appendix F.1). <u>Mothers of small babies</u>: Socio-demographic characteristics (Section A of Appendix F.1), responses to the items on knowledge, attitude and support received (Section B of Appendix F.1) were entered in another MS excel sheet. <u>fKMC providers:</u> The same procedure as for mothers was used for data obtained from fKMC providers (Section C of Appendix F.1)	investigator against each baby (See details in Section 4.8.5). Any missing data was counter-checked with the questionnaires or separate MS excel sheets.

4.7.2. <u>Data on outcome measures:</u>

The WHO project data was collected by FIs who were trained by the WHO project team leader, in charge of monitoring and evaluation. Mothers were first contacted by the FI at the health facility and informed about the study: the plan for follow-up visits to their homes by the WHO project team at different intervals to obtain outcome measures on the 7th day after discharge and 28th day of life. The FI obtained informed consent from the mother or a family member, after having sufficiently clarified any uncertainties. A description of data management by the WHO project is provided in Figure 13.

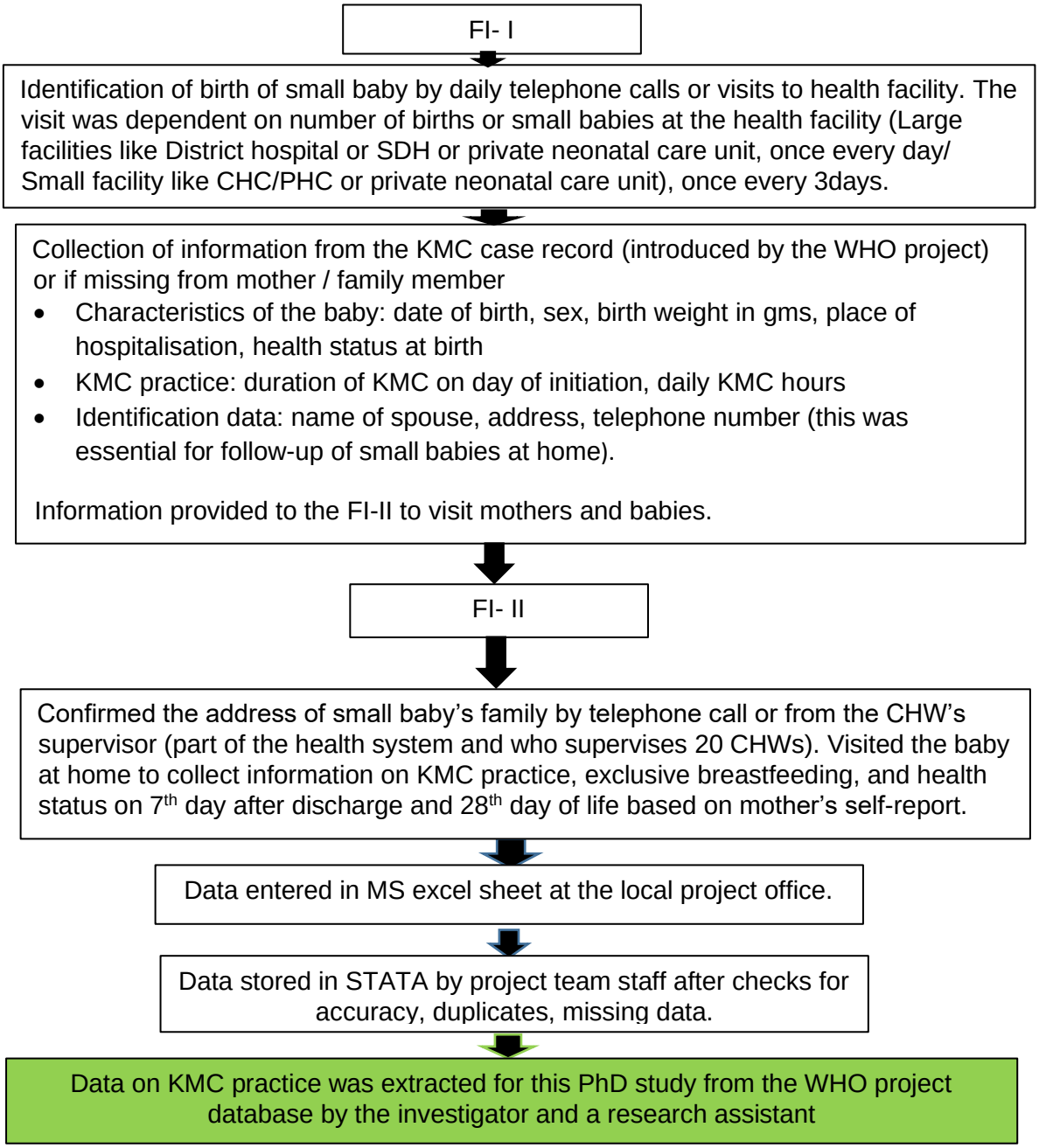


Figure 13: Data collection process of the WHO project

The WHO project database was cleaned by May 2019, and then outcome measures were extracted for the babies recruited and not recruited to the study. Cleaning, in this instance, referred to identifying:

- Duplicate entries: When the data of a baby was entered twice.
- Merging data: When data of the birth of a baby was obtained from the first health facility and KMC details from the second health facility, where the baby was hospitalised.

4.8. Data analyses

All the data collected was exported into SPSS (Version 24) with the assistance of a statistician from St. John's Research Institute, where the investigator was employed. Data analysis was carried out based on the objectives of the study.

4.8.1. Health facility preparedness for KMC implementation:

The steps used for computation of health facility preparedness is given below:

Step 1: Health facility preparedness was first computed for each health facility as a percentage score at time-point 1 and 2 separately (Annexure -I, Table I.1).

- Step 2: Data on KMC practice was collected for babies born over a period (Table 8). Hence an average score was computed to reflect this period, given that capacity building strategies of the WHO project (Annexure C) were ongoing. The average score was computed for each health facility for both time-points as illustrated through Example 4.2.

  Example 4.2: There were three CHCs: Thus, if the scores for each CHC was as follows

  Time-point 1: CHC 1 = 0; CHC 2 = 0; CHC 3 = 0

  Time-point 2: CHC 1 = 70%; CHC 2 = 90%; CHC 3 = 70%

  Average Score: CHC 1= 35%; CHC 2 = 45%; CHC 3 = 35%

  Thus, average composite score of CHCs=35+45+35=115/3=38.3%

- Step 3: To determine the relationship of health facility preparedness with KMC practice components, the composite average score was first obtained for time-point 1 and time-Point 2 (as in Example 4.3 for CHCs = 38.3%). Health facility, a categorical variable was categorised as public and private health facilities. Thus, an average score for all public health facilities combined (SDH, CHC, and PHC) and for private health facilities was computed, in a similar method as described in Step ~~3~~ 2. This was presented as mean (± Standard Deviation [S.D.]; Table 27-32).

4.8.2. Evaluate change in KMC knowledge, attitudes and skills of HCWs

Descriptive statistics such as mean (± standard deviation {S.D.}), were used to summarise KMC knowledge and skills while median and interquartile range (IQR) were used to summarise the attitudes of HCWs. Then paired t-test or Wilcoxon paired test (Polit & Beck, 2010; Scheff, 2016) was computed to determine if there was a difference in scores obtained at the time-point 1 and time-point 2 for HCWs who completed both assessments as was relevant.

Then competence score was computed as a composite score of knowledge, attitude, and skill scores. This score was computed only for HCWs who completed all three domains at either time-point 1 or time-point 2.

Example 4.4 illustrates the computation of competence score:

	Time-point 1				Time-point 2			
Domain	**K**	**A**	**S**	**C**	**K**	**A**	**S**	**C**
Score	**60**	**60**	**50**	**170**	**60**	**60**	**50**	**170**
SDH-1	43	-	26	**-**	48	50	46.9	**145**
SDH-3	51	55	23	**129**	46	59	39.5	**145**

- Step 1: The competence score for individual HCWs was computed. As shown above the competence score for HCW SDH-1 was not computed for time-point 1, but for time- point 2. The HCW SDH-3's competence score computed was:
    - At time-point 1 =129
    - At time-point 2 = 145
- Step 2: The mean competence of HCWs for each health facility was computed separately at time-point 1 and time-point 2 assessments based on the number of HCWs who had completed all three domain assessments.
    - Average competence score for SDH at time-point 1 = 129 (since only 1HCW completed all three domains)
    - Average competence score for SDH at time-point 2 = ∑ (145+145)/2 = 145
- Step 3: Since data on KMC practice for small babies was collected over a period of 9 months (Table8), there was a possibility the knowledge, attitude, and skills of HCWs could have changed with the different concurrent capacity building strategies of the WHO project (See Annexure C). Hence the average score was computed to represent this period based on the assumption that it best reflected the value of these variables for that period. Then a composite average score was computed using the two time-points averages for SDH:
    - Composite average competence score for SDH = ∑ (129+145) / 2 = 137

4.8.3. Knowledge, attitude and support received for KMC practice by mothers

KMC knowledge, attitude, and support of mothers and fKMC providers were analysed separately using descriptive statistics such as percentage, mean (± S.D.), and median (IQR). Knowledge, attitude, and support were compared with the mother's socio-demographic variables such as age, occupation, education, and number of children using the student's t-test (t) or Analysis of Variance.

KMC support received by mothers was also described based on categories, but is not presented in Chapter 5 but in Appendix J. The categories were decided based on quartiles of maximum possible score as:

- "No support" (score=0): if the mother reported she did not receive any assistance or help for KMC at the healthcare facility or home
- Poor support (Score=≤25%)
- Minimal Support (Score=26-50%)
- Good Support (Score = 51-75%)
- Excellent Support (Score= >75%).

The components of KMC support at the health facility and at home are given in Table 11 and was measured based on the responses provided by mothers or fKMC providers. Weightage was given for each component accordingly.

Table 11: Scoring system - Support for KMC practice at health facility or at home

Components of support for KMC at the health facility	**Item No***	**Scoring system**	**Maximum score**
KMC initiation support			
● Counselled/Informed about KMC (*as many reported)*	No 12 [b]	0=No one; 1= Yes Plus 1= for each person reported	7
● Assistance for KMC initiation (*as many reported)*	No 13 [b]	0=No one; 1= Yes, Plus 1 = for each person reported	7
KMC maintenance support			
● Person providing most help (*as many reported)*	No 14 [b]	0=No one; 1= Yes, Plus 2=1-2 persons 3= 3-4 persons 4=>4 persons	5
● Provision of KMC kit	No 15 [b]	0= No 5= Yes	5
● Availability of foster KMC provider	No 18 [c]	0=No 5= Yes	5
Components of KMC maintenance support at home			
● Person providing most help *(As many reported)*	No 18[b]	0 = No support 3 = ≥1 persons	3

● Number of persons available to support mother at home (*As many reported)*	No 25[a]	0 = No support 1 = 1 person 2 = 2 persons 3 = ≥3 persons	3
● fKMC provider available *(yes or no)*	Part[c]	0 = No fKMC provider 5 = fKMC available	5
● Daily duration of KMC by fKMC provider *(as reported)*	No 5[c]	0 = No fKMC provider 2 = fKMC provider not available 3 = Daily KMC 2hours 4 = Daily KMC 3-4hours 5 = Daily KMC 5-6hours 6 = Daily KMC >7hours	6
● fKMC knowledge score *(maximum score 30 points)*	No 6-16[c]	1 = fKMC provider not available 2 = ≤25% 3 = 26-50% 4 = 51-75% 5 = >76%	5
● fKMC KMC support score *(maximum score 18 points).*	No 17[c] No 18[c] No 20[c]	1 = fKMC provider not available 2 = ≤ 25% 3 = 26-50% 4 = 51-75% 5 = >76%	5
● fKMC Attitude score *(maximum score 4 points)*	No 19 [c] No 21-23 [c]	1 = fKMC provider not available 2 = ≤ 25% 3 = 26-50% 4 = 51-75% 5 = >76%	5
● KMC Support from the CHW *(Maximum score of 6)*	No 15 [a] No 17 [b]	1 point for each appropriate response	6

** Annexure F.1; a: Part A; b: Part B; c: Part C of Annexure F.1*

4.8.4. Characteristics of babies

Initially all babies available in the sub-district were categorised as those recruited and not recruited to the PhD study. Data on characteristics for babies recruited and not recruited to the study were obtained from the WHO database. Babies not recruited included those that did not survive >4 weeks of life and those that were out of the study area. Analysis was performed to identify if these two groups were different based on the following characteristics:

- Sex: Categorised as male and female (Table 24)
- Birth weight in gms: Categorised as ≤1500gms and >1500gms (Table 24) based on classification of WHO (2011).
- Health status at birth: Categorised as "well" and "sick" (defined in Section 4.3.2.1) based on the documentation in the KMC case record (Table 24).
- Whether or not KMC was initiated at health facility: This was obtained from the WHO database, irrespective of whether they were recruited or not recruited to the study (Table 24).
- Duration of KMC hours: The duration of KMC on the day of initiation, day before discharge, 7th day after discharge and 28th day of life was obtained from the WHO project database after data cleaning (Table 25).
- Numbers that received effective KMC. Effective KMC was defined as provision of ≥ 8 hours of daily SSC (Ahmed, et al., 2011) and exclusive breastfeeding as defined in the WHO project. This was assessed on the day before discharge and on the 7th day after discharge for babies recruited and not recruited to the study (Table 26).

4.8.5. Association between KMC practice and possible determinants

KMC practice, the primary outcome of the study is described only for recruited babies as follows:

- Day of life of KMC initiation: Described in numbers and percentages of small babies who were initiated on KMC (see Section 5.5.1) on Day 1 of life, Days 2-3 of life, Days 4-7 of life, or after day 7 of life (without adjusting for gestational age). To identify potential determinants of day of initiation of KMC (Table 27), this variable was categorised as "≤3 days" (early KMC) and ">3 days". This categorisation is based on the median (interquartile range) duration of hospitalisation of babies, found to be 4.57 days (5). Additionally, a meta-analysis (Mekonnen, et al., 2019) had earlier shown that with KMC, the mean time for initiation of breastfeeding was 2.6 days (95% CI 1.23, 3.96).
- Duration of KMC in hours was presented on four different days and was collected as secondary data only from the WHO database (Sec 4.7.2). These included duration of KMC on the day of its initiation, on the day before discharge from the health facility, on the 7th day after discharge and on the 28th day of life. This data is presented as median (IQR) as

the data was not normally distributed. The data for babies recruited and not recruited to the study were compared to check if they differed by these characteristics (Table 24 and Table 25). To identify potential determinants of duration of KMC (Tables 27-32), this variable was categorised as "<8 hours", and "≥ 8 hours" of KMC per day based on evidence that >7 hours of KMC on the first two days of life impacted on survival of a baby (Ahmed, et al., 2011).

- Number of days of KMC: Described using median (IQR) as the data was not normally distributed (See Sec 5.5.1).

KMC practice is presented based on type of variable:

- For discrete / categorical variables: for e.g., for the variables, initiation of KMC at health facility and day of initiation of KMC -- number and percentages are presented.
- For continuous variables: for e.g., for the variable, duration of KMC in hours –mean (±S.D.) are presented.

Operational research helps to find out possible solutions to problems. Hence, to answer questions such as *"What would facilitate early initiation of KMC in small babies?" "What factors influenced the daily duration of KMC?*" further analyses are performed with KMC practice data. First, bivariate analysis was undertaken, and results presented as unadjusted relative risk, 95% confidence interval and p value (du Prel & Hommel, 2009; Habibzadeh, 2017; Polit & Beck, 2010; Scheff, 2016; Viera, 2008) to determine association of a KMC practice component with the possible determinants. Statistical significance of a test is preferably expressed as 95% confidence interval (95% CI) rather than p value (du Prel & Hommel, 2009; Habibzadeh, 2017). A 95% CI for mean would give additional information because it provides a range of values within which the mean is likely to fall (du Prel & Hommel, 2009; Habibzadeh, 2017). Table 12 shows the independent variables considered in this study as possible determinants of KMC practice, highlights the type of variable and if categorical, how these were categorised in this study.

Table 12: Possible determinants of KMC practice

Variables			Categories
Independent	**Possible determinants**	**Type**	
Health facility characteristics	- Preparedness	Continuous	-
	- Place of birth	Discrete	- Public / private health facility / home
	- Place of hospitalisation	Discrete	- Public / private health facility
	- Hospitalisation duration	Discrete	- ≤3 days />3 days
	- KMC initiation support	Continuous	-
	- KMC maintenance support	Continuous	-
HCWs characteristics	- Knowledge	Continuous	-
	- Attitude	Continuous	-
	- Skill	Continuous	-
	- Competence	Continuous	-
Small baby characteristics	- Weight	Discrete	- ≤ / > 1500 gms
	- Sex	Discrete	- Male / Female
	- Status at birth	Discrete	- Well / Sick
Mothers and community characteristics	- Age	Continuous	-
	- Occupation (employed)	Discrete	- Yes (Unskilled or skilled workers) / No (Homemakers)
	- Education	Discrete	- ≤/> 8th grade
	- Number of children	Discrete	- 1 / ≥2
	- KMC knowledge	Continuous	-
	- Attitude	Continuous	-
	- KMC maintenance support for	Continuous	-

Although information on support for KMC initiation and maintenance at the health facility was collected from the mothers, these variables directly implied health facility characteristics and were thus categorised under it. While support for KMC maintenance at home was categorised under “mothers and community characteristics”.

To address the study objective "*To determine relationship between KMC practice with characteristics of the health facility, HCWs, the mother, and the small baby"* a composite average was computed for these variables: (i) health facility preparedness, and (ii) knowledge, attitude, skills, and competence of HCWs. Since babies could have been born in one health facility and referred to another for management of a health problem such as breathing problem, sepsis, jaundice, preterm, feeding problem, etc., the average score was computed to represent both facilities. Thus, this composite average score was computed as follows:

- Firstly, an average score (time-point 1 and time-point 2) on health facility preparedness; knowledge, attitude, skills, and competence of HCWs was obtained for each of the eight health facilities selected in this PhD study (Example 4.2-4.4). Rationale for computation of average scores is provided in Section 4.8.1 and 4.8.2. Furthermore, an average was obtained for the three CHCs and three PHCs (Example 4.2) to help represent those health facilities that were not selected for the study.
- Secondly, if a baby was either born or hospitalised in a health facility that was not selected for the study, then the composite average score accorded to the type of health facility (CHC or PHC) was allocated against the baby. For example, if the baby was born in a PHC not selected for assessing health facility preparedness or knowledge, attitude, and skills, including competence of HCWs, then composite average score of these variables computed for PHCs was allocated against that baby based on the assumption that all other similar type of health facilities would have similar preparedness levels or HCWs knowledge, attitude and skills levels.
- Thirdly, if a baby was born in one health facility but admitted in another, then the average of these two health facilities' scores was obtained and documented against the respective baby. For example, if the baby was born in SDH but hospitalised in the selected private health facility, then the average score was obtained for SDH and the private health facility and this was allocated against that baby.

Multivariate analysis was then undertaken. The term multivariate analysis refers to analyses dealing with at least three or more variables simultaneously (Polit & Beck, 2010; Lefèvre, et al., 2014; Lewis & Ward, 2013). Two common statistical methods used are multiple regression analysis and analysis of covariance (ANCOVA) (Polit & Beck, 2010; Lewis & Ward, 2013). Multivariate analysis "indicates whether an independent variable is significantly related to the dependent variable *even when* the other variables are controlled" (Polit & Beck, 2010, p. 424). To find out the determinants of outcomes, in this study, for e.g., "day of life of KMC initiation" >1 independent variable was included in multiple regression analysis that allowed explanation of a dependent variable with multiple independent variables. "In multiple regression, the dependent variables are interval- or ratio-level variables. Independent variables are either

interval- or ratio-level variables or dichotomous nominal-level variables, such as male or female" (Polit & Beck, 2010; Lewis & Ward, 2013). Since this study included a cohort of LBW babies for whom data on KMC practice was collected from the day of life of KMC initiation till the 28th day of life, adjusted relative risk was computed (Andrade, 2015) using log-binomial regression analysis after adjusting for all co-variates. "The relative risk or risk ratio (RR) of an event is the likelihood of its occurrence after exposure to a risk variable as compared with the likelihood of its occurrence in a control or reference group" (Andrade, 2015). In this study for example, the RR would provide the likelihood of a baby being initiated early on KMC (≤3 days of life) – the dependent variable, if hospitalised (i.e., exposed group) in a public versus a private health facility (reference group) – the independent variables. Independent variables that were included in these analyses as possible determinants were based on a cut off at 0.1 p-value on bivariate analyses.

4.9. Ethical considerations and statutory approval

4.9.1. Institutional Ethics Committee approval

Ethics approval from the St. John's Medical College Institutional Ethics Committee (IEC) was obtained for the WHO project (Appendix I.1) first. Then ethics approval for the PhD study was obtained for a period of 1 year in May 2017 (Ref No 64/2017), this was again renewed for the period of the study (Annexure I.3). All the Participant Information Sheets and Informed Consent Forms were approved by the IEC.

4.9.2. Approval from the University Ethics Committee, University of Stirling

Approval was sought from General University Ethics Panel early January 2017. However, since this study involved LBW babies and mothers in a clinical setting and community. Approval was obtained for the study proposed from the NHS Invasive or Clinical Research (Ref NICR 16/17 – Paper 48) Committee on 25th May 2017 (Annexure I.4). To acknowledge adherence to regulations, the NHS Governance Framework Regulations Form was signed by the investigator and supervisor – Local and University of Stirling representative (Appendix I.5).

4.9.3. Study registration

The WHO project was registered with the Clinical Trials Registry of India (CTRI/2017/07008988) as seen in Annexure B. Since the PhD study was part of the WHO project; it was confirmed that no additional registration was required.

4.9.4. Permission from the State Government of Karnataka

Permission to conduct the WHO project in Koppal District was obtained from the Government of Karnataka (Annexure I.2). The District Health Officer provided written permission for entry

into public health facilities of Koppal District. Permission was also obtained separately from the respective management of private health facilities. Approval for the WHO project was obtained from the Health Ministry's Screening Committee, of the Indian Council of Medical Research, Government of India since it was supported by the WHO.

This chapter thus outlines the methodology – the overarching strategy and methods – the tools and procedures for collecting and analysing data used in the PhD study. Chapter 5 presents the results of the data analysed.

CHAPTER 5. RESULTS

From a total of 21 health facilities in Gangawati, 38% (8/21) were selected for this study (Table D.1, Annexure D). Almost half, 47% (7/15) represented the primary [Community Health Centres (CHCs)/Primary Health Centres (PHCs)] and secondary [Sub-district Hospital (SDH)] level public health facilities, and 17% (1/6) represented the private health facilities in the sub-district. Most [139 (61.2%)] of the small babies (227) recruited to the study were hospitalised in the selected health facilities [SDH – 52/227 (22.9%); CHCs- 14/227 (6.2%); PHCs-13/227 (5.7%); Private- 60/227 (26.4%)]. Even among those babies not recruited to the study, most [111/181 (61.3%) were hospitalised in the selected facilities [SDH-67/181 (37.0%); CHCs-20/181 (11.0%); PHCs 3/181 (1.7%); Private- 21/181(11.6%)]. While the remaining babies recruited and not recruited to the study were admitted in other public [28/227 (12.3%) and 19/181 (10.5%) respectively] or private [60/227 (26.4%) and 51/181 (28.2%) respectively] health facilities. Health facilities are grouped based on similarity of characteristics (SDH and district hospital, all CHCs and PHCs as one group, all private as another group) when presenting results. Other details of babies such as birth weight and sex are provided in Table 24. Most of the babies recruited and not recruited to the study were sick at birth {[190/227 (83.7%)] and [149/181 (82.3%)]; p=0.77]. The length of hospitalisation for babies recruited is presented after Figure 14.

The results are presented below in five sections, as per the objectives of the study.

5.1. Health facility preparedness for KMC implementation

Health facility preparedness was assessed using the observation checklist (Annexure G) and is shown in Table 13 for the different health facilities.

Table 13: Health facility preparedness score of health facilities

Health facility preparedness	Score of health facilities											
	Public Facility						Private facility (n_c=1)			All facilities (Average) (n=8)		
	SDH (n_a=1)			CHC/PHCs (n_b=6)								
Domains	1	2	3	1	2	3	1	2	3	1	2	3
Health workforce[d]												
● HCWs trained on KMC	10	10	10	0	10	5	0	10	5	3.3	10	6.7
● Specialists –NB care	10	10	10	0	0	0	10	10	10	6.7	6.7	6.7

● Support staff	10	10	10	3.3	3.3	3.3	10	10	10	7.8	7.8	7.8
Sub-total	30	30	30	3.3	13.3	8.3	20	30	25	17.8	24.5	21.2
Health information systems[e]												
● KMC case record	0	10	5	0	10	5	0	10	5	0	10	5
● KMC reporting	0	10	5	0	6.6	3.3	0	10	5	0	8.7	4.4
Sub-total	0	20	10	0	16.6	8.5	0	20	10	0	18.7	9.4
Health service delivery[f]												
● KMC area/unit	0	10	5	0	10	5	0	10	5	0	10	5
● Digital weighing scale	10	10	10	0	10	5	10	10	10	6.7	10	8.4
● Feeding equipment	10	10	10	0	6.6	3.3	0	10	5	3.3	8.7	6.0
● Health education material	0	10	5	0	10	5	0	10	5	0	10	5
Sub-total	20	40	30	0	36.6	18.3	10	40	25	10	38.7	24.4
Leadership and governance[g]												
● Written policy	0	10	5	0	10	5	0	10	5	0	10	5
Sub-total	0	10	5	0	10	5	0	10	5	0	10	5
Total[h]	50	100	75	3.3	76.5	39.9	30	100	65	27.8	91.9	59.9

n_a, n_b, n_b: Subset of health facilities (n=8); NB: Newborn; SDH: Sub-district Hospital; CHC: Community Health Centre; PHC: Primary Health Centres; Maximum score for each component=10; maximum score: d= 30; e=20; f= 40; g=10; h (health facility preparedness)=100%; 1(Time-point 1: 6 months after start of WHO project); 2 (Time-point 2: A year after Time-point 1); 3 (Average of time-points 1 & 2)

The average health facility preparedness score was found to be highest for the SDH and private health facility and least in the primary level public health facilities - CHCs/PHCs, (100% & 76.5% respectively) at time-point 2. HCWs were trained on KMC in all health facilities by time-point 2, unlike at time-point 1, when only SDH had their HCWs trained at Table 13. All eight health facilities had case records to document KMC practice, a separate area for KMC practice, feeding equipment, health education material, and a written policy for KMC at time-point 2, none of which were available at time-point 1. CHCs/PHCs showed the largest change in health facility preparedness scores, 3.3% to 76.5% from time-point 1 to time-point 2. However, unlike SDH and the private health facility, these primary health facilities had not reached scores of 10 in all components of health facility preparedness.

During the period June 2017 to December 2018, the overall change, from 27.8% to 91.9% in health facility preparedness scores for KMC implementation was substantial. Details of health facility preparedness scores for each PHC and CHC are shown in Annexure I (Table I.1).

Key findings of health facility preparedness

- Health facility preparedness scores improved during the period June 2017 to December 2018 from 27.8% to 91.9%.
- The SDH and the private health facility had both reached maximum possible scores in all four domains; the CHCs/PHCs had not reached maximum possible scores in three of four domains.

5.2. Competence of HCWs for KMC implementation

The competence of HCWs for KMC implementation was measured by the composite score of their knowledge, attitude (Questionnaire - Annexure E.1), and skills (OSCE- Annexure E.2). Table 14 details the socio-demographic characteristics of 83.2% (79/95) of the HCWs who attended either one or both assessments at time-point 1 or time-point 2.

Table 14: Socio-demographic characteristics of HCWs

Socio-demographic characteristics (n=79)	No. (%)
Sex	
● Female	61 (77%)
● Male	18 (23%)
Qualification	
● High school / Higher secondary	9 (11%)
● Diploma / Degree in nursing	56 (71%)
● Master's in social work	3 (4%)
● Allopathic / Alternative* medicine	11 (14%)
Area of work	
● Level II / Special Newborn Care Unit (SNCU)	11 (14%)
● Level I / Newborn Stabilising Unit (NBSU)	14 (18%)
● KMC ward	2 (3%)
● Postnatal and Labour room	52 (66%)
Place of employment	
● SDH	28 (35%)
● CHC / PHC	35 (44%)
● Private	16 (20%)

**Alternative medicine: AYUSH - Ayurveda, Unani, Siddha, Homeopathy (6/11=55%)*

The mean (±SD) age of HCWs was 32.1 (±8.3) years with a range of 18-52 years. The median [Interquartile Range (IQR)] of work experience of HCWs was 7 (9) years. Over three-fourths, [77% (61/79)] of HCWs were female. Nurses constituted 71% (56/79) of the total number of HCWs. Among the 14% (11/79) who had completed medicine, six had completed alternative medicine (AYUSH), while those who had completed allopathic medicine had qualifications in either MD-Paediatrics /Obstetrics or a basic medical degree (M.B.B.S).

The scores of HCWs on knowledge, attitude, skills, and overall competence on KMC implementation are shown in Table 15-18. In each of these tables the scores of all HCWs who attempted any one assessment are shown; in addition, the subset of those who completed the assessment at both time-points are also shown for comparison and statistical testing.

Table 15: Knowledge score of HCWs on KMC implementation

	Score of HCWs who completed either one /both assessments (n=79)			
		Mean (±SD)	**Mean (±SD)**	
Knowledge domains	**Max Score**	**Time-point1 (n_a=51)**	**Time-point 2 (n_b=64)**	
● Identification of small babies for KMC	12	7.3 (±2.0)	7.8 (±1.8)	
● Components of & requirements for KMC	16	10.3 (±2.5)	10.6 (±2.1)	
● Provision of & monitoring during KMC	12	8.4 (±2.3)	9.1 (±2.3)	
● Maintenance of KMC	20	14.2 (±3.0)	15.3 (±2.0)	
Total KMC knowledge	60	40.0 (±6.3)	42.8 (±4.6)	
	Score of HCWs who completed both assessments (n_c=35)			**Paired t-test**
Knowledge domains		**Time-point1**	**Time-point 2**	**[95% CI]**
● Identification of small babies for KMC	12	7.3 (±2.1)	8.1 (±1.8)	-2.1 [-1.43, -0.01]*
● Components of & requirements for KMC	16	10.5 (±2.6)	10.9 (±1.7)	-0.7 [-1.39, 0.71]
● Provision of & monitoring during KMC	12	8.2 (±2.5)	9.4 (±2.4)	-2.0 [-1.89, 0.01]

● Maintenance of KMC	20	14.8 (±3.4)	15.2 (±2.1)	-1.8 [-2.25, 0.14] *
Total KMC knowledge	60	38.6 (±6.3)	43.6 (±4.5)	-2.8 [-5.71, -0.96]**

*n_a, n_b, n_c: Subset of HCWs (n=79); 95% C.I. 95% Confidence Interval; p=0.05; **p<0.001*

As depicted in Table 15, the mean (±SD) score of the knowledge of HCWs who did time-point 1 assessment was highest (14.2±3.0) in the domain "*Maintenance of KMC*", which was 71% of the maximum score. It had increased to (15.3±2.0), 76.5% of the maximum score at time-point 2. > half, 44.3% (35/79), of HCWs had completed the assessments at both time points. Among these HCWs, there was a statistically significant increase in the mean scores from time-point 1 to time-point 2 in two domains(p=0.05): "*Identification of small babies eligible for KMC*" (6.7% increase) and "*Provision of and monitoring a baby while on KMC*" (10% increase). The overall knowledge scores of HCWs had also increased statistically significantly from time-point 1 to time-point 2 (95% CI, -5.71 to-0.96; p=0.007). The number and percentage of HCWs who responded correctly to each item on the questionnaire is detailed in Annexure I (Table I.2). Attitude scores of HCWs at time-points 1 and 2 are shown in Table 16. Overall HCWs had very positive attitudes towards the practice of KMC as indicated by their high scores.

Table 16: Attitude score of HCWs on KMC

	Score of HCWs who completed either one/both assessment (n=79)			
Attitude domains	**Maximum Score**	**Median (IQR) Time-point 1 (n_a=50)**	**Median (IQR) Time-point 2 (n_b=64)**	
● Benefits of KMC	24	22 (4.0)	22 (4.0)	
● Requirements for KMC	12	12 (3.0)	11(3.0)	
● KMC implementation	24	15 (4.0)	16 (4.0)	
Total attitude score	60	48 (10.0)	48 (8.0)	
Attitude domains	**Score of HCWs who completed both assessments (n_c=34)**			**Wilcoxon's signed-rank test (p)**
		Time-point 1	**Time-point 2**	
● Benefits of KMC	24	22 (3.8)	22.5 (4.0)	z=0.27 (p=0.79)
● Requirements for KMC	12	10.5 (3.0)	11.0(3.0)	z=0.85(p=0.39)
● KMC implementation	24	15 (3.8)	16.0 (3.0)	z=2.75 (p=0.005)
Total attitude score	60	46.5 (9.0)	48.5 (7.0)	z=2.05 (p=0.04)

n_a, n_b, n_c: Subset of HCWs (n=79)

The attitude assessment at both time-points was completed by less than half, 43% (34/79) of HCWs. Among these HCWs, there was a statistically significant change in the attitude scores from time-point 1 to time-point 2 (p=0.04). This was mainly due to change in the domain of "*KMC implementation*" (p<0.005), with a higher median (IQR) of 16 (3.0) at time-point 2, compared to 15 (3.8) at time-point 1, as seen in Table 16. Responses of HCWs to items on the attitude Likert scale could be found in Annexure I (Table I.3). KMC skills score are depicted in Table 17.

Table 17: KMC skills score of HCWs

	Score of HCWs who completed either one/both assessment (n=79)**		
	Mean (±SD)	**Mean (±SD)**	
Skill domains	**Time-point 1 (n_a=39)**	**Time-point 2 (n_b=53)**	
● Check weight & swaddle	3.5 (±2.2)	9.5 (±0.5)	
● Counsel-KMC initiation	5.2 (±2.6)	8.0 (±1.3)	
● Express breastmilk and administer *pallada* feed	2.3 (±1.0)	5.9 (±1.6)	
● Insert orogastric tube and calculate feed quantity	2.0 (±1.2)	7.3 (±2.2)	
● Counsel-KMC discharge	4.1 (±1.6)	8.6 (±1.7)	
Total skills score	16.4 (±6.0)	39.3 (±4.5)	
	Score of HCWs who completed both assessments (n_c=25)		
Skill domains	**Time-point 1**	**Time-point 2**	**Paired t-test [95%CI]**
● Check weight & swaddle	3.7 (±1.9)	9.5 (±0.5)	-14.93 [-6.71, -5.09]*
● Counsel-KMC initiation	5.9 (±2.3)	8.1 (±1.1)	-5.17 [-3.72, -1.62]*
● Express breastmilk and administer *pallada* feed	2.4 (± 2.3)	5.8 (±1.3)	-7.38 [-4.39, -2.49]*
● Insert orogastric tube and calculate feed quantity	2.1 (±1.2)	7.2 (±2.0)	-11.55 [-5.80, -4.06]*
● Counsel-KMC discharge	4.1 (±1.4)	8.8 (±1.6)	-10.99 [-5.40, -3.70]*
Total skills score	18.1 (±4.6)	39.5 (±3.6)	-22.56[-24.15,-20.14]*

*n_a, n_b, n_c: Subset of HCWs (n=79); **Maximum possible score for each domain=10; Total Skills Score=50; pallada-small bowl / cup with a long narrow tip used to feed a baby; 95% CI: 95% Confidence Interval; * p<0.001*

At both time-points, less than a third, [31.6% (25/79)] of HCWs were present for assessment of skills as seen in Table 17. Skills score among these HCWs showed dramatic improvements from 36.2% (18.1/50) to 79% (39.5/50) of maximum possible score over the 1-year period (t=-22.56, [95% CI: -24.15, -20.14], p<0.001). The change in scores between the time-points for all skill domains increased statistically significantly (p<0.001) but was highest for the domain "*Checking weight & swaddling*" and was lowest for the domain "*Expressing breastmilk and pallada feed*".

The competence score of HCWs on KMC implementation are given in Table 18.

Table 18: Competence score of HCWs on KMC implementation

	Competence score^^ of HCWs who completed either/ both assessment (n=79)		
	Mean (±SD)	**Mean (±SD)**	
Competence	**Time-point 1 (n_a=34)**	**Time-point 2 (n_b=45)**	
Total score	101.8 (±14.9)	129.3 (±14.9)	
	Competence score^^ of HCWs who completed both assessments (n_c=24)		**Paired t-test [95% CI]**
	Time-point 1	**Time-point 2**	
Total score	102.8 (±16.0)	124.1 (±15.1)	-9.42 [-58.52, -37.82] ***

*n_a, n_b, n_c: Subset of HCWs (n=79); ^^Maximum possible competence score = 170 (100%); 95% CI: 95% Confidence Interval; *** p<0.001*

The competence score was computed for less than a third, [30.4% (24/79)] of all HCWs for both time-points as seen in Table 18. Among these HCWs, the mean competence score improved from 60.5% (102.8/170) to 73% (124.1/170) of the maximum score from time-point 1 to time-point 2 and this was statistically significant (t=-9.42 [95% CI: -58.52, -37.82] p<0.001).

Key findings of HCWs competence for KMC implementation

The key findings for only the subset of HCWs who had completed assessments on knowledge, attitude, and skills at both time-points are presented below. These findings included:

- A statistically significant increase in knowledge scores (p<0.007) from time-point 1 [38.6± 6.3] to time-point 2 [43.6±4.5]. The awareness of HCWs on "*Identification of*

small babies eligible for KMC" [7.3±2.1 to 8.1±1.8] and "*Provision of & Monitoring a baby on KMC*" [8.2±2.5 to 9.4±2.4] improved statistically significantly in this period (p=0.05).

- A significant improvement (p=0.005), in perceptions of HCWs on KMC implementation from a median (IQR) of 15 (3.8) to16 (3.0) and overall attitude score [46.5 (9.0) to 48.5 (7.0), p=0.04].
- No significant change in perceptions of HCWs on the benefits and requirements of KMC as the scores were incredibly positive at time-point 1.
- A statistically significant increase in scores of all KMC related skills (p<0.001) over the two time-points. The most dramatic improvement was in the skill scores compared to the knowledge and attitude scores.

5.3. Preparedness of mothers and foster KMC (fKMC) providers for KMC practice

It was assumed that the mothers' and fKMC providers' preparedness for KMC practice could be measured by their own knowledge and attitude, including the support they received at the health facility and home.

A total of 209 mothers with small babies (18 mothers with twins) were the participants for this component of the study. One fKMC provider, if available, was selected for each small baby in this study. Nearly half, [47.3% (99/209)] of the mothers, had the support of fKMC provider/s. more than three-fourths, [77% (76/99)] of the fKMC providers, were females (either part of the extended family or friend). The remaining 23% (22/79) were males (15% spouses and 8% other male relatives).

However, of the total fKMC providers, only 84% (83/99) had completed the questionnaire (Annexure F.1, Section C). Reasons for non-participation included:

- They were otherwise employed and had reported for work -11% (11/99).
- They were caretakers for a family member who was hospitalised - 2% (2/99).
- They had returned to their own homes (these were extended family members who had come to support with household chores) - 2% (2/99).
- She had a hearing impairment and hence declined 1% (1/99).

This Section 5.3 presents the descriptive results of socio-demographic characteristics, knowledge, attitude, and support received as reported by mothers and fKMC providers without

any attempt of making comparisons between the two groups. Table 19 presents the socio-demographic characteristics of mothers and fKMC providers.

Table 19: Socio-demographic characteristics of mothers and fKMC providers

Socio-demographic characteristics	Mothers (n=209)	fKMC providers (n=83)
Age* (years)		
- Mean (±SD)	23.5 (±4) years	36.9 (±13.9) years
- Range	17-35 years	16-70 years
Education [No. (%)]		
- ≤8th grade	134 (64.0%)	65 (78.3%)
- >8th grade	75 (36.0%)	18 (21.7%)
Occupation [No. (%)]		
- Skilled workers	18 (8.6%)	6 (7.2%)
- Unskilled workers	109 (52.2%)	51 (61.5%)
- Homemakers	82 (39.2%)	26 (31.3%)
Number of children [No. (%)]		
- 1	114 (55%)	
- 2	61 (29%)	
- 3	26 (12%)	
- >3	8 (4%)	

There was one couple (Mother 50 years and Father 62 years) who had adopted a baby by the 3rd day of life since the baby's mother had not survived. They had started KMC for the baby on the 6th day of life. This mother's age was not included in the computation of mean age.

The mean (±SD) age of mothers was 23.5 (±4) years, while that of fKMC providers was 36.9 (±13.9) years. More than a third, [39.2% (82/209)] of the mothers, and less than a third, [31.3% (26/83)] of fKMC providers were homemakers. A higher percentage of mothers, [36% (75/209)] had completed higher than 8th grade as compared to [21.7% (18/83)] of fKMC providers as seen in Table 19.

More than half, [55% (114/209)] of mothers, were first-time mothers. More than three-fourths, [78.3% (65/83)] of fKMC providers were females. The aggregate scores of mothers and fKMC providers on knowledge and attitude on KMC are presented in Table 20.

Table 20: Knowledge and attitude scores of mothers and fKMC providers on KMC

Knowledge domains	Maximum score	Knowledge score: Mothers (n=209) Mean (±SD)	Knowledge score: fKMC providers (n=83) Mean (± SD)
● General knowledge of KMC	16	12.4 (±1.6)	12.3 (±1.6)
● Benefits of KMC	9	3.2 (±1.4)	2.9 (±1.3)
● Monitoring a baby while providing KMC	5	1.7 (±1.1)	1.6 (±1.1)
Overall knowledge of KMC	30	17.3 (±3.2)	16.8 (±3.1)
	Attitude score		
	Maximum score	**Median (IQR)**	**Median (IQR)**
Attitude towards KMC	4	4.0 (0)	4.0 (0)

Both mothers and fKMC providers had similar knowledge regarding KMC, with overall scores being marginally over 50% (17.3/30 and 16.8/30 respectively) of the maximum score. Both had extremely favourable attitude towards KMC (Table 20).

The responses of mothers and fKMC providers to individual items on the knowledge and attitude questionnaire (Annexure F.1) are detailed in Annexure I (Table I.5 -Table I.7).

KMC support provided at the health facility (Table 21-22) and home (Table 23) was measured using the questionnaire (Annexure F.1). Table 19 depicts the sources of support as reported by the mothers and fKMC providers for KMC initiation and maintenance at the health facility.

Table 21: Sources of support for KMC practice at the health facility for mothers and fKMC providers

Sources of support at health facility	Mothers (n=209)	fKMC providers (n=83)
A. For KMC initiation	**No. (%)**	**No. (%)**
1. Counselled/informed about KMC		
No one	13 (6%)	25 (30%)
	(n_a=196*)	**(n_b=58*)**
● Nurse / health assistant	159 (81%)	45 (78%)
● Nurse mentor	65 (33%)	16 (28%)
● Counsellor	12 (6%)	2 (3%)

● Doctor	66 (34%)	11 (19%)
● Peer mother	54 (28%)	16 (28%)
● Audio-visual aids	10 (5%)	4 (2%)
2. **Assistance for KMC initiation**	**Mothers (n=209)**	
None	22 (11%)	
	(n_c=187*)	
● Nurse / Health Assistant	157 (84%)	
● Nurse mentor	69 (44%)	
● Counsellor	4 (3%)	
● Doctor	60 (38%)	
● Peer mother	40 (26%)	
B. For KMC maintenance		
1. Person providing most support	**Mothers (n=209)**	**fKMC providers (n=83)**
No one	22 (11%)	35 (42%)
	(n_d=186*)	**(n_e=48*)**
● Nurse / Health Assistant	125 (67%)	35 (73%)
● Nurse mentor	55 (29%)	12 (25%)
● Counsellor	3 (2%)	2 (4%)
● Doctor	15 (8%)	2 (4%)
● Peer mother	28 (15%)	10 (21%)
2. Provision of KMC kit	**(n=209)**	
● Yes	157 (75%)	
● No	52 (25%)	
3. Availability of fKMC provider	(**n=209)**	
● Yes	44 (21%)	
● No	165 (79%)	

**Multiple responses hence percent >100%*
n_a / n_b (subset of mothers / fKMC providers who were counselled/informed about KMC);:
n_c (subset of mothers who had assistance for initiating KMC);
n_d / n_e (subset of mothers / fKMC provider respectively who reported on person/s who provided most support

Nurses / Health assistants were the primary HCWs who counselled/informed more than three-fourths of mothers and fKMC providers [81% (159/196) and [78% (45/58) respectively] as seen in Table 21. Six percent (13/209) of mothers had not received any information on KMC at the health facility and 11% (22/209) of them had not received any assistance to initiate KMC at the health facility. Nurses / health assistants assisted most mothers, [84% (157/187)] to initiate KMC at the health facility.

The scores obtained on support received at the health facility and at home are presented in Table 22-23.

Table 22: Support score of mothers for KMC practice at the health facility

Support for KMC practice at the health facility	**Support score of mothers (n=209)**	
1. KMC initiation support	**Maximum possible score**	**Mean (±SD)**
● Counselled/Informed about KMC	7	3.3 (±1.2)
● Assistance to initiate KMC	7	3.0 (±1.3)
Subtotal	14	6.3 (±2.3)
2. KMC maintenance support		
● Person providing most support	5	2.8 (±1.1)
● Provision of KMC kit	5	3.8 (±2.2)
● Availability of fKMC provider	5	1.1 (±2.0)
Subtotal	15	7.7 (±3.7)
Total support for KMC at health facility	**29**	**13.9 (**±5.2)

The KMC initiation support score obtained by mothers was 45% (6.3/14) of maximum score (computed from mean shown in Table 22) and KMC maintenance support score at the health facility was 51.3% (7.7/15) of maximum score.

Table 23: KMC maintenance support score of mothers for at home

KMC maintenance support at home Domains	**KMC maintenance support score of mothers at home (n=209)**		
	Maximum Score	**Mean (±SD)**	**Median (IQR)**
● Support with household chores	3	2.9(±0.36)	3 (0)
● Number of persons to support mother	3	1.4(±0.72)	1 (1)
● fKMC provider available at home	5	2.4(±2.50)	5 (5)
● Daily KMC duration by fKMC provider	6	1.7(±2.01)	0 (4)
● Knowledge of fKMC provider	5	1.6(±1.84)	1 (4)
● Attitude of fKMC provider	5	2.0(±2.34)	1 (5)
● Support of fKMC provider	5	1.3(±1.52)	1 (3)
● Support mother received from CHW	6	3.7(±0.88)	4 (1)
Total support for KMC at home	38	16.9(±10.25)	13 (20)

Of all the domains of KMC maintenance support, the domain "*Support with household chores*" was the highest, [2.9(±0.36), 96.7% (computed from mean score shown in Table 23) of the maximum score]. The lowest score was for the domain "*Support of fKMC provider*" [26% (1.3/5) of maximum score].

KMC initiation support score at the health facility in the first five months of data collection period (Dec 2017 to Apr 2018) was lower [6.1±1.71 vs 6.5±2.5] than that in the latter five months (May-Sept 2018) but not statistically significant [p=0.08]. However, support for KMC maintenance at the health facility was significantly lower in the first five months compared to the latter five months (7.2±4.0 vs 8.4±3.5; p=0.006). Support scores were categorised based on percentages of maximum possible scores. These results are presented in Figure I.4-1.6, I.8 of Annexure I. Table 1.9 and Table I.11 (Annexure I) showed that first time mothers received more support both at the health facility and at home.

Key findings of preparedness of mothers and fKMC providers for KMC practice

- Overall awareness of mothers and fKMC providers on KMC practice was average, 57.6% and 56% respectively of maximum possible score. Knowledge score of mothers and fKMC providers on "*General aspects of KMC*" was highest, 77.5% and 76.9% of maximum score. However, their scores on *"Benefits of KMC*" and "*Monitoring a baby on KMC"* were low, 35.7% and 34.0% of maximum score, respectively.
- Attitude score of mothers and fKMC providers on KMC practice indicated a notably positive attitude.
- Most mothers, 81% (159/196) were counselled on KMC by their nurse. Nurses initiated KMC for 84% (157/187) of mothers.
- Overall KMC initiation support at health facility was minimal, 45% of the maximum score while that of KMC maintenance support at health facility as reported by mothers was 51.3% of the maximum score.
- Overall KMC maintenance support at home was minimal, 44.5% of the maximum score.

5.4. Characteristics of small babies from Gangawati sub-district

A total of 408 LBW babies with birth weight < 2000 gms were available in the sub-district Gangawati, during the period from December 2017 to September 2018 (Figure 11 and Table 8, Chapter 4). Babies who did not survive 4 weeks of life (51/408=12.5%) or were out of the study area (90/408=22.1%) were excluded from the study. Of the babies available for recruitment (n=267), 40 could not be recruited as they were not available even after two consecutive visits (Figure 14).

Data on characteristics of all babies available for recruitment was obtained from the WHO database (Section 4.8.4.). Then babies recruited (n=227) and not recruited (n=181) were compared by characteristics (birth weight, sex, status at birth, place of hospitalisation) and by primary outcomes - KMC practice (whether KMC was initiated, duration of KMC on the day of initiation, day before discharge, 7th day after discharge and 28th day of life) to see if there was a systematic difference in the two groups (Tables 24-25).

Table 24: Characteristics of small babies in Gangawati sub-district

Characteristics	Total	Small babies		Test for significance (p)
		Recruited to the study (n=227)	Not recruited (n=181)*	
Birth weight (gms)				
- Mean (±SD)	1639.9(±263.1)	1693.6 (±221.4)	1572.7 (±294.6)	t test=4.73; p<0.001
		No (%)	No (%)	
Sex				
- Male	183 (44.9%)	94 (41.4%)	89 (49.2%)	$\chi 2$=2.5; p=0.11
- Female	225 (55.1%)	133 (58.6%)	92 (50.8%)	
Status at birth				
- Well	69 (16.9%)	37 (16.3%)	32 (17.7%)	$\chi 2$=0.1; p=0.77
- Sick	339 (83.1%)	190 (83.7%)	149 (82.3%)	
Place of hospitalisation				
- SDH	146 (35.8%)	69 (30.4%)	77 (42.5%)	$\chi 2$=8.48; p=0.014
- CHC/PHC	68 (16.7%)	36 (15.9%)	32 (17.7%)	
- Private	194 (47.5%)	122 (53.7%)	72 (39.8%)	
KMC initiated at health facility				
- Yes	332 (81.4%)	216 (95.2%)	116 (64.1%)	$\chi 2$=64.1; p<0.001
- No	76 (18.6%)	11 (4.8%)	65 (35.9%)	

** 181 babies were not recruited: [51 babies died <28 days of life; 90 babies were out of study area; 40 babies not available at home despite two consecutive visits*

The babies not recruited to the study were more likely to be born with lower birth weight (120 gms), more likely to be hospitalised in a government health facility (60.2% versus 46.3%) and less likely to be initiated on KMC at the health facility (64.1% vs 95.2%) compared to those babies recruited to the study. These differences were statistically significant (Table 24).

Table 25: Duration of KMC (hours) provided

KMC duration in hours provided to small babies										
	TOTAL (n=408)			Recruited to the study (n=227)			Not recruited (n=181)			Mann-Whitney U-test[i] (p)
KMC on										95% CI for Mean
	n_a	Median (IQR)	Mean (±SD)	n_b	Median (IQR)	Mean (±SD)	n_c	Median (IQR)	Mean (±SD)	
Day of KMC initiation	332	5.0(8.5)	[6.05±4.47]	216	6.0 (7.0)	[6.07±4.63]	116	6.0 (7.0)	[6.02±4.18]	z=-0.059 (p=0.95) -0.88, 1.17
Day before discharge	346	6.0(10.0)	[7.03±5.09]	216	8.0 (7.2)	[7.81±4.95]	111	8.0 (8.0)	[6.70±4.84]	z=1.95 (p=0.05) -0.03, 2.23
7th day after discharge	320	6.0 (9.0)	[5.32±4.63]	219	6.0 (7.3)	[6.4±.4.49]	91	0[d] (8.0)	[3.31±4.41]	z=5.40 (p<0.001) 2.05, 4.18
28th day of life	248	2.0 (6.0)	[3.41±3.89]	169	3.0 (7.0)	[3.8±3.87]	72	0[e] (5.1)	[2.84±3.90]	z=2.11 (p=0.03) -0.13, 2.04

n_a, n_b, n_c: Data available only for subset of babies who were recruited and not recruited; z score is used since the data is approximately normal

d:56.0% [51/91] = 0 hours of KMC on 7th day after discharge; e: 58.0% [42/72] = 0 hours of KMC on 28th day of life

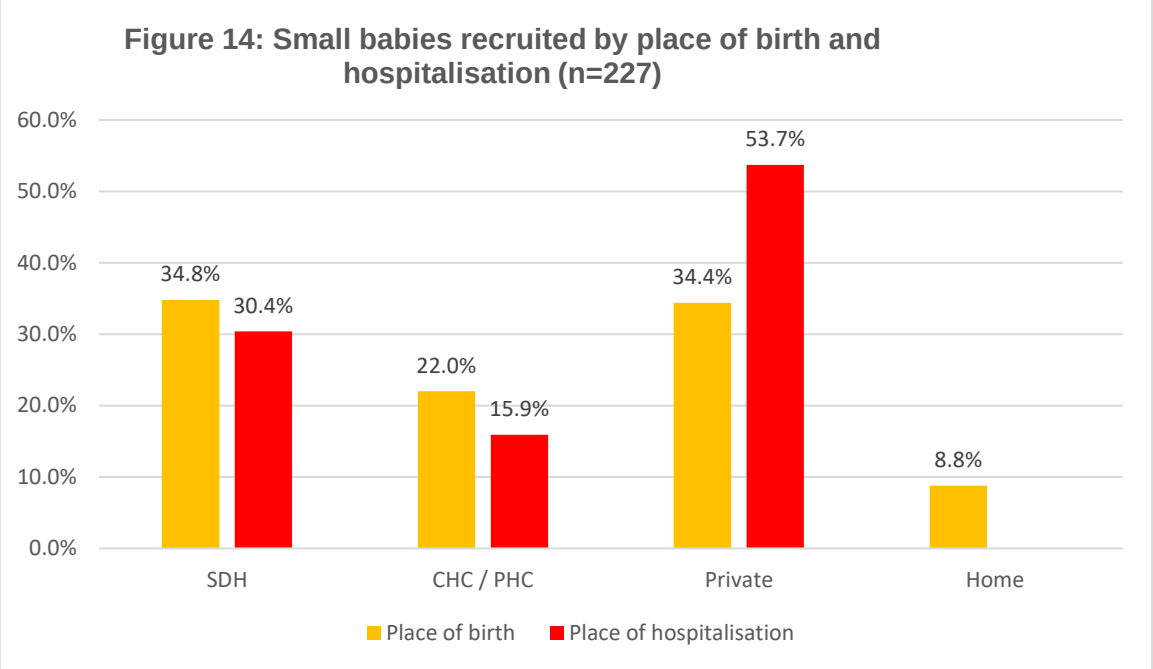
The median duration of KMC hours (Table 25) was significantly higher for the babies recruited to the study compared to those who were not recruited on the 7th day after discharge (p<0.001) and 28th day of life (p=0.03). Of the babies not recruited who did not survive 28 days of life, 25/51 (49%) were initiated on KMC at the health facility.

Table 26: Number of small babies that received effective KMC

	Small babies in Gangawati sub-district (n=408)			
Effective KMC* on	**Total (n_a=327)**	**Recruited to the study (n_b=216)**	**Not recruited (n_c=111)**	Chi-square Test (p) 95% CI
Day before discharge	**No. (%)**	**No. (%)**	**No. (%)**	
- Yes	209 (64.9%)	118 (54.6%)	91 (82.0%)	$\chi 2$=23.78 (p<0.001)
- No	118 (36.1%)	98 (45.4%)	20 (18.0%)	
7th day after discharge	**Total (n_d=310)**	**Recruited to the study (n_e=219)**	**Not recruited (n_f=91)**	
- Yes	139 (44.8%)	93 (42.5%)	46 (50.5%)	$\chi 2$=1.69 (p=0.19)
- No	171 (55.2%)	126 (57.5%)	45 (49.5%)	

*****Effective KMC= ≥8 hours of KMC per day + exclusive breastfeeding; n_a/ n_b/ n_c/ n_d/ n_e/ n_f: Subset of babies available in Gangawati (n=408) that were recruited (n=227) or not recruited (n=181) into the study as data was available only for them; 95% CI: 95% Confidence Interval*

More than two third [64.9% (209/327)] of all small babies available in Gangawati sub-district received effective KMC on the day before discharge and 44.8% (139/310) on the 7th day after discharge. There was a significant difference in the number of babies who received effective KMC on the day before discharge, with a significantly higher percentage of babies not recruited receiving effective KMC (p<0.001). By the 7th day after discharge, although there was a higher percentage of babies not recruited who received effective KMC compared to the babies recruited, the difference was not statistically significant as seen in Table 26. Figure 14 presents details of place of birth (obtained from the mother) and hospitalisation of only babies that were recruited to the study.



Although very few, [8.8% (20/227)] of small babies recruited to the study were born at home, they were hospitalised in a health facility after birth (Figure 14). Duration of hospitalisation days of small babies recruited to the study was found to be as follows:

- ≤3 days: 45.1% (102/226)
- 4-7 days: 23.5% (53/226)
- 8-14 days: 24.3% (55/226)
- >14 days: 7.1% (16/226)

The median (IQR) duration of hospitalisation for the babies recruited to the study was 4.57 (5) days, with a range of 1-30 days.

Key findings of characteristics of small babies in Gangawati sub-district:

- Babies recruited to the study were significantly different from those not recruited; they:
  - Had higher birth weight.
  - Were more likely to be admitted in the private health facilities.
  - Were more likely to be initiated on KMC in the health facility.
  - Had received longer duration of KMC on day before discharge, 7thday after discharge and 28th day of life.
  - Were more likely to have received effective KMC on the day before discharge and on the 7th day after discharge.
- Median (IQR) duration of hospitalisation of small babies recruited was 4.57 (5) days.

5.5. Outcomes of the study

The outcomes described in this Section 5.5 are only for small babies that were recruited to the study.

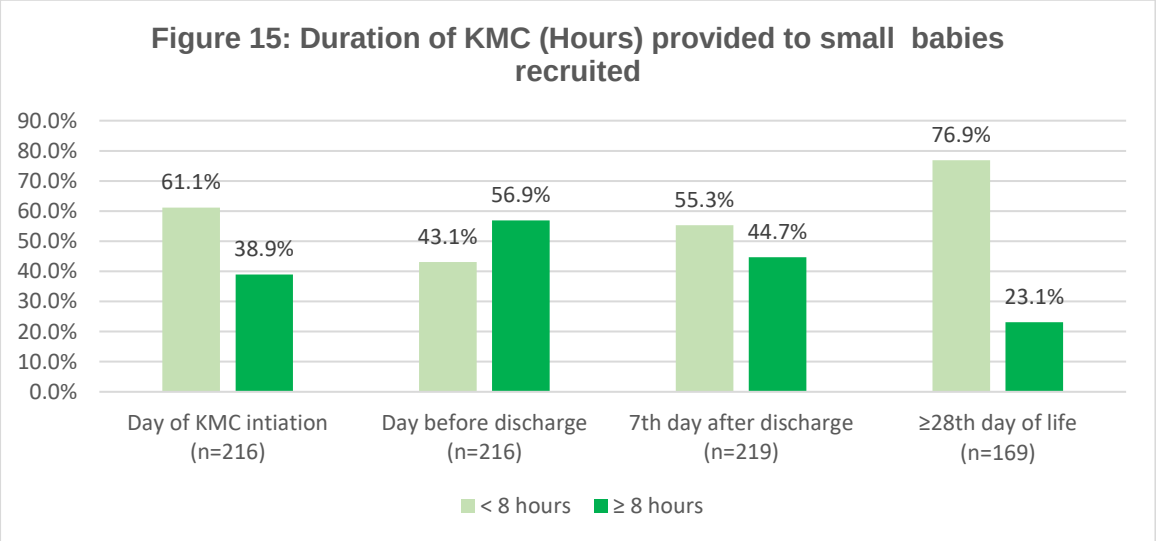
5.5.1. KMC practice

The components of KMC practice in this study included:

- KMC initiation at the health facility,
- Day of life when KMC was initiated,
- KMC duration (in hours) on the day of initiation, day before discharge, 7th day after discharge and 28th day of life (Figure 16),
- Effective KMC on the day before discharge and 7th day after discharge (Figure 16),
- Duration of KMC by days.

All babies recruited into the study, 100% (n=227) were *initiated on KMC*, 95.2% (216/227) were initiated at the health facility and only [4.8% (11/227)] initiated KMC at home. Nearly a third, [30% (68/227)] initiated KMC in the SDH, 19% (43/227) in the CHC/PHC and 46.2% (105/227) in the private health facilities.

Data was available only for 223 babies on '*day of life of KMC initiation*', as four mothers could not recall the day when KMC was initiated. More than a quarter, [28.7% (64/223)] of mothers reported that they had initiated KMC on day 1 of life, 30.9% (69/223) on day 2-3 of life, 26% (58/223) on day 4-7 of life and 14.3% (32/223) after the first week of life. The median (IQR) day of life for KMC initiation was 3 (5) days.

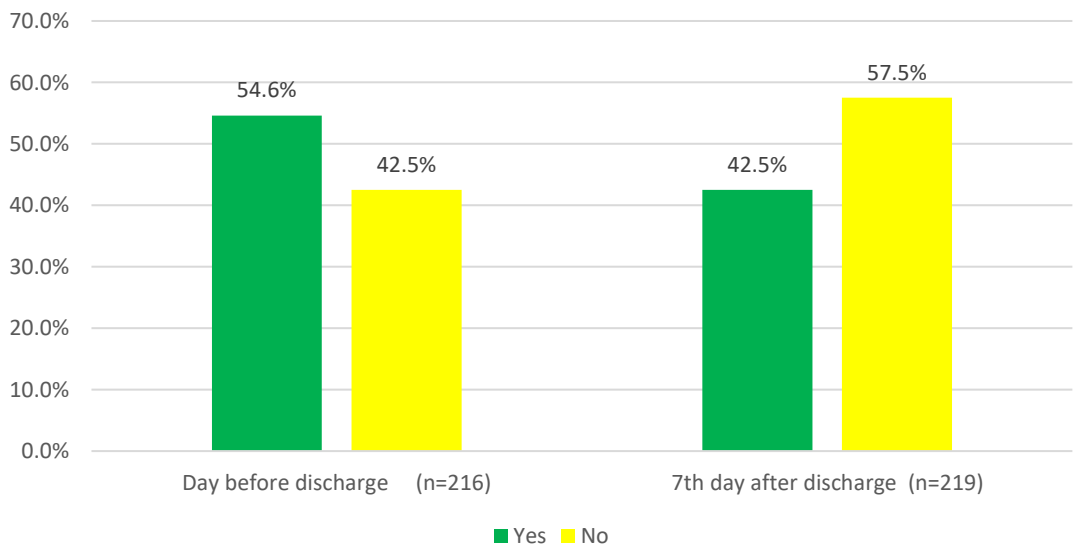


The *duration of KMC:* Over a third, [38.9% (84/216), 95% C.I. 32.4, 45.7] of the babies, had received ≥8 hours KMC on the day of initiation (Figure 15). On the day before discharge, More

than half, 56.9% [95% C.I. 50.1, 63.6 (123/216)] of babies received ≥8 hours KMC and then this tapered to 44.7% [95% C.I. 38.1, 51.6 (98/219)] of babies a week after discharge, and 23.1% [95% C.I. 17, 30.2 (39/169)] on the 28th day of life.

A comparison of duration of KMC was performed for babies recruited in the earlier [first five months (Dec 2017-Apr 2018)] and latter (May-Sept 2018) period of data collection. The median (IQR) hours of KMC duration for those babies recruited in the later period was significantly higher on the day of initiation [7.0 (7.5) vs 4.0 (6.3), p=0.001]; day before discharge [9.0 (7.0) vs 6.5 (7.8), p<0.001], but not significantly different for the 7th day after discharge [6.0 (7.4) vs 8.0 (6.3), p=0.178] compared to those recruited in the earlier period.

Figure 16: Effective KMC provided to small babies recruited



Effective KMC (≥8 hours of KMC and exclusive breastfeeding) was received by 54.6% [95% C.I. 48, 61 (118/216)] of the babies on the day before discharge (Figure 16). This percentage decreased to 42.5% [95% C.I. 35.8, 49.3 (93/219)] a week after discharge.

Data was available for 71.4% (162/227) babies on the *number of days KMC was provided*. KMC was provided for 30.2 (±8.5) days with a range of 2-45 days for these babies. Nearly three-fourths, 71.6% (116/162) of mothers were continuing KMC on the day when the questionnaire was administered (Annexure F.1). The unadjusted age of the babies on this day was 35.6±7.5 days (range 28-51). Since most mothers were continuing KMC, this data was not analysed further to assess determinants for this outcome.

5.5.2. Determinants of KMC practice using bivariate analyses

Results of the bivariate analyses on determinants of KMC practice (day of life of KMC initiation, duration of and effective KMC on day before discharge and 7th day after discharge, and duration of KMC on the 28th day of life) are shown in Tables 27-32. Bivariate analyses were not computed for determinants of KMC initiation at the health facility since only a small percentage [4.8% (11/227)] of babies were initiated on KMC at home compared to those initiated at the health facility [95.2% (216/227)].

Table 27: Determinants of day of life of KMC initiation

Variables	**Day of life of KMC initiation (n=223)***		**uRR (95%CI) p**
Health facility characteristics	**≤3 days (n_a=133)**	**>3 days (n_b=90)**	
Facility preparedness			
- [Mean (±SD)]	61.1(±14.6)	65.1 (±6.5)	0.98 (0.98, 0.99) p<0.001
Place of birth [No. (%)]			
- Public facility	94 (70.7%)	33 (36.7%)	4.74 (1.60, 13.5) p=0.004
- Private facility	22 (16.5%)	54 (60.0%)	1.73 (0.58, 5.12) p=0.32
- Home	17 (12.8%)	3 (3.3%)	1.0
Place of hospitalisation [No. (%)]			
- Public facility	91 (68.4%)	14 (15.6%)	4.83 (2.91, 8.01) p<0.001
- Private facility	42 (31.6%)	76 (84.4%)	1.0
Hospitalisation duration [No. (%)]			
- ≤3 days	87 (65.4%)	15 (16.7%)	4.21 (2.58, 6.86) p<0.001
- >3 days	46 (34.6%)	75 (83.3%)	1.0
KMC initiation support			
- [Mean (±SD)]	6.8 (±1.6)	5.8 (±2.7)	1.06 (1.01, 1.11) p=0.007
KMC maintenance support			
- [Mean (±SD)]	8.5 (±3.4)	7.0 (±3.9)	1.04 (1.01, 1.07) p=0.004
HCW characteristics			
Knowledge [Mean (±SD)]	70.4 (± 3.1)	69.9 (±0.8)	1.07 (0.98, 1.17) p=0.12
Attitude [Median (IQR)]	77.0 (3.0)	71.0 (3.0)	1.09 (1.07, 1.11) p<0.001
Skills [Mean (±SD)]	56.3 (± 4.9)	52.6 (±3.6)	1.08 (1.05, 1.11) p<0.001
Competence [Mean (±SD)]	68.0(± 4.9)	62.0(± 3.6)	1.05 (1.04, 1.06) p<0.001

Maternal & community characteristics			
Age {yrs.} [Mean (±SD)]	23.3 (± 3.6)	23.9 (± 4.5)	1.03 (0.98, 1.07) p=0.17
Education [No. (%)]			
- ≤8th grade	89 (66.9%)	53 (58.9%)	1.22 (0.89, 1.68) p=0.21
- >8th grade	44 (33.1%)	37 (41.1%)	1.0
Employed [No. (%)]			
- Yes	81 (60.9%)	53 (58.8%)	1.05 (0.76, 1.45) p=0.76
- No	52 (39.1%)	37 (41.1%)	1.0
No of children [No. (%)]			
- 1	68 (51.1%)	54 (60.0%)	1.24 (0.89, 1.72) p=0.19
- ≥2	65 (48.9%)	36 (40.0%)	1.0
KMC maintenance support - home [Mean (± SD)]	16.7(±10.2)	18.3(±`0.5)	0.99 (0.98, 1.010) p=0.26
Baby characteristics			
Sex [No. (%)]			
- Male	53 (39.8%)	39 (43.3%)	0.91 (0.66, 1.26) p=0.60
- Female	80 (60.2%)	51 (56.7%)	1.0
Birth weight [No. (%)]			
- ≤1500 gms	18 (13.5%)	29 (32.2%)	0.56 (0.42, 0.76) p<0.001
- >1500 gms	115 (86.5%)	61 (67.8%)	1.0
Status at birth [No. (%)]			
- Well	16 (12.0%)	19 (21.1%)	0.69 (0.48, 0.99) p=0.045
- Sick	117 (88.0%)	71 (78.9%)	1.0

Health facility preparedness and HCW characteristics: Knowledge, attitude, skills, and competencies are expressed in percentage of maximum scores; n_a / n_b: Subset of small babies (n=227) KMC initiated ≤3days / >3days, respectively.
uRR: unadjusted Relative Risk; 95% CI: 95% Confidence Interval; Reference groups for categorical variables are indicated as uRR=1.0

Health facility preparedness, place of birth and place of hospitalisation were significantly associated with the day of life of KMC initiation (Table 27). Those babies for whom KMC was initiated earlier (≤3 days of life) compared to those who were initiated later (>3days) were:

- 2% less likely to be hospitalised in health facilities with lower health facility preparedness scores [(95% CI: 0.98, 0.99); p<0.001].
- More likely to be born in the public by 374% [uRR 4.74 (95% CI: 1.6, 13.5) p=0.004] health facility compared to those born at home.

- 383% [uRR 4.83 (95% CI: 2.91, 8.01) p<0.001] more likely to be hospitalised in the public health facilities.
- 321% [uRR 4.21 (95% CI: 2.58, 6.86) p<0.001] more undoubtedly hospitalized for ≤3 days.

Additional health facility characteristics that were related to the day of KMC initiation included support for KMC initiation and maintenance received by the mother. Higher KMC initiation support score [uRR 1.06 (95% CI: 1.01, 1.11), p=0.007] and higher KMC maintenance support score [uRR 1.04 (95% CI: 2.01, 1.07) p=0.004] more certainly increased earlier KMC initiation by 6% and 4% respectively.

Of the characteristics of HCWs, their attitude, skills, and competencies were associated with earlier KMC initiation. Higher attitude score of HCWs had 9% greater influence on earlier KMC initiation compared to lower attitude score [median 77 (3) vs 71(3); uRR=1.09 (95% CI: 1.07, 1.11) p<0.001]. Similarly, higher skills score [uRR=1.08 (95% CI 1.05, 1.11); p<0.001] and higher competence score [uRR 1.05 (95% CI: 1.04, 1.06) p<0.001] of HCWs were more likely to increase the likelihood of earlier KMC initiation by 8% and 5% respectively.

None of the maternal characteristics were significantly associated with day of KMC initiation. Of the baby characteristics, only birth weight was significantly associated with earlier KMC initiation. The likelihood of earlier KMC initiation decreased by 44% (uRR0.56, 95% CI: 0.42, 0.76) if the birth weight of the baby was ≤1500gms.

Table 28: Determinants of KMC duration on day before discharge

Variables	**KMC duration-day before discharge (n=216*)**		**uRR (95% CI) p**
Health facility characteristics	**≥8 hours (n_a=123)**	**<8 hours (n_b=93)**	
Facility preparedness			
- [Mean (±SD)]	63.8(±12.7)	61.4 (±11.6)	0.99 (0.98-1.00) p=0.17
Place of birth [No. (%)]			
- Public facility	75 (60.9%)	51 (51.6%)	1.71 (0.84, 3.47) p=0.13
- Private facility	34 (27.6%)	36 (41.9%)	1.35 (0.66, 2.72) p=0.40
- Home	14 (11.4%)	6 (6.5%)	1.0
Place of hospitalisation [No.(%)]			
- Public facility	76 (61.8%)	28 (30.1%)	2.15 (1.15, 3.07) p<0.001
- Private facility	47 (38.2%)	65 (69.9%)	1.0

Hospitalisation duration [No.(%)]			
- ≤3 days	63 (51.2%)	38 (40.9%)	1.27 (0.93, 1.74) p=0.14
- >3 days	60 (48.8%)	55 (59.1%)	1.0
KMC initiation support			
- [Mean (±SD)]	6.8 (±1.9)	6.1 (±1.7)	1.10 (1.04, 1.17) p=0.001
KMC maintenance support			
- [Mean (±SD)]	8.6 (± 3.4)	7.4(± 3.8)	1.04 (1.003, 1.06) p=0.03
HCW characteristics			
Knowledge [Mean (±SD)]	70.2 (±2.7)	70.3 (± 2.3)	0.99 (0.92, 1.06) p=0.88
Attitude [Median (IQR)]	77.0 (6.0)	74.0 (5.0)	1.01 (0.99, 1.02) p=0.08
Skills [Mean (±SD)]	55.8 (±5.0)	53.7 (± 4.2)	1.05 (1.02, 1.08) p=0.001
Competence [Mean(±SD)]	66.0(± 5.1)	64.0(± 5.1)	1.02(1.005,1.03) p=0.004
Maternal characteristics			
Age {yrs.} [Mean (±SD)]	23.5 (± 3.6)	23.4 (± 4.3)	1.002 (0.97, 1.02) p=0.87
Education [No. (%)]			
- ≤8th grade	85 (69.1%)	52 (55.9%)	1.37 (1.01, 1.84) 0.04
- >8th grade	38 (30.9%)	41 (44.1%)	1.0
Employed [No. (%)]			
- Yes	78 (63.0%)	51 (54.8%)	1.22 (0.90, 1.65) 0.19
- No	45 (36.0%)	42 (45.2%)	1.0
No. of children [No. (%)]			
- 1	69 (56.1%)	50 (53.8%)	1.05 (0.77, 1.43) 0.73
- ≥2	54 (43.9%)	43 (46.2%)	1.0
Baby characteristics			
Sex [No. (%)]			
- Male	57 (46.3%)	36 (38.7%)	0.83 (0.60, 1.15) p=0.27
- Female	66 (53.7%)	57 (61.3%)	1.0
Birth weight [No. (%)]			
- ≤1500 gms	23 (18.7%)	25 (26.9%)	0.77 (0.56, 1.08) p=0.13
- >1500 gms	100(81.3%)	68 (73.1%)	1.0
Status at birth [No. (%)]			
- Well	13 (10.6%)	21 (22.6%)	0.64 (0.46, 0.88) p=0.006
- Sick	110(89.4%)	72 (77.4%)	1.0

Health facility preparedness and HCW characteristics: Knowledge, attitude, skills, and competencies are expressed in percentage of maximum scores; n_a / n_b: Subset of small babies (n=227) KMC duration ≥8hours / <8 hours, respectively. uRR: unadjusted Relative Risk; 95% CI: 95% Confidence Interval; Reference groups of categorical variables are indicated as uRR=1.0

Duration of KMC on the day before discharge was associated only with the place of hospitalisation among all the health facility characteristics (Table 28). Babies admitted in public health facilities, 115 % (uRR 2.15; 95% CI: 1.15, 3.07) more likely to receive ≥8 hours of KMC on the day before discharge compared to those admitted in private health facilities (p<0.001). Additionally, those mothers who reported higher KMC initiation support score [6.8 (±1.9) vs 6.1 (±1.7), uRR 1.10 (95% CI: 1.04, 1.17)] and higher KMC maintenance support score [8.6 (± 3.4) vs 7.4(± 3.8), p=0.02, uRR 1.04 (95% CI: 1.01, 1.84)] at the health facility had increased likelihood of providing ≥8 hours of KMC on the day before discharge by 10% and 4%respectively.

Of the HCW characteristics, the skills and competence scores were significantly associated with the duration of KMC on the day before discharge. Higher skills score of HCWs [55.8±5.0 vs 53.7±4.2; uRR=1.05 (95% CI: 1.02, 1.08)] and higher competence score of HCWs [66.0±5.1 vs 64.0±5.1; uRR=1.02 (95% CI: 1.005, 1.03)] increased by 5% and 2% respectively the likelihood for KMC duration of ≥8 hours on the day before discharge.

Of the maternal characteristic's education level was associated with duration of KMC on the day before discharge. The mothers with ≤8 grade education was 37% [95% CI 1.01, 1.84] more likely to provide ≥8 hours of KMC on the day before discharge than those with >8 grade education.

Of the baby characteristics, only status at birth was associated with KMC duration on the day before discharge. Babies who were well had 36% lower likelihood to receive ≥8 hours KMC on the day before discharge [uRR 0.64 (95% CI 0.46, 0.88)] compared to those babies were sick at birth.

Table 29: Determinants of effective KMC on day before discharge

Determinants	**Effective KMC-Day before discharge (n= 216) ***		**uRR (95% CI) p**
Facility characteristics	**Yes (n_a=118)**	**No (n_b=98)**	
Facility preparedness			
- [Mean (±SD)]	64.0(±12.9)	62.0(±11.4)	1.008 (0.99, 1.02) p=0.18
Place of birth [No. (%)]			
- Public facility	73 (61.9%)	53 (54.1%)	1.33 (0.99 ,1.79) p=0.052
- Private facility	31 (26.3%)	39 (39.8%)	0.72 (0.35, 1.45) p=0.36

- Home	14 (11.8%)	6 (6.1%)	1.0
Place of hospitalisation [No. (%)]			
- Public facility	76 (64.4%)	28 (28.6%)	2.31 (1.63, 3.27) p<0.001
- Private facility	42 (35.6%)	70 (71.4%)	1.0
Hospitalisation duration [No. (%)]	62 (52.5%)	39 (39.8%)	1.31 (0.97, 1.78) p=0.07
- ≤3days	56 (47.5%)	59 (61.2%	1.0
- >3 days			
KMC initiation support			
- [Mean (±SD)]	7.0 (±1.9)	6.0 (±1.7)	1.11 (1.04, 1.17) p=0.002
KMC maintenance support			
- [Mean (±SD)]	9.0 (±3.4)	8 (±3.8)	1.03 (0.99, 1.06) p=0.06
HCWs characteristics			
Knowledge [Mean (±SD)]	70.0 (± 2.7)	70.0 (±2.2)	0.99 (0.94, 1.05) p=0.84
Attitude [Median (IQR)]	77.0 (6.0)	74.0 (5.0)	1.02 (1.001, 1.03) p=0.02
Skills [Mean (±SD)]	56.0 (± 5.0)	54.0 (±4.1)	1.06 (1.02, 1.08) p<0.001
Competence [Mean(±SD)	67.0(± 5.1)	64.0(± 5.1)	1.02(1.008,1.03) p=0.001
Maternal characteristics			
Age {yrs.} [Mean (±SD)]	23.0 (± 3.6)	23.0 (± 4.3)	0.99 (0.97, 1.02) p=0.97
Education [No. (%)]			
- ≤8th grade	81 (68.6%)	56 (57.1%)	1.28 (0.96, 1.72) p=0.09
- >8th grade	37 (31.4%)	42 (42.9%)	1.0
Employed [No. (%)]			
- Yes	76 (64.4%)	53 (54.1%)	1.24 (0.93, 1.66) p=0.14
- No	42 (35.6%)	45 (45.9%)	1.0
No. of children [No. (%)]			
- 1	67 (56.8%)	52 (53.1%)	1.09 (0.82, 1.47) p=0.54
- ≥2	51 (43.2%)	46 (46.9%)	1.0
Baby characteristics			
Sex [No. (%)]			
- Male	52 (44.1%)	41 (41.8%)	1.07 (0.78, 1.44) p=0.67
- Female	66 (55.9%)	57 (58.2%)	1.0
Birth weight [No. (%)]			
- ≤1500 gms	21 (17.8%)	27 (27.6%)	0.75 (0.55, 1.01) p=0.06
- >1500 gms	97 (82.2%)	71 (72.4%)	1.0

Status at birth [No. (%)]			
- Well	12 (10.2%)	22 (22.4%)	0.64 (0.47, 0.86) p=0.004
- Sick	106(89.8%)	76 (77.6%)	1.0

Health facility preparedness and HCW characteristics: Knowledge, attitude, skills, and competencies are expressed in percentage of maximum scores; n_a / n_b: Subset of small babies (n=227) who received and did not receive effective KMC (≥8 hours KMC + exclusive breastfeeding) respectively; uRR: unadjusted Relative Risk; 95% CI: 95% Confidence Interval; Reference groups of categorical variables are indicated as uRR=1.0

Effective KMC on the day before discharge (Table 29) was significantly associated with the health facility where the baby was hospitalised (p<0.001) and KMC initiation support received at the health facility. Babies who were hospitalised in the public health facilities had 131% [95% CI: 1.63,3.27] increased likelihood of receiving effective KMC on the day before discharge compared to those in private health facilities. Higher KMC initiation support score at the health facility [7.0±1.9 vs 6.0±1.7] increased the provision for effective KMC by 11% (uRR 1.11, 95% CI: 1.04, 1.17).

Of the HCWs characteristics, their attitude, skills, and competence were associated with a baby receiving effective KMC on the day before discharge. Higher attitude score [77.0 (6.0) vs 74.0 (5.0), uRR 1.02 (95% CI: 1.001, 1.03)], higher skills score [56.0±5.0 vs 54±4.1, uRR 1.06 (95% CI: 1.02, 1.08)] and higher competence score [67.0±5.1 vs 64.0±5.1, uRR 1.02 (95% CI: 1.008, 1.03)] of HCWs increased by 2%, 6% and 2% respectively the likelihood of effective KMC on the day before discharge.

None of the maternal characteristics, were associated with effective KMC provision on the day before discharge. Of the baby characteristics, only status at birth was associated with effective KMC on the day before discharge. Babies who were well at birth were 36% less likely to receive effective KMC on the day before discharge compared to those who were sick at birth [uRR 0.64 (95% CI: 0.47, 0.86)].

Table 30: Determinants of KMC duration on 7th day after discharge

Variables	KMC duration- 7th Day after discharge (n=219*)		uRR (95% CI) p
Facility characteristics	**≥8 hrs (n_a=98)**	**<8 hrs (n_b=121)**	
Facility preparedness			
- [Mean (±SD)]	61.0 (±13.2)	64.0(±11.2)	0.98 (0.97, 0.99) p=0.03
Place of birth [No (%)]			
- Public facility	56 (57.1%)	69 (57.0%)	1.10 (0.86, 1.40) p=0.43
- Private facility	29 (29.6%)	45 (37.0%)	0.63 (0.34, 1.17) p=0.15
- Home	13 (13.3%)	7 (5.8%)	1.0
Place of hospitalisation [No. (%)]			
- Public facility	54 (55.1%)	49 (40.5%)	1.31 (1.01, 1.67) p=0.03
- Private facility	44 (44.9%)	72 (59.5%)	1.0
Hospitalisation duration [No. (%)]			
- ≤3 days	48 (49.0%)	53 (43.8%)	0.91 (0.71, 1.16) p=0.44
- >3 days	50 (51.0%)	68 (56.2%)	1.0
KMC initiation support			
- [Mean (± SD)]	6.5 (±2.1)	6.03(±2.1)	1.03 (0.9, 1.11) p=0.42
KMC maintenance support			
- [Mean (±SD)]	8.0 (±3.9)	8.1(±3.6)	0.99 (0.95, 1.03) p=0.85
HCW characteristics			
Knowledge [Mean(±SD)]	70.7 (±2.7)	69.9 (± 2.1)	1.05 (1.01, 1.09) p=0.005
Attitude [Median (IQR)]	76.0 (6.0)	74.0 (5.0)	1.02 (1.005, 1.05) p=0.01
Skills [Mean (±SD)]	55.3 (±4.8)	54.4 (± 4.8)	1.02 (0.99, 1.05) p=0.13
Competence [Mean(±SD)]	67.0(± 5.3)	65.0(± 5.0)	1.02 (1.007,1.04) =0.005
Maternal and community characteristics			
Age {yrs.} [Mean (±SD)]	23.5 (± 4.5)	23.6 (± 3.5)	0.99 (0.95, 1.03) p=0.84
Education [No. (%)]			
- ≤8th grade	59 (60.2%)	79 (65.3%)	0.91 (0.70, 1.16) p=0.44
- >8th grade	39 (39.8%)	42 (34.7%)	1.0
Employed [No. (%)]			
- Yes	58 (59.2%)	74 (61.2%)	1.04 (0.81, 1.32) p=0.76
- No	40 (40.8%)	47 (38.8%)	1.0

No of children [No. (%)]			
- 1	57 (58.2%)	63 (52.1%)	1.11 (0.88, 1.41) p=0.36
- ≥2	41 (41.8%)	58 (47.9%)	1.0
Knowledge [Mean (±SD)]	17.6 (±3.0)	17.4 (±3.4)	1.01 (0.96, 1.06) p=0.64
Attitude [Median (IQR)]	4.0 (0)	4.0 (0)	-
KMC maintenance support -home			
- [Median (IQR)]	12 (20.8)	17 (20.0)	0.99 (0.98, 1.01) p=0.61
Baby characteristics			
Sex [No. (%)]			
- Male	43 (43.9%)	48 (39.7%)	0.92 (0.72, 1.18) p=0.53
- Female	55 (56.1%)	73 (60.3%)	1.0
Birth weight [No. (%)]			
- ≤1500 gms	23 (23.5%)	26 (21.5%)	0.95 (0.70, 1.27) p=0.73
- >1500 gms	75 (76.5%)	95 (78.5%)	1.0
Status at birth [No. (%)]			
- Well	17 (17.3%)	20 (16.5%)	0.97 (0.7, 1.34) p=0.87
- Sick	81 (82.7%)	101 (83.5%)	1.0

*Health facility preparedness and HCW characteristics: Knowledge, attitude, skills, and competencies are expressed in percentage of maximum scores; n_a / n_b : Subset of small babies (n=227) who received KMC (≥8 hours/<8hours) respectively. uRR: unadjusted Relative Risk; 95% CI: 95% Confidence Interval; *: p value significant*

Reference groups of categorical variables are indicated as uRR=1.0

As shown in Table 30, of the health facility characteristics, health facility preparedness and the place of hospitalisation were associated significantly with the duration of KMC on the 7th day after discharge. The babies who received ≥8 hours duration of KMC on the 7th day after discharge, were predominantly from health facilities with lower health facility preparedness score [uRR 0.98 (95% CI: 0.97, 0.99) p=0.03]. Babies admitted in public health facilities had 31% [uRR 1.31, (95% CI: 1.01, 1.67)] increased likelihood of receiving ≥8 hours duration of KMC on the 7th day after discharge compared to those admitted in private health facilities.

Except for HCWs skills, all other characteristics of HCWs were significantly associated with the duration of KMC on the 7th day after discharge. Higher knowledge score of HCWs increased likelihood of babies receiving ≥8 hours duration of KMC on the 7th day after discharge by 5% [95% CI: 1.01, 1.09]; higher attitude score increased this likelihood by 2% [95% CI: 1.005, 1.05)] and higher competence score by increased this likelihood 2 % [95% CI: 1.007, 1.04)].

None of the maternal & community characteristics or baby characteristics were significantly associated with the duration of KMC on the 7th day after discharge (p>0.05).

Table 31: Determinants of effective KMC on 7th day after discharge

Variables	Effective KMC - 7th day after discharge (n=219)		uRR (95% CI) p
Health facility characteristics	**Yes (n_a=93)**	**No (n_b=126)**	
Facility preparedness			
- [Mean (±SD)]	60.5 (±13.3)	64.5(±11.0)	0.98 (0.97, 0.99) =0.007
Place of birth [No. (%)]			
- Public facility	52 (55.9%)	73 (57.9%)	1.77 (0.95, 3.31) p=0.07
- Private facility	28 (30.1%)	46 (36.5%)	1.66 (0.90, 3.08) p=0.10
- Home	13 (14.0%)	7 (5.6%)	1.0
Place of hospitalisation [No. (%)]			
- Public facility	52 (55.9%)	51 (40.5%)	1.31 (1.03, 1.65) p=0.02
- Private facility	41 (44.1%)	75 (59.5%)	1.0
Hospitalisation duration [No. (%)]			
- ≤3 days	47 (50.5%)	54 (42.9%)	1.14 (0.90, 1.43) p=0.27
- >3 days	46 (49.5%)	72 (57.1%)	1.0
KMC initiation support	6.52 (±2.0)	6.29 (±2.2)	1.03 (0.95, 1.11) p=0.43
- [Mean (± SD)]			
KMC maintenance support	7.95 (±3.8)	8.1 (±3.6)	0.99 (0.95, 1.03) p=0.82
- [Mean (± SD)]			
HCWs characteristics			
Knowledge [Mean (±SD)]	71.0 (± 2.8)	70.0 (±2.1)	1.05 (1.02, 1.09) p=0.002
Attitude [Median (IQR)]	77.0 (6.0)	74.0 (8.0)	1.03(1.008, 1.04) p=0.006
Skills [Mean (±SD)]	55.0 (± 4.8)	54.0 (±4.7)	1.02 (0.99, 1.05) p=0.18
Competence [Mean(±SD)]	67.0(± 5.4)	65.0(± 4.9)	1.03 (1.007, 1.04) p=0.004
Maternal and community characteristics			
Age {yrs.} [Mean (±SD)	23.0 (± 4.6)	24.0 (±3.4)	0.99 (0.05, 1.03) p=0.77
Education [No. (%)]			
- ≤8th grade	54 (58.1%)	84 (66.7%)	1.17 (0.91, 1.50) p=0.20
- >8th grade	39 (41.9%)	42 (33.3%)	1.0

Employed [No. (%)]			
- Yes	54 (58.1%)	78 (61.9%)	1.07 (0.84, 1.35) p=0.57
- No	39 (41.9%)	48 (38.1%)	1.0
No. of children [No. (%)]			
- 1	55 (59.1%)	65 (51.6%)	1.13 (0.90, 1.42) p=0.26
- ≥2	38 (40.9%)	61 (48.4%)	1.0
Knowledge [Mean (±SD)]	17.5 (±2.9)	17.5 (±3.4)	1.0 (0.90, 1.01) p=0.94
Attitude [Median (IQR)]	4.0 (0)	4.0 (0)	-
KMC maintenance support -home [Median (IQR)]	16 (10.4)	18 (10.4)	0.99 (0.97, 1.00) p=0.43
Baby characteristics			
Sex [No. (%)]			
- Male	41 (44.1%)	50 (39.7%)	0.93 (0.73, 1.17) 0.51
- Female	52 (55.9%)	76 (60.3%)	1.0
Birth weight [No. (%)]			
- ≤1500 gms	21 (22.6%)	28 (22.2%)	0.98 (0.75, 1.30) 0.95
- >1500 gms	72 (77.4%)	98 (77.8%)	1.0
Status at birth [No. (%)]			
- Well	17 (18.3%)	20 (15.9%)	0.92 (0.67, 1.28) 0.65
- Sick	76 (81.7%)	106 (84.1%)	1.0

Health facility preparedness and HCW characteristics: Knowledge, attitude, skills, and competencies are expressed in percentage of maximum scores; n_a / n_b: Subset of small babies (n=227) who received / did not receive effective KMC (≥8 hours KMC + exclusive breastfeeding) respectively; uRR: unadjusted Relative Risk; 95% CI: 95% Confidence Interval; Reference groups of categorical variables are indicated as uRR=1.0

The health facility characteristics that were significantly associated with effective KMC on the 7th day after discharge included health facility preparedness and place of hospitalisation as shown in Table 31. Babies hospitalised in health facilities with lower health facility preparedness scores were 2% [uRR 0.98 95% CI: 0.97, 0.99) less likely to have received effective KMC on the 7th day after discharge compared to those in health facilities with higher scores. Babies admitted in the public over private health facilities had 31% [95% CI: 1.03, 1.65] higher likelihood to receive effective KMC.

Of the characteristics of HCWs, their knowledge, attitude, and overall competence scores were significantly associated with the provision of effective KMC. HCWs higher knowledge scores [uRR 1.05 (95% CI: 1.02, 1.09), higher attitude scores [uRR 1.03 (1.008, 1.04)] and

higher competence scores [1.03 (95% CI: 1.007, 1.04)] increased the likelihood of effective KMC on the 7th day after discharge by 5%, 3% and 3% respectively.

None of the maternal or baby characteristics were associated with the provision of effective KMC on the 7th day after discharge.

Table 32: Determinants of KMC duration on 28th day of life

Determinants	KMC duration -28th of life (n=169) *		
Facility characteristics	**≥ 8 hours (n_a=39)**	**<8 hours (n_b=130)**	**uRR (95% CI) p**
Facility preparedness			
- [Mean (±SD)]	60.2(±12.1)	64.9 (±11.1)	0.98 (0.96, 0.99) p=0.02
Place of birth [No. (%)]			
- Public facility	15 (57.9%)	79 (55.9%)	2.35 (1.15, 4.77) p=0.02
- Private facility	15 (36.5%)	46 (30.1%)	2.11 (1.03, 4.32) p=0.04
- Home	9 (5.6%)	5 (14.0%)	1.0
Place of hospitalisation [No. (%)]			
- Public facility	21 (53.8%)	57 (43.8%)	1.09 (0.93, 1.30) p=0.27
- Private facility	18 (46.2%)	73 (56.2%)	1.0
Hospitalisation duration [No. (%)]			
- ≤3 days	18 (46.2%)	55 (42.3%)	1.03 (0.87, 1.22) p=0.67
- >3 days	21(54.8%)	75 (57.7%)	1.0
KMC initiation support			
- [Mean (±SD)]	7.1 (± 1.6)	6.5 (± 2.8)	1.12 (0.95, 1.31) p=0.15
KMC maintenance support			
- [Mean (±SD)]	9.5(± 2.8)	8.0 (± 3.6)	1.10 (1.003, 1.22) p=0.04
HCWs characteristics			
Knowledge [Mean (±SD)]	70.4 (±2.7)	69.8 (± 2.0)	1.07 (0.98, 1.17) p=0.09
Attitude [Median (IQR)]	76 (8)	74 (6)	1.03 (0.99, 1.07) p=0.06
Skills [Mean (±SD)]	54.8 (±4.9)	54.8 (± 4.7)	1.005 (0.94, 1.06) p=0.98
Competence [Mean(±SD)]	66.0(± 5.9)	65.0(± 5.0)	1.02 (0.09, 1.06) p=0.20
Maternal and community characteristics			
Age {yrs.} [Mean (±SD)]	23.3 (± 5.6)	23.6 (± 3.4)	0.98 (0.90, 1.07) p=0.67

Education [No. (%)]			
- ≤8th grade	26 (66.7%)	83 (63.8%)	0.97 (0.82, 1.15) p=0.74
- >8th grade	13 (33.3%)	47 (36.2%)	1.0
Employed [No. (%)]			
- Yes	21 (53.9%)	78 (60.0%)	1.06 (0.89, 1.25) p=0.50
- No	18 (46.1%)	52 (40.0%)	1.0
No of children [No. (%)]			
- 1	26 (66.7%)	69 (53.1%)	1.13 (0.96, 1.33) p=0.12
- ≥2	13 (33.3%)	61 (46.9%)	1.0
Knowledge [Mean (±SD)]	18.6 (±2.8)	17.7 (±3.2)	1.07 (0.97, 1.19) p=0.15
Attitude [Median (IQR)]	4.0 (0)	4.0 (0)	-
KMC maintenance support- home [Median (IQR)]	15 (20)	10 (21)	1.003 (0.97, 1.03) p=0.84
Baby characteristics			
Sex [No. (%)]			
- Male	16 (41.0%)	52 (40.0%)	1.01 (0.85, 1.19) p=0.90
- Female	23 (59.0%)	78 (60.0%)	1.0
Birth weight [No. (%)]			
- ≤1500 gms	15 (38.5%)	27 (20.8%)	0.79 (0.62, 1.00) p=0.05
- >1500 gms	24 (61.5%)	103 (79.2%)	1.0
Status at birth [No. (%)]			
- Well	7 (17.9%)	20 (15.4%)	0.95 (0.75, 1.21) p=0.72
- Sick	32 (82.1%)	110 (84.5%)	1.0

Health facility preparedness and HCW characteristics: Knowledge, attitude, skills, and competencies are expressed in percentage of maximum scores; n_a / n_b : Subset of small babies (n=227) who received (≥8 hours/<8 hours) of KMC respectively; uRR: unadjusted Relative Risk; 95% CI: 95% Confidence Interval; Reference groups of categorical variables are indicated as uRR=1.0

Of the health facility characteristics, facility preparedness, place of birth and KMC maintenance support scores at the health facility were significantly associated with duration of KMC on the 28th day of life as shown in Table 32. Babies hospitalised in health facilities with lower health facility preparedness scores were 2% less likely to receive of ≥8 hours of KMC on the 28th day of life [uRR 0.98, 95% CI: 0.96, 0.99, p=0.02]. Additionally, babies born in public health facilities had 135% [95% CI: 1.15, 4.77, p=0.02] while those born in private health facilities had 111% [uRR 2.11, 95% CI: 1.03, 4.32, p=0.04] more likelihood of receiving ≥8 hours of KMC on the 28th day of life compared to those born at home. Mothers who reported higher KMC maintenance support at the health facility were 10% more likely to

provide ≥8 hours of KMC on the 28th day of life compared to those who received lesser support [9.5±2.8 vs 8.0±3.6, uRR 1.10 (95% CI: 1.003, 1.22)].

None of the HCWs, maternal or baby characteristics were significantly associated with the duration of KMC provided on the 28th day of life.

5.5.3. Determinants of KMC practice using multivariate analyses

The variables that had p-value up to 0.10 in the unadjusted relative risk computation (seen in Section 5.5.2.- Tables 27-32), were included in the model for computation of multivariate log-binomial regression analyses as shown in Table 33-34. Among HCW characteristics, competence was not included in the multivariate analyses since it was a composite measure of knowledge, attitude, and skills.

Table 33: Variables selected for regression analyses in health facility phase of KMC practice

Variables	KMC practice components: Health facility phase		
	1: Day of life of KMC initiation	***2: Duration of KMC on day before discharge***	***3: Effective KMC on day before discharge***
Health facility characteristics			
- Health facility preparedness	✓		
- Place of birth	✓		✓
- Place of hospitalization	✓	✓	✓
- Hospitalisation duration	✓		✓
- KMC initiation support	✓	✓	✓
- KMC maintenance support	✓	✓	✓
HCWs characteristics			
- Knowledge			
- Attitude	✓	✓	✓
- Skills	✓	✓	✓
Maternal characteristics			
- Age			
- Education		✓	✓
- Occupation			
- Number of children			
Baby characteristics			
- Sex			
- Birth weight	✓		✓
- Status at birth	✓	✓	✓

✓**:** *Included in analysis based on p value up to 0.1 on bivariate analysis*

Table 34: Variables selected for analysis in community phase of KMC practice

Variables	KMC practice components: Community phase		
	4: Duration of KMC- 7th day after discharge	***5: Effective KMC- 7th day after discharge***	***6: Duration of KMC- 28th day of life***
Health facility characteristics			
- Health facility preparedness	✓	✓	✓
- Place of birth			✓
- Place of hospitalisation	✓	✓	✓
- Hospitalisation duration			
- KMC initiation support			
- KMC maintenance support			✓
HCWs characteristics			
- Knowledge	✓	✓	✓
- Attitude	✓	✓	✓
- Skills			
Maternal & community characteristics			
- Age			
- Education			
- Occupation			
- Number of children			
- Knowledge on KMC			
- Attitude on KMC			
- KMC maintenance support – home			
Baby characteristics			
- Sex			
- Birth weight			✓
- Status at birth			

✓**:** *Included in analysis based on p value up to 0.1 on bivariate analysis*

The results of log-binomial regression analyses are shown in Table 35.

Table 35: Determinants of KMC practice in health facility and community phases

Outcome variables	Determinants	Adjusted RR (95% CI)	p value
Health facility phase of KMC practice			
Day of life of KMC initiation (≤3 / >3 days)	Place of hospitalisation (Public *vs* private*)	2.68 (1.31,5.51)	0.007
	HCWs attitude (Median 77 *vs* 71*)	1.01 (1.00, 1.01)	0.042
	KMC initiation support	1.03 (1.02, 1.04)	0.045

	(Mean 8.5 *vs* 7.0*)		
KMC duration-day before discharge (≥8 / <8 hrs)	HCWs skills (Mean 55.8 *vs* 53.7*)	1.05 (1.01, 1.07)	0.017
	KMC maintenance support (Mean 8.6 *vs* 7.4*)	1.03 (1.00, 1.06)	0.003
Effective KMC – Day before discharge (Yes/No)	Hospitalisation duration (≤3 days *vs* >3 days*)	3.22 (1.97, 5.28)	<0.0001
	HCWs attitude (Median 77 *vs* 74*)	1.05 (1.01, 1.08)	0.013
Community phase of KMC practice			
KMC duration- 7th day after discharge (≥8 /<8 hrs)	Place of hospitalisation (Public *vs* private*)	1.31 (1.02, 1.68)	0.035
	HCWs knowledge (Mean 70.7 *vs* 69.9*)	1.02 (1.01, 1.04)	0.039
Effective KMC-7th day after discharge (Yes/No)	HCWs knowledge (Mean 71.0 *vs* 70.0*)	1.02 (1.00, 1.05)	0.027
KMC duration on 28th day of life (≥8 /<8 hrs)	Place of birth (Public *vs* private*)	2.20 (1.07,4.54)	0.031

*RR: relative risk; 95% CI: 95% confidence interval; * referent group*

Health facility phase of KMC practice

Day of life of KMC initiation

The place of hospitalisation, attitude of HCWs and KMC initiation support at the health facility were independent variables significantly associated with the day of life of KMC initiation after adjusting other covariates. Earlier (≤3 days of life) KMC initiation increased with admission to a public over a private health facility by 168% (p=0.007); every unit increase of HCWs' attitude score by 1% [aRR 1.01 (95% CI: 1.00,1.01) p=0.042]; and every unit raise in KMC initiation support from HCWs by 3% (95% CI: 1.02-1.04, p<0.045).

KMC duration and effective KMC on day before discharge

HCWs skills and KMC maintenance support at health facility were independent ~~predictor~~ variables associated with KMC duration on the day before discharge, after other covariates were adjusted. Higher HCWs skills score increased the likelihood of duration of ≥8 hours KMC by 5% [aRR 1.05 (95% CI: 1.01, 1.07) p=0.017]. A unit increase in KMC maintenance support

received by the mothers at the health facility increased the likelihood of ≥8 hours KMC on the day before discharge by 3% [aRR 1.03 (95% CI: 1.00, 1.06), p=0.003].

The variables that were significantly associated with effective KMC provision on the day before discharge were place of hospitalisation, and attitude of HCWs. The likelihood of effective KMC being provided increased by 222% with babies being hospitalised for ≤3days compared to those hospitalised for >3days (aRR=3.22 [95% CI: 1.97, 5.28] p<0.0001) and by 5% with higher attitude score of HCWs [aRR 1.05 (95% CI: 1.01-1.08) p<0.013].

Community phase of KMC practice

KMC duration and effective KMC on 7th day after discharge

Place of hospitalisation and HCWs knowledge were the only variables/independent factors associated with KMC duration on the 7th day after discharge, after adjusting for other covariates. Babies admitted in public health facilities [aRR 1.31 (95% CI: 1.02,1.68) p=0.035] and higher knowledge score of HCWs (aRR1.02 [95% CI: 1.01, 1.04] p=0.039) increased the likelihood of ≥8 hours duration of KMC on the 7th day after discharge by 31% and 2 % respectively.

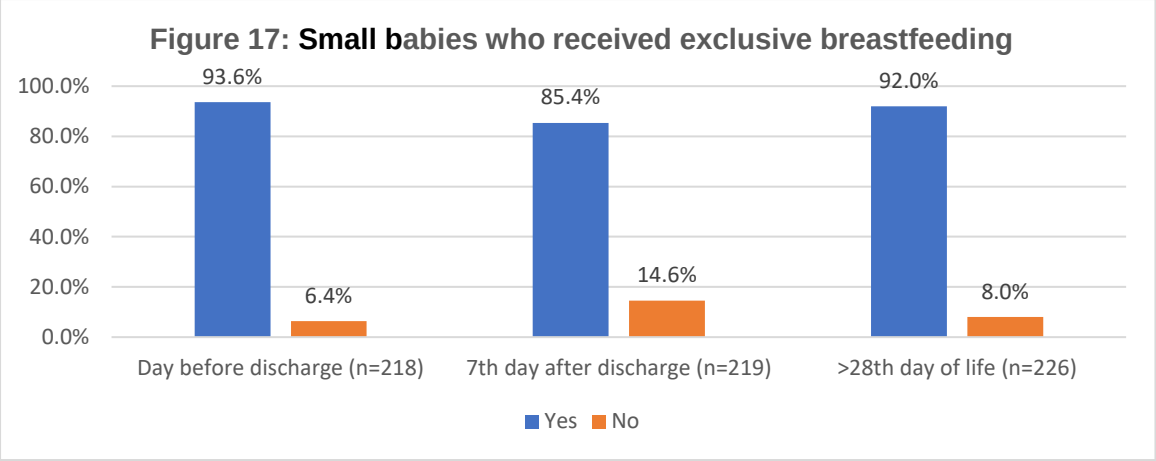
Higher knowledge score of HCWs after adjusting for covariates, increased the likelihood of effective KMC on the 7th day after discharge by 2% (p=0.027).

KMC duration on 28th Day of Life

The place of birth was the only independent ~~predictor~~ variable that was significantly associated with KMC duration on the 28th day of life, after adjusting for all other covariates. Duration of ≥8 hours of KMC on the 28th day of life was 120% more likely for babies born in public health facilities compared to those in private health facilities (aRR 2.20 [95%CI: 1.07,4.54] p=0.031).

5.5.4 Exclusive breastfeeding and follow-up of small babies in the health facility

Almost all, [93.6% - (202/218)], of the babies as shown in Figure 17, were exclusively breastfed on the day before discharge. This percentage however dropped to 85.4% (187/219) on the 7th day after discharge, and then increased to [92% (208/226)] on the 28th day of life. Determinants were not ascertained for exclusive breastfeeding since it was included as a component of effective KMC.



Only a little over half, [56.8% (129/227)] of the small babies were taken to a health facility for a check-up within two weeks of discharge.

Thus, chapter 5 presented the results on health facility preparedness, competence of HCWs for KMC implementation, preparedness of mothers and family members for KMC practice, characteristics of small babies and finally the results on the primary outcome - KMC practice and its determinants. Additional tables are shown in Annexure I. These have been referred to, in Chapter 6, along with discussion on the results aligned to the objectives, hypotheses, and conceptual framework (Chapter 3, Figure 6).

CHAPTER 6. DISCUSSION

KMC is a complex intervention requiring commitment and collaborative engagement of multiple stakeholders across the health facility-community continuum for its scale-up. The stakeholders include DHOs, health facility managers, Health Care Workers (HCWs) at the health facility, Community Health Workers (CHWs) in the community and mothers of small babies along with their families (Chan, et al., 2017; Smith, et al., 2017). This study used operational research to evaluate specific operations such as health facility preparedness, KMC competence (knowledge, attitude, and skills) of HCWs inclusive of support they provided to mothers for KMC practice at the health facility. All of these were presumed determinants for KMC practice along the health facility-community continuum. Other determinants presumed in this study for KMC practice included the preparedness of mothers that was assessed by their knowledge and attitude towards KMC. This study purported to identify which of these were associated with KMC practice along the health facility-community continuum for the cohort of small babies that survived 4 weeks of life and were with their mothers in Gangawati sub-district.

The components of KMC practice for this study included day and place of KMC initiation, KMC duration and provision of effective KMC [≥8 hours of skin-to-skin (SSC) plus exclusive breastfeeding] on the day before discharge, a week after discharge, and on the 28th day of the baby's life. None of these components were directly observed but were either extracted as secondary data from the WHO project database where there were quality checks in place for robustness of data collected or as self-report from the mother. New knowledge from this study on early initiation and duration of KMC are discussed in Section 6.1. This is followed by discussion on the key findings in relation to early initiation and duration of KMC (Table 33) in Section 6.2-6.3. The limitations of the study are also identified within each of these sections. The chapter concludes with implications for KMC scale-up based on the findings from this study in Section 6.4.

6.1. *New knowledge from this study*

This study clearly demonstrated to the best of my knowledge, that the type of health facility; support for KMC practice at the health facility; knowledge, attitude, and skills in relation to KMC of HCWs were independent variables associated with early initiation and duration of KMC at the health facility, findings that has not been accessed in previous studies. The sub-district of Gangawati which is primarily rural, has 71% (15/21) public health facilities and 29% (6/21) private health facilities (excluding the maternity homes) that provided services for small babies. The type of health facility was ~~a~~ significant ~~predictor~~ determinant of KMC practice in

this setting with public health facilities performing better than private health facilities, a finding that was not reported in previous studies. Findings from this study concluded that small babies hospitalised (Table 35) in public health facilities as opposed to private health facilities were more likely to:

- Be initiated earlier (≤3 days of life) on KMC,
- Receive effective KMC on the day before discharge,
- Receive with ≥8 hours of KMC a week after discharge from the health facility.

Additionally, small babies born in public health facilities were more likely to be provided with ≥8 hours of KMC on the 28th day of the life compared to those born in private health facilities. The probable reasons for the two latter findings could be that the public health facilities had more onsite nurse mentor visits and supportive supervision visits than the private health facilities (Appendix C, Table C.1). Hence HCWs' confidence to implement KMC might have probably improved with this support. Although this finding must be interpreted with caution since it refers to only those babies who survived >4 weeks of life.

Testing the following hypotheses (Chapter 4, Section 4.1.2) has also contributed to new knowledge and evidence on KMC practice:

- H1: "*Health facility preparedness will be associated with early initiation and duration of KMC*". Health facility preparedness in this study, on its own was not a determinant variable for any of the KMC practice components.
- H2: "*HCWs who are competent in knowledge, attitude and skills related to KMC are likely to impact on KMC practice*" was accepted based on the following findings: Knowledge of HCWs was a determinant for ≥8 hours KMC duration alone and effective KMC provision on 7th day after discharge; HCWs' attitude was significantly associated with earlier initiation of KMC and effective KMC on the day before discharge, while HCWs' skills was significantly associated with duration of ≥8 hours KMC on the day before discharge. This study had operational research as its design, primarily to identify which of these components of competence had an impact on the outcome namely KMC practice in the cohort of babies that survived >4 weeks of life. Hence to guide programmatic decisions, the association of knowledge, attitude, and skills of HCWs with KMC practice was determined individually rather than competence with KMC practice components.
- H3: "*Mothers who are supported by HCWs at the health facility and at home by family members and the CHWs are more likely to practice KMC for longer duration, exclusively breastfeed their babies and return for follow up to the health facility",* was accepted partly as support for KMC initiation at the health facility was a determinant for earlier KMC initiation; support for KMC maintenance at the health facility was a determinant for ≥8

hours KMC duration before discharge. However, support for KMC maintenance at home was not a determinant of any of the components of KMC practice, although support score was higher for those mothers who provided ≥8 hours of KMC or effective KMC a week after discharge from the health facility. Since effective KMC included exclusive breastfeeding, the association of support received with exclusive breastfeeding was not tested independently in this study.

- H4: "*Health status at birth of a small baby will determine initiation and maintenance of KMC*": This hypothesis was tested only for babies that survived >4 weeks of life, of whom 83.7% (190/227) were sick at birth (secondary data retrieved from WHO project database). Bivariate analysis showed an association between status at birth with earlier KMC initiation, ≥8 hours KMC duration and provision of effective KMC on the day before discharge. However, when regression analysis was performed after adjusting for all co-variates, health status at birth was not associated with any KMC practice components, hence this hypothesis is rejected. Yet, this conclusion must be inferred cautiously since this computation was performed only for babies recruited to the study and was not consolidated with those babies not recruited to the study. Moreover health status at birth was not verified by direct observation.

The variables that were associated with early KMC initiation and the duration of KMC just before discharge from the health facility, a week after discharge and at 28 days of the baby's life are discussed further in Section 6.2 and 6.3, respectively.

6.2. Early initiation of KMC practice

Early initiation of KMC practice is known to improve health status and impact survival of LBW babies (Ahmed et al., 2011; Conde-Agudelo & Díaz-Rossello, 2016). More than a quarter of small babies [59.6% (133/223)] were initiated on KMC early in this study (Section 5.5.1 – Chapter 5), even though majority of them [83.7% (190/227) were sick at birth. Characteristically, the type of health facility had an impact on early KMC initiation. Although the primary (CHC/PHCs) level public health facilities had lower health facility preparedness scores (Table 11), they fared better in their performance of early KMC initiation of small babies hospitalised in them compared to those in private health facilities. The chance of having a sick baby was unlikely in primary level public health settings, and improved knowledge, attitude and skills of HCWs could be the probable reasons for early KMC initiation in these settings. While in private health facilities the likelihood of having a greater number of small babies with more complex health problems, although not verified by direct observation in this study could have resulted in delays with KMC initiation in private health facilities. Fear of nosocomial

infections, shortage of staff and spaces cited as reasons for delay in KMC initiation (Chan, et al., 2016b & 2017; Seidman, et al., 2015; Yue, et al., 2020), could also be possible reasons for delay in KMC initiation in these settings. Further studies would be required to explore these reasons in this setting, as they were not explored, specifically in this study. Private practitioners who were surveyed in India on EMBRACE™ (Figure J.1 in Annexure J) a low-cost warmer for use in neonates preferred EMBRACE™ over KMC since they perceived it had more advantages. Quoting Nimbalkar and colleagues, their perceptions on EMBRACE™ were as follows: "more compliance of EMBRACE™ with nurses and relatives," "counselling for KMC requires 30 minutes," "training staff is a headache," "hygiene issues in mother," "EMBRACE™ is equivalent to KMC," "KMC is not possible in private setups," and "there is no space to provide KMC" (Nimbalkar, et al., 2014; pp 3). The reasons for delay in KMC initiation at private health facilities were not specifically explored in this PhD study, but the above survey findings could resound the same in this setting. Nonetheless, it could be assumed that physiologically stable small babies were more often hospitalised in public than private health facilities, with resultant frequent turnover of babies in these settings as they would not require any complex intervention. The fact that mothers preferred early discharge after childbirth (Devasenapathy, et al., 2014), could have also supported the early initiation of KMC in public health facilities.

Previous studies highlighted the importance of health facilities preparedness for KMC implementation (Chan, et al., 2016b & 2017; Seidman, et al., 2015; Smith, et al., 2016). Yet findings from this study did not show any association between health facility preparedness score and early KMC initiation, despite there being an overall improvement in these scores from June 2017 to December 2018 (Table 11). A standardised tool was used by Bergh, et al., (2013) to document the stage of health facilities preparedness of district health facilities, either individually or as a group and measure KMC practice. Unlike the study by Bergh where the focus was on district health facilities (Bergh, et al., 2013), this study included primary and secondary level public health facilities, and thus a researcher developed validated tool was used instead to assess health facility preparedness. This tool (Annexure G) was designed to identify availability of trained HCWs, specialists and support staff, documentation, reporting of KMC; dedicated spaces with relevant materials, devices, and equipment for comfortable KMC practice and a policy on KMC at all levels of public and private health facilities (Annexure G). KMC practice was not directly observed through the tool. Hence, the tool might not have been a sufficiently valid measure of health facility preparedness. Moreover, methodological constraints in computation of health facility preparedness score (See Section 4.8.5) could have impacted the significance of association between this variable and KMC practice components. Measurement of real-time health facility preparedness could have possibly been a better option but was not feasible, for the following reasons. Firstly, babies were born in one

health facility and referred to another for management of health problems [in this study 52% (119/227)]. Secondly, capacity building strategies of the WHO project were concurrent with the period when small babies were recruited to the study, and the purpose of this study was to determine what would facilitate KMC practice along the health facility-community continuum. Hence an average score of the time-point assessments (Figure 10) was considered the best fit to reflect this period and achieve the purpose of the study. Thirdly, direct observation of KMC practice was not appropriate since this information was collected by robust means through the WHO project (See Section 4.6.1 and Figure 13).

The KMC initiation support at the health facility provided to mothers, although below average (<50% of maximum possible score) also significantly increased earlier KMC initiation at the health facility by 2-4% (95% CI: 1.02, 1.04) (Table 22 and Table 35 respectively). This clearly indicates that even minimal support from the HCWs and peer mothers for KMC practice measured in this study by counselling and information along with assistance for positioning a baby would be sufficient and valuable (Blomqvist, et al., 2012) to facilitate KMC practice. Yet, one must acknowledge the methodological constraints of how KMC support was measured. Responses of mothers were quantified rather than described and scored against a pre-fixed key based on the related items in the questionnaire, developed for the purpose of this study as, there was no standardised tool that could be accessed to measure this variable. The investigator was not able to access research that quantified KMC support at the health facility. Moreover support was measured 4-8 weeks after initiating KMC, and hence the chance that the mothers might not have recalled who all supported them at the health facility could have impacted the minimal support score obtained.

KMC knowledge, attitude, and skills of HCWs were assessed in this study to evaluate the support mechanisms available through the WHO project (Annexure C). A more positive attitude of HCWs was a determinant of earlier KMC initiation in this study (Table 35). The fact that there was significant increase in knowledge (Table 15 & Table I.2 in Annexure I), significant change in attitude (Table 16 & Table I.3, in Annexure I) and skills (Table 17) in relation to KMC implementation of HCWs is a confirmation that increased knowledge is linked to better attitudes and practices (The Health Communication Capacity Collaborative {HC3}, 2016), as in this case even minimal support and early initiation of KMC. An intervention in Tanzania that included training for HCWs, provision of essential equipment, supportive supervision, and improvements to health information systems had resulted in significant improvements in the quality of newborn care, including SSC, delayed cord clamping and breastfeeding (Makene et al., 2014). The improvement in knowledge, attitude, and skills of HCWs (Table 15-17) in this study, presumably could be attributed to the evidence-based

support mechanisms (Ameh, et al., 2016; Jeyanna, et al., 2016; Namazzi, et al., 2015) that comprised of a one-day skill-based training on KMC, onsite nurse mentoring and supportive supervision by specialists in health facilities (Annexure C, Table C.1) made available through the WHO project to build competence of HCWs on KMC implementation and facilitate health facility preparedness (Annexure-C). These findings denote that probably investments in building competence of HCWs would have far reaching impacts on morbidity and mortality of small babies through KMC initiation it early. Preference of mothers for early discharge (Devasenapathy, 2014) coupled with inaccessibility of the public health facility 24/7, two possible barriers to KMC practice could have been countermanded by the positive attitude of HCWs for early KMC initiation. This statement is justified by the fact that 4.8% (11/227) of babies were initiated on KMC at home, after being informed about it at the health facility. Consideration of the fact that a small percent [3% (6/226)] of small babies were discharged on the first day of life, and 7% (16/226) were discharged from the health facility by the second day of life; accounting for a substantial number of babies (10%) in this sub-district is important for scale-up of KMC. Mothers would require time and support to be confident in positioning babies, monitoring them while on KMC, and providing KMC of sufficient daily duration before discharge from the health facility. This is more crucial for those with twins since they would need to be confident to position both babies in direct SSC and have constant support of an fKMC provider to enable optimal duration of KMC. Thus, strategies such as onsite mentoring and supportive supervision to build knowledge and skills of HCWs would be crucial to promote positive attitude in them, so that they could support mothers within the short hospitalisation period to motivate mothers to continue the KMC practice for the next 4-6 weeks of the baby's life.

Another important finding that cannot be ignored from this study was the fact that more than half (56.8%) of babies recruited to the study were born in public health facilities, yet more than half (53.7%) were hospitalised in private health facilities in this sub-district (Figure 14), directing attention of the occurrence of referrals between public and private health facilities. Given the possibility, that public health facilities are likely to initiate KMC earlier, hospitalise babies for a shorter duration or refer babies to private health facilities for management of complex care needs, it is important that effective linkages are established between public and private health facilities to facilitate KMC implementation. The best possible link could be the CHWs who are expected to accompany mothers for childbirth to the health facilities or even during referral which is incentivised (National Health Mission, 2019). Moreover, nearly a quarter of babies (22%) were born at primary level public health facilities (Figure 14). Although these primary level public health facilities are expected to provide 24/7 services, only 62.8% are known to be functional 24/7 (Niti Ayog, World Bank & MoHFW, 2019), demonstrating that

mothers with stable small babies would be expected to go home within a day of childbirth. This study showed that 45% (102/226) of small babies were discharged ≤3 days of birth. Incredibly, despite these limitations more than a quarter of babies (28.7%) were initiated on KMC on day 1 of life, 30.9% on days 2-3 of life. Yet, the fact remains that KMC needs to be continued at home once initiated for approximately 4-6 weeks of life. This reiterates the importance for the mother to have adequate knowledge, a positive attitude, and support at home to be confident and continue KMC practice at home. Early initiation, soon after birth of a stable baby at the health facility would provide the mother an opportunity for supervised KMC practice that would facilitate her confidence with positioning and monitoring the LBW baby subsequently. Nonetheless, one must also be mindful that the health status at birth of a small baby might dictate how early KMC can be initiated. Only 64.1% (116/181) of babies not recruited to the study (Table 24) were initiated on KMC at the health facility. This information was not verified further by the investigator as it was beyond the scope of this study and reasons for this occurrence would require further exploration.

6.3 Duration of KMC practice

6.3.1 Duration of KMC practice – Health facility phase

Daily duration of KMC ≥8 hours especially in the first two days of life and continued till required has been shown to impact on morbidity and mortality of LBW babies (Ahmed, et al., 2011; Lawn, et al., 2010). This coupled with exclusive breastfeeding could have double impact to reduce morbidity and mortality of these vulnerable babies (Khan, et al., 2015). HCWs could play a central role at the start of life for these vulnerable babies, as they are their first contacts. It is therefore essential that they are equipped with the right knowledge, attitudes, and skills to implement KMC as part of ENC for small babies. This study showed that the skills of HCWs and KMC maintenance support at the health facility increased the likelihood of ≥8 hours of KMC on the day before discharge from the health facility (Table 35). KMC maintenance support was significantly [p=0.006] better in the latter period of data collection (May-Sept 2018) compared to earlier period (Dec 2017-Apr 2018), typically showing that with sustained capacity building strategies, skills of HCWs are likely to improve. This finding draws attention to supportive mechanisms to facilitate further improvement in skills of HCWs to support mothers to maintain KMC practice. KMC maintenance support at the health facility was measured by the number of people who helped the mother, the presence of a foster KMC (fKMC) provider and provision of a KMC kit that would assist the mother in positioning the baby safely for KMC. There were at least 2-5 people who supported the mother in the health facility either through counselling or assistance to position the small baby. These included the nurse/health assistant, doctor, nurse mentor, peer mothers, and counsellor (Table 21). If KMC

maintenance support, an essential characteristic of the health facility was to be bettered, there is a possibility that the duration of KMC could be enhanced further. An area that draws attention from this study is that less than a quarter of mothers [21% (44/209)] had an fKMC provider at the health facility. Efforts by HCWs to educate and counsel one or two family members at childbirth of a small baby, in addition to the mother, with more attention for those with twins on KMC could thus be a viable option to further increase KMC maintenance support for through them becoming fKMC providers.

Effective KMC was more likely to be provided if the HCWs had higher attitude score, and with shorter duration of hospitalisation of ≤3 days (Table 35) in this study. Consideration of the finding that the duration of KMC increased from the day of its initiation to discharge from the health facility (Table 25 & Figure 15), one could extrapolate that the mothers had learnt the skills of positioning and providing KMC for long duration within a short span of 1-3 days following childbirth. This is also an indication of the support the mothers received from HCWs at the health facility, albeit minimal and the ease with which they could learn this behaviour, despite their babies being small [Mean birth weight 1693.6 (±221.4) gms].

The study however did not show any relationship of health facility preparedness with KMC duration in the health facility. The average score (of two time-points – Figure 10) of health facility preparedness as well as of HCWs' knowledge, attitude, and skills on KMC implementation were used to compute the association of these variables with KMC practice components rather than improvement percentage scores. This was considered the best method for the following reasons. Firstly, the capacity building strategies of the WHO project were not one-time strategies but occurred concurrently through the period of data collection for this study (Dec 2017-Sept 2018). Hence the likelihood that capacity building strategies would influence these variables, was high. It was thus assumed once the capacity building strategies were weaned off, the value for these variables were likely to plateau over a period, hence the average was considered a better value. Secondly, when the correlation between these average scores with improvement percentage [(Time-point 2 score minus time-point 1 score / Time-point 1 score) multiplied by 100] score (another alternative way of presenting the results) was performed for each of these variables, they were significantly positively correlated for all, except for health facility preparedness scores which showed a negative correlation (Table I.13, in Appendix I). Despite these constraints, this study showed that HCWs' skills and attitude specifically and indirectly their knowledge on KMC (as they educated, informed, and supported mothers) increased the likelihood of more KMC duration before discharge. Hence perhaps, health facility preparedness probably was not a variable that mattered so much to mothers who initiated and maintained KMC in the health facility.

6.3.2. Duration of KMC practice – Community phase

The knowledge of HCWs had impacted provision of ≥8 hours KMC as well as effective KMC a week after discharge from the health facility (Table 35). This study clearly affirms that investments on short skill-based training, followed by supportive supervision and onsite mentoring (Ameh, et al., 2016; Jayanna, et al., 2016; Namazzi, et al., 2015) make a difference in knowledge, attitude, and skills of HCWs for KMC implementation rather than a one-off training (Adams, et al., 2014). Additionally, increased knowledge of HCWs could possibly mean that HCWs were confident to teach mothers about KMC and this in turn potentially influenced their and fKMC providers knowledge on KMC, attitude and perhaps the continuation of KMC with sufficient duration even a week after discharge from the health facility.

Additional determinants for duration of KMC practice included the place of hospitalisation and place of birth. Small babies hospitalised in public health facilities had also received ≥8 hours KMC a week after discharge from the health facility. The place of birth also influenced ≥8 hours KMC duration on the 28th day of the baby's life in this study with the public health facilities being superior to the private health facilities (Table 35). This finding clearly reflects that the mothers with small babies admitted to public health facilities (46.3%) were motivated more to continue KMC even after discharge, credit for which must be given to the efforts of HCWs in these settings. HCWs in public health facilities received more nurse mentor visits and supportive supervision visits than private health facilities. This could have probably accounted for longer duration of KMC being provided by mothers with small babies hospitalised in these settings compared to private health facilities. A potential confounder namely socio-economic status not measured in this study is a limitation. Mothers' education level in this setting was less than secondary education [Median-7, IQR-7] and they were mostly young (mean 23-5±3.95 years). These variables could probably reflect the socio-economic status. However, none of these variables namely education level, age nor number of children, were not significantly associated with on KMC duration. Perchance that mothers who came from lower socio-economic status sought admission in public versus private health facilities, much to their advantage since they would have initiated KMC early, but socio-economic status was not verified in this study. These findings on KMC duration a week after discharge from the health facility reflects that the knowledge, attitude, and skills of HCWs had probably influenced the mothers and fKMC providers, who were both unaware of KMC before childbirth to learn quickly and adhere to the need for KMC, indirectly reaffirming the importance of support mechanisms to promote the competence of HCWs (Jayanna, et al., 2016; Namazzi, et al., 2015). One might argue that KMC duration at home, might not be accurate since it was self-reported. Yet, the reported duration seemingly dropped on the 7th day after discharge and

subsequently on the 28th day of life, indicating it could be credible since mothers mostly returned to their own homes for childbirth, there were fKMC providers available and more than enough people to help with childcare and other household chores.

KMC maintenance support at home after discharge from the health facility, a variable categorised under characteristics of mothers & community, comprised of a composite score of support by family members for household chores, support from fKMC providers inclusive of their knowledge, attitude and support they received for KMC practice and finally support from CHWs. This variable was not a determinant of any of the components of KMC practice in the study. In fact, the mean duration of KMC gradually decreased from the day before discharge, to a week after discharge from the health facility and logically further on the 28th day of life (Table 23). Here again the methodological computation of support for KMC maintenance at home (Chapter 4, Section 4.8.3, Table 9) could have accounted for a resultant low score. There were 47.3% (99/209) of mothers who had fKMC providers available to support them with KMC provision at home. Of all the fKMC providers identified, only 84% (83/99) of them could be accessed to collect information on knowledge, attitude and support received for KMC practice. These scores of fKMC providers were in-built as components of KMC maintenance support at home. This could have resulted in low scores of KMC maintenance support at home. Despite this, it was evident that KMC maintenance support score at home was higher among those mothers who provided ≥8 hours of KMC on the 28th day of life, compared to those who provided <8 hours of KMC, although the difference was not statistically significant. The support provided by CHWs was also incorporated into the KMC maintenance support at home received by mothers. The role of CHWs to support KMC practice was not assessed exclusively and hence could not be quantified. Nevertheless, this study highlighted the critical role played by CHWs for KMC practice, by the fact that more than a month duration of KMC was provided to small babies, indicating most of it being provided at home, given the short duration of hospitalisation.

Yet, these findings typically indicate that mothers would require additional support for increasing the duration of KMC at home, especially in the first week after discharge. This could be more relevant especially in this setting where mothers with twins was considerably high [8% (18/209)]. Nevertheless, the association of KMC maintenance support at home with duration of KMC would need further exploration by determining this association independently with support received from family members, fKMC providers and CHWs.

6.3.3. Impact of characteristics of mothers and babies on duration of KMC practice along the health facility-community continuum

None of the characteristics of mothers (age, education, occupation) neither their KMC knowledge, or attitude nor the characteristics of babies (birth weight, sex, health status at birth), were determinants for KMC practice before discharge or even after discharge from the health facility. Although it was postulated in the conceptual framework, that if mothers had adequate knowledge and positive attitude towards KMC, they would then practice KMC (Anderzén-Carlsson, et al., 2014a; Bajaj, et al., 2015; Gabriels, et al., 2015) along the health facility-community continuum, these variables were not associated with duration of KMC practice after discharge (Table 35). One might argue that the construct validity of the tool used to measure knowledge and attitude was not ascertained, hence it might not have been an adequate measure of these variables. However, since both mothers and fKMC providers were similar by these characteristics it was presumed that the tool measured these variables. Awareness and positive attitude a month after initiating KMC, nonetheless, were probably key to the mothers and fKMC providers continuing to practice KMC at home. Moreover knowledge of mothers who provided ≥8 hours of KMC was slightly higher than those who provided <8 hours on the 7th day after discharge as well as on the 28th day of life. This shows that their behaviour to provide KMC was possibly influenced by their knowledge and attitude. Moreover, these findings suggest that mothers were more than willing to learn as well as practice KMC despite being oblivious to this during pregnancy but having become KMC aware after childbirth, took on the practice of KMC primarily to improve the health of their small baby. The milestone of continuing KMC for 30.2 (±8.5) days could not have been achieved were they not supported through information or assistance in providing KMC both in the health facility by HCWs and by the support of CHWs and fKMC providers inclusive of other family members, at home. The above findings along with the fact that the remaining 4.8 % (11 / 227) mothers initiated KMC at home with support from the CHWs perhaps indicates the ease with which mothers could be trained to practice KMC even following discharge from the health facility (Seidman, et al., 2015).

First-time mothers reported more support for KMC at the health facility (p=0.035) and home after discharge from the health facility (p=0.006) compared to mothers who had two or more children (Table I.9 & Table I.11, respectively in Annexure I), an extraordinary finding reflecting the sensitivity of HCWs and CHWs inclusive of family members to support mothers' need for assistance with KMC practice. The duration of KMC practice increased from the day of its initiation to discharge from the health facility (Table 25 & Figure 15), demonstrating that the skills of positioning and providing KMC for long durations were learnt by mothers within a short span of 1-3 days from childbirth, an indication of the support the mothers received from HCWs

at the health facility, although minimal, and the ease with which they could learn this behaviour, despite their babies being small [1693.6 (±221.4) gms]. However, the KMC duration dropped slightly a week after discharge from the health facility and further on the 28th day of life (Table 25 & Figure 15), inferring the need for additional support for mothers even at home (Dawar, et al., 2019), especially during the first week after discharge. HCWs and CHWs would need to be cautioned to also pay attention to mothers with two or more children, and to those with twins as provision of KMC is a skill that needs to be learnt, accepted, experienced as beneficial, safe, and comfortable before it becomes a habit. Hence it is critical that focused attention of HCWs at the health facility before mothers are discharged and CHWs who are expected to visit families daily for the first week after discharge, must be towards sustaining the recommended duration for effective KMC practice at home. This could be achieved by identifying the barriers specific to each mother for increasing rates of effective KMC and collaboratively finding an amenable solution. A previous study showed that CHWs were able to convince mothers on provision of KMC but were generally unable to convince most mothers on increasing the duration of KMC (Ahmed, et al., 2011). Hence both HCWs and CHWs require to be trained by experienced professionals on how to negotiate with family members to support all mothers with provision of KMC either through assistance with household chores or as foster KMC providers. The simple math of prescribing duration of KMC as two sessions of 3 hours each or 3 sessions of 2 hours each and then requesting the fKMC provider to provide one session of 3 hours duration would add up to provision of ≥8 hours of KMC per day. This practical and feasible option would help mothers learn to organise their day of household chores, childcare and expressing breastmilk. Empowering HCWs & CHWs with these skills might make all the difference in the ability of the average HCW and CHW to convince mothers for optimal duration of KMC (≥8 hours) till required (Ahmed, et al., 2011).

Seidman et al. (2015) suggested that lack of resources in the community such as beds and readily available food could be barriers for KMC practice at home. Yet in this study, homes that were visited had a single room with a cot (that had a base made of metal or ropes), few or no bed linen, and sometimes just clothes piled up to ensure the head of the mother was elevated while providing KMC. Despite these circumstances, mothers continued to provide KMC for >4 weeks, indicating that mothers were not only aware of but had experienced the benefits of KMC, and were confident in positioning the baby for KMC. Yet, for KMC practice to become routine universally, i.e., by HCWs supporting all mothers of stable small babies to initiate and maintain KMC, CHWs reinforcing and supporting mothers at home to practice KMC for optimal duration till required. Quoting Ditsa (2013) “when the intentions are high, the habits well established, and the arousal optimal, there may be no behaviour if the geography of the situation makes the behaviour impossible: thus, facilitating conditions are seen as important

determinants of behaviour" (Ditsa, 2013; pp: nil). In this context, the health facility-community continuum – the social context (Ditsa, 2013; Smith, et al., 2017) was probably conducive despite the provision of minimal support, if not optimal for KCM practice with the result of any or effective KMC provision for >4 weeks.

Ahmed et al (2011) demonstrated that mortality rate of LBW babies was much higher in those held <1 hour/day, with fewer but still considerable deaths in those held >1- <7 hours a day, while the mortality was a quarter of Bangladesh's national rural norm for those held >7 hours per day. This study showed that by the 28th day the median duration of KMC provided was 3.0 (7.0) hours (Table 25). Thus, although providing KMC might have become a habit for mothers' irrespective of the sociodemographic characteristics of this population, due focus would need to be paid on increasing its duration to at least >8 hours as it is an important marker for reduced mortality and morbidity in small babies. Nonetheless one cannot overlook the fact that mothers were willing to learn and practice KMC, but with support especially from competent HCWs at the health facility. These findings have definite implications for scale-up of KMC.

6.4 *Implications for KMC scale-up*

Scale-up of KMC calls for concerted and coordinated efforts of all stakeholders – the DHOs, health facility managers, HCWs, CHWs inclusive of the mothers and family members of small babies across health facility-community continuum. This study demonstrated that effective KMC practice was possible and could be enhanced rapidly from <5% to >54.6% on the day before discharge and 42.5% on the 7th day after discharge (Table 26) within a short period of more than a year in this sub-district, nonetheless through a dedicated project. Additionally, mothers were willing to provide KMC for a duration of >1 month, implying they received information and were supported in initiating and maintaining KMC along the continuum. Thus, effective scale-up of KMC would require the following crucial components:

6.4.1 ***Before birth of the baby***

Specific roles of CHWs and HCWs can be extrapolated from the findings on early initiation of KMC and its optimal daily duration, discussed in Section 6.2 and 6.3. Firstly, in these settings, CHWs could help mothers and family members make an informed choice on place of childbirth or where to seek neonatal services for a stable baby born at home, when the need for KMC practice arises. The evidence of early KMC on reduction of morbidity and mortality (Ahmed, et al., 2011; Lawn, et al., 2010), the economic ramifications for the family both in terms of shorter duration of hospitalisation, lower hospitalisation cost and better health outcomes with KMC provision would need to be exemplified to mothers, in addition to benefit of early and longer duration of KMC if hospitalised in a public health facility.

Secondly, in the context of short hospitalisation period, it would be ideal if women along with their spouses and other significant family members are sensitised during pregnancy on KMC in groups at the antenatal clinics. CHWs and HCWs could do well to provide prenatal KMC education, known to impact on early KMC initiation and increased duration of KMC at home (Ahmed, et al., 2011; Rasaily, et al., 2017). This awareness building could be part of the high-risk antenatal clinics conducted monthly on the 9th of every month in each district as part of the "Pradhan Mantri Surakshit Matritva Abhiyan" launched by the Ministry of Health and Family Welfare (MoHFW, 2021).

6.4.2 *KMC practice at the health facility*

Health officials and health facility managers must ensure that support mechanisms (onsite mentors and supportive supervision) and health facilities with basic infrastructure for the comfort, safety and privacy of the mother are in place to facilitate HCWs and CHWs with KMC implementation. Although the study clearly did not reveal a significant relationship between health facility preparedness scores and components of KMC practice, the latter could not have occurred in a vacuum but would have been triggered by enhancing feasibility through appropriate spaces in health facilities and building competence of HCWs for KMC implementation, both of which were components of health facility preparedness. The fact that KMC duration improved in the latter part of the study period compared to the first five months, is an indication of improved confidence of HCWs including CHWs in implementing KMC acquired through probably experience and support mechanisms that were in place through the WHO project.

Taking cognisance, the mothers in this study were young, more than half of them were first-time mothers (Table 19) and discharged early, it was incredible, that KMC was initiated at the primary or secondary level public and private health facilities, for majority, (95.2% - 216/227) of the babies recruited to the study (Table 24). Considering more than half (54.6% - 118/216) of babies received effective KMC before discharge (Table 26) validated use of improved KMC competence of HCWs to support these mothers, especially first-time mothers (Whyte, 2010). Thus, for scale-up of KMC, it is vital that DHOs and health facility managers ensure that support mechanisms are in place and sustained to improve all three components of HCWs' competence – [knowledge, attitude, and skills] on KMC implementation. Evidence suggests that onsite mentoring, supportive supervision inclusive of skill-based training positively impacts on knowledge and quality of care provided by HCWs particularly nurses (Batra & Mamta, 2014; Dalal, Bala, Chauhan, 2014; Hendricks-Munoz & Mayers, 2014; Jayanna, et al.,

2016; Shah, Sainju & Joshi, 2018; Solomons & Rosant, 2012; Nyqvist & Larsson, 2011). HCWs' KMC competence would need to be enhanced through short skill-based workshops. These workshops must focus on soft skills of counselling, coaching, negotiating with mothers and family members additionally (Ahmed, et al., 2011). Continuing education of HCWs particularly for nurses who work in neonatal and postnatal units of the public health system is established to some extent. Nonetheless, the current approach to HCWs' continuing education uses traditional methods of centralised teaching or use train-the-trainer models, low-dose/high-frequency models by formal tutors away from the place of work (Woods, 2015; Azad, et al., 2020), by far not as effective in improving skills of HCWs either onsite or offsite the workplace. An innovative system of self-directed learning by groups of HCWs would be crucial whilst taking advantage of social media channels. Two known effective methods to translate knowledge to practice, namely onsite mentoring, or supportive supervision (Jayanna, et al., 2016; Namazzi, et al., 2015) is far from being established in the public health system. The DHOs must find ways to ensure that resources are developed to enhance capacity for onsite mentoring and supportive supervision through collaboration with local medical and nursing education institutions.

The nurses and health assistants were the key HCWs in this study to counsel, assist in initiation and maintenance of KMC practice at the health facility (Table 21), in the present study. Health facility managers must seek pathways that ensure the use of soft skills (communicating with empathy) by these HCWs, in all levels of health facilities – private and public. Experiential learning that fosters introspection of perceptions on KMC and improves their ability to provide support to these mothers would be key (Chan, et al., 2016; Foote & Tamburlini, 2015; Mathais, Mianda, & Ginindaz, 2020; Seidman, et al., 2015; Smith, et al., 2017), especially in private health facilities. Although support for KMC practice was an important determinant for its practice at the health facility, it was not optimal and therefore has the potential and scope to be enhanced.

The knowledge, attitude and support for mothers was assessed at 4-8 weeks of the small babies' life. Although the knowledge of mothers was average (just above 50%), they had extremely favourable attitude towards KMC (Table 20, Table I.5-I.7 of Annexure I). There is a possibility they would not recall all the information provided to them at the health facility, resulting in average knowledge scores. The support HCWs and CHWs provided to mothers at the health facility and community respectively, must have resulted in the awareness of mothers on KMC, however, it is important that they pay attention to ensuring mothers are aware of how to monitor a baby while on KMC and the benefits of KMC, since the scores of mothers were way below average (<35%). Perhaps information on the benefits of KMC and how to monitor

a baby can be reinforced by CHWs after discharge. Findings from a previous study had shown that even illiterate mothers had good awareness on KMC with just a single education session (Muddu, Boju, Chodavarapu, 2013). Counselling and education must be conducted incrementally for mothers especially for those with education ≤8th grade through availability of multiple resources (Smith et al., 2017). Availability of multiple resources that provide information on KMC would be beneficial for mothers and family members given that duration of hospitalisation is short (45.1% were hospitalised for ≤3 days), mothers are not informed routinely about KMC antenatally, the fact that mothers with higher education (>8th grade) retained information on KMC more than those with ≤8th grade education (Table I.8, Annexure I). These sources HCWs, CHWs, peer mothers, fKMC providers, education materials – brochures, posters, videos must be available in the health facility to saturate mothers on KMC. Assistance to position the baby when initiating KMC for the first time and subsequently till the mother is confident is crucial for early initiation and maintenance of KMC. The assistance could be provided by the HCWs or even peer mothers (those who were already practicing KMC) available in the health facility. Given that first-time mothers had received significantly more support (p=0.035) for KMC practice at the health facility compared to those who had one or more children (Table I.9, Annexure I), HCWs must be cautioned to provide support to all mothers irrespective of the number of children a mother has, as learning about KMC and to position a small baby on the chest would require skill and confidence.

KMC maintenance support at the health facility could be strengthened by ensuring that there is a support network available to assist the mother in the health facility and subsequently at home. Health facility managers would thus need to ensure an open visitation policy for family members. This could help HCWs to identify and equip a fKMC provider with knowledge, attitude, and skills for KMC practice at the health facility first. The KMC kit must be available, or mothers could be taught how to improvise and use materials at home to ensure the baby is safe and secure when on KMC.

More than half the LBW babies (54.6%) recruited to the study (Table 26) were provided effective KMC (SSC of ≥8 hours plus exclusive breastfeeding) on the day before discharge. Hence a focused breastfeeding programme directed towards increased SSC, frequent breastfeeding, good positioning, and enhanced involvement of the father known to improve short and long-term (6months) breastfeeding success in a scenario of shortened hospitalisation (Nilsson, et al., 2016), is implied in this setting too given the short hospitalisation of nearly half (45.1%) of babies in this study. HCWs should reinforce to mothers that both components, SSC and exclusive breastfeeding are equally important for improving the health of the LBW baby. First-time mothers and even mothers with twins would require

additional support to learn the skill of expressing breastmilk and be confident that they would be successful in feeding the baby before discharge from the health facility and continued reinforcement as well as support at home through daily CHWs visits, especially for the first week after discharge.

6.4.3 ***KMC practice in the community***

Mothers of small babies typically face the challenge of caring for a "tiny baby" often before their expected arrival. Perceptions such as they would hurt the baby, or that the baby would not enjoy KMC or be uncomfortable during KMC due to hot weather were cited as barriers to KMC practice (Smith et al., 2017). It was therefore essential that mothers and family members were prepared adequately, i.e., have the required knowledge, attitude, and support to take on this new role of not only parenting, but the need for exclusive breastfeeding along with SSC for long durations daily over 4-6 weeks of the baby's life (Chan, et al., 2016; Whyte, 2010). Awareness on KMC and its benefits for the baby's health and their belief in the efficacy of KMC were cited as enablers for KMC practice (Chan, et al., 2016b; Seidman, et al., 2015) that was confirmed by the findings of this study when > 90% of mothers stated that they had "good" feelings while providing KMC, it was not difficult to practice, they were not embarrassed to practice KMC in front of others and that they would recommend KMC to other peer mothers (Table I.7, Annexure I).

Thus, for sustainable KMC practice at home once discharged from the health facility it is essential to take cognisance of the following findings. Firstly, this study showed that KMC is practiced for limited days in the health facility (<3-5 days), and thus must be continued for approximately 4-6 weeks at least at home. Hence, DHOs must make provisions to build KMC competence of CHWs along with HCWs, support them through positive reinforcement, since they are key stakeholders in ensuring that KMC is maintained at home. Secondly, mothers need to be supported by CHWs, and by family members, significant others, or community (Seidman, et al., 2015). KMC maintenance support at home was minimal and was not associated with duration of KMC. Attention is demanded by the finding that more than a quarter [21% (44/209)] of mothers had an fKMC provider at the health facility (Table 21) but at the community this increased to nearly half [47% (99/209)] of all mothers (Section 5.3) being supported by a fKMC provider. This clearly shows that CHWs had probably identified fKMC providers at homes, educated and assisted them to position the LBW baby for KMC. The fKMC providers' knowledge and attitude on KMC was comparable to that of the mothers (Table 20), confirming the role CHWs played in ensuring KMC maintenance in the community. Hence for scale-up of KMC it is crucial that at least key family members (men and women) in each family (Smith, et al., 2017) are proactively identified and counselled on the benefits of

KMC first by HCWs at the health facility and subsequently by the CHWs to enable them to take on the role of an fKMC provider.

CHWs need to be sensitised to the cultural context, an important criterion for successful uptake of KMC at scale (Chan, et al., 2016). Typically, in this district, most of the mothers returned to their parent's home for childbirth for at least 3-5 months based on the type of delivery (vaginal or caesarean respectively), had 1-5 adult family members available at home, were not permitted to do any household chores, and were housed in a room with the LBW baby or a corner in the single-roomed homes with little or no contact with others. KMC could be physically and emotionally draining for a mother to do alone, especially if the duration needs to be for >8 hours daily. Given that the number of babies who received effective KMC dropped by the 7th day after discharge (54.6% to 42.5%) it would be imperative for CHWs to ensure mothers through daily visits, received the required support through fKMC provision especially in the first week after discharge from the health facility and assistance in household chores, if they came from a nuclear family. Therefore, it is important that CHWs' competence to coach mothers (Smith, et al., 2017), especially since the latter were young, on how to negotiate with family members preferably her own mother or mother-in-law, and the spouse or sibling (Blomqvist, et al., 2012) to assume fKMC providers role, would need to be enhanced.

The drop in number of babies receiving effective KMC from 54.6% to 42.5% could mean that mothers would not only require support for SSC but also exclusive breastmilk feeding. Given the average birth weight of these babies was 1693.6 (±221.4) gms, and that 45.1% are discharged from the health facility within 3 days of life, it is possible that the babies would not be suckling effectively at the breast and are likely to lose weight in the first week of life. Hence CHWs must ensure that mothers are supported to express breastmilk, provide this milk safely to the baby, be able to assure mothers to provide optimal duration of KMC and of its link with facilitating successful lactation. This reinforces that support mechanisms would be critical for CHWs too, to enhance their confidence in supporting mothers for provision of long durations of SSC and exclusive breastfeeding.

CHWs' competence although not explored directly in this study could be inferred as optimal by the facts, firstly that mothers continued to provide KMC for >28 days at home. Given that the average days of hospitalisation was <1 week (median 4.57 [interquartile range 5]) this study showed that the support from CHWs and even of family members could have influenced the mothers to provide KMC for >4.5 weeks. Secondly, there was an increase in the number of fKMC providers in the community compared to when mothers were at the health facilities. One could extrapolate that this could have occurred only by the support provided by the

CHWs. Hence it is essential to acknowledge the role of CHWs to further increase KMC maintenance support at home for mothers. Their role of regular home visits, motivating family members to assist mothers either in household chores or as fKMC providers need to be emphasised.

6.5. Conclusion

This PhD study that was conducted in Gangawati, sub-district included all small babies who were born or referred to any health facility within the sub-district and were accessible in the sub-district between 4-8 weeks of life. Between December 12, 2017, - September 26, 2018, there were a total of 22052 live births, of whom 1305 were small babies (accounting for 5.9% of all live births) in Koppal District, identified from the WHO database. In this same period, a cohort of 408 small babies, were identified in Gangawati district out of which more than a third (34.6% - 141/408) were not available for recruitment since they had not survived >4 weeks of life or were not available in the study area at 4-8 weeks of life. From those available for recruitment (267/408 – 65.4%), only 227 (85% of 267) were recruited to the study, since 40 LBW babies (15%) could not be accessed at their homes despite two consecutive visits. This study specifically explored firstly health facility preparedness of eight private and public (primary and secondary) health facilities of the total 21 (38%) available in the sub-district that provided services to >80% of babies in the district. Secondly, competence (knowledge, attitude and skills) of HCWs related to KMC implementation from these eight health facilities was assessed; Thirdly preparedness of mothers was assessed by their knowledge and attitude related to KMC practice inclusive of the support they received for KMC practice along the health facility – community continuum, finally characteristics of ~~LBW~~ babies and KMC practice in terms of day of KMC initiation and duration of KMC on the day before discharge, a week after discharge from the health facility and on the 28th day of the LBW baby's life were assessed. The determinants of KMC practice were computed using regression analysis.

Notably effective KMC (≥8 hours SSC and exclusive breastfeeding) was provided for 54.6% of LBW babies (n=216/227) on the day before discharge from the health facility, which dropped to 42.5% (n=219/227) a week after discharge from the health facility. This study demonstrated the programmatic strategies that could be implemented for KMC scale-up in similar districts by strategically targeting both public and private health facilities that cater to most of the small babies. It was evident that health facility preparedness strategies required focus on health workforce training and support mechanisms to build competence namely knowledge, attitude, and skills for KMC implementation of HCWs, specifically that of nurses (Figure 18) and of CHWs.

6.5.1. Proposed framework for scale-up of KMC along the health facility-community continuum

This study to the best of the investigator's knowledge for the first time has demonstrated the key determinants of KMC practice along the health facility-community continuum in a primarily rural sub-district of northern Karnataka. In this sub-district and those geographies with similar characteristics, it would be reasonable to suggest to women to access services of a public health facilities either for childbirth or in the event of a birth of a small baby at home if stable, in favour of private health facilities. Nevertheless, to facilitate the process of early KMC initiation and increase of KMC duration in private health facilities that notwithstanding are complementing vital services for small babies, unavailable in the public health facilities, DHOs could offer additional support to these facilities. Based on the findings from this study and its implications, the following conceptual framework is proposed for scale-up of KMC (Figure 6, Chapter 3) along the health facility community continuum (Figure 18).

Given that the proportion of women having childbirth at health facilities has been increasing, with early discharge if the baby is stable (Mazumder, et al., 2018) as also seen in this study, it is crucial that mothers are educated about KMC as part of routine antenatal care. This would help them to better assimilate information on KMC – SSC and exclusive breastfeeding after childbirth, in the event of the birth of a small baby. Programmatic priority must be given to enhancing competence of HCWs and CHWs to ensure health facility initiated KMC is continued as effective KMC at home after discharge from the health facility. Systematic improvements in the competence of both HCWs and CHWs need to be ensured through skill-based workshops and support mechanisms with a focus on improving their ability to counsel, educate, and aid mothers inclusive of family members for KMC practice (Cattanneo, et al., 2018) for a period of 4-6 weeks following childbirth / discharge. Given the short duration of hospitalisation after childbirth even for stable small babies, it is essential that CHWs are motivated and supported to ensure families continue optimal duration of KMC till required. Additionally, there is an urgent need to integrate documentation of KMC as a vital indicator within the health information system, to monitor and track effective KMC practice along the continuum.

Although knowledge and attitude of mothers on KMC were not associated with its practice, the fact that mothers continued KMC for >3-8 hours and for several days (>28 days) is an indication that they adopted KMC practice as an intervention to improve the health and wellbeing of the baby (Table I.6). None of the baby characteristics were determinants of KMC

practice. This reaffirms that mothers and family members were more than willing to practice KMC irrespective of the weight, sex, or health status of the baby at birth.

Unequivocally, this study showed that mothers were willing to learn and adopt KMC practice in caring for their small babies at the health facility and continue KMC at home, if supported at the health facility for its initiation and maintenance, by HCWs who are competent with KMC implementation across all types of health facilities. Subsequently, mothers would require support at home for the first week of its practice especially, to sustain effective KMC provision. These variables are likely to ensure that mothers embrace KMC and continue to practice it for as long as required to provide the best start in life for their vulnerable babies. Although mothers demonstrated that they could learn and practice KMC, this could not have been achieved without the assistance provided by HCWs, CHWs and family members who would be paramount in facilitating this great start in life for the babies! Findings from this study have clearly demonstrated that there is both scope and potential for effective KMC practice to be scaled up by adopting the proposed conceptual framework with better coordination of resources and systems along the health facility-community continuum.

	KMC scale-up along the health facility – community continuum		
	Community ⟷	**Health facility** ⟷	**Community**
Context	Antenatal Care	Pregnancy + Childbirth + Hospitalisation of the LBW baby	Continuation of KMC for 4-6 weeks at home
	CHWs role ⟷	**HCWs role** ⟷	**CHWs role**
Input	- Educate and counsel mothers and the community at large on KMC and exclusive breastfeeding, - Inform about choice of health facility for childbirth, - Identify peer mothers as KMC champions, - Identify potential fKMC providers.	- Support (Educate and counsel) mothers at antenatal visits on effective KMC, - Ensure support (assistance from all HCWs including peer mothers as required, KMC kit and foster KMC providers) for mothers to initiate and maintain effective KMC, - Recognise HCWs who promote effective KMC as champions, - Ensure fKMC providers are identified and begin supervised KMC provision at the health facility before discharge.	- Provide support through daily home visits after discharge for a week, identification of barriers and solutions collaboratively to enhance effective KMC, and encouragement of fKMC providers to provide KMC or assist with household chores. - Ensure mothers monitor babies during KMC and refer those babies with danger signs to the health facility, - Monitor the growth and development of the babies till the first three months of the baby to ensure that the required support for its development.
DHOs' role	**<u>Ensure support mechanisms to build competence of HCWs & CHWs through commitment of local medical and nursing colleges</u>** - Skill-based sensitisation training with emphasis on soft skills (communication, how to work as a team, providing support), - Onsite mentoring at all public and private health facilities / community on clinical skills based on load of LBW baby services, - Supportive supervision by specialists – nurses/doctors from local Medical & Nursing Colleges based on load of LBW baby services. **<u>Ensure community mobilisation for KMC through multiple methods – street plays, drama, local TV progms, posters & billboards</u>**		
Resources & systems requisites		- Dedicated KMC space, - HCWs trained on KMC and supported, - Equipment – adjustable beds, weighing scale, feeding articles, and screens for privacy along with basic amenities -food, toilet, water for mothers, - Education materials: brochures/videos/posters - Documentation to monitor KMC progress, - Monthly meetings of HCWs & CHWs to monitor KMC implementation, - Ensure link cards are provided to mothers on discharge, so that CHWs are informed on the need to visit small baby at home.	- Space at home for KMC practice, - Identify, train and designate CHWs as KMC link workers for KMC maintenance, - Train CHWs how to monitor the growth and development of babies and to identify areas of support required. This could enable early identification of possible developmental delays and is suggested since >40% of mothers did not return to the health facility for a check-up, - Small baby helpline in the event of any danger signs, - Referral of babies with any danger signs.

Figure 18. Proposed framework for KMC scale-up along the health facility-community continuum based on study findings

CHAPTER 7. RECOMMENDATIONS AND CONCLUSIONS

The WHO defined KMC as early, continuous, and prolonged SSC between the mother and LBW baby; exclusive breastfeeding or breastmilk feeding; early discharge after hospital initiated KMC with continuation at home; and adequate support and follow-up for mothers at home (Chan, et al., 2016a). This PhD study used operational research as its design to explore for the first time, KMC practice along the health facility-community continuum. A conceptual framework was developed for the purpose of this study that guided the methodology used in this study. Presumable determinants of KMC practice such as health facility preparedness, competence of health care workers (HCWs) in terms of their knowledge, attitude and skills related to KMC implementation were evaluated over two-time points; while support received for KMC practice at the health facility and at home were explored with mothers along with their knowledge and attitudes towards KMC practice. The primary outcomes for this study included the day and place of KMC initiation,duration of KMC (hours of KMC provision / day) on the day prior to discharge, a week after discharge and on the 28th day of life for small babies in the sub-district of Gangawati. The determinants for components of KMC practice along the health facility-community continuum were assessed through this study. Chapter 7 presents the delimitations, and recommendations for scale-up of KMC including plans for dissemination of new knowledge from this study.

7.1. Delimitations of the study

- Findings from this study could be generalised to all ~~LBW~~ babies either born or hospitalised in the sub-district of Gangawati and similar settings, irrespective of health status at birth except those who did not survive 28 days of life. However, the determinants for KMC practice would need to be interpreted cautiously for those babies not recruited to the study (Table 21) since there was a significant difference in the birth weight (1527±294.6 vs 1693.6±221.4, p<0.001) and the number of babies hospitalised in public health facilities (46.3%, vs 56.2%, p=0.014) compared to those that were recruited. These findings must be cautiously generalized since information on place of birth, and duration of hospitalization was not obtained for these babies. Yet overall, there is credence for generalizability to all stable small babies with birth weight >1600 gms, from similar settings namely rural or semi-urban, where dependence on primary and secondary level health facilities for neonatal care and services is high.

7.2. Recommendations for scale-up of KMC

This study assumed that KMC practice occurred within the social system (i.e.) the health facility-community continuum (Figure 6) facilitated by competent HCWs and CHWs (Chan, et al., 2016b & 2017; Namnabati et al., 2016; Seidman, et al., 2015; Smith, et al., 2017; Soni, et al., 2016) and through support systems inclusive of a conducive environment within the health facility and home (Chan, et al., 2016b; Seidman, et al., 2015). Based on the findings of this study, a framework for scale-up of KMC along the health facility-community continuum was proposed (Figure 18). Hence recommendations for scale-up of KMC relevant to either policy, practice, education, or future research are discussed within the context of this proposed framework.

7.2.1. Recommendations for policy

- This study showed that KMC could be initiated in all settings, at home, primary and secondary level public as well as private health facilities. Specific emphasis must be laid on initiation of KMC for all stable small babies irrespective of the place of birth. The MoHFW guidelines recommend that a KMC unit or area must be available near the SNCU, NBSU or in the postnatal ward and staffed with HCWs 24/7 who are trained on essential neonatal care (MoHFW, 2014a). Given that childbirth occurs at home (in this study 8.8%, but likely to be higher in other states of India), or at all levels of public and private health facilities, it is crucial that information on KMC implementation percolates the primary and secondary level health facilities, since a bulk (>80%) of stable small babies (>1800gms) could be cared for in these settings. Additionally, since more than half of all babies recruited to this study were hospitalised in the private health facilities, the MoHFW must mandate that KMC is a component of ENC of small babies.
- Guidelines on education of the community and all women during pregnancy on KMC, would be essential to ensure that KMC is initiated without delay for a stable ~~LBW~~ small baby at birth. More than half [59.6% (133/233)] ~~LBW~~ babies were initiated on KMC within the first three days of life. The place of hospitalization, attitude and support received for KMC initiation (that included counselling and education on KMC) were variables significantly associated with early KMC initiation in this study (Table 35). Early initiation of KMC has been documented to be beneficial for survival of LBW babies (Ahmed, et al, 2011) and positive perceptions of the benefits of KMC among mothers, fathers and families are known to promote uptake KMC (Chan, et al., 2016b). Hence at the policy level, education of mothers, their spouses and family members on KMC by HCWs and CHWs during antenatal visits could be mandated to facilitate early KMC initiation for all stable

~~LBW~~ babies and even for sick babies under close monitoring and supervision by experienced HCWs (WHO immediate KMC study group, 2021).

7.2.2. <u>Recommendations for practice:</u> Evidence generated from this study, can be utilised by DHOs, health facility managers and HCWs inclusive of CHWs to improve KMC practice at scale along the health facility-community continuum. Thus, the recommendations at the practice level based on the study findings are:

- DHOs could <u>promote "community participation" for KMC scale-up</u> by building their awareness particularly on KMC benefits and its impact on neonatal morbidity and mortality. This could be enabled through culturally and technology appropriate strategies to expand their understanding on KMC. This education must be included as part of routine antenatal services, as it is known to improve KMC practice (Ahmed, et al., 2011; Rasaily, et al., 2016) in both public and private health facilities for KMC scale-up along the health facility – community continuum. More than 45% of mothers recruited to this study provided KMC for <3 days at the health facility, while the mean duration of KMC was 30.2(±8.5) days with a range of 2-45 days indicating KMC maintenance at home was for >4 weeks duration. Hence if the community and other family members are sensitised about KMC before childbirth, it would perhaps improve early KMC initiation and practice through their demand of it. KMC education including access and support for KMC practice postnatally must be an essential component of maternal care as it is known to enhance KMC practice.
- <u>District skill labs must be set up to facilitate HCWs including CHWs gain confidence in KMC practice</u> – positioning and monitoring a baby on KMC, communication skills to counsel and educate mothers as well as family members on KMC. Notwithstanding a half-day continuing education program to sensitise HCWs as well as CHWs on these aspects would be beneficial. DHOs could ensure support mechanisms to facilitate improved competence of HCWs and CHWs through collaborative commitments of local medical / nursing specialists and on-site mentors to build confidence of HCWs & CHWs on KMC implementation along the health facility-community continuum.
- Health facility managers must focus on <u>building competence of HCWs, specifically nurses on KMC implementation</u> at all levels of public and private health facilities that provide neonatal services. Nurses trained as KMC mentors could also potentially support CHWs attached to their respective health facilities. Both HCWs and CHWs are crucial for KMC practice along the health facility-community continuum. CHWs are key players for KMC maintenance at home for at least 4-6 weeks. Their skills on assessment of the growth and development of a small baby including timely referral

needs strengthening given the fact that nearly half the proportion of babies in this study were not brought back to the health facility for a follow-up examination.

- DHOs and health facility managers must ensure that KMC practice is a component included in the health information database of neonates, with systems in place to monitor and review progress of KMC implementation both at the health facility and district level.
- DHOs and health facility managers need to ensure that basic amenities in health facilities such as adjustable beds or back rests, screens for privacy, food, water, clean toilets, and education materials for mothers to practice KMC comfortably at the health facility by using the budget allocated for setting up KMC units in sub-district hospitals. The six-bedded primary health centres that lack space could improvise (for example - allocate one bed with screens and extra pillows for a mother with a small baby, to create a dedicated KMC space). Health facility managers could implement an open visitation policy so that at least two family members could be identified as potential foster KMC (fKMC) providers, who can then be supported to begin their role as fKMC providers at the health facility under the supervision of HCWs and to continue this role after discharge with the support of a CHW.
- DHOs along with health facility managers must ensure effective networking and collaboration between CHWs and HCWs through link cards or the use of telephone calls to enable follow-up of LBW babies in their homes in the first week after discharge. Special attention must be paid to strengthen networks and systems in private health facilities where KMC is implemented including follow up of the LBW baby in the community following discharge.
- Systems and mechanisms must be ensured for HCWs and CHWs to advocate, counsel, educate and support mothers and family members for early initiation of KMC along the health facility-community continuum.

7.2.3. Recommendations for education:

- There is scope to mandate KMC awareness and relevant skill training for all HCWs in public and private health facilities that provide maternal and neonatal services.
- Pre – registration education for all HCWs on KMC implementation, so that KMC practice becomes a norm and standard practice of neonatal care.

7.2.4. Recommendations for research:

Based on the findings from this initial research, there is scope for further multicentric studies to answer the following questions:

- KMC education as part of routine antenatal care: Does this intervention promote KMC scale-up? A randomized controlled trial (RCT) could be conducted to determine the impact of KMC education as part of antenatal care on KMC practice and scale-up along the health facility-community continuum.
- How would individual components of health facility preparedness impact on KMC practice? A longitudinal study on how change in the individual components of health facility preparedness (Table 13), individually impact on KMC practice at the health facility could be conducted. This would help generate evidence on what components require focus during scale-up of KMC along the health facility-community continuum.
- What is the impact of fKMC providers on provision of effective KMC? A RCT to establish the role of foster KMC for effective KMC could help establish the specific role of fKMC providers as it was not explored in this study.
- CHWs as KMC champions along the health facility-community continuum – a fact or myth? A longitudinal exploratory study could be conducted to ascertain how support provided by CHWs from pregnancy till childbirth and after childbirth impacts on provision of effective KMC.
- Does effective KMC impact neurodevelopment in LBW babies? A cohort of LBW babies who received effective KMC could be followed up to determine its impact on their neurodevelopment.

7.3 Plans for dissemination of the PhD study

Conventionally dissemination of key research findings has been at conferences through oral /poster presentations or peer-reviewed journal publications (Macaden, 2020). Yet, in keeping with the times, a suite of channels has been chosen and explained below for dissemination of findings from the present study for conceptual, instrumental, competence building and connectivity impact to enable continued expansion of this study findings and influence, with engaged outreach and personal connections and networks (Bradley, et al., 2017; Macaden, 2020).

7.3.1. Publication strategies:

Publication of potential articles, the first of which is in its draft form, as given below in relevant journals (possible journals – Global Health Science and Practice or BioMed Central-Globalisation and Health or PLoS one or other National Journals) that has as its audience policy makers, health officials, health facility managers, health care practitioners, academicians, and researchers:

- "A conceptual framework for scale-up of KMC along the health facility-community continuum in Low- and Middle-Income Countries" (tentative title). It is anticipated that this output would provide inputs for DHOs and health facility managers to review policies on KMC implementation.
- "Impact of health facility preparedness and competence of HCWs on KMC practice". This article will target health facility managers specifically to review strategies and focus on capacity building initiatives to promote KMC practice.
- "Impact of support for mothers for KMC practice along the health facility-community continuum".

7.3.2. Knowledge exchange strategies

The current digital literacy and explosive use of social media demands that knowledge exchange plans for this study findings ensure advancement of local, national, and global connectivity for interdisciplinary research engagement and practice. Hence for scale-up of KMC along the health facility-community continuum, the following is planned:

- Presentation of key findings in National Paediatric / Neonatal / KMC Conference in 2021 / 2022.
- Webinars on how to scale-up KMC with academicians, researchers, and practitioners is planned. Other webinars for prospective mothers and the public on the benefits of early KMC along the health facility-community continuum will also be planned.
- Integration of findings from this study during presentations at local and national workshops particularly focused on facilitators for scale-up of KMC practice.
- Given the impetus of reach through social media such as Instagram, Facebook, YouTube channels, key findings will be presented through these channels for wider reach including mothers and the community at large.
- Other additional professional and interdisciplinary networks that will be targeted for dissemination include LinkedIn, Research Gate, and online professional networks such as Global Network of WHO Collaborating Centre, Nursing Research Society of India. In this era of the COVID 19 pandemic opportunities to conduct virtual webinars for students in training and HCWs will be explored with relevant stakeholders and networks including the World Health Organisation [WHO]. An executive summary with key findings after successful completion of the viva voce will be provided to the institutional library, WHO, Indian Nursing Council, Trained Nurses' Association of India, Directorate of Health and Family Welfare, Karnataka to disseminate the findings of this study to enhance the reach to professional organisations, professionals, and key policy makers.

7.4. Conclusion

Recommendations from previous research included evaluation of acceptance of KMC scale-up in the community, optimum time of initiation and duration of KMC and impact of community-based KMC in reducing neonatal mortality (Rasaily, et al., 2017; Mazumder, et al., 2020). Findings from this study have clearly demonstrated that it is possible to scale-up KMC along the health facility-community continuum. The study also showed that <3 days of KMC was provided at the health facility, while >4 weeks of KMC was provided at home in the community. This typically indicates that KMC could be initiated at the place of birth for stable small babies. The study also reinforced that the competence (knowledge, attitude, and skills) of HCWs for KMC implementation which improved through support mechanisms were important ~~predictors~~ determinants of early KMC initiation as well as duration of KMC for ≥8hours / day. Interestingly, findings also revealed that mothers and fKMC providers were equally knowledgeable and had positive attitudes towards KMC practice, even a month after its initiation. More importantly findings highlight how support for the mother at the health facility could facilitate early KMC initiation and longer duration of KMC provision. It would be worthwhile to explore the unique benefit of CHWs and fKMC providers support along the continuum for effective KMC provision as it was not explored in this study. A framework for scale-up of KMC along the health facility-community continuum has been proposed based on the findings from this study. This framework could be implemented in other sub-districts and evaluated for its ability to sustain provision of effective KMC along the health facility-community continuum both locally and nationally, thus ensuring the LBW baby gets the best start in life! The findings of this study could also have implications for other low- and middle-income countries, especially so for India whilst planning for scale-up of KMC along the health facility-community continuum to achieve the sustainable development goal (SDG-3) and India Newborn Action Plan (INAP) targets of <12 neonatal deaths per 1000 live births (Liu, et al., 2019; MoHFW & INAP, 2014) by 2030.

ANNEXURE – A

Organisation of public health care in India

The public healthcare system of India is three tiered (primary, secondary and tertiary level) and co-exists with private health facilities. Table A.1 shows organisation and the number of health facilities in Koppal District.

Table A1: Organisation of public health care facilities and distribution in Koppal

	Level of Health Care Facility	Population Served	No. in Koppal
Primary Level	**Sub Centres** • Workforce: 1 female and male health worker • Provide health education for control of communicable diseases, maternal, neonatal & child health (MNCH)	A population of 5000 - living within a 10km. radius or 30minute walking distance.	**Total 31:**
	Primary Health Centres • Workforce: 1 medical officer, 3 nurses and paramedical staff. • Provide basic MNCH services • 24/7 labour room facility. • Provide preventive, curative, and rehabilitative health care.	20000-30000 population – living within a 10km. radius or 30minute walking distance.	**Total 46** • Koppal: (14) • Gangawati: (11) • Kushtagi:(8) • Yalburga: (13)
	Community Health Centres (CHCs) • Workforce: 4 specialists - surgeon, physician, obstetrician and paediatrician plus 7-8 nurses and paramedical staff. • Referral centre for 4 PHCs • Provide specialist MNCH, general medical and surgical services. • Have at least 6-30 in-patient beds.	80000 to 160000 population - approximately a 50km. radius or 30-60minutes of walking distance.	**Total 9** • Koppal: (3) • Gangawati: (3) • Kustagi: (1) • Yalburga: (2)
Secondary Level	**Sub-District Hospitals (SDHs)** • Staffed with specialists - surgeon, physician, obstetrician and paediatrician plus 16-20 nurses and paramedical staff.	A population of 5 lakhs (500,000).	**Total 3** • Gangawati SDH with an NBSU since 2018 • Kustagi SDH

	• Provides basic and emergency MNCH, general medical, surgery, orthopaedic, ophthalmology, ENT, dental care, including imaging and lab services. • 100-150 inpatient beds • NBSU (with 2 nurses).		• Yelburga SDH
	<u>District Level Hospitals (DHs)</u> • Workforce: A paediatrician, obstetrician, other general medical, surgical, orthopaedic, ENT, dental, ophthalmology specialists plus staff nurses and paramedical staff • 100-500 inpatient beds • 12-15 bedded SNCU with 12 nurses. • Services like SDH.	Community within the district and neighbouring districts.	**<u>Total - 1</u>** Koppal DH with a Medical College since 2015.

ANNEXURE – B

Clinical Trials Registry of India (CTRI) registration of WHO project

CLINICAL TRIALS REGISTRY - INDIA
NATIONAL INSTITUTE OF MEDICAL STATISTICS
(INDIAN COUNCIL OF MEDICAL RESEARCH)

REF/2017/02/013469
CTRI Website URL - http://ctri.nic.in

Clinical Trial Details (PDF Generation Date :- Sat, 03 Feb 2018 04:22:15 GMT)

CTRI Number	CTRI/2017/07/008988 [Registered on: 06/07/2017] - Trial Registered Retrospectively
Last Modified On	27/06/2017
Post Graduate Thesis	No
Type of Trial	Observational
Type of Study	Follow up - Implementation Research
Study Design	Other
Public Title of Study	Scale up of Kangaroo Mother Care in Koppal District, Karnataka
Scientific Title of Study	Implementation Research in India (Karnataka state) towards accelerating scale-up of Kangaroo Mother Care (KMC)

Secondary IDs if Any

Secondary ID	Identifier
NIL	NIL

Details of Principal Investigator or overall Trial Coordinator (multi-center study)

Details of Principal Investigator	
Name	Dr Prem K Mony
Designation	Principal Investigator
Affiliation	St Johns Research Institute (SJRI)
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Details Contact Person (Scientific Query)

Details Contact Person (Scientific Query)	
Name	Dr Prem K Mony
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Details Contact Person (Public Query)

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Name	Dr Prem K Mony
Designation	Principal Investigator
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Source of Monetary or Material Support

Source of Monetary or Material Support
> Department of Health and Family Welfare, Koppal District, Karnataka State

Primary Sponsor

Primary Sponsor Details	
Name	World Health Organisation WHO
Address	Avenue Appia 20, 1211 Geneva 27, Switzerland
Type of Sponsor	Other [International Organisation]

Details of Secondary Sponsor

Name	Address
NIL	NIL

Countries of Recruitment

List of Countries
India

Sites of Study

Name of Principal Investigator	Name of Site	Site Address	Phone/Fax/Email
Dr Prem K Mony	Community Health Center	Hiresindogi, Koppal Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	Community Health Center	Munirabad, Koppal Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	Community Health Center	Karatagi, Gangawati Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	Community Health Center	Kanakgiri, Gangawati Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	Community Health Center	SR Nagar, Gangawati Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	Community Health Center	Kukanur, Yalburga Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	Community Health Center	Tavaragere, Kushtagi Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	District Hospital	Koppal Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	Taluk Hospital	Gangavathi Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com
Dr Prem K Mony	Taluk Hospital	Yalburga Taluk Koppal KARNATAKA	49467030 premkmony@gmail.co

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	Dr Prem K Mony	Taluk Hospital	Kustagi Taluk Koppal KARNATAKA	49467030 premkmony@gmail.com

Details of Ethics Committee

Name of Committee	Approval Status	Date of Approval	Is Independent Ethics Committee?
Approval Letter	No Objection Certificate	28/04/2017	No
Institutional Ethics Committee, St Johns Medical College and Hospital	Approved	27/06/2016	No
Permission Letter	No Objection Certificate	23/05/2016	No

Regulatory Clearance Status from DCGI

Status	Date
Not Applicable	No Date Specified

Health Condition / Problems Studied

Health Type	Condition
Patients	Stable LBW babies with birth weight less than 2500 grams (specifically all those less than 2000grams)and their mothers and family members; Health care professionals; Community health workers

Intervention / Comparator Agent

Type	Name	Details

Inclusion Criteria

Inclusion Criteria	
Age From	1.00 Day(s)
Age To	60.00 Year(s)
Gender	Both
Details	1. LBW babies with birth weight less than 2500grams (specifically those less than 2000 grams) who are stable and in Koppal district 2. Mothers and family members of LBW babies who consent to provide KMC for the LBW baby. 3. Health care professionals (nurses and doctors) working in public and private health care facilities in Koppal District and who work in the neonatal intensive care unit (NICU); Sick newborn care unit (SNCU); Newborn Stabilisation Unit (NBSU); Postnatal ward and Labour room. 4. Community health workers which includes ANMs, ASHA facilitators, ASHA workers and Community coordinators

Exclusion Criteria

Exclusion Criteria	
Details	1. LBW babies that are not stable, or who have been shifted out of Koppal district for advanced care 2. Mothers and family members of LBW babies not able to provide KMC, and not available. 3. Health care professionals not consenting to take part in the study 4. Community health workers who are not available or not willing to participate in the study.

Method of Generating Random Sequence	Not Applicable
Method of Concealment	Not Applicable
Blinding/Masking	Not Applicable

Primary Outcome

Outcome	Timepoints
To develop a delivery model that will result in	Phase 1: Will be the first 6 months and includes

	high coverage (80%+) and quality of KMC for all eligible LBW babies in Koppal district of Karnataka state in Southern India	formative research to identify barriers including identification of LBW (specifically those below 2000grams); and to develop a model for scale up. Phase 2: to test a model for scale up in 5-10 health care facilities; identify successes and develop costed scale up plans Phase 3: Scale up KMC coverage throughout Koppal district

Secondary Outcome

Outcome	Timepoints
1.Facility-level effective coverage of KMC; 2.Continued facility-level effective coverage of KMC; 3.Population-level duration of KMC; 4.Percent of LBW infants who are exclusively breastfed; 5.Percent of LBW infants less than 2000grams who have signs of a severe neonatal infection; 6.Early neonatal mortality rate; and 7.Neonatal mortality rate.	1.The percent of LBW infants at a KMC facility (specifically those less than 2000grams) who received KMC in a facility at time of discharge (no of days and for no. of hours); 2.The percent of LBW infants at a KMC facility who continued to receive KMC 7 days after discharge. 3. No of days of KMC received by LBW infants in the population at 28 days of age; 4.At 7 and 28 days of age; 5.At 7 and 28 days of age; 6. Measured at 7 days of age; and 7. Measured at 28 days of age

Target Sample Size	**Total Sample Size**=3000 **Sample Size from India**=3000
Phase of Trial	N/A
Date of First Enrollment (India)	26/01/2017
Date of First Enrollment (Global)	No Date Specified
Estimated Duration of Trial	**Years**=2 **Months**=0 **Days**=0
Recruitment Status of Trial (Global)	Not Applicable
Recruitment Status of Trial (India)	Open to Recruitment
Publication Details	Not applicable
Brief Summary	The project is being piloted in 5 health care facilities - the district hospital, 1 CHC, 2 PHCs and 1 private hospital in Koppal taluk. All LBW babies born /referred (via tablet) will be recruited. Subsequently care in hospital will be monitored through medical records and a special KMC case sheet. Outcome data on effective KMC (skin to skin care plus exclusive breast feeding) as well as survival is captured on tablet of Phase 1.

ANNEXURE - C

Implementation strategy of the WHO project

The WHO project was implemented in Koppal District by St Johns Research Institute and their implementation partners, Karnataka Health Promotion Trust (KHPT), both of which are in Bengaluru.

The following strategies were adopted by the WHO project:

Continuing education program: One day KMC skills-based training for nurses, counsellors, and health assistants from the selected health facilities in June 2017, at Gangawati. Topics covered included basics of KMC; breastfeeding; counselling for KMC practice; common health problems of LBW babies including orientation to use of KMC case record to document practice. Doctors attended a half-day orientation session in Gangawati on KMC implementation and how they could engage to support the WHO project strategies. All CHWs were given a one-day skills-based training to support mothers for KMC maintenance at home.

Onsite nurse mentors at health facilities: Nurse mentors, part of the project team was accountable to local supervisors of the WHO project. Nurse mentors helped establish birth weight validation, identification of LBW babies (Mony et al., 2019); facilitation of KMC implementation directly or by assisting HCWs; and in improving care of LBW babies. They also participated in the quality improvement committee (QIC) meetings to oversee health facility preparedness along with health managers. The details of onsite nurse mentor visits to health facilities in the sub-districts between June 2017 and December 2018 are provided in Table C.1.

Supportive supervision visits to health facilities and at the community. Supportive supervision visits (Table C.1) were performed neonatologist and a nurse specialist team from Bengaluru. The aim of these visits was to strengthen onsite mentoring and build capacity of HCWs on care of LBW babies. They also advocated for health facility preparedness for KMC practice. They introduced motivational activities for HCWs through recognition of a KMC Champion within each health facility identified by the medical officer or the QIC. The monthly KMC monitoring chart was audited and they collaboratively found ways to enhance KMC uptake. Supportive supervision for CHWs was also available through project staff and CHW supervisors who were part of the public health system.

Table C1: Number of onsite mentoring and supportive supervision visits from June 2017-December 2018 in Gangawati sub-district

Type of Health Facility	Mentoring Visits			Supportive Supervision Visits	
	Total Number	Number per month	Frequency	Total Number	Frequency
SDH	504	28	~daily	16	Once a month
CHC	84	5	Once a week	7	Once in 3 months
PHC	21	1	Once a month	4	Once in 6 months
Private	252	14	Once in 2-3 days	11	Once in 2 months
TOTAL	861			38	

Engagement of HCWs with mothers and the community: HCWs were trained by the WHO project team to provide information to individuals or groups of mothers and significant others on KMC using a format “Rapport, Ask, Listen, Praise, Advice, and Clarify” to promote uptake of KMC practice. They were also oriented to encourage fKMC providers who could be any significant other (a family member /friend) and the AKKA (older sister in Kannada) model, to engage with mothers to enhance KMC uptake. Context specific education materials (posters, videos, and brochures) were available. CHWs were trained on how to address barriers for KMC maintenance at home, to identify danger signs in LBW babies, and make timely and appropriate referrals (Malhotra & Zodpey, 2010) inclusive of their expected roles for KMC implementation. The micro-planning communication tool helped them to address barriers and provide solutions to improve KMC practice, to monitor KMC duration at home. The linkage card was provided to mothers at the time of discharge from the health facility to improve demand for service by CHWs. Mothers were encouraged to contact the CHW soon as they reached home after discharge, to facilitate an early visit by the CHWs.

Engagement with the leadership – State, district, and sub-district level health officials: District and state level health officials were involved right from the development stage of the WHO proposal. They approved the conduct of the project in Koppal. They were briefed monthly by the WHO project staff on the progress made, challenges faced, and their suggestions were sought to resolve the challenges.

ANNEXURE – C.1
Distinctiveness of PhD study from the WHO project

The WHO project was implemented from July 2016 to December 2018 in Koppal District. The PhD study data collection began from July 2017 till Mar 2020. Table C1.1 highlights the uniqueness of the PhD study from the WHO project.

Table C1.1: Distinctiveness of the PhD study from the WHO project

	PhD study	***WHO project***
Title	Operations research on uptake of KMC for small babies along the health care facility – community continuum	Implementation research to develop models that are scalable for KMC implementation
Choice of Location made by	By the Principal Investigator for WHO project - Sub-district with second highest number of health facilities and services for neonates - highest number of private health facilities in Koppal district	Government of Karnataka – State and DHOs based on poorer health indicators of Koppal
Location	Gangawati sub-district	Koppal district
Setting	8 health facilities – 7/15 public and 1/6 private	All health facilities – public and private
Primary target group	- Health facility managers - Community health supervisors	- District and sub-DHOs
District level strategies	- Nil	- Advocacy with district and sub-DHOs. - Capacity building of HCWs, CHWs at district level - Strengthening networks with health facilities and community - Community mobilisation - Monitoring and evaluation of KMC implementation
Research Participants	- HCWs from selected health facilities - Mothers with small babies (4-8 weeks of age) and fKMC providers	- Managers of health facilities - LBW babies from birth to 4 weeks of life
Methods / strategies used	- Evaluation of capacity building activities through assessment at two time-points of ➢ health facility preparedness. ➢ knowledge, attitude, and skills of HCWs.	- Capacity building of HCWs and CHWs for KMC implementation o Onsite nurse mentoring o Supportive supervision by specialists to catalyse WHO project activities.

	- Assessment of knowledge on and attitude towards KMC including support received at health facility and home for KMC practice by mothers and fKMC providers.	○ Linkages with health facilities and CHWs - Monitoring and evaluation of KMC implementation at health facility and community.
Data collected	<u>Primary Data</u> - Health facility preparedness - Competence (knowledge, attitude, and skills) of HCWs - Knowledge, attitude, and support received – mothers and fKMC providers at 4-8 weeks of life of the baby at home - KMC Practice: Day of life of KMC initiation, duration and number of days provided - Follow-up of baby at health facility <u>Secondary Data:</u> Data from the WHO project databases - KMC initiation at health facility - Exclusive breastfeeding and Duration of daily KMC hours on day of its initiation, day before discharge, 7th day after discharge and 28th day of life	- Qualitative interviews / observations and focus groups discussions to identify barriers for and gaps in KMC implementation with health officials, managers of health care facilities, HCWs, CHWs, mothers - Coverage of KMC on eligible LBW babies through record review and self-report. - Effective KMC (exclusive breastfeeding and SSC ≥8 hours) on day prior to discharge, 7th day after discharge and 28th day of life.
Potential Outcome	Determinants of KMC practice along the health facility-community continuum	Model for implementation of KMC at scale

ANNEXURE - D

Neonatal care model in India and health facilities providing neonatal care in Koppal district

Neonatal care provided in health facilities is classified into levels based on the National Neonatal Forum in India.

- **Level I** neonatal care units **(NBSU, in India)** provide care for babies weighing >2000 gms at birth or ≥37 weeks gestation, basic resuscitation and stable neonatal care.
- **Level II** neonatal care units **(SNCU)** provide care for preterm neonates (32-36 weeks gestation) or babies weighing between 1500-2000 gms at birth. These units are resourced with equipment for resuscitation, maintenance of thermo-neutral environment, intravenous infusion and gavage feeding, phototherapy and exchange transfusion (Oommen, 2015; Nagesh, 2016). Such a unit is located within the district hospital, which is a secondary level health facility in Koppal district. Gangawati sub-district does not have such facility, but there at least six private fee-for-service health facilities that function with level I or II neonatal care units.
- **Level III** units provide neonatal care for extreme preterm neonates who weigh <1500 gms or born <32 weeks of gestation. These units have capacity for advanced respiratory and hemodynamic support (Oommen, 2015; Nagesh, 2016).

Organisation of health facilities in Koppal

There are totally 90 health facilities (59 government and 31 private) in Koppal district (Table A.1, ANNEXURE A). Within the private health facilities, 21 are maternity homes and 10 are private Level I or II neonatal units. The health facilities with neonatal services in Gangawati is provided (Table D.1) and the number of HCWs who provided neonatal services along with the number recruited for the study is shown in Table D.2. Estimated number of LBW babies (Table D.3) plan for data collection.

Table D.1: Health facilities in Gangawati (Source: Health Management Information System-2016-17) with neonatal services

Facility Name	Facility Type	No. of Deliveries 2016-17	No of Live births 2016-17	No of LBW <2500gms 2016-17	Distance from Sub-district Head quarter	mentor days/ month
Gangawati Sub-District Hospital	Secondary	3060	3000	510	0	4-7 days
Community Health Center						
Karatagi	PRIMARY	1197	1176	216	30	4 days
Kanakagiri		565	563	69	25	2 days

Sriramnagar		375	369	45	18	2 days
Primary Health Center						
Musalpur		411	411	62	35	1 day
Venkatagiri		342	340	79	25	2 days
Navali		234	232	37	40	2 days
Anegundi		138	138	16	14	1 day
Budagumpa		129	128	11	45	1 day
Hosakera		93	92	13	10	1 day
Bennur		91	91	2	40	2 days
Mustar		61	61	1	12	1 day
Sangapura		10	10	2	5	1 day
Siddapura		0	0	0	15	1 day
Gangawati -Urban		0	0	0	0	0
Private children's hospitals						
Tejaswini	PRIVATE	NA	NA	40	~2	4-8 days
Anand		NA	NA	NA	~1.5	4-8 days
Amar		NA	NA	141	3	4-8 days
Bhagirathi		NA	NA	45	4	4-8 days
Chiniwal		NA	NA	-	-	When needed
Padmaja		NA	NA	-	-	When needed
TOTAL		6706	6611	1289		

**All facilities marked in green- selected for assessing health facility preparedness and HCW preparedness. NA: Not available.*

*** source for private health facilities:*

http://pcpndt.karnataka.gov.in/PvtGovtCentresHomepage.aspx?unitid=HbyPiQySlfB%2BVAWrSj70Bw%3D%3D&role=Tg3R3dzL5d8qh2W0SyPhDQ%3D%3D&DistWiseCount=mELirpUhRYksFj7k8%2FXBcQ%3D%3D&PvtGovt=nBg%2BoK7HWWeZVo4G1oAzng%3D%3D

Table D.2: Number of HCWs involved in neonatal services in Gangawati

	HCWs available			Number of HCWs assessed*	
Health Facility	**No. of nurses, counsellors, health assistants**	**No. of doctors**	**Total No. HCWs**	**No**	**%**
Secondary (SDH*)	25	3	28	28	100%
Primary (CHC / PHC)	30	9	39	35	90%
Private	27	1	28	16	57%
TOTAL	82	13	95	79	83%

***HCWs assessed at either or both Time-point 1 (Jan 2018, six months from the start of the WHO project in Gangawati) and Time-point 2** (December 2018, end of the WHO project)

Table D.3: Expected number of LBW Babies per annum in Koppal district

Parameter	Koppal District	Gangawati Sub-district
Total population (Census, 2011)	1391212	459905
No of annual births @ crude birth rate 19.3/1000	26850	8876
Place of childbirth (annual)		
a. Estimated child births at home	@15%=4027	@12%=1065
b. Estimated child births in public health care facilities	@66%=17721	@65%=5769
c. Estimated child births in private health care facilities	@19%=5102	@23%=2045
Estimated eligible LBW babies (<2500gms) @27%	**7249**	**2397**
Estimated eligible LBW babies (< 2000 gms) @ 5%	**1343**	**443**

ANNEXURE –E

Participant Information Sheet - Health Care Workers

Introduction

Kangaroo Mother Care (KMC) has been proven to be a cost-effective treatment in the care of LBW infants. It is found to be most effective when it is provided for >10 hours per day and especially for those babies <2000 gms. We are exploring different ways to help mothers to accept and practice kangaroo mother care for their LBW babies in Koppal District. We thus plan to come out with a design that can be used in other districts so that KMC can be practiced by all mothers who have LBW babies.

Before you decide to participate, it is important for you to understand why the project is being done and what it will involve. This information sheet will explain what we are doing. Please take time to **read** the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information on. Take time to decide whether you wish to take part.

Who are we?

We are a team of doctors, nurses and public health specialists from the St. John's Medical College and Hospital and Karnataka Health Promotion Trust that are based in Bengaluru, Karnataka. This is a PhD project as part of a larger WHO project that is being done in Koppal District. The larger WHO project is being funded by the World Health Organisation – an International Organisation that works towards improving the health of people. The Ministry of Health and Family Welfare, Government of Karnataka has granted permission for the project to be conducted in the Koppal district.

What is the purpose of the project?

We are trying to find out ways by which mothers with LBW babies can be supported by doctors, nurses, and community health workers to practice KMC for their babies both in the hospital and in their own homes following discharge from the health care facility.

Why have I been chosen?

You have been chosen because you are currently working as a doctor / nurse / health assistant / counsellor in the selected government hospitals in Gangawati Taluk/Sub district, Koppal District. Your understanding, perceptions and skills related to providing care for LBW infants with specific emphasis on KMC will be very valuable to inform this research project.

Do I have to take part?

No, you do not have to take part in this project. If you do decide to take part, you will be given this information sheet to keep and sign a consent form. You are still free to withdraw from the study at any time and you do not need to give a reason for doing so. Your participation is voluntary and will not affect positively or negatively in anyway or access to any of the benefits of being employed by the government.

What will I have to do?

If you are interested in taking part, you will be invited to complete a questionnaire which would approximately take around 20 – 30 minutes, when you are deputed for the continuing education skill-based training or when you are at work in the health facility with special permission being granted by the head of the health facility. Additionally, your skills for KMC implementation will be assessed through a rapid assessment, where you will be expected to perform a particular activity and will an observer present will assess your performance using a checklist. All the data will be anonymized and confidential. This means that you will not be identified in any of the results or publications from this project. You will not have any bear any expenses because of this project.

Has this project been reviewed by an ethics committee?

Yes, the Institution Ethics Committee of St John's Medical College and Hospital and General University Ethics Panel of the University of Stirling, UK have both reviewed the project and have found no ethical objections to this study being carried out.

What will happen to the results of the project?

The findings from this research will be used to inform how best KMC can be implemented in health facilities and at the homes. A report about the study and related articles will be published in academic journals or presented at national and international academic conferences. You will not be identified in any way in any report or publication. A summary of the findings from this research will also be sent to you if you wish.

Who has designed the research project?

The larger WHO project has been designed by a team of doctors, public health professionals and nurses from the St. John's Medical College and Hospital that includes St John's Research Institute, Bengaluru and from Karnataka Health Promotion Trust. The PhD study has been designed by faculty of St Johns Research Institute, Bengaluru and Health Sciences & Sport, University of Stirling, Scotland, UK inclusive of myself.

What will you get out of this study?

You will directly benefit by improving your understanding and skills in identifying LBW babies, initiating, and maintaining KMC for these babies, counselling mothers on KMC practice in the health care facility and recognizing warning signs in LBW babies. The information that we get from this study will help us design a model so that KMC can be practiced both in the health facility and community by all eligible mothers and babies. This will help us to share information to other health officials in the state so that KMC can be implemented state-wide. You will find that when a mother provides KMC for her baby in the Sick Newborn Care Unit or Newborn Stabilising Unit, or postnatal ward the baby is not left alone. It will help you to monitor the baby more easily since the mother will be able to report any changes she sees or observes.

What is the "risk" to you?

While you may feel anxious about giving any information in the questionnaire, no additional risk or discomfort will be encountered by you. KMC guidelines have been published by the Ministry of Health and Family Welfare, Government of India (Sept 2014) to help find ways to implement it in the health facility and continue it at home. It is the right of the mother to know about KMC and for her to provide KMC given its known effectiveness for the care of LBW babies. Every effort will be made by myself or other FIs including nurse mentors and specialists who visit your hospital, to make you feel at ease and comfortable when you are completing the questionnaire or when we are collecting any information in relation to the project.

Where can I get further information about the project?

If you have any questions or would like further information about the project, please contact *Ms Maryann Washington, Principal Investigator, St John's Research Institute, Bengaluru 560034 (Tel: +9180 49467000 Ext 7030-Secretary;+919686207443;maryannvc@sjri.res.in) OR Dr Prem K Mony, Principal Investigator of the WHO Project, Professor and Head, Div. of Epidemiology and Population Health, St John's Research Institute, Bengaluru 560034 (Tel: +9180 49467000 Ext 7030 – Secretary; premkmony@sjri.res.in) OR Dr Leah Macaden, Faculty of Health Sciences & Sport, Highland Campus, University of Stirling (Tel: 01463 255 641; Email: leah.macaden@stir.ac.uk)*. She would be happy to discuss any queries you may have. If you wish to speak to an independent advisor about the project, or if you have any complaints, please contact:

Dr Jayanthi Savio, Member Secretary, Institutional Ethics Committee, St John's Medical College and Hospital, Sarjapur, Bengaluru 560034 (Tel: +9180 25634123/49466346)

Thank you for taking the time to read this information.

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Tel: 0044 1463 255641
Email: *leah.macaden@stir.ac.uk*

INFORMED CONSENT FORM

1. I confirm that I have read and understood the Participant Information Sheet (V……Dated: …../…../…..).
2. I am aware that I will not have to bear any expenses because of the project.
3. I have had the opportunity to consider the information and ask questions and have had these answered satisfactorily.
4. I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason, without any of my rights being affected.
5. I understand that all information (including all written information) from this study will be kept in a locked filing cabinet at the St. John's Research Institute, Bengaluru and stored in a password protected folder on the computer hard drive to which only the research team will have access.
6. I agree to take part in this project.

Name of Participant (Nurse mentor/Nurse/Doctor)	Date	Signature
Name of Person taking consent	Date	Signature

Please complete two copies: 1 for participant; 1 for researcher's site file.

ANNEXURE - E.1.

ಕೇ. ಎಂ. ಸೀ. ಯ ಬಗ್ಗೆ ಆರೋಗ್ಯ ಸೇವೆ ನಿರೂಪಿಸುವವರಿಗಾದ ಪ್ರಶ್ನಾವಳಿ

Quesionnaire of HCWs on KMC

ಬಳಕೆ (ವೈದ್ಯರು, ದಾದಿಯರು, ಸಮಾಲೋಚನೆ ನೀಡುವವರು, ಸಂಬಂಧಪಟ್ಟ ಆರೋಗ್ಯ ಕೆಲಸಗಾರರು, ಆರೋಗ್ಯ ಸೇವೆ ಸೌಲಬ್ಯಗಳಿಗೆ)

For use (By Doctors, Nurses, Counsellors and other Allied Health Care Workers, in Health Care Facilities)

[November, 2017)

ವಿಭಾಗ ' ಏ' - ಮೂಲಭೂತ ಮಾಹಿತಿ

Section A – Baseline Information

ಕ್ರ. ಸಂ / S.No.: …….. ದಿನಾಂಕ / Date:…….....

ದಯವಿಟ್ಟು ಸಂಬಂಧಿತ ಬಾಕ್ಸನ್ನು ಕಪ್ಪುಗೊಳಿಸುವುದರ ಮೂಲಕ ಅಗತ್ಯವಾದ ಮಾಹಿತಿಯನ್ನು ಪೂರ್ತಿಮಾಡಿ.

Please complete the information required by shading the relevant box

1. **Facility type (colour/shade the box for the most appropriate option)** ಸೌಲಭ್ಯದ ವಿಧ (ಸೂಕ್ತ ಆಯ್ಕೆಗಾಗಿ ಬಾಕ್ಸನ್ನು ಛಾಯಗೊಳಿಸಿ)	i. District hospital ಜಿಲ್ಲಾ ಆಸ್ಪತ್ರೆ ☐ ii. Taluk hospital ತಾಲೂಕು ಆಸ್ಪತ್ರೆ ☐ iii. CHC ಸಮುದಾಯ ಆರೋಗ್ಯ ಕೇಂದ್ರ ☐ Specify ಸೂಚಿಸಿ…… iv. Private ಖಾಸಗಿ ☐Specify ಸೂಚಿಸಿ…….. v. PHC ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯ ಕೇಂದ್ರ ☐ Specify ಸೂಚಿಸಿ……
2. **Area of work.** ಕೆಲಸದ ಪ್ರದೇಶ	i. SNCU ವಿಶೇಷ ನವಜಾತ ಆರೈಕೆ ಘಟಕ ☐ ii. NBSU ನವಜಾತ ಸ್ಥಿರಗೊಳಿಸುವಿಕೆ ಘಟಕ ☐ iii. NICU ನವಜಾತ ತೀವ್ರ ಚಿಕಿತ್ಸೆ ಘಟಕ ☐ iv. Postnatal ward ಹೆರಿಗೆಯ ನಂತರದ ವಾರ್ಡ್ ☐ v. Labour Room ಹೆರಿಗೆ ಕೊಠಡಿ ☐ **vi.** KMC ward ಕೇ. ಎಮ್. ಸೀ ಘಟಕ ☐
3. **Age (in years)** ವಯಸ್ಸು (ವರ್ಷಗಳಲ್ಲಿ)	4. **Work experience (in years)** ಉದ್ಯೋಗ ಅನುಭವ (ವರ್ಷಗಳಲ್ಲಿ)
5. **Designation** ಪದನಾಮ	
6. **Highest academic qualification** ಅತ್ಯಧಿಕ ಶೈಕ್ಷಣಿಕ ಅರ್ಹತೆ	i. GNM ಜಿ. ಎನ್. ಎಮ್ ☐ ii. BSc ಬೀ. ಎಸ್. ಸ. ☐ iii. MSc ಎಮ್. ಎಸ್ ಸೀ ☐ iv. High School (Till 10th) ಎಮ್ ಬೀ ಬೀ ಎಸ್☐ v. Higher Secondary (Till 12th) ಡಿ ಸೀ ಏಚ☐
7. **Sex** ಲಿಂಗ	i. Female ಗಂಡು ☐ ii. Male ಹೆಣ್ಣು ☐ **iii.** Other ಬೇರೆ ☐

8. **Previous training attended** ಮೊದಲು ಭಾಗವಹಿಸಿದ ತರಬೇತಿ	i. Skilled Birth Attendant (SBA) If Yes, When ಸ್ಕಿಲ್ಡ್ ಬರ್ತ್ ಅಟೆಂಡೆಂಟ್ (ಎಸ್ ಬೀ ಏ); ಹೌದು ಎಂದರೆ, ಯಾವಾಗ: ..... ii. NSSK (Essential Care of Newborn) If yes, When ಎಸೆನ್ಶಿಯಲ್ ಕೇರ್ ಆಫ್ ನ್ಯೂ ಬಾರ್ನ್. (ಎನ್ ಎಸ್ ಎಸ್ ಕೇ) ಹೌದು ಎಂದರೆ, ಯಾವಾಗ:..... iii. KMC (Kangaroo Mother Care), If Yes, When ಕ್ಯಾಂಗ್ರೂ ಮದರ್ ಕೇರ್(ಕೇ. ಎಮ್ ಸೀ); ಹೌದು ಎಂದರೆ, ಯಾವಾಗ:..... **iv.** Other (Specify……..), If Yes, When ಬೇರೆ ಸೂಚಿಸಿ..... ಹೌದು ಎಂದರೆ, ಯಾವಾಗ:.....
9. **Have you participated in similar projects in the past?** ಇದೇ ರೀತಿಯ ಯೋಜನೆಗಳಲ್ಲಿ ಹಿಂದಿನ ಭಾಗವಹಿಸುವಿಕೆ	i. Sukshema MNCH project ಸುಕ್ಷೇಮ ಎಮ್ ಏನ್ ಸೀ ಏಚ್ ಯೋಜನೆ ii. Otherಬೇರೆ ☐ **iii.** Skills and Drills Projectಸ್ಕಿಲ್ಸ್ ಅಂಡ್ ಡ್ರಿಲ್ಸ್ ಯೋಜನೆ
10. **Have you heard of KMC before this project started?** ಈ ಯೋಜನೆ ಪ್ರಾರಂಭಿಸುವ ಮೊದಲು ಕೇ. ಎಮ್. ಸೀ ಯ ಬಗ್ಗೆ ಕೇಳಿದ್ದೀರಾ	i. Yes ಹೌದು☐ **ii.** No ಇಲ್ಲ ☐

<u>Section B:</u> Knowledge Questionnaire <u>ವಿಭಾಗ ' ಬೀ'</u> : ತಿಳಿವು ಪ್ರಶ್ನಾವಳಿ

Below are a few statements related to KMC. The answer can either be “YES” (Y), “NO” (N) or “DO NOT KNOW” (DNK). Please shade/colour the box for the most appropriate answer for each statement.

ಕೇ. ಎಮ್. ಸೀ ಯ ಬಗ್ಗೆ ನಿಮ್ಮ ತಿಳಿವಿಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಕೆಲವು ಪ್ರಶ್ನೆಗಳು ಕೆಳಗಿವೆ. ಇದಕ್ಕೆ ಉತ್ತರ "ಹೌದು", "ಇಲ್ಲ" ಅಥವಾ "ಗೊತಿಲ್ಲ" ಎಂದಿರಬಹುದು. ದಯವಿಟ್ಟು ಈ ಕೆಳಕಂಡ ಪ್ರಶ್ನೆಗಳ ಸೂಕ್ತ ಉತ್ತರದ ಬಾಕ್ಸನ್ನು ಛಾಯೆಗೊಳಿಸಿ.

ಪ್ರದೇಶ	**ಪ್ರಶ್ನೆ**	**ಹೌದು**	**ಇಲ್ಲ**	**ಗೊತಿಲ್ಲ**
Identification of a newborn eligible for KMC (8 items) ಕೇ. ಎಮ್. ಸೀ ಗೆ ಅರ್ಹತೆ ಇರುವ ನವಜಾತ ಶಿಶುವಿನ ಗುರುತಿಸುವಿಕೆ (8 ಅಂಶಗಳು)	11. KMC can be routinely used in the care of all stable low birth weight babies. ಸ್ಥಿರವಾಗಿರುವ ಎಲ್ಲ ಕಡಿಮೆ ತೂಕ ಶಿಶುಗಳ ಆರೈಕೆಯಲ್ಲಿ ಕೇ. ಎಮ್. ಸೀ ಯನ್ನು ವಾಡಿಕೆಯಂತೆ ಉಪಯೋಗಿಸಬಹುದು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	12. A baby whose birth weight is <2000 gms is called a term baby. 2000 ಗ್ರಾಂ ಗಿಂತ ಕಡಿಮೆ ಜನನ ತೂಕವಿರುವ ಮಗುವನ್ನು ' ಪೂರ್ಣ ಅವಧಿ' ಶಿಶು ಎನ್ನುತ್ತೇವೆ.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐

	13. Kangaroo Mother Care (KMC) can be started as soon as possible after birth for stable babies of birth weights 1800-2000 gms ಕೇ. ಎಮ್. ಸೀ ಯನ್ನು 1800-2000 ಗ್ರಾಂ ಜನನ ತೂಕವಿರುವ ಸ್ಥಿರವಾದ ಶಿಶುಗಳಿಗೆ ಹೆರಿಗೆಯ ನಂತರ ಆದಷ್ಟು ಬೇಗನೆ ಪ್ರಾರಂಭಿಸಬಹುದು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	14. A stable low birth weight baby is one who can maintain body temperature, is lethargic and has a respiratory rate of 80/minute. ದೇಹದ ತಾಪಮಾನವನ್ನು ನಿರ್ವಹಿಸಲು ಸಾಧ್ಯವಾಗಿ, ಅತಿ ನಿಧಾನಗತಿಯಲ್ಲಿ ಇದ್ದು, 80/ನಿಮಿಷ ಉಸಿರಾಟದ ದರವಿದಲ್ಲಿ ಅದು ಸ್ಥಿರವಾದ ಕಡಿಮೆ ತೂಕ ಮಗುವಾಗುತ್ತದೆ.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	15. It might take days to weeks before a baby <1200gms can be started on KMC since these babies can have serious health problems 1200 ಗ್ರಾಂ ಗಿಂತ ಕಡಿಮೆ ತೂಕ ಶಿಶುಗಳಿಗೆ ಗಂಭೀರ ಆರೋಗ್ಯ ಸಮಸ್ಯೆಗಳಿರಬಹುದು ಎಂಬ ಕಾರಣಕ್ಕಾಗಿ ಅವರಿಗೆ ಕೇ. ಎಮ್. ಸೀ ಆರಂಭಿಸಲು ಕೆಲವು ದಿನಗಳಿಂದ ವಾರಗಳಾಗಬಹುದು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	16. KMC can be given to all stable babies except for those with severe jaundice. ಕೇ. ಎಮ್. ಸೀ ಯನ್ನು ತೀವ್ರ ಕಾಮಾಲೆ ಇರುವ ಶಿಶು ಹೊರತು ಸ್ಥಿರವಾಗಿರುವ ಎಲ್ಲ ಶಿಶುಗಳಿಗೆ ನೀಡಬಹುದು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	17. KMC can be provided in the special newborn care unit (SNCU) intermittently (1-2 hours per session) to a stable baby with birth weight between 1200 to 1800 gms, receiving oxygen, IV fluids and antibiotics ಆಮ್ಲಜನಕ , ಐ ವೀ ದ್ರವಗಳು ಮತ್ತು ಆಂಟಿಬಯಾಟಿಕ್	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐

	ಸ್ವೀಕರಿಸುತ್ತಿರುವ 1200- 1800 ಗ್ರಾಂ ಜನನ ತೂಕವಿರುವ ಸ್ಥಿರವಾದ ಶಿಶುವಿಗೆ ವಿಶೇಷ ನವಜಾತ ಆರೈಕೆ ಘಟಕದಲ್ಲಿ ಮಧ್ಯ ಮಧ್ಯ (1- 2 ಗಂಟೆ ಪ್ರತಿ ಸಾರಿ) ಕೇ. ಎಮ್. ಸೀ ನೀಡಬಹುದು.			
	18. If a baby's body temperature is <37^{0}C, it is called hypothermia ಒಂದು ಮಗುವಿನ ದೇಹ ತಾಪಮಾನ 37° C ಗಿಂತ ಕಡಿಮೆ ಇದ್ದರೆ, ಅದಕ್ಕೆ ಹೈಪೊತರ್ಮಿಯ ಎನುತ್ತೇವೆ.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
Components of and Requirements for KMC (10 items) ಕೇ. ಎಮ್ . ಸೀ ಯ ಅಂಗಗಳು ಮತ್ತು ಅಗತ್ಯಗಳು (10 ಅಂಶಗಳು)	19. The basic component of KMC is skin to skin contact between mother /care provider and the baby. ಕೇ. ಎಮ್. ಸೀ ಯ ಮೂಲಭೂತ ಅಂಗ ತಾಯಿ / ಆರೈಕೆ ಒದಗಿಸುವವರ ಮತ್ತು ಶಿಶುವಿನ ನಡುವಿನ ಚರ್ಮದಿಂದ ಚರ್ಮಕ್ಕೆ ಸಂಪರ್ಕ ಹೊಂದಿರಬೇಕು.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	20. Exclusive breast feeding is a component of KMC ಪ್ರತ್ಯೇಕವಾದ ಸ್ತನ್ಯಪಾನ ಕೇ. ಎಮ್. ಸೀ ಯ ಒಂದು ಅಂಗ.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	21. A baby must be kept in lateral position with head slightly extended and face turned to one side whilst receiving KMC ಕೇ. ಎಮ್. ಸೀ ಸ್ವೀಕರಿಸುವಾಗ ಮಗುವಿನ ತಲೆಯನ್ನು ಒಂದು ಕಡೆ ತಿರುಗಿಸಿ ಸ್ವಲ್ಪ ಚಾಚಿ ಪಾರ್ಶ್ವದ ಸ್ಥಾನದಲ್ಲಿ ಇಟ್ಟಿರಬೇಕು.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	22. When in KMC position, the baby's abdomen must be in direct contact with the mother/care provider's epigastrium (upper abdomen) ಕೇ. ಎಮ್. ಸೀ ಸ್ಥಾನದಲ್ಲಿರುವಾಗ, ಮಗುವಿನ ಹೊಟ್ಟೆ ತಾಯಿಯ/ ಆರೈಕೆ ನೀಡುವವರ ಮೇಲಿನ ಹೊಟ್ಟೆಯ ಮಟ್ಟದಲ್ಲಿ ಇರಬೇಕು.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	23. The baby's bottom needs not be supported with a binder / bag while receiving KMC	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □

	ಕೇ. ಎಮ್. ಸೀ ಸ್ಥಾನದಲ್ಲಿರುವಾಗ, ಮಗುವನ್ನು ಕೆಳಗಿನಿಂದ ಬೈಂಡರ್ ಉಪಯೋಗಿಸಿ ನೆರವು ನೀಡುಲು ಅಗತ್ಯವಿಲ್ಲ.			
	24. KMC must be provided when the baby is fully clothed and in contact with the mother's skin ಶಿಶು ಪೂರ್ಣವಾಗಿ ಬಟ್ಟೆ ಧರಿಸಿ ತಾಯಿಯ ಚರ್ಮದ ಸಂಪರ್ಕದಲ್ಲಿರುವಾಗಲೇ ಕೇ. ಎಮ್. ಸೀ ನೀಡಬೇಕು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	25. The baby's neck and lower back of the head must be supported with the binder or KMC bag when used to position the baby for KMC ಮಗುವನ್ನು ಕೇ. ಎಮ್. ಸೀ ಸ್ಥಾನದಲ್ಲಿ ಇಡುವುದಕ್ಕೆ ಬೈಂಡರ್ ಉಪಯೋಗಿಸಿದರೆ, ಬೈಂಡರ್ ರಿನ ಮೇಲ್ಬಾಗ ಕಿವಿಯ ಕೆಳಭಾಗದಲ್ಲಿ ಇಡಬೇಕು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	26. A baby in KMC position must be not have any clothes except a cap, socks for feet and napkin/diaper ಕೇ. ಎಮ್. ಸೀ ಸ್ಥಾನದಲ್ಲಿರುವ ಒಂದು ಮಗು ಟೋಪಿ, ಪಾದಕ್ಕೆ ಸಾಕ್ಸ್ ಮತ್ತು ಡಯಾಪರ್ ಹೊರತು ಬೇರೆ ಯಾವ ಬಟ್ಟೆಯನ್ನು ಧರಿಸಿರಬಾರದು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	27. An incubator is the best alternative to keep a stable low birth weight baby warm, if the mother is not available ತಾಯಿ ಲಬ್ಯವಿಲ್ಲದೆ ಇರುವಾಗ, ಸ್ಥಿರವಾದ ಕಡಿಮೆ ತೂಕ ಶಿಶುವನ್ನು ಬೆಚ್ಚಗೆ ಇಡಲು ಶಾಕಸಂಪುಟ (ಇನಕುಬೆಟರ್) ಅತಿ ಸೂಕ್ತ ಪರ್ಯಾಯವಾಗಿದೆ.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	28. The room temperature when providing KMC must ideally be 25-28 degrees centigrade ಕ್. ಎಮ್. ಸೀ ಒದಗಿಸುವಾಗ ಕೊಠಡಿಯ ಉಷ್ಣಾಂಶ ಆದರ್ಶವಾಗಿ 25- 28 ° C ಆಗಿರಬೇಕು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	29. KMC can be given only by the mother of the low birth weight baby	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐

Who can provide and Monitoring of KMC (6 Items) ಯಾರು ಕೇ. ಎಮ್. ಸೀ ಒದಗಿಸಿ ಮೇಲ್ವಿಚಾರಣೆ ಮಾಡಬಹುದು. (6 ಅಂಶಗಳು)	ಕಡಿಮೆ ತೂಕ ಶಿಶುವಿನ ತಾಯಿ ಮಾತ್ರ ಕೇ. ಎಮ್. ಸೀ ನೀಡಬಹುದು.			
	30. The minimum duration for one KMC session is 40 minutes ಪ್ರತಿ ಕೇ. ಎಮ್. ಸೀ ಯ ಅಧಿವೇಶನ ಕನಿಷ್ಟ 40 ನಿಮಷಗಳ ಅವಧಿಯಾಗಿದೆ.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	31. KMC is said to be continuous if it is given for 24 hours a day ದಿನಕ್ಕೆ 24 ಗಂಟೆ ಕಾಲ ಒದಗಿಸಿದರೆ ಮಾತ್ರ ಕೇ. ಎಮ್. ಸೀ ಯನ್ನು ನಿರಂತರ ಎನ್ನಬಹುದು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	32. During KMC, the health care provider needs to only monitor body temperature of the baby every 4-6 hours ಕೇ. ಎಮ್. ಸೀ ಯ ಸಮಯದಲ್ಲಿ , ಆರೈಕೆ ನೀಡುವವರು ಪ್ರತಿ 4- 6 ಗಂಟೆಗಳಿಗೆ ಕೇವಲ ಶಿಶುವಿನ ದೇಹದ ಉಷ್ಣಾಂಶವನ್ನು ಮಾತ್ರ ಪರೀಕ್ಷಿಸಿದರೆ ಸಾಕು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	33. A mother must be taught to observe the temperature, activity, breathing and colour of the baby while in KMC ಮಗು ಕೇ. ಎಮ್. ಸೀ ಸ್ಥಾನದಲ್ಲಿರುವಾಗ , ಮಗುವಿನ ಬಣ್ಣ, ಉಸಿರಾಟ, ಉಷ್ಣಾಂಶ ಮತ್ತು ಚಟುವಟಿಕೆಯನ್ನು ಗಮನಿಸಲು ತಾಯಿಗೆ ಕಲಿಸಬೇಕು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	34. Adequate weight gain for a baby receiving KMC is 15-20 gms per day ಕೇ. ಎಮ್. ಸೀ ಸ್ವೀಕರಿಸುವ ಮಗುವಿನ ಸರಿಯಾದ ತೂಕ ಹೆಚ್ಚುವಿಕೆ ದಿನಕ್ಕೆ 15-20 ಗ್ರಾಂ ಆಗಿದೆ.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
Maintenance of KMC (10 items) ಕೇ. ಎಮ್. ಸೀ ಯನ್ನು ನಡೆಸುವುದು (10 ಅಂಶಗಳು)	35. KMC must be given for as long as possible up to 24 hours daily and till the baby is 2500 gms. ಕೇ. ಎಮ್. ಸೀ ಯನ್ನು ಪ್ರತಿ ದಿನ ಆದಷ್ಟು ಸಮಯ 24 ಗಂಟೆಗಳ ವರೆಗೂ ಹಾಗೂ ಮಗು 2500 ಗ್ರಾಂ ಆಗುವ ತನಕ ನೀಡುತ್ತಾ ಇರಬೇಕು.	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐
	36. A good way to transport a 1200 gram stable baby from one hospital to another is in the KMC position. ಒಂದು 1200 ಗ್ರಾಂ ಸ್ಥಿರವಾದ ಶಿಶುವನ್ನು ಒಂದು ಆಸ್ಪತ್ರೆಯಿಂದ ಮತ್ತೊಂದು	**ಹೌದು** ☐	**ಇಲ್ಲ** ☐	**ಗೊತಿಲ್ಲ** ☐

	ಆಸ್ಪತ್ರೆಗೆ ಸಾಗಿಸಲು ಅತ್ಯುತ್ತಮವಾದ ಮಾರ್ಗ ಕೇ. ಎಮ್. ಸೀ ಸ್ಥಾನದಲ್ಲಿ.			
	37. A mother / care provider can give KMC when lying down or resting in a semi reclined position (head raised) at an angle of 20 degrees. ಒಂದು ತಾಯಿ / ಆರೈಕೆ ನೀಡುವವರು ಕೇ. ಎಮ್. ಸೀ ಯನ್ನು ಮಲಗಿರುವಾಗ ಅಥವಾ 20 ಕೋನದಲ್ಲಿ ಅರೆ ಒರಗಿರುವಾಗ (ತಲೆ ಎತ್ತಿ) ಕೇ. ಎಮ್. ಸೀ ನೀಡಬಹುದು.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	38. Breast milk when expressed can be kept at room temperature for up to 24 hours. ಎದೆ ಹಾಲನ್ನು ಹಿಂಡಿದ ಮೇಲೆ ಕೊಠಡಿಯ ತಾಪಮಾನದಲ್ಲಿ 24 ಗಂಟೆಗಳ ವರೆಗೆ ಇಡಬಹುದು.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	39. A mother can breast feed her baby while she is giving KMC. ಮಗು ಕೇ. ಎಮ್. ಸೀ ಸ್ಥಾನದಲ್ಲಿರುವಾಗ ತಾಯಿ ಮಗುವಿಗೆ ಸ್ತನ್ಯಪಾನ ನೀಡಬಹುದು.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	40. An LBW baby receiving KMC can be given daily bath. ಕೇ. ಎಮ್ . ಸೀ ಸ್ವೀಕರಿಸುತ್ತಿರುವ ಒಂದು ಕಡಿಮೆ ತೂಕ ಶಿಶುವಿಗೆ ಪ್ರತಿ ದಿನ ಸ್ನಾನ ಮಾಡಿಸಬಹುದು.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	41. A low birth weight baby is ready for discharge if the baby gains 15-20gms weight daily, maintains normal body temperature and feeds well for 3 continuous days. ಒಂದು ಕಡಿಮೆ ತೂಕ ಶಿಶು ಪ್ರತಿ ದಿನ 15- 20 ಗ್ರಾಂ ತೂಕ ಸಂಪಾದಿಸಿ, ಸಾಮಾನ್ಯವಾದ ದೇಹ ಉಷ್ಣಾಂಶವನ್ನು ಹೊಂದಿ, ನಿರಂತರವಾಗಿ 3 ದಿನಗಳ ಕಾಲ ಚನ್ನಾಗಿ ಎದೆ ಹಾಲು ಕುಡಿದರೆ , ಮಗು ಆಸ್ಪತ್ರೆಯಿಂದ ಹೊರ ಇಳಿಯಲು ತಯಾರಾಗಿದೆ ಎನ್ನಬಹುದು.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	42. When an LBW baby is discharged, it is best to cover the baby with warm clothes from head to toe, when taking the baby home. ಒಂದು ಕಡಿಮೆ	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □

	ತೂಕ ಶಿಶುವನ್ನು ಆಸ್ಪತ್ರೆಯಿಂದ ಹೊರ ಇಳಿಸಿ ಮನೆಗೆ ಹೋಗುವಾಗ ಮಗುವಿನ ತಲೆಯಿಂದ ಪಾದದ ವರೆಗೆ ಬೆಚ್ಚಗಿನ ಬಟ್ಟೆಯಿಂದ ಹೊದಿಸುವುದು ಅತ್ಯುತ್ತಮ ಮಾರ್ಗ.			
	43. An LBW baby is at greater risk for infection when KMC is provided. ಒಂದು ಕಡಿಮೆ ತೂಕ ಶಿಶುವಿಗೆ ಕೇ. ಎಮ್. ಸೀ ಒದಗಿಸಿದಾಗ ಸೋಂಕಿನ ಅಪಾಯ ಹೆಚ್ಚಾಗಿರುತ್ತದೆ.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □
	44. KMC satisfies all the 5 senses of the baby (touch, hearing, sight, taste, and smell). ಕೇ. ಎಮ್. ಸೀ ಒಂದು ಮಗುವಿನ ಎಲ್ಲ ಇಂದ್ರಿಯಗಳನ್ನು(ಸ್ಪರ್ಶ, ಶ್ರಾವಣ, ದೃಷ್ಟು, ರುಚಿ, ವಾಸನೆ) ತೃಪ್ತಿಗೊಳಿಸುತ್ತದೆ.	**ಹೌದು** □	**ಇಲ್ಲ** □	**ಗೊತಿಲ್ಲ** □

45) Please list at least 3 advantages of KMC. ಕೇ. ಎಮ್. ಸೀ ಯ ಕನಿಷ್ಟಪಕ್ಷ 3 ಲಾಭಗಳನ್ನು ಪಟ್ಟಿಮಾಡಿ.

1……
……
2……
……
3……
……

Section C: ವಿಭಾಗ - 'ಸೀ'

Please Shade the box YES or NO items 46 and 47. ದಯವಿಟ್ಟು 46 ಮತ್ತು 47 ನೇ ಅಂಶಗಳಿಗೆ ಹೌದು ಅಥವಾ ಇಲ್ಲ ಎಂದು ಗುರುತಿಸಿ.

46. I have initiated KMC on my own for stable LBW babies ನಾನು ಸ್ವಂತವಾಗಿ ಸ್ಥಿರವಾದ ಕಡಿಮೆ ತೂಕ ಶಿಶುಗಳಿಗೆ ಕೇ. ಎಮ್. ಸೀ ಪ್ರಾರಂಭಿಸಿದ್ದೇನೆ. YES ಹೌದು □ NO ಇಲ್ಲ □

47. I have counselled mothers in groups on KMC for their stable LBW babies ನಾನು ತಾಯಂದಿರನ್ನು ಗುಂಪಿನಲ್ಲಿ ಅವರ ಸ್ಥಿರವಾದ ಕಡಿಮೆ ತೂಕ ಶಿಶುಗಳಿಗಾಗಿ ಕೇ. ಎಮ್. ಸೀ ಯ ಬಗ್ಗೆ ಸಮಾಲೋಚನೆ ನೀಡಿದ್ದೀನಿ.

YES ಹೌದು □ NO ಇಲ್ಲ □

Could you please read each statement and express your opinion on KMC by choosing any one of the options: strongly disagree, disagree, unsure, agree and strongly agree. Colour /shade the appropriate box (ϒ) that most closely reflects your opinion.
ಕೇ. ಎಮ್. ಸೀ ಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಹೇಳಿಕೆಗಳು ಕೆಳಗಿವೆ. ದಯವಿಟ್ಟು ಪ್ರತಿ ಹೇಳಿಕೆಯನ್ನು ಗಮನವಾಗಿ ಓದಿ ಈ ಆಯ್ಕೆಗಳಿಂದ ಒಂದನ್ನು ಆರಿಸಿ: ಖಂಡಿತವಾಗಿ ಒಪ್ಪುವುದಿಲ್ಲ,

ಒಪ್ಪುವುದಿಲ್ಲ, ನಿಶ್ಚಯವಿಲ್ಲ, ಒಪ್ಪುತ್ತೇನೆ, ಖಂಡಿತವಾಗಿ ಒಪ್ಪುತ್ತೇನೆ. ನಿಕಟವಾಗಿ ನಿಮ್ಮ ಪ್ರತಿಕ್ರಿಯೆಯನ್ನು ಪ್ರತಿಬಿಂಬಿಸುವ ಸೂಕ್ತವಾದ ಬಾಕ್ಸನ್ನು(□) ಛಾಯೆಗೊಳಿಸಿ.

Statements ಹೇಳಿಕೆಗಳು **I feel ……..**	**Strongly Disagree** ಖಂಡಿತವಾಗಿ ಒಪ್ಪುವುದಿಲ್ಲ	**Disagree** ಒಪ್ಪುವುದಿಲ್ಲ	**Unsure** ನಿಶ್ಚಯವಿಲ್ಲ	**Agree** ಒಪ್ಪುತ್ತೇನೆ	**Strongly Agree** ಖಂಡಿತವಾಗಿ ಒಪ್ಪುತ್ತೇನೆ
48. Kangaroo Mother Care (KMC) is beneficial for both mother and the baby. ಕೇ. ಎಮ್. ಸೀ ಗೆ ತಾಯಿ ಮಗು ಇಬ್ಬರಿಗೂ ಹಿತಕರವಾದದ್ದು.					
49. KMC increases attachment, feelings of closeness and bonding between the mother and the baby.ಕೇ. ಎಮ್. ಸೀ ತಾಯಿ ಮಗು ನಡುವೆ ಲಗತ್ತು , ನಿಕಟತೆಯ ಭಾವನೆ ಮತ್ತು ಬಂಧನವನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ.					
50. Assisting mothers to provide KMC for their LBW baby is not an efficient use of my time*. ಕಡಿಮೆ ತೂಕ ಶಿಶುಗಳಿಗೆ ಕೇ. ಎಮ್. ಸೀ ಒದಗಿಸಲು ತಾಯಂದಿರಿಗೆ ನೆರವು ನೀಡುವುದು ನನ್ನ ಸಮಯದ ಸಮರ್ಥ ಬಳಕೆಯಲ್ಲ.					
51. KMC can increase self confidence in the mother to care for her LBW baby. ತನ್ನ ಕಡಿಮೆ ತೂಕ ಮಗುವಿನ ಕಾಳಜಿ ವಹಿಸಲು ತಾಯಿಗೆ ಆತ್ಮವಿಶ್ವಾಸವನ್ನು ಕೇ. ಎಮ್. ಸೀ ಹೆಚ್ಚಿಸುತ್ತದೆ.					
52. Mothers like to give KMC ತಾಯಂದಿರು ಕೇ. ಎಮ್. ಸೀ ಒದಗಿಸಲು ಇಷ್ಟಪಡುತ್ತಾರೆ.					
53. KMC helps health care providers to care effectively for LBW babies in the hospital since the mother can also monitor					

the baby. ತಾಯಿ ಮಗುವನ್ನು ಮೇಲ್ವಿಚಾರಣೆ ಮಾಡುವ ಕಾರಣ ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ಕಡಿಮೆ ಜನನ ತೂಕವಿರುವ ಶಿಶುಗಳಿಗೆ ಪರಿಣಾಮಕಾರಿಯಾಗಿ ಕಾಳಜಿ ವಹಿಸಲು ಆರೋಗ್ಯ ರಕ್ಷಣೆ ನೀಡುಗರಿಗೆ ಕೇ. ಎಮ್. ಸೀ ಸಹಕರಿಸುತ್ತದೆ.					
54. As a health care provider, I am too busy with more important work than to help a mother provide KMC. ಒಂದು ಆರೋಗ್ಯ ರಕ್ಷಣೆ ನೀಡುಗರಾಗಿ ತಾಯಿಗೆ ಕೇ. ಎಮ್. ಸೀ ಒದಗಿಸುವುದರಲ್ಲಿ ಸಹಕರಿಸುವುದಕ್ಕಿಂತ ಹೆಚ್ಚು ಪ್ರಮುಖ ಕೆಲಸದೊಂದಿಗೆ ನಿರತವಾಗಿರುವೆನು.					
55. All mothers, fathers, grandparents must be counselled about KMC by health care providers ಎಲ್ಲ ತಾಯಂದಿರು/ ತಂದೆಯರು/ ಅಜ್ಜ ಅಜ್ಜಿಯರಿಗೆ ಆರೋಗ್ಯ ಸಿಬ್ಬಂದಿಯವರಿ ಕೇ. ಎಮ್. ಸೀ ಯ ಬಗ್ಗೆ ಸಮಾಲೋಚನೆ ನೀಡಬೇಕು.					
56. KMC increases my workload* ಕೇ. ಎಮ್ .ಸೀ ನನ್ನ ಕೆಲಸದ ಹೊರೆಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ.					
57. KMC can potentially increase the risk for infection for LBW babies. ಕೇ. ಎಮ್ ಸೀ ಎಲ್ಬಿಡಬ್ಲ್ಯೂ ಮಕ್ಕಳಿಗೆ ಸೋಂಕಿನ ಅಪಾಯವನ್ನು ಸಂಭಾವ್ಯವಾಗಿ ಹೆಚ್ಚಿಸುತ್ತದೆ.					
58. All health care providers have an important responsibility to help mothers start and continue with KMC as part of LBW management. ಕಡಿಮೆ ಜನನ ತೂಕದ ನಿರ್ವಹನದ					

ಭಾಗವಾಗಿ ಎಲ್ಲ ಆರೋಗ್ಯ ಸಿಬ್ಬಂದಿಯವರು ತಾಯಂದಿರಿಗೆ ಕೇ. ಎಮ್. ಸೀ ಪ್ರಾರಂಭಿಸಲು ಮತ್ತು ಮುಂದುವರಿಸಲು ಸಹಕರಿಸುವ ಪ್ರಮುಖ ಜವಾಬ್ದಾರಿಯನ್ನು ಹೊಂದಿದ್ದಾರೆ.					
59. KMC can result in effective breast feeding. ಪ್ರಭಾವಶಾಲಿ ಸ್ಥನ್ಯಪಾನವು ಕೇ. ಎಮ್. ಸೀ ಯ ಪರಿಣಾಮವಾಗುತ್ತದೆ.					
60. It is best to have a dedicated health care provider in hospitals to help mothers provide KMC. ತಾಯಂದಿರಿಗೆ ಕೇ. ಎಮ್. ಸೀ ಒದಗಿಸಲು ಸಹಕರಿಸಲು ಆಸ್ಪತ್ರೆಗಳಲ್ಲಿ ಮೀಸಲಾದ ಒಂದು ಆರೋಗ್ಯ ರಕ್ಷಣಾ ನೀಡುಗಾರರಿರುವುದು ಉತ್ತಮ.					
61. I can get irritated and impatient with mothers when they ask questions about how to give KMC for the baby. ತಾಯಂದಿರು ಮಗುವಿಗೆ ಹೇಗೆ ಕೇ. ಎಮ್. ಸೀ ಒದಗಿಸುವುದು ಎಂಬುದರ ಬಗ್ಗೆ ಪ್ರಶ್ನಿಸಿದಾಗ ನನಗೆ ಕಿರುಕುಳ ಅಥವಾ ಅಸಹನೆ ಆಗಬಹುದು.					
62. I will recommend KMC for all LBW babies. ಕಡಿಮೆ ತೂಕ ಶಿಶುಗಳನ್ನು ಹೊಂದಿರುವ ಎಲ್ಲ ತಾಯಂದಿರಿಗೆ ನಾನು. ಎಮ್. ಸೀ ಯನ್ನು ಶಿಫಾರಿಸು ಮಾಡುತ್ತೇನೆ.					

ನಿಮ್ಮ ಸಮಯಕ್ಕಾಗಿ ಧನ್ಯವಾದಗಳು

Scoring Key (ತಿಳಿವು ಪ್ರಶ್ನಾವಳಿ) : 60 (marks/ಅಂಕಗಳು)

Identification of a newborn eligible for KMC (8 items)	**Components of and requirements for KMC (10 items)**	**Who can provide and monitoring of KMC (6 items)** .	**Maintenance of KMC (10 items)**
Item No-Key (Score)			
11- False (1) 12- False (1) 13- True (2) 14- False (2) 15- True (1) 16- True (1) 17- True (2) 18- True (1)	19- True (1) 20- True (1) 21- False (2) 22- True (2) 23- False (2) 24- False (2) 25- True (1) 26- True (2) 27- False (2) 28- True (1)	29- False (2) 30- False (2) 31- False (2) 32- False (2) 33- True (2) 34- True (2)	35- True (1) 36- True (1) 37- False (2) 38- False (2) 39- True (2) 40- False (2) 41- True (2) 42- False (2) 43- False (1) 44- True (2) 45- 1 for each correct response (3)
8 Questions: 12	10 Questions: 16	6 Questions: 12	11 Questions: 20

Attitude Statements:

15 statements: 9 are positively stated, 6 negatively* stated: Total marks =60 marks

Statements positively stated (SD=0, D=1, US=2, A=3, SA=4): 48, 49, 51, 52, 53, 55, 58, 59, 62

Statements negatively stated (SD=4, D=3, US=2, A=1, SA=0): 50, 54, 56, 57, 60, 61

ANNEXURE – E.2.

Objective Structured Clinical Examination (OSCE) Guide

(Use with Health Care Workers)

This is a guide for the rapid assessment of skills on care of LBW including KMC for HCWs using OSCEs.

Assessment Plan

Station	Details	Marks	Observed /Not Observed
1.	Checking temperature, weight and swaddling a NB	**10**	Observed
2.	Counselling a mother / family member on KMC	10	Observed
3.	REST		
4.	Expressing breastmilk and pallada feeding	10	Observed
5.	Inserting Orogastric tube, calculating feed quantity and giving tube feed	10	Observed
6.	Counselling at discharge for KMC maintenance – barriers; danger signs and follow-up	10	Observed
	TOTAL	50	

General instructions to be given by one facilitator to all the participants:

- You will go through 5 observed stations and 1 rest station manned by a facilitator. The facilitator will assess you but will not provide any assistance. At each station you will be expected to perform an activity. Complete the task within 5 minutes. The whole assessment will be approximately 30 minutes. You will not be allowed to go out of the room till you complete 5 stations.
- When the bell rings, go to the assigned station based on participant number. Do not face the station first. On the second ring of the bell, turn and read instructions. Complete the task given. If you complete the task before time given, sit in the chair and wait. On the third ring of the bell, move to the next station.

Requirements for each rapid assessment station

General requirements

- Juice for volunteers and faculty
- Snacks
- Cello tape
- Facilitator to role play and score
- Instructions for each station
- Files to place the score key for station –5
- Bell, stopwatch
- Table and chairs

Station 1: Checking the temperature, weight and swaddling a new-born • Mannequin - baby • Thermometer • Spirit swab • Kidney tray • Container to keep thermometer in after completing the procedure • Alcohol rub solution • One baby sheet/ towel. • Weighing machine - Infant • Kidney tray • Chit of paper to record weight	**Station 2: Counselling a mother / caretaker on KMC** • Baby- Preemie Natalie • Dupatta / KMC bag • Chair (2) / Table (1) Optional **Station 3:** **REST**
Station 4: **Expressing breastmilk and pallada feeding** • Breastmilk model • Pallada • Preemie Natalie – cap and napkin • Cloth to swaddle • Container to store breastmilk • Syringe to measure feed quantity • Alcohol hand scrub •	**Station 5:** **Inserting orogastric tube, calculating feed quantity and giving tube feed** • Infant feeding tube 6 or 8 • Clean bowl with water • Stethoscope • Syringe • Expressed breastmilk in a container • Adhesive/micropore to fix the tube • Gloves (optional) • Mackintosh to place under the face of the baby • Mannequin – cap and napkin • Cloth to swaddle
Station 6: **Counselling at discharge for KMC maintenance – barriers; danger signs and follow-up** • Mannequin – cap and napkin • Cloth to cover baby	

Station 1: Checking temperature, weight and swaddling a newborn

Show how you would.

i. Check the temperature, weight of newborn mannequin.

ii. Swaddle / wrap the newborn mannequin.

Station 1: Observation checklist with score key for checking temperature, weight and swaddling a newborn (10)

			HCW (S. No)				
	Observations	**Score**	**1**	**2**	**3**	**4**	**5**
1.	Collects the articles/supplies-thermometer, cotton swab with spirit, dry cotton balls, weighing machine, clean cloth to place on weighing machine pan	**0.5**					

2.	Cleans the weighing machine pan with spirit swab / soap and water soaked cotton swab / gauze. Then clean with a dry swab	**0.5**					
3.	Places clean cloth over the weighing machine pan in centre and sets the scale to zero by adjusting the knob or allowing the scale to adjust automatically	**1.0**					
4.	Cleans hands using alcohol hand rub	**0.5**					
5.	Removes all clothes of the mannequin baby except napkin and places it in the centre of the pan	**0.5**					
6.	Notes and records the weight to the nearest 0.01kg / or till the number displayed is stable	**1.0**					
7.	Swaddles the baby correctly: • Puts clothes on – cap, socks, mitten, and dress. • Folds one corner of the sheet and places the mannequin on the sheet with head on the folded part. • Wraps the side over the abdomen and under the opposite side. Does the same for the other side. • Tucks the middle portion on top. Hands over to mother.	**0.25X 8=2.0**					
8.	Wipes digital thermometer with dry cotton from bulb to stem and switches on the button	**0.5**					
9.	Places the thermometer horizontal to body of the mannequin in arm pit, so that bulb is in close skin contact. Hold the arm close to the body	**0.5**					
10.	Removes thermometer once it beeps/after 3 mins, wipes the thermometer with spirit swab from stem to bulb, reads the temperature on the display.	**1.0**					
11.	Informs the observer the temperature	**1.0**					
12.	Reinforces how to keep baby warm – KMC/Swaddling	**1.0**					
	TOTAL	**10.0**					

Station 2: Counselling a mother on KMC

Ms Asha has a 1800gm baby that is stable. Counsel her on KMC and show how you would help her to start KMC.

Station 2: Observation checklist and score Key for counselling a mother on KMC

			HCW (S. No)				
	Observations	**Score**	**1**	**2**	**3**	**4**	**5**
1.	Introduces self	**0.5**					
2.	Explains the advantages of KMC (warmth/breast feeding/growth/less infection/ any other)	**0.5x4 = 2.0**					
3.	Informs requirements for KMC: • For mother/fKMC provider: Front open dress/shirt, KMC bag or binder or shawl, KMC chair if available. • For baby: Cap, socks, and diaper.	**1.0**					
4.	Puts cap, socks, and diaper for the baby and shows how to place the baby in the KMC bag if available.	**0.5**					
5.	Positions the baby for KMC: • Places the baby between breast in an upright position	**1.0**					
	• Flexes arms and legs, ensures head turned - slightly extended	**1.0**					
	• Supports the bottom with a sling/binder and palm	**1.0**					
	• Secures snugly with a binder	**1.0**					
8	Checks on facilitators for KMC practice. Reinforces importance of giving KMC for as long as possible and on getting aid from a fKMC provider.	**1.0**					
11	Has good rapport, maintains eye contact, answers questions, summarises	**1.0**					
	TOTAL	**10**					

Station 3 Rest

Station 4: Expression of breastmilk and pallada feeding

A 34 weeks 1600 gms female baby is born in your hospital by normal delivery. The baby is stable. Baby is not taking enough feed directly on Day 1. You want to try pallada feeds.

Show how you would

1. Express breastmilk using the breast model.
2. How much feed you will give this baby
3. Feed the baby using a palada.

Station 4: Observation checklist and score key for expression of breastmilk, Calculating feed quantity and pallada feeding

			HCW (S. No)				
	Observations	**Score**	**1**	**2**	**3**	**4**	**5**
1	Collects all articles	**0.5**					
2	Washes hands/ uses alcohol scrub	**0.5**					
3	Using breast model demonstrates how to express breastmilk: ✓ Holds clean container under nipple. ✓ Places thumb above and first finger below and behind the areola. ✓ Support the breast with other fingers Press the breast gently towards chest wall. Compresses breast between thumb and finger. *Avoids sliding thumb and finger on the skin of the breast.* ✓ Rotate the position of the thumb and fingers around the breast with each compression till milk stops dripping.	**1.0x4**					
5	Ensures the baby mannequin is wrapped well, held in semi upright position	**0.5**					
6	Measures the amount (8ml) of feed using a syringe and fills the pallada.	**1.0**					
7	Recounts what she will do while feeding the baby: ✓ Holds the pallada so that the end rests lightly on the baby's lower lip, touching the outer upper lip. ✓ Tips the pallada so that milk reaches the baby's lip and allows the baby to feed at his/her pace. ✓ Ensures that milk is not poured *into the mouth.* ✓ Takes care no choking, coughing or change in colour. ✓ Burps after the feed.	**0.5 x 5= 2.5**					
8	Says will or acts like feed quantity is recorded	**0.5**					
9	Says she will wash pallada with soap and water, then boiled water and air dried before next use	**0.5**					
	TOTAL	**10**					

Station 5: Alternate feeding through rube

A 32 weeks 1300 gms female baby is born in your hospital by normal delivery. Baby is stable. You have been asked to give tube feed for the baby.

Show how you would

1. Insert the nasogastric tube
2. Calculate the amount of feed to be given to the baby.
3. Show how you will feed the baby through tube.

Station 5: Observation checklist and key for alternate feeding through tube

			HCW (S. No)				
	Observations	**Score**	**1**	**2**	**3**	**4**	**5**
1.	Explains about need for tube feeding and to express breastmilk and how this would help maintain breastmilk	**1.0**					
2.	Collects all the articles/supplies (tube 5-6 French, adhesive, clean cup with water, syringe, bowl with measured breast milk). Washes hands	**1.0**					
3.	Measures the tube from tip of the nose to ear lobe to halfway between tip of breastbone and umbilicus. Mark the measurement on the tube with an adhesive.	**1.0**					
4.	Lubricates the tube with expressed milk. Inserts the tube (5-6 French size) through mouth/nose into the stomach till the mark	**0.5**					
5.	Checks the placement of tube - Push 1ml air through the tube while listening for the sound of air entering the stomach using a stethoscope over the upper abdomen. Or - Withdraw air from the stomach and look for small amounts of gastric fluid	**1.0**					
6.	Fixes the tube on the cheek with micropore	**0.5**					
7.	Takes a measured amount of feed (1300gms – Day 1=80x1.3Kg=104/12=9ml every 2 hours.	**2.0**					
8.	Attaches the sterile 10cc syringe (without plunger) at the outer end of the tube, pours measured amount of milk and allows milk to flow down by gravity. Closes the outer end of tube after feeding. *Rotates the plunger slightly if the feed does not go in first and then removes the plunger. Does not push the feed with the plunger.*	**2.0**					
9.	Records amount of feed given and if there was any abdominal distension, vomiting	**1.0**					
	TOTAL	**10.0**					

Station 6: Counselling of a mother KMC maintenance – barriers; danger signs and follow-up

A 34 weeks 1750 gms female baby is born in your facility by normal delivery.

The mother is confident in giving KMC and the baby is stable and ready for discharge. Show how you would

- Counsel the mother on KMC maintenance – barriers; danger signs and follow-up

Station 6: Observation checklist and score key for counselling a mother on KMC maintenance

	Observations	Scores	1	2	3	4	5
1.	Introduces self. Greets the mother and praises her for efforts in taking care of the baby	**0.5**					
2.	Checks how to prolong KMC duration and difficulties encountered during KMC	**1.0**					
3.	Reinforces any correct information	**0.5**					
4.	Explains the baby is stable and ready for discharge	**0.5**					
5.	Reinforces on A-Activity, B-Breathing, C-Colour and T-Temperature to be observed while on KMC	**2.0**					
6.	Reinforces on importance of exclusive breastfeeding	**1.0**					
7.	Reinforces on the need to continue KMC for as long as possible	**0.5**					
8.	Informs to return a week after discharge for follow up or if any problem occurs. Confirms that in the event of an any abnormality in ABCT, to report to CHW or doctor at the hospital	**2.0**					
9.	Maintains good body posture / eye to eye contact/asks for any doubts / listens and clarifies	**0.5 x4 = 2.0**					
	TOTAL	**10.0**					

APPENDEX – F

Participant Information Sheet for mothers and foster KMC providers

Introduction

Kangaroo Mother Care (KMC) is direct skin to skin contact of the mother-baby, has been shown to be a low cost and effective treatment in the care of LBW infants. It is found to be most effective when a mother or family member provides it for >10 hours per day and especially for those babies < 2000 gms. We are exploring different ways to help mothers to accept and practice kangaroo mother care for your LBW babies in Koppal District. We thus plan to come out with a design that can be used in other districts so that KMC can be practiced by all mothers who have LBW babies. Before you decide to participate, it is important for you to understand why the project is being done and what it will involve. This information sheet will explain what we are doing. Please take time to **read** the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information on. Take time to decide whether you wish to take part.

Who are we?

We are a team of doctors, nurses and public health specialists from the St. John's Medical College and Hospital and Karnataka Health Promotion Trust that is based in Bengaluru, Karnataka. This is part of a larger WHO project that is being done in Koppal District.

What is the purpose of the project?

We are trying to find ways by which mothers with LBW babies can be supported by HCWs and CHWs to practice KMC both in the hospital and in their own homes till the baby wants it.

Why have I been chosen?

You have been chosen because you are a mother or a family member with a baby who was born with a weight <2500gms. These babies will grow better, be kept warmer, have reduced chance of getting an infection, and will feed better if you keep the baby in KMC. Your awareness, opinions on KMC and support you received while providing this care for your LBW infants will be very valuable to inform this research project.

Do I have to take part?

No, you do not have to take part in this project. If you do decide to take part, you will be given this information sheet to keep and sign a consent form. You are still free to withdraw from the study at any time and you do not need to give a reason for doing so. Your participation is

voluntary and will not affect positively or negatively upon your work relations or access to any of the benefits of being employed by the government.

What will I have to do?

If you are interested in taking part you will be invited to complete a questionnaire which would approximately take around 20 – 30 minutes. This will be done once when you are in the discharged from the hospital after 4 weeks of life of the baby at your home. We will contact to plan for the time when it is most convenient for you to visit you at your home. All the information you provide will not be shared with anyone other than the research team. No information that you provide will be linked with you or with your address. The information you provide will help us understand better how we can support you to practice KMC both at the hospital and home. You will not have to spend any money by taking part in the project.

Has this project been reviewed by an ethics committee?

Yes, the Institution Ethics Committee of St John's Medical College and Hospital and Research Ethics Committee in the School of Sports and Health Sciences at the University of Stirling has reviewed the project and has found no ethical objections to this study being carried out.

What will happen to the results of the project?

The findings from this research will help us to find ways to support mothers with LBW babies and their families in the providing KMC. A report about the study and related articles will be published in academic journals or presented at national and international academic conferences, so that others can use the information. You will not be identified in any way in any report or publication. A summary of the research findings can be obtained on request.

Who has designed the research project?

The research project has been designed by a team of teachers /researchers from the St. John's Research Institute, Bengaluru and School of Sports and Health Sciences, University of Stirling, Scotland, UK.

What will you get out of this study?

You will directly benefit by improving your understanding and ability to provide KMC in confidence for your baby. Since the baby is with you when providing KMC you will be able to recognise early if there are any changes in your baby and can report it early enough to the doctor or nurse. This will also help in you getting the care required for your baby faster.

What is the "risk" to you?

While you may be worried anxious about giving any information in the questionnaire, no additional risk or discomfort will be encountered by you. Kangaroo mother care has been recommended even by the Ministry of Health and Family Welfare, Government of India (Sept 2014) for all LBW babies. It is your right to know about KMC and for you to provide KMC for your LBW baby. Every effort will be made by the researcher or other project staff to make you feel at ease when you are completing the questionnaire or when we are collecting any information in relation to the project.

Where can I get further information about the project?

If you have any questions or would like further information about the project, please contact: *Ms Maryann Washington, St John's Research Institute (SJRI), Bengaluru 560034 (Tel: +9180 49467000 Ext 7030-Secretary;+919686207443;maryannvc@sjri.res.in) OR Dr Prem K Mony, Principal Investigator of the Larger WHO Project, Professor and Head, Div. of Epidemiology and Population Health, SJRI, Bengaluru 560034 (Tel: +9180 49467000 Ext 7030 – Secretary; premkmony@sjri.res.in) OR Dr Leah Macaden, Faculty of Health Sciences & Sport, Highland Campus, University of Stirling (Tel: 01463 255 641; Email: leah.macaden@stir.ac.uk)*. They would be happy to discuss any queries you may have. If you wish to speak to an independent advisor about the project, or if you have any complaints, please contact:
Dr Jayanthi Savio, Member Secretary, Institutional Ethics Committee, St John's Medical College and Hospital, Sarjapur, Bengaluru 560034 (Tel: +9180 25634123/49466346)

Thank you for taking the time to read this information.

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INFORMED CONSENT FORM

1.	I confirm that I have read or have been read and understood the Participant Information Sheet (V……Dated: ……/……/…..).
2.	I have had the opportunity to consider the information and ask questions and have had these answered satisfactorily.
3.	I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason, without any of my rights being affected.
4.	I agree to the research team visiting me and the baby at home following discharge from the health care facility.
5.	I consent to the research team accessing my Home address and contact telephone number for the purpose of follow up.
6.	I understand that all information (including all written information) from this study will be kept in a locked filing cabinet at the St. John's Research Institute, Bengaluru and stored in a password protected folder on the computer hard drive to which only the research team will have access.
7.	I am aware that I will not have to spend any money because of taking part in the project.
8.	I agree to take part in this project.

_____ _____ _____

Name of Participant (Mother/Family member) Date Signature

_____ _____ _____

Name of Person taking consent Date Signature

Please complete two copies: 1 for participant; 1 for researcher's site

ANNEXURE – F.1.

Questionnaire for Mothers and Foster KMC Providers

S. No: …… Date: ……
Thayi Card No.: ……
Telephone No: ……/ ……..……..
Name of Place: …….. Rural / Urban:
……

PART A: I will be asking you some questions. Please give me your response to them.

Details of baby	
1. Date of birth of baby (DD/MM/YY)	☐☐ ☐☐ ☐☐
2. Where was baby born	i. District hospital □ ii. Taluka hospital □ iii. CHC □ Specify: ……. iv. Pvt □ Specify: ……. v. PHC □ Specify: ……. vi. Home □ Why: …….
3. Gestational age of baby (weeks) / **EDD**	☐☐ / ☐☐ ☐☐ ☐☐
4. Birth weight of baby (gms)	☐☐☐☐
5. Sex of baby	i. Male □ ii. Female □ iii. Other □
6. How is the baby?	i. Well □ ii. Sick □ Receiving treatment: Yes □ No □ iii. Died □ Date ☐☐ ☐☐ ☐☐
7. Was the baby admitted at any time in hospital from birth to now?	i. Yes (If Yes Answer Qs 7-9) ii. No (If No, G to Qs 10)
8. Where was your baby admitted?	i. District hospital □ SNCU □ ii. Taluka hospital □ NBSU □ iii. CHC □ Specify: …….. iv. Pvt □ Specify: ……. v. PHC □ Specify: ……..
9. If admitted duration of admission	From ☐☐ ☐☐ ☐☐ To ☐☐ ☐☐ ☐☐
10. Diagnosis	
Details from WHO project	
11. KMC started first on	i. Day of life ☐☐ Date: ii. Place: DH □ TH □ CHC □ PHC □ Pvt □ Home □
12. KMC duration (hours) **on**	i. D7 ☐☐ ii. D28
13. KMC given for (number of days)	☐☐ from ☐☐ ☐☐ ☐☐

	To ☐☐ ☐☐ ☐☐
14. Weight (gms) **of baby on**	i. D7 ☐☐☐☐ ii. D28 ☐☐☐☐
15. Follow up done by CHW at home	i. Yes □ **If Yes Date** ☐☐ ☐☐ ☐☐ ii. No □
16. Did you go for a follow up to the hospital	i. YES □ If Yes Date: ☐☐ ☐☐ ☐☐ ii. NO □
Details of mother (*Can be obtained from Thayi Card/ Interviewing mother/family member)*	
17. Age (Years)	
18. Education	
19. Occupation	
20. Spouse's education	
21. Spouses' occupation	
22. Type of family (*Presently where mother is staying)*	i. Nuclear □ ii. Joint □ **If joint number of people living in the house:** - **>18 years: …….** - **Between 12-18 years: ……..** - **Between 5-12 years: ……** - **<5 years: ……..** iii. Single parent □
23. Have you practiced KMC for a previous baby	i. YES □ ii. NO □
24. Number of children: …….	i. Number of male: ii. No of female:
25. Who else helps you to give KMC at home? (Relationship to the mother)	i. No one □ ii. Mother / Mother in law □ iii. Husband □ iv. Sister / Sister in law or Co-sister □ v. Any other ϒ (specify)……..

PART B (For Mother)

I will read ask you some questions. Please answer based on what you know. We want to see how we can improve what we are doing in the hospital and community for mothers and babies.

Ask these questions. Do not give any hint or suggestions when asking the question.		**Scoring**
1. What is KMC?	i. SSC: Baby and mother or fKMC provider □ ii. Baby placed on chest in direct skin to skin □ iii. Exclusive breast feeding □ iv. **Any other**	

2. How will you position the baby when giving KMC?	i. Upright □ ii. Head turned slightly upward and to a side □ iii. Legs flexed □ / Hands raised and flexed □ / frog like □ iv. **Any other**	
3. For which babies will you give KMC?	i. Those <2500gms □ ii. Those < 2000 gms □ iii. Those who are not sick □ iv. **Any other**	
4. What will you wear for the baby before giving KMC?	i. Caps □ ii. Socks □ iii. Napkin □ iv. **Any other**	
5. What must you wear when you give KMC for the baby?	i. Saree and front open blouse □ ii. Shirt, which is open, remove the banyan □ iii. **Any other**	
6. What is the duration of KMC for	i. One session? ……..(minutes or hours) ii. One day? ……. (mins or hours)	
7. Do you think KMC will harm the baby?	i. YES □ ii. NO □ iii. **Any other**	
8. Can you give KMC when resting?	i. YES □ ii. NO □ If YES, what else will you need when giving KMC while resting / sleeping? i. Pillows to raise head □ ii. Something to hold the baby securely – shawl/cloth/KMC bag □ iii. Reclining chair □ iv. Any other	
9. Can you give KMC when doing routine work at home-cleaning, cooking, drying clothes	i. YES □ ii. NO □ If YES, what else will you need when giving KMC while doing routine work? i. Something to keep the baby secure – shawl/ cloth / bag □ **ii.** Help from others at home □ **iii. Any other**	
10. What are the benefits of giving KMC?	i. Increased weight □ ii. Better growth □ iii. More intelligent □ iv. Better breast feeding □ v. Baby will be warm / normal temperature □ vi. Good bonding □ vii. **Any other**	

11. What must you watch the baby for when giving KMC?	i. Breathing □ ii. Activity □ iii. Colour □ iv. Temperature: touching legs/hands & abdomen □ v. Heartbeat □ vi. **Any other**	
12. Who helped you start KMC in the hospital?	i. No one □ ii. It was not started in the hospital □ iii. Nurse □ iv. Nurse mentor □ v. Counsellor □ vi. Doctor □ vii. Other mothers □ viii. **Any other**	
13. Who gave you information of KMC in the hospital?	i. No one □ ii. Nurse □ iii. Nurse mentor □ iv. Counsellor □ v. Doctor □ vi. Other mothers □ vii. **Any other**	
14. Who helped you most in the hospital to give KMC?	i. No one □ ii. Nurse □ iii. Nurse mentor □ iv. Counsellor □ v. Doctor □ vi. Other mothers □ vii. **Any other**	
15. Did you receive KMC Kit from hospital?	i. YES □ ii. NO □ If Yes, What all did you receive i. Shawl □ ii. KMC Bag □ iii. Napkins □ iv. Caps and Socks □ If Yes, how useful was it for you?	
16. How do /did you feel when you give /gave KMC?	i. Happy □ ii. Good □ iii. Anxious □ iv. Stressed □ v. Frightened □ vi. Nice □ vii. **Any other**	
17. How did the ASHA help you at home?	i. Did not help at all □ **/** Did not visit at all □ ii. Gave information about KMC □ iii. Checked weight of baby □ iv. Helped find ways to increase KMC duration □	

	v. How to monitor a baby on KMC □ vi. **Any other**	
18. Who helped you most at home to continue KMC	i. Mother □ ii. Father □ iii. Sister □ iv. Husband / Spouse □ v. CHW □ vi. **Any other**	
19. Did you have any difficulty to give KMC?	i. YES □ ii. NO □ If YES, Please, specify what difficulty you faced?	
20. Do you feel shy or embarrassed to give KMC in front of others	i. YES □ ii. NO □	
21. Will you tell other mothers about KMC if they need to do it?	i. YES □ ii. NO □ If Yes, Give ONE Message you will tell mothers	
22. What are you feeding the baby?	i. Only breast milk □ ii. **Any other: ……..** If feeding breastmilk, do you feed while in KMC position? i. Yes ii. No Number of feeds given for one day: …… For how many months will you give ONLY breast milk to the baby? ……..	
23. What do you think will help most for mothers to practice KMC for long duration (>10 hours)?	i. In the Hospital? ii. At home?	

Thank you for your time.

PART C (For family member – Select a family member who gave KMC)

I will read ask you some questions. Please answer based on what you know. We want to see how we can improve what we are doing in the hospital and community for mothers and babies.

Baseline Information: ***Ask this information. Write / Tick the responses as the family member answers***		
1. Age (years)		
2. Education (highest education)		

3. Occupation		
4. Relationship to mother *(Shade the box with the correct response)*	i. Mother / Mother in law □ ii. Husband □ iii. Sister / Sister in law or Co-sister □ iv. Any other □ (specify)……..	
5. How many hours did you give KMC for each day		
Ask these questions. Do not give any hint or suggestions when asking the question. Tick the boxes against those responses answered by the family member		***Scoring***
6. What is KMC?	i. SSC – Baby and mother or KMC provider □ ii. Baby placed on chest in direct skin to skin □ iii. Exclusive breastfeeding □ iv. **Any other:**	
7. How will you position the baby when giving KMC?	i. Upright □ ii. Head turned slightly upward and to a side □ iii. Legs flexed □ / Hands raised and flexed □/ frog like □ iv. **Any other**	
8. For which babies will you give KMC?	i. Those <2500 gms □ ii. Those <2000 gms □ iii. Those who are not sick □ iv. **Any other**	
9. What would you wear for the baby before giving KMC?	i. Caps □ ii. Socks □ iii. Napkin □ iv. **Any other**	
10. What must you wear when you give KMC for the baby?	i. Saree and front open blouse □ ii. Front open shirt, remove banyan □ iii. **Any other**	
11. How long must KMC be for?	i. One session: …….. ii. One day: …….	
12. Do you think KMC will harm the baby?	i. YES □ ii. NO □ iii. **Any other**	
13. Can you give KMC when resting?	i. YES □ ii. NO □ If YES, what else will you need when giving KMC while resting / sleeping? i. Pillows to raise head □ ii. Something to keep the baby secure – shawl/cloth/KMC bag □ iii. Reclining chair □ iv. Any other	

14. Can you give KMC when doing routine work at home-cleaning, cooking, drying clothes	i. YES □ ii. NO □ If YES. what else will you need when giving KMC while doing routine work? i. Something to keep the baby secure – shawl/ cloth / bag □ ii. Help from others at home □ **iii. Any other**	
15. What are the benefits of giving KMC?	i. Increased weight □ ii. Better growth □ iii. More intelligent □ iv. Better breastfeeding □ v. Baby will be warm / normal temperature □ vi. Good bonding □ vii. **Any other**	
16. What must you watch the baby for when giving KMC?	i. Breathing □ ii. Activity □ iii. Colour □ iv. Temperature: Touching legs/hands & abdomen □ v. Heartbeat □ vi. **Any other**	
17. Who gave you information of KMC in the hospital?	i. No one □ ii. Nurse □ iii. Nurse mentor □ iv. Counsellor □ v. Doctor □ vi. Other mothers □ vii. **Any other**	
18. Did you give KMC in the hospital	i. YES □ ii. NO □ Who helped you most in the hospital to give KMC? i. No one □ ii. Nurse □ iii. Nurse mentor □ iv. Counsellor □ v. Doctor □ vi. Other mothers □ vii. **Any other**	
19. How do you feel when you give KMC?	i. Happy □ ii. Good □ iii. Fear □ iv. Stressed □ v. Anxious □ vi. Nice □ vii. **Any other**	
20. How did the ASHA help you at home?	i. Did not help at all □ ii. Gave information about KMC □ iii. Checked weight of baby □ iv. Helped to find ways to increase KMC duration □ v. How to monitor a baby during KMC □	

	vi. **Any other**	
21. Did you have any difficulty to give KMC	i. YES □ **What:……..** ii. NO □	
22. Do you feel shy or bad to give KMC in front of others	i. YES □ ii. NO □	
23. Will you tell other mothers about KMC if they need to do it	i. YES □ ii. NO □ If Yes, Give ONE Message you will tell mothers	
24. What feeds must be given for the baby?	i. Only breast milk □ ii. **Any other:** If feeding breast milk, can the baby be fed while in KMC position? iii. Yes □ iv. No □ For how many months must a baby be given ONLY breast milk? ……..	

Thank you for your time.

APPENDEX – G

Observation Checklist – Health Facility Preparedness

Place a check mark against the item that is present, a cross against the item that is not present.

Health Facility: ……..

Date: ……..

Project Team member who completed the Checklist: ……

WHO building block	Items	Present	Not present
1. Health Workforce	i. HCWs trained on KMC		
	ii. Specialists available		
	iii. Support staff available		
2. Health Information Systems	iv. KMC case record		
	v. KMC reporting		
3. Health Service Delivery	vi. Separate KMC ward/area		
	vii. Digital weighing machine		
	viii. Feeding equipment		
	ix. Posters / brochures		
4. Leadership and Governance	x. Written policy		
	TOTAL SCORE (100)		
Each check mark against "present" will carry a score of 10			

ANNEXURE - H
Institutional Ethics Approval – WHO Project

ST. JOHN'S MEDICAL COLLEGE & HOSPITAL
INSTITUTIONAL ETHICS COMMITTEE

No : IEC/1/480/2016 — 27th June 2016

Dr. Prem Mony
Professor & Head
Division of epidemiology &
Population Health
St. John's Research Institute
Bangalore – 560 034.

IEC Study Ref No. 157 / 2016

Dear Doctor,

Sub : Approval of Research proposal by the I.E.C.

I wish to inform you that your Research Project entitled, **"Implementation Research in India (Karnataka State) towards Accelerating Scle – up of Kangaroo Mother Care (KMC)"** has been approved by the Institutional Ethics Committee (IEC), SJMCH on **20th June 2016.**

The approval of I.E.C. is valid for a period of TWO YEARS from 27th June 2016 to 26th June 2018.

The recruitment of the 1st subject to start only after the submission of Permission from the local Governmental agencies

You must inform the IEC of the following:

1. The Occurrence of Serious Adverse Events (SAE) / AE / Protocol violations and/or Death, during the study period, in the IEC specified format, as per DCGI regulations.
2. Protocol amendment in the IEC specified format
3. (a) Discontinuation (b) Abandonment (c) Completion of this Study, stating the reasons, if the situation of 3(a) or 3(b) is encountered.
4. (a) It is mandatory that a Report for continuing review on the status of the project to be submitted to the Member Secretary in the IEC specified format.
   (b) It is the responsibility of the Principal Investigator to apply for renewal of approval, sufficiently early (**by April 2018)** before the expiry of the existing approval, failing which the existing approval shall lapse.
   (c) On completion of the above Research Project – the Principal Investigator is responsible for submitting a brief summary of the results obtained, to the Member Secretary of the Institutional Ethics Committee at the stipulated time specified by IEC.

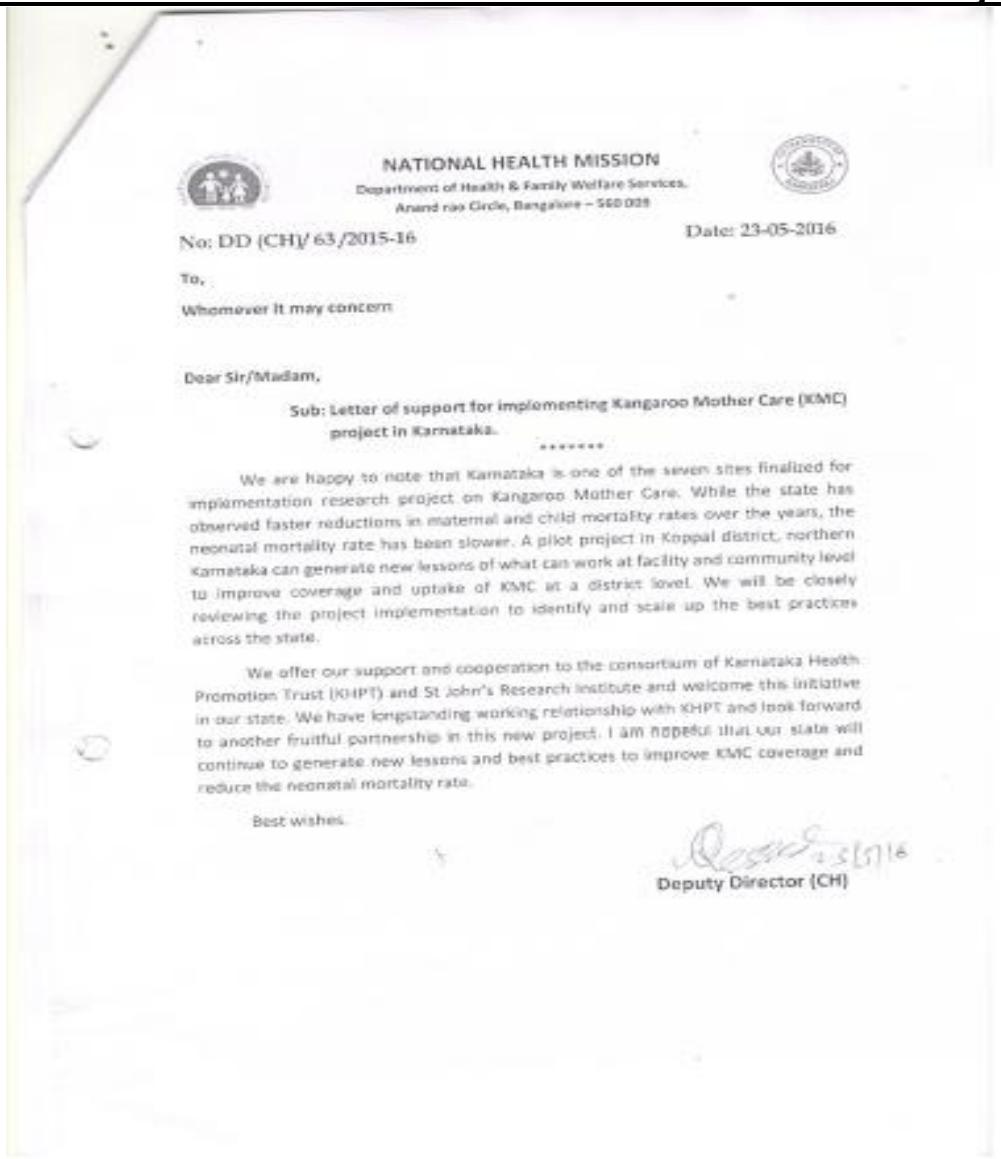
With best wishes,

Mr. V.C. Joseph
Co- Chairperson
Co – CHAIRPERSON
Institutional Ethics Committee
St. John's Medical College & Hospital
Sarjapur Road,
Bangalore-560 034, India.

CC : The Dean, SJRI

ANNEXURE - H.1.

Permission from the Government of Karnataka-WHO Project



NATIONAL HEALTH MISSION

Department of Health & Family Welfare Services.
Anand rao Circle, Bangalore – 560 009

No: DD (CH)/ 63/2015-16

Date: 23-05-2016

To,

Whomever it may concern

Dear Sir/Madam,

Sub: Letter of support for implementing Kangaroo Mother Care (KMC) project in Karnataka.

****

We are happy to note that Karnataka is one of the seven sites finalized for implementation research project on Kangaroo Mother Care. While the state has observed faster reductions in maternal and child mortality rates over the years, the neonatal mortality rate has been slower. A pilot project in Koppal district, northern Karnataka can generate new lessons of what can work at facility and community level to improve coverage and uptake of KMC at a district level. We will be closely reviewing the project implementation to identify and scale up the best practices across the state.

We offer our support and cooperation to the consortium of Karnataka Health Promotion Trust (KHPT) and St John's Research Institute and welcome this initiative in our state. We have longstanding working relationship with KHPT and look forward to another fruitful partnership in this new project. I am hopeful that our state will continue to generate new lessons and best practices to improve KMC coverage and reduce the neonatal mortality rate.

Best wishes.

23/5/16

Deputy Director (CH)

ANNEXURE - H.2.
Institutional Ethics Committee Approval

INSTITUTIONAL ETHICS COMMITTEE

No : IEC/1/374/2017 — 17th April 2017

Ms. Maryann Washington
Adjunct Faculty
Division of Epidemiology & Population Health
St. John's Research Institute
Bangalore – 560 034

IEC Study Ref No. 64 / 2017

Dear Ms. Maryann,

Sub : Approval of Research proposal by the I.E.C.

I wish to inform you that your Research Project entitled, **"Operational Research to test a logical framework for the successful uptake of Kangaroo Mother Care (KMC) for low birth weight (LBW) infants along a facility-community continuum in a selected Sub District of Northern Karnataka, India"** has been approved by the Institutional Ethics Committee (IEC), SJMC in its meeting held on **6th April 2017.**

The approval of I.E.C. is valid for a period of ONE YEAR from 6th April 2017 to 5th April 2018.

You must inform the IEC of the following:

1. The Occurrence of Serious Adverse Events (SAE) / AE / Protocol violations and/or Death, during the study period, in the IEC specified format, as per DCGI regulations.
2. Protocol amendment in the IEC specified format.
3. (a) Discontinuation (b) Abandonment (c) Completion of this Study, stating the reasons, if the situation of 3(a) or 3(b) is encountered.
4. (a) It is mandatory that a Report for continuing review on the status of the project to be submitted to the Member Secretary in the IEC specified format.
   (b) It is the responsibility of the Principal Investigator to apply for renewal of approval, sufficiently early (**by February 2018**) before the expiry of the existing approval, failing which the existing approval shall lapse.
   (c) On completion of the above Research Project – the Principal Investigator is responsible for submitting a brief summary of the results obtained, to the Member Secretary of the Institutional Ethics Committee at the stipulated time specified by IEC.

With best wishes,

Rev. Fr. Shaji George Kochuthara
Chairperson
CHAIRPERSON
Institutional Ethics Committee
St. John's Medical College & Hospital
Sarjapur Road,
Bangalore-560 034, India.

CC : The Dean, SJMC / SJRI
The Chief of Medical Services, SJMCH
The HOD for file

Ground Floor, St. John's Medical College, Sarjapur Road
Bangalore - 560 034, India. Telephone : (080) 25634123 / 49466346 E-mail: sjmcierb@gmail.com

Request for extension of ethical approval and change in Title- as mentioned in Page 1 was sent to IEC in Feb 2018, along with the interim report. The IEC extended approval till Feb 2019.

INSTITUTIONAL ETHICS COMMITTEE

No : IEC/1/236/2018 — 5th March 2018

Ms. Maryann Washington
Adjunct Faculty
Division of Epidemiology
St. John's Research Institute
Bangalore – 560 034.

IEC Study Ref. No. 64 / 2017

Dear Ms. Maryann,

Ref : Study titled **"Operational Research to Test a Logical Framework for the successful uptake of Kangaroo Mother Care (KMC) for Low Birth Weight (LBW) Infants along a facility-community continuum in a selected Sub District of Northern Karnataka, India"**

Following the Institutional Ethics Committee (IEC) meeting held on 1st March 2018, your request for extension of approval for your study entitled **"Operational Research to Test a Logical Framework for the successful uptake of Kangaroo Mother Care (KMC) for Low Birth Weight (LBW) Infants along a facility-community continuum in a selected Sub District of Northern Karnataka, India"** has been reviewed and the approval has been extended further for a period of **ONE YEAR from 6th April 2018 to 5th April 2019.**

In case the study needs renewal of approval, please **apply for a renewal by February 2019.** You are requested to submit the interim reports periodically and study related documents to the IEC.

Regards,

Dr. Jayanthi Savio, MD.,
Member Secretary
Institutional Ethics Committee
MEMBER SECRETARY
Institutional Ethics Committee
St. John's Medical College & Hospital
Sarjapur Road,
Bangalore-560 034, India.

Ground Floor, St. John's Medical College, Sarjapur Road
Bangalore - 560 034, India. Telephone : (080) 25634123 / 49466346 E-mail: sjmcierb@gmail.com

ANNEXURE - H.3.
NHS Invasive or Clinical Research Committee Approval

JE/SF

25 May 2017

UNIVERSITY of STIRLING

NHS, Invasive or Clinical Research (NICR) Committee

Room G10
Pathfoot Building
University of Stirling
Stirling FK9 4LA

Tel: +44 (0) 1786 467390
Email: nicr@stir.ac.uk

Mrs M Washington
St John's Research Institute
Opp Bda Complex
Koramangala
Bangalore
Bangalore City
Karnataka
560034
INDIA

Dear Maryann

Operational Research to Test a Logical Framework for the Successful Uptake of Kangaroo Mother Care (KMC) for Low Birth Weight (LBW) Infants along a Facility-Community Continuum in a selected Sub District of Northern Karnataka, India
NICR 16/17 - Paper No.48

Thank you for your email of 18 May 2017, including the amended documents:

- Covering letter
- Amended application and support documentation

We note that you have addressed all the points raised by Committee. I am pleased to advise that your study has been granted approval, and wish you and your team all the best.

May I remind you of the need to inform NICR (nicr@stir.ac.uk) prior to making any amendments to this protocol, or any changes to the duration of the project and provide notification of study completion. A site file of all documents related to the research should be maintained throughout the life of the project, and kept up to date at all times. The site file template can be found on the NICR webpage at:
http://www.stir.ac.uk/research/integritygovernanceethics/researchethics/formsandguidance/

Please bear in mind that your study could be audited for adherence to research governance and research ethics protocols.

NICR 16/17 - Paper No.48
Please quote this number on all correspondence

Yours sincerely

Dr Josie Evans
(Depute Chair)

ANNEXURE - H.4.
NHS Research Governance Framework Requirements

UNIVERSITY OF STIRLING

NHS RESEARCH GOVERNANCE FRAMEWORK REQUIREMENTS
(FORM 1)

Responsibility of Sponsor organisation – Confirmation of Compliance with RGF

In agreeing to act as a "sponsor" as defined in the Chief Scientific Office Research Governance Framework (RGF) for Health and Community Care, the University of Stirling gives a commitment to fulfil its responsibilities as sponsor. The definition of "sponsor" as defined in the Chief Scientific Office Research Governance Framework (RGF) is "the organisation taking primary responsibility for ensuring that the design of the study meets appropriate standards and that arrangements are in place to ensure appropriate conduct and reporting [...]".

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/139565/dh_4122427.pdf

While the University of Stirling has sponsor responsibilities, the day-to-day local management and conduct of the research project rests with the principal investigator (PI) and/or academic supervisor from the University; and responsibility for the quality of the research and appropriate experience of the PI rests with the Head of the host academic School.

Ensuring compliance with RGF requirements and undertaking to safeguard the integrity of every aspect of the research are serious responsibilities. You are asked to read the following responsibilities and to confirm your agreement to undertaking this role by signing the declaration overleaf. Your Head of School (or designated representative) should then countersign. On receipt of the signed form, the Research Funding and Development Team in the Research and Enterprise Office, will issue a letter to the funding body or NHS partner(s), confirming the University's acceptance as a sponsor.

Title of project	Operational Research to Test a Logical Framework for the Successful Uptake of Kangaroo Mother Care (KMC) for Low Birth Weight (LBW) Infants along a Facility-Community Continuum in a selected Sub District of Northern Karnataka, India.		
Funding Body	University of Stirling (UoS) , Inverness, UK. International Impact PhD Fellowship		
Chief Investigator for the University	Dr Leah Macaden, Lecturer, University of Stirling (Highland Campus)		
School	Center for Health Sciences, Old Perth Road, Inverness, IV2 3JH Tel: 0044 1463 255641		
Other partners	Dr Prem K Mony, Professor and Head - Division of Epidemiology and Population Health, St John's Research Institute, Bangalore 560034		
Project Reference			
Start date	1 Apr 2017	End date	30 Nov 2020

UNIVERSITY OF STIRLING

DECLARATION OF ACCEPTANCE OF THE RESPONSIBILITIES OF THE ROLE OF SPONSOR ON A RESEARCH PROJECT CONDUCTED ON NHS PREMISES OR INVOLVING NHS PATIENTS, STAFF, DATA, ASSOCIATED CARERS, HUMAN ORGANS OR TISSUES.

INTERNAL ETHICAL APPROVAL STATUS: To be sought/ Response awaited/ Granted

EXTERNAL ETHICAL APPROVAL STATUS: To be sought/ Response awaited/ Granted

I have read and understood the list of requirements and responsibilities detailed in the Chief Scientific Office RGF for Health and Community Care and wish to nominate the University as sponsor for this project, on which I will be Principal Investigator/ Lead Researcher/ Academic Supervisor for the University of Stirling

Principal Investigator/ Academic Supervisor (*delete as appropriate*)

Name _____ Signature _____

Date _____

Student (If applicable) – *if the PI is a student, the academic supervisor must sign above and the student below.*

Name MARYANN VICTORIA WASHINGTON Signature Maryann

Date 08/02/2017

Countersigned by the ~~Head of School~~/ Authorised School Signatory

Name DR PROF K. MONY Signature

Date 08/02/2017

Notes

For student projects, these responsibilities rest with the academic supervisor

Other models of sponsorship may be considered if a significant part of the work and responsibilities are attributed to other organisations:

(a) Joint sponsorship – where all partners are equally responsible (and liable) for sponsorship requirements for the research taking place under their auspices, including external collaborators

(b) Co-sponsorship – where specific responsibilities of sponsorship are divided amongst, and delegated to, partner organisations in the project

If the single sponsorship model is adopted, as defined in the present agreement, and external collaborators and partners are involved in the project, PIs must obtain confirmation of their compliance to RGF using the Responsibility of External Collaborators – Confirmation of Compliance with RGF form, available from the University's Research and Enterprise office.

Guidance and advice on any aspect of RGF procedures and requirements is available from the University's Research and Enterprise Office – [Contact the Research Funding and Development Team].

I have read and understood the list of requirements and responsibilities detailed in the Chief Scientific Office RGF for Health and Community Care and wish to nominate the University as sponsor for this project, on which I will be Principal Investigator/ Lead Researcher/ Academic Supervisor for the University of Stirling

~~Principal Investigator~~/ Academic Supervisor (*delete as appropriate*)

Name: Leah Macaden

Signature

Date 08 Feb 2017

Student (If applicable) – *if the PI is a student, the academic supervisor must sign above and the student below.*

Name MARYANN VICTORIA WASHINGTON Signature

Date 09 Feb 2017

Countersigned by the Head of School/ Authorised School Signatory

Name _____ Signature _____

Date _____

Notes

For student projects, these responsibilities rest with the academic supervisor

Other models of sponsorship may be considered if a significant part of the work and responsibilities are attributed to other organisations:

(a) Joint sponsorship – where all partners are equally responsible (and liable) for sponsorship requirements for the research taking place under their auspices, including external collaborators

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Guidance and advice on any aspect of RGF procedures and requirements is available from the University's Research and Enterprise Office – [Contact the Research Funding and Development Team].

ANNEXURE- I
Additional results

Table I.1: Health facility preparedness score of eight health facilities

WHO Building Blocks	Health Work Force			Health Information Systems		Health Service Delivery				Leadership	FACILITY PREPAREDNESS SCORE (%)
Components	HCWs trained on KMC	Specialists available	Support Staff available	KMC case record	KMC reporting	Separate KMC area / ward	Weighing machine	Feeding equipment	Posters / brochures	Written policy	
Sub-District Hospital											
Time-point1	10	10	10	0	0	0	10	10	0	0	50%
Time-point2	10	10	10	10	10	10	10	10	10	10	100%
Community Health Centre (CHC) – Karatagi											
Time-point1	0	0	0	0	0	0	0	0	0	0	0
Time-point2	10	0	0	10	0	10	10	10	10	10	70.0%
CHC-Kanakagiri											
Time-point1	0	0	0	0	0	0	0	0	0	0	0
Time-point2	10	0	10	10	10	10	10	10	10	10	90
CHC-Sriram Nagar											
Time-point1	0	0	0	0	0	0	0	0	0	0	0
Time-point2	10	0	0	10	10	10	10	0	10	10	70
Primary Health Centre (PHC)-Venkatagiri											
Time-point1	0	0	0	0	0	0	0	0	0	0	0
Time-point2	10	0	0	10	0	10	10	10	10	10	70
PHC-Muslapur											
Time-point1	0	0	10	0	0	0	0	0	0	0	10
Time-point2	10	0	10	10	10	10	10	0	10	10	80
PHC-Navli											
Time-point1	0	0	0	0	0	0	0	0	0	0	0
Time-point2	10	0	0	10	0	10	10	0	10	10	60
PRIVATE											
Time-point1	0	10	10	0	0	0	10	0	0	0	30%
Time-point2	10	10	10	10	10	10	10	10	10	10	100%

Time-point 1 (June 2017); Time-point 2 (December 2018)

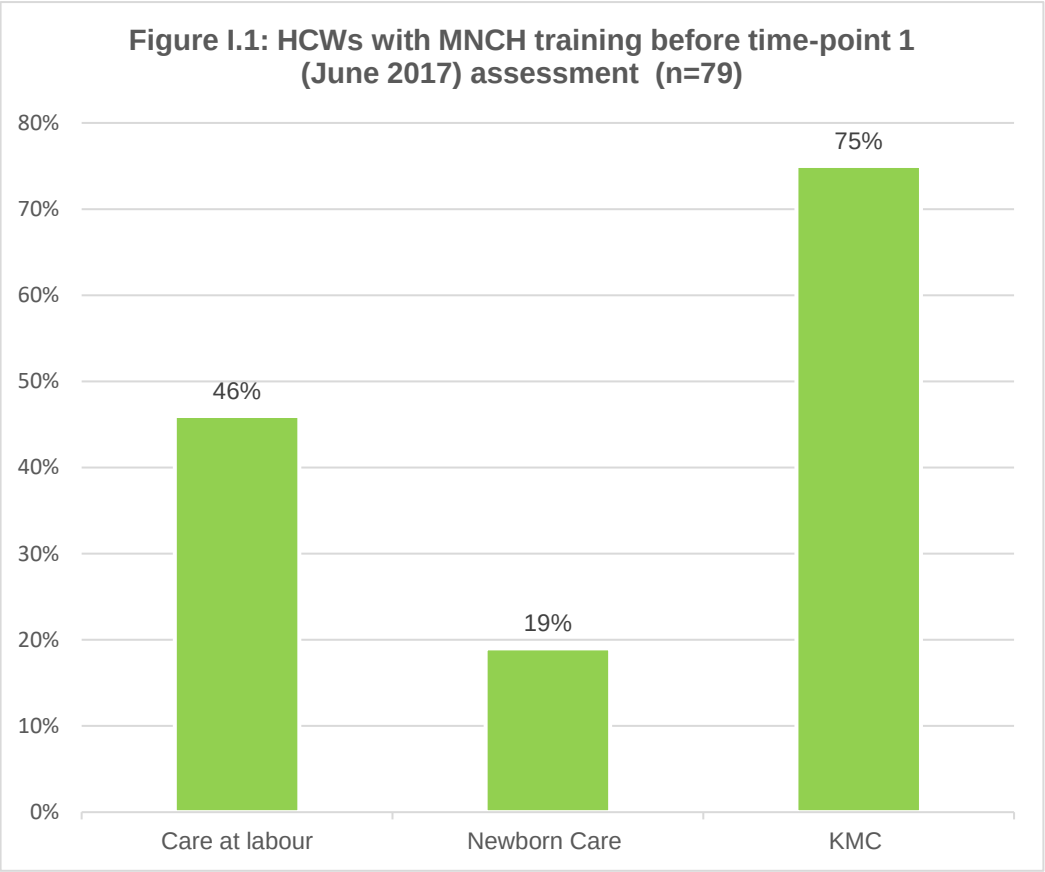
Figure I.1: HCWs with MNCH training before time-point 1 (June 2017) assessment (n=79)
80%
70%
60%
50%
40%
30%
20%
10%
0%
46%
19%
75%
Care at labour
Newborn Care
KMC

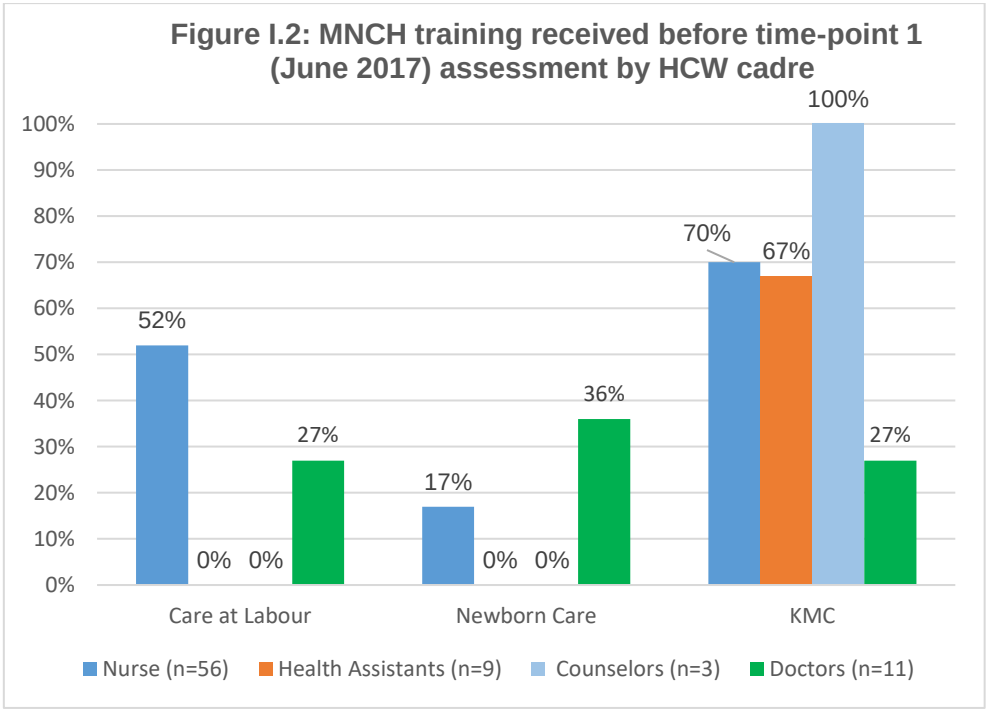
Figure I.2: MNCH training received before time-point 1 (June 2017) assessment by HCW cadre
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
52%
0%
0%
27%
17%
0%
0%
36%
70%
67%
100%
27%
Care at Labour
Newborn Care
KMC
Nurse (n=56)
Health Assistants (n=9)
Counselors (n=3)
Doctors (n=11)

Table I.2: Correct responses of HCWs to knowledge items

Knowledge Items	Time-point 1 (n=51)		Time-point 2 (n=64)	
Identifying a baby for KMC	**n**	**%**	**n**	**%**
1. KMC routine care for stable-LBW	49	96%	60	94%
2. Birth weight < 2000 gms is called term	32	63%	41	64%
3. KMC initiated after birth for stable baby 800-2000gms	44	86%	60	94%
4. Stable LBW baby-maintain temperature, lethargic, RR80/min	30	58%	30	47%
5. Takes weeks for <1200gms to be started on KMC	33	65%	45	70%
6. KMC given for stable babies but without severe jaundice	32	63%	47	73%
7. Intermittent KMC in SNCU for baby 1200-1800gms on oxygen, IV fluids, antibiotics	26	53%	46	72%
8. Temperature <37^{0}C is called hypothermia	13	26%	17	27%
Components and requirement for KMC				
9. KMC is SSC with mother	51	100%	64	100%
10. Exclusive breastfeeding- component of KMC	50	98%	60	94%
11. Baby's abdomen must be at mother's epigastrium	1	2%	4	6%
12. Position of baby lateral with head to one side for KMC	46	90%	55	86%
13. Baby's bottom to be supported with binder/hand during KMC	25	49%	21	33%
14. KMC provided when baby fully clothed	36	71%	61	95%
15. Top of binder behind ears when baby on KMC	38	75%	42	66%
16. Baby must have only cap, socks, and napkin in KMC position	46	90%	63	98%
17. Incubator best for keeping baby warm if mother is not available	18	35%	26	41%
18. Room temperature 25-28^0 C	34	67%	49	77%
Provider of and monitoring during KMC				
19. KMC can be given only by mother	39	77%	56	88%
20. Duration of one session	36	71%	49	77%
21. KMC continuous if given for 24 hours	15	29%	21	33%
22. HCWs must monitor baby's temperature 4hourly during KMC	27	53%	40	63%
23. Mother must be taught to monitor TABC of baby during KMC	50	98%	64	100%
24. Adequate weight gain 15-20gms/day	46	90%	61	95%
KMC maintenance				
25. KMC till baby is 2500 gms	49	97%	64	100%
26. Transport of a baby 2000gms best by KMC	46	90%	63	98%
27. Mother can provide KMC when lying down	10	20%	21	33%
28. Expressed breastmilk at room temp 24 hours	32	63%	39	61%
29. Breastfeeding in KMC position possible	39	77%	51	80%
30. Daily bath for LBW getting KMC	44	86%	60	94%
31. Discharge criteria: gained weight, temperature maintained, feeds well	45	88%	61	95%
32. Transportation is best by carrying baby with warm clothes	5	10%	12	19%
33. More chance of infection with KMC	44	86%	57	89%
34. KMC satisfies all 5 senses	48	94%	64	100%

Table I.3: Responses of HCWs on the attitude scale on KMC

	Time-point1 (n=50)			Time-point2 (n=64)		
	SDA/DA	UD	A/SA	SDA/DA	UD	A/SA
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Benefits: KMC						
Is beneficial	2(4%)	0 (---)	48 (96%)	2 (3%)	0 (----)	62 (97%)
Increases bonding	1(2%)	0 (---)	49 (98%)	1 (2%)	0 (----)	63 (98%)
Increases mother's confidence	1(2%)	0 (---)	49 (98%)	2 (3%)	0 (----)	62 (97%)
Is liked by mothers	2 (4%)	2 (4%)	46 (92%)	6 (9%)	0 (----)	58 (91%)
Helps HCWs to care for LBWs	1 (2%)	0 (---)	49 (98%)	4 (6%)	2 (3%)	58 (91%)
Results in effective breastfeeding	2 (4%)	0 (---)	48 (96%)	13 (20%)	2 (3%)	49 (77%)
Requirements for KMC implementation: KMC…						
Counselling of mothers / fKMC Providers	2(4%)	1 (2%)	47 (94%)	5 (8)	0 (---)	59 (92%)
To be initiated by HCWs	0 (---)	1 (2%)	49 (98%)	3 (5%)	0 (---)	61 (96%)
Will be recommended by me	4(8%)	1 (2%)	45 (86%)	6 (9%)	0 (---)	58 (91%)
KMC Practice: KMC…						
Does not aid in efficient use of time.*	12(24%)	1 (2%)	37 (74%)	9 (14%)	0 (---)	55 (86%)
Is secondary to more important work.*	23(46%)	1 (2%)	26 (52%)	19 (30%)	0 (---)	45 (70%)
*Increases workload**	13(26%)	4 (8%)	33 (66%)	10 (16%)	2 (3%)	52 (81%)
Increases the infections for LBW babies.*	10(20%)	1 (2%)	39 (78%)	12 (29%)	3 (5%)	49 (77%)
Requires a dedicated HCW*.	48(96%)	0 (---)	2 (4%)	55 (86%)	1 (2%)	8 (12%)
Questions from mothers is irritating.*	3 (6%)	3 (6%)	44 (88%)	7 (11%)	2 (3%)	55 (86%)

SDA=Strongly Disagree; DA=Disagree; U=Undecided, A=Agree, SA=Strongly Agree

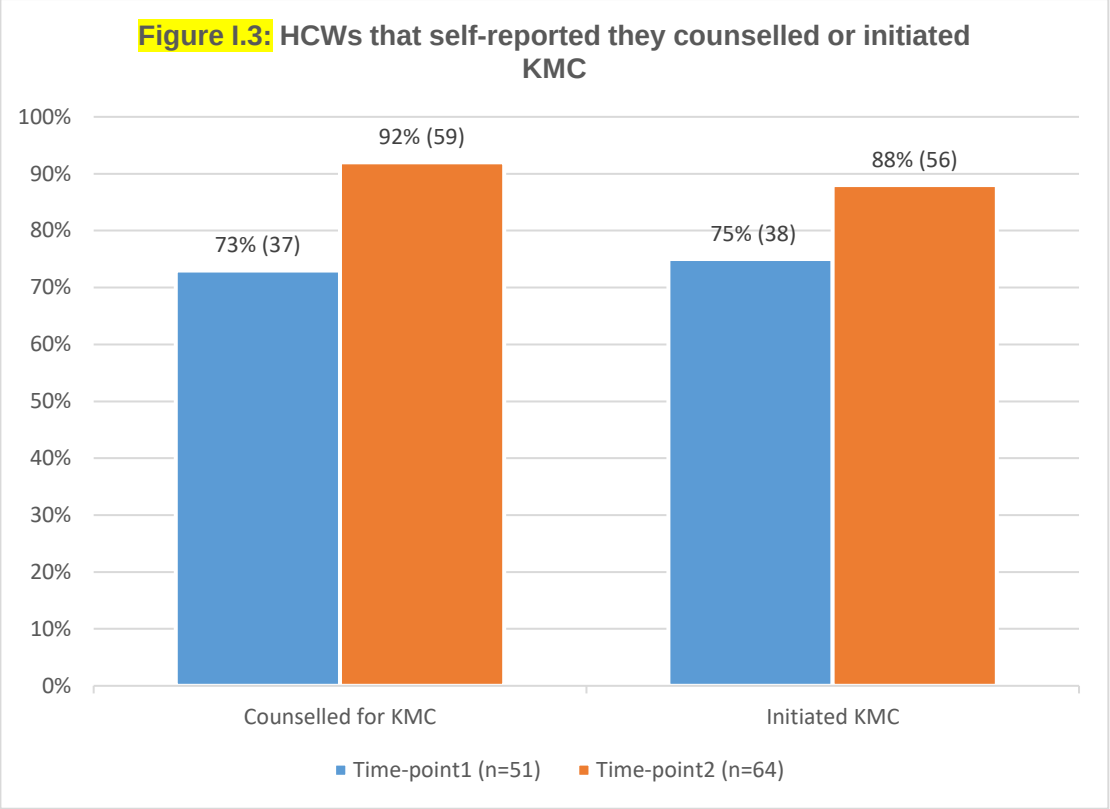

Table I.4: HCWs who counselled and initiated KMC by cadre and place of employment

Counselled on KMC	Time-point 1 (n=51)			Time-point 2 (n=64)		
	N	n	%	N	N	%
Cadre of HCWs						
- Doctors	0	-	-	11	9	82%
- Nurses	45	34	76%	43	40	91%
- Counsellors	3	1	33%	3	3	100%
- Health Assistants	3	2	67%	7	7	100%
Employed at						
- SDH	19	13	68%	26	24	92%
- CHC/PHC	23	16	70%	30	27	90%
- Private	9	8	89%	8	8	100%
Initiated KMC						
Cadre of HCWs						
- Doctors	0	0	-	11	8	73%
- Nurses	45	35	78%	43	39	89%
- Counsellors	3	1	33%	3	3	100%
- Health Assistants	3	2	67%	7	6	86%
Employed at						
- SDH	19	13	68%	26	24	92%
- CHC/PHC	23	17	74%	30	25	90%
- Private	9	8	89%	8	7	88%

Table I.5: Mothers and fKMC providers responses to knowledge questionnaire

KMC…...	Mothers (n=209)		FKMC Providers (n=83)	
	No	**%**	**No**	**%**
1. Meaning				
- SSC / on chest	186	89%	79	95%
- Exclusive breastfeeds + SSC	23	11%	4	5%
2. Position				
- Upright	16	7.7%	11	14%
- Head turned +upright	82	39.2%	36	43%
- Froglike+ Head turned +upright	108	51.7%	36	43%
- Do not know	3	1.4%	0	-
3. Indicated for				
- Correct-<2500gms babies	202	96.7%	78	94%
- Do not know	7	3.1%	5	6%
4. Preparation of a baby				
- Correct-naked, cap, socks	208	99.5%	83	100%
- Do not know	1	0.5%	0	-
5. Preparation of self				
- Correct-front open shirt/blouse	209	100%	79	95%
- Do not know	0	-	4	5%
6. Duration				
- One session->60 minutes	33	15.8%	27	33%
- One day (>10 hours)	174	83.3%	55	66%
- Do not know	2	1.0%	1	1%
7. Side-effects				
- Correct – no harm	204	97.6%	83	100%
- Do not know	5	2.4%	0	-
8. When resting				
- Yes	15	7.2%	4	5%
- How-Chair/Secure/Bed with pillows	193	92.3%	46	55%
- Do not know	1	0.5%	33	40%
9. During routine housework				
- Yes	38	18%	12	15%
- Yes+ Keep baby secure	99	46.9%	41	49%
- Yes+ Secure baby+ Help from others	5	2.4%	NA	-
- Do not know	69	32.7%	30	36%

Table I.6: Mothers and fKMC providers responses to KMC benefits and monitoring

Benefits	Mothers (n=209)			fKMC Providers (n=83)		
	No	%	Rank Order	No	%	Rank Order
Weight gain	187	91%	1	72	87%	1
Increased growth	160	77%	2	70	84%	2
Better IQ	87	42%	3	27	33%	3
Reduces infection	57	27%	4	17	21%	5
Helps in breastfeeding	54	26%	5	13	16%	7
Increased bonding	51	24%	6	14	17%	6
Increased warmth	34	16%	7	18	22%	4
More alert	32	15%	8	6	7%	8
Less cost	15	7%	9	4	5%	9
Monitoring a Baby on KMC	**Mothers (n=209)**			**fKMC Providers (n=83)**		
	No	**%**	**Rank Order**	**No**	**%**	**Rank Order**
Breathing	119	57%	2	46	55%	2
Activity	153	73%	1	59	71%	1
Colour	23	11%	5	7	3%	5
Temperature	30	14%	4	11	5%	3
HR	36	17%	3	9	11%	4

Table I.7: Responses of mothers & fKMC Providers on attitude items

Attitude on KMC	Mothers (n=209)		fKMC Providers (n=83)	
	No	%	No	%
Positive towards KMC	200	95.7%	80	96.4%
KMC is not difficult	202	96.7%	80	96.4%
Not embarrassed to give KMC before others	192	91.9%	80	96.4%
Will recommend KMC	201	96.2%	81	97.6%)

Table I.8: Knowledge of mothers on KMC by maternal characteristics

Maternal Characteristics	Knowledge of mothers (n=209)		Test of significance
	No	Mean(±SD)	
Age:	209		r=0.02; p=0.773
Education			
- ≤8th grade	134	16.9(±3.1)	Student's t test =2.88 (p=0.004)
- >8th grade	75	18.2(±3.2)	
Occupation (n=208)			
- Skilled workers	18	19.3 (±3.5)	F =7.00 p=0.001
- Unskilled workers	109	16.7 (±3.1)	
- Home-makers	82	17.8 (±2.9)	
No. of Children			
- 1 child	114	17.4(±3.0)	t=0.14 p=0.896
- ≥2 children	95	17.3(±3.4)	

Figure I.4: Level of KMC initiation support at the health facility (n=209)

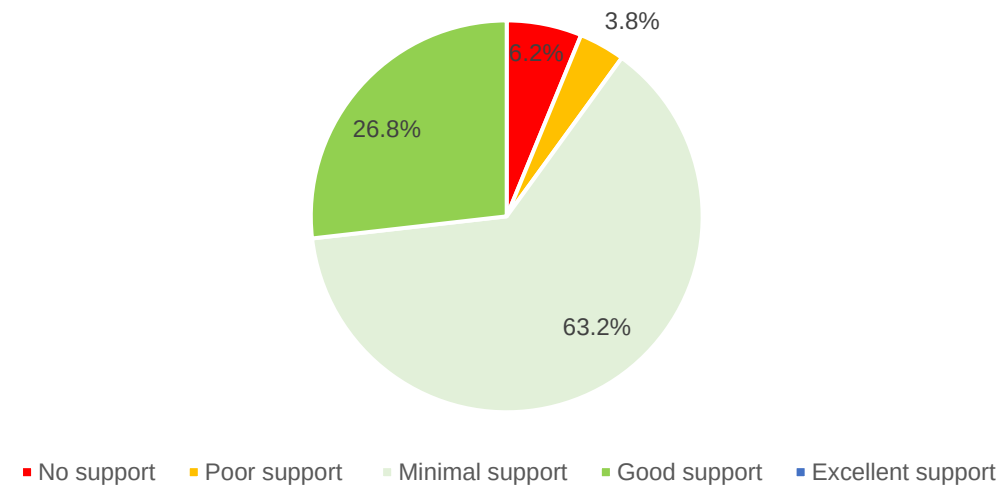

Figure I.5: Level of KMC maintenance support at the health facility (n=209)

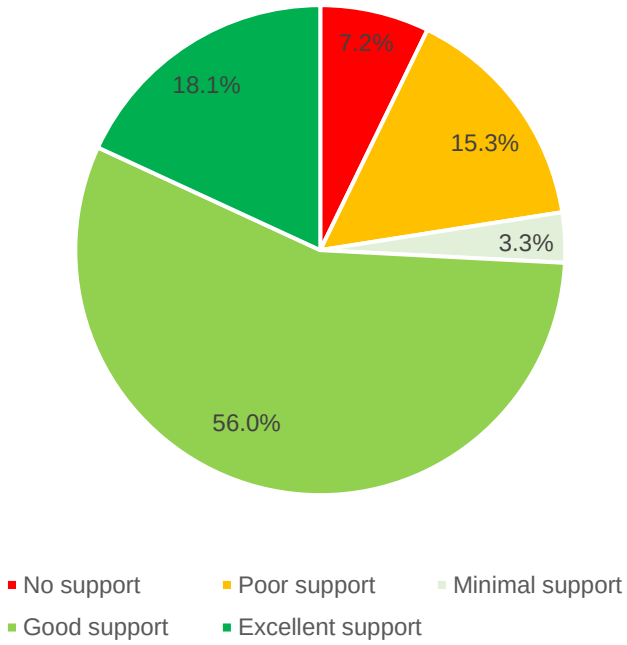

Figure I.6: Level of overall support for KMC practice at the health facility (n=209)

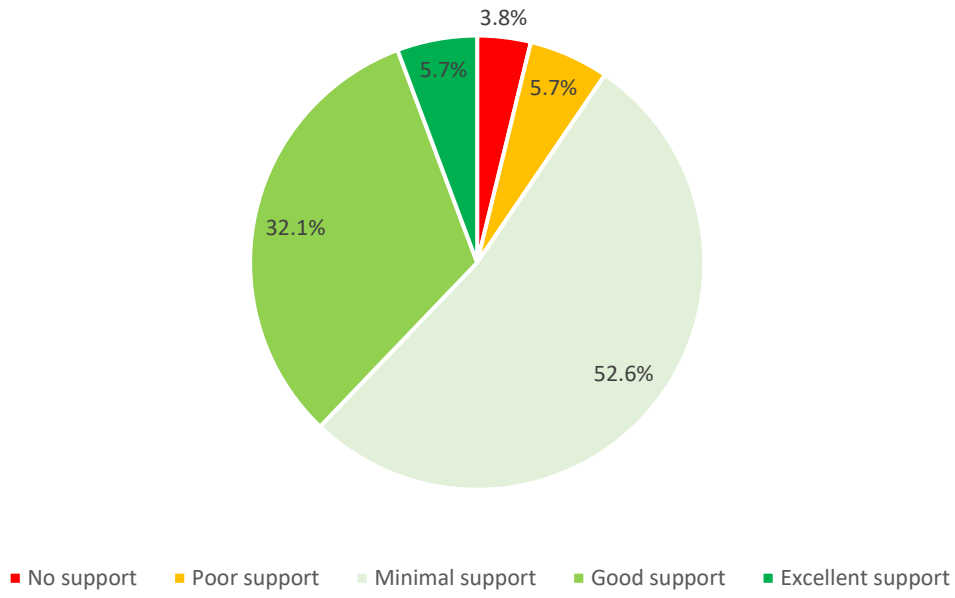

Table I.9: Support for KMC practice at the health facility by maternal characteristics

Maternal characteristics	Support for KMC practice (n=209)		Level of significance
	n	Mean (±SD)	
Age in years	209	-	r=0.09; p=0.194
Education			
- ≤8th grade	134	13.8 (±5.3)	t =0.40 p=0.687
- >8th grade	75	14.1 (±4.9)	
Occupation (n=208)			
- Skilled workers	18	12.3 (±5.7)	F =1.27
- Unskilled workers	109	13.8 (±5.4)	p=0.283
- Homemakers	82	14.4 (±4.7)	
No. of children			
- 1 child	114	14.6(±5.1)	t=2.12
- ≥2 children	95	13.1(±5.1)	p=0.035

Figure I.7: Number of persons available at home to support the mother for KMC practice (n=209)

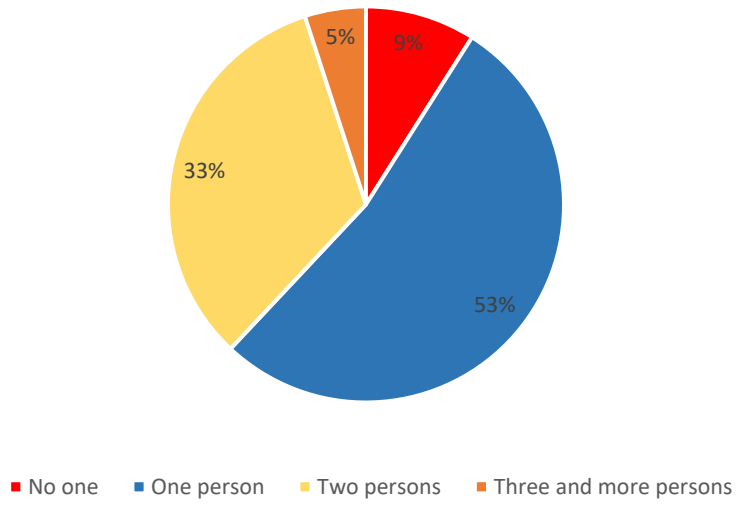

Table I.10: KMC maintenance support at home for mothers and fKMC providers

KMC maintenance support for at Home	Mothers (n=208)*	fKMC Providers (n=79)*
1. Provided by CHWs	**No. (%)****	**No. (%**)**
Information on KMC	201 (97%)	79 (100%)
Checked weight	185 (89%)	67 (85%)
Helped find ways to increase KMC	129 (62%)	53 (67%)
Gave information on how to watch the baby while on KMC	19 (9%)	5 (6%)
Referred baby to facility for a health issue	25 (12%)	3 (4%)
2. **Person who supported at home**	**n =191*** **	Not applicable
Maternal Mother / Mother-in-law	163 (85%)	
Maternal Father	8 (4%)	
Sister / Sister-in-law	59 (31%)	
Spouse	24 (13%)	
CHW	25 (13%)	

**One mother and four fKMC providers reported CHW had not visited*

***Multiple responses- percent >100*

****18 mothers did not have anyone to support them with household chores or as fKMC provider*

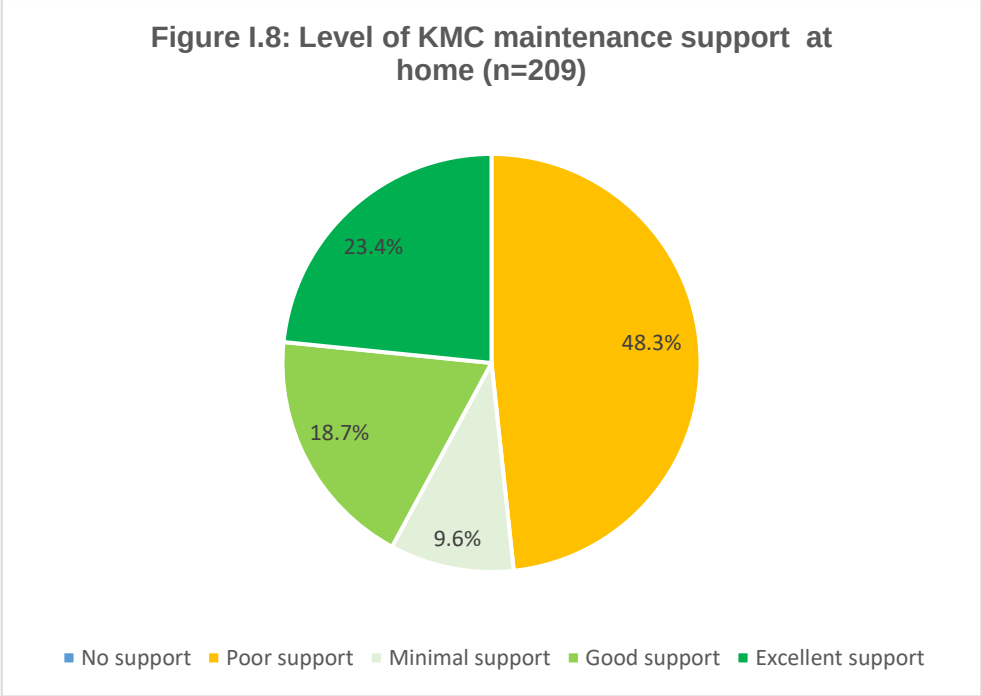

Table I.11: KMC maintenance support at home by maternal characteristics

Maternal characteristics	Support for KMC maintenance at home (n=209)			Level of significance
	N	M (±SD)	Median (IQR)	
Age:	209		-	r=0.03; p=0.666
Education				Mann Whitney U=4369 p=0.119
- ≤8th grade	134	16.3(±10.2)	9 (20.7)	
- >8th grade	75	17.8(±10.3)	15 (20.0)	
Occupation (n=208)				Kruskal-Wallis=1.655 p=0.437
- Skilled workers	18	16.7 (±10.8)	11 (1)	
- Unskilled workers	109	16.8 (±10.2)	9 (2)	
- Home-makers	82	17.1 (±10.3)	10 (2)	
No. of children				Mann-Whitney U=5032.0 p=0.006
- 1 child	114	18.4(±10.2)	18 (10)	
- ≥ 2 children	95	15.1(±10.1)	9 (1)	

‘

Table I.12: Correlation coefficient of knowledge, attitude, skills of HCWs

	Spearman Brown's r
Correlation coefficient – Time-point 1 (n=25)	
Knowledge – attitude	0.58
Knowledge – skill	0.49
Skill – attitude	0.47
Correlation coefficient (Time-point 1 and time-point 2) n=25	
Knowledge	0.38
Attitude	0.56
Skills	0.48
Critical value at 0.05 level of significance for (n=23)=0.39	

Table I.13: Correlation between improvement % and average of HCWs' knowledge, attitude and skills allocated for babies (n=227)

	Spearman Brown's r	p
Knowledge – Average and improvement %	0.257	0.001
Attitude – Average and improvement %	0.987	<0.001
Skills – Average and improvement%	0.049	0.518
Health facility preparedness: Average and improvement %	-0.92	<0.001
Average knowledge with improvement % skill	0.457	<0.001
Average knowledge with improvement % attitude	0.385	<0.001
Average attitude with improvement % skill	0.517	<0.001
Average skill with Improvement % knowledge	0.400	<0.001
Average skill with improvement % attitude	0.354	<0.001
Average: knowledge scores of two time points *Improvement: Change from time-point 1 to time-point 2/ score of time-point 1 *100*		

ANNEXURE – J

Pictures

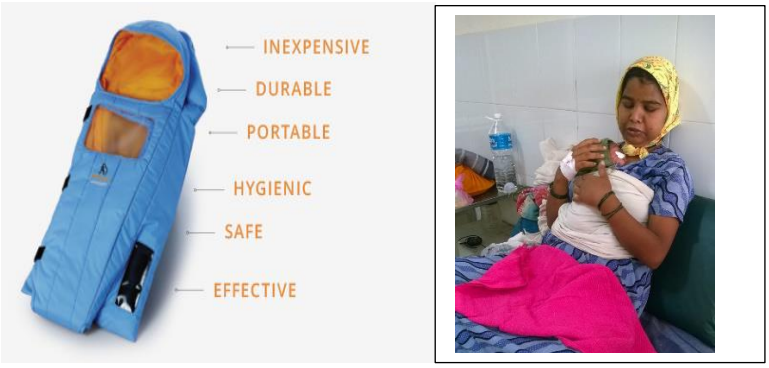

Figure J.1. EMBRACE – An infant warmer (Source: Indiamart.com) versus KMC (Photo courtesy WHO Database)

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