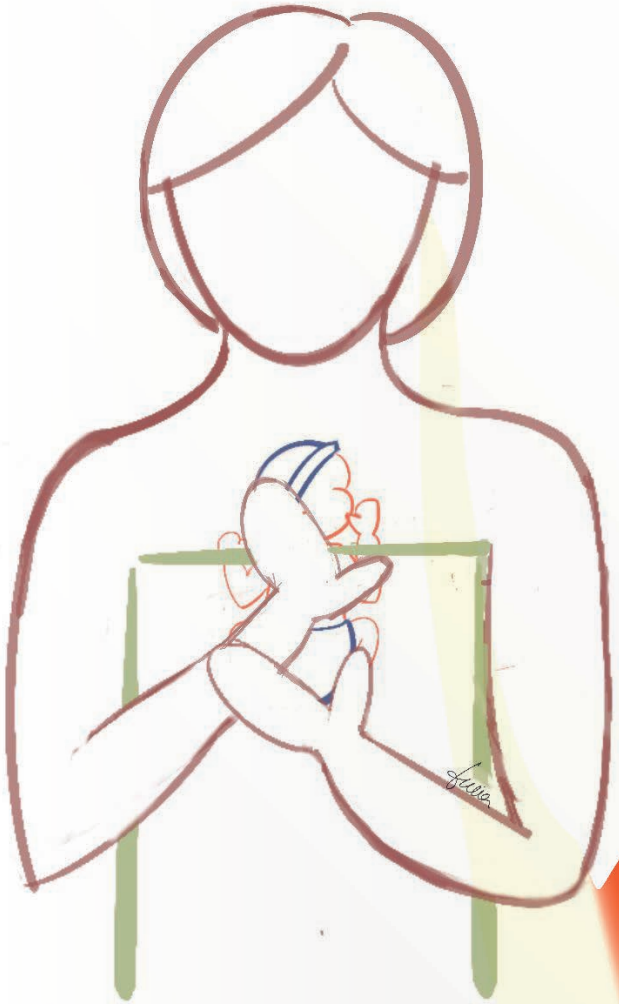

SPANISH SOCIETY OF NEONATAL NURSING

CLINICAL PRACTICE GUIDELINE | ON KANGAROO MOTHER CARE

SPANISH GENERAL COUNCIL OF NURSING

Consejo General de Colegios Oficiales de Enfermería de España

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CLINICAL PRACTICE GUIDELINE ON KANGAROO MOTHER CARE

Working Group on Developmental- and Family-Centred Care
Spanish Society of Neonatal Nursing

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LIST OF ABBREVIATIONS

aEEG: Amplitude-Integrated Electroencephalography
BF: Breastfeeding
BPD: Bronchopulmonary Dysplasia
CI: Confidence Interval
CPAP: Continuous Positive Airway Pressure
CPG: Clinical Practice Guideline
CPG-DWG: Clinical Practice Guideline Development Working Group
DFCC: Development- and Family-Centred Care
EBF: Exclusive Breastfeeding
EEN: Exclusive Enteral Nutrition
EPT: Extremely Preterm
ETT: Endotracheal Tube
FICare: Family Integrated Care
FiO2: Fraction of Inspired Oxygen
GA: Gestational Age
HFOV: High-Frequency Oscillatory Ventilation
HR: Heart Rate
IMV: Invasive Mechanical Ventilation
IVH: Intraventricular Haemorrhage
KMC: Kangaroo Mother Care
LBWN: Low Birth Weight Newborn
MD: Mean Difference
MeSH: Medical Subject Headings
MRSA: Methicillin-Resistant Staphylococcus aureus
NAVA: Neurally Adjusted Ventilatory Assistance
NB: Newborn
NICU: Neonatal Intensive Care Unit
NIMV: Non-Invasive Mechanical Ventilation
PIPP: Premature Infant Pain Profile
PMA: Postmenstrual Age
PTNB: Preterm Newborn

RCT: Randomised Controlled Trial

RR: Respiratory Rate

rScO2: Regional Cerebral Oxygen Saturation

SEEN: Spanish Society of Neonatal Nursing

SpO2: Oxygen Saturation

TOER: Tissue Oxygen Extraction Ratio

WHO: World Health Organisation

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Foreword

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1. FOREWORD

In recent years, the volume of scientific evidence on neonatal care has increased, particularly regarding preterm newborns, which has seen an exponential growth in scientific evidence. This evidence has contributed to improvements in clinical practice, leading to enhanced quality of care for this type of patient and their respective families.

However, practices such as the Kangaroo Mother Care (KMC) method, despite abundant scientific evidence supporting its application, face variability in clinical implementation and, occasionally, encounter barriers and limitations. Kangaroo Mother Care is a methodology for neonatal care that actively involves the mother (and family) in the direct provision of basic care for the infant through two fundamental components: kangaroo positioning (continuous and for as long as possible) and feeding based on breast milk administration and/or breastfeeding. An additional feature of KMC, when initiated in hospitals, is the early discharge from intensive care or neonatal units to a lower level of care within the hospital (kangaroo accommodation) or at home, with continuous kangaroo positioning and close follow-up in Primary Care.

Defined in this way, and in line with Nils Bergman's perspective, KMC provides the appropriate habitat for the newborn and their mother, which will offer an adequate level of regulation to buffer the stress caused by the extrauterine environment and the context of prematurity.

There are various factors related to the implementation of KMC, including clinical variability among healthcare professionals, hospital/community centres, and Autonomous Communities. Many studies, forums, and contexts have called for standardised guidelines for KMC implementation in Spanish neonatal units. Therefore, the Spanish Society of Neonatal Nursing (SEEN), as part of the strategy of the Working Group on Developmental and Family-Centred Care, undertook the creation of a Clinical Practice Guideline (CPG) on KMC for hospitalised preterm newborns (PTNB) and/or low birth weight infants, with the aim of promoting and standardising this clinical practice.

At the beginning of the CPG, readers will find a list of the clinical questions formulated and their recommendations, which were answered by a group of experts after an

exhaustivenliterature review. The clinical questions are organised into six thematic blocks: 1. Impact of KMC; 2. Candidates for KMC; 3. Family training; 4. KMC implementation; 5. Facilitators and barriers of KMC; and 6. Extreme prematurity and KMC, with each question featuring a summary of the most current evidence and a recommendation for clinical practice.

It is worth noting that, following consultation with experts and in line with documents published by WHO and the designated descriptor for the concept, the guideline development group has chosen the term KMC, unifying terms such as kangaroo care, kangaroo positioning, kangaroo technique, kangaroo programme, kangaroo method, skinto-skin contact, or skin-to-skin.[1]

This guideline is the result of the efforts and work of over 30 professionals from various fields and Autonomous Communities, to whom we owe a debt of gratitude for their time, commitment, and expertise.

As Nathalie Charpak puts it, KMC is to the brain what surfactant is to the lung. Therefore, and in view of everything presented throughout this CPG, Kangaroo Care should be promoted as a safe, effective, accessible, cost-free, and sustainable clinical practice.

María José Cano Ochoa
President of the Spanish Society of Neonatal Nursing during the development of this Guideline

Leticia Bazo Hernández
President of the Spanish Society of Neonatal Nursing

[1] It should be noted that the term Kangaroo Mother Care refers to the provider of kangaroo care being the mother, father, or partner.

Questions and Summary of Recommendations

2

2. QUESTIONS AND SUMMARY OF RECOMMENDATIONS

SECTION 1: IMPACT OF KANGAROO MOTHER CARE (KMC)

1. What is the impact of KMC on morbidity and mortality in PTNBs?

Quality of evidence: HIGH

2. Is KMC effective in reducing healthcare-associated infections in PTNBs?

Quality of evidence: HIGH

Summary: KMC is effective in reducing healthcare-associated infections and sepsis in PTNBs.

3. Does KMC reduce hospital stay and the likelihood of readmission in PTNBs?

Quality of evidence: MODERATE

Summary: KMC appears to be effective in reducing hospital stay and readmission rates in PTNBs.

4. Does KMC improve apnoea, heart rate, temperature, respiratory rate, and oxygen saturation?

Quality of evidence: HIGH

Summary: KMC stabilises heart rate, respiratory rate, oxygen saturation, and temperature, thus contributing to stabilising and improving cardiorespiratory function in PTNBs.

5. Is KMC beneficial for the neurodevelopment of PTNBs?

Quality of evidence: HIGH

Summary: KMC promotes neurocognitive development in PTNBs compared to conventional incubator care.

6. Does KMC improve cerebral oxygenation in PTNBs?

Quality of evidence: MODERATE

Summary: Stable PTNBs, regardless of respiratory support, maintain stable cerebral oxygen saturation (rScO2) during KMC with a slight upward trend.

7. What is the impact of KMC on the prevention of intraventricular haemorrhage in PTNBs?

Quality of evidence: LOW

Summary: KMC may benefit cerebral oximetry and aid in the prevention of intraventricular haemorrhage in PTNBs.

8. What is the impact of KMC on PTNB sleep?

Quality of evidence: MODERATE

Summary: KMC is more effective during sleep periods, as it improves sleep cycles and reduces the number of awakenings, thereby improving oxygenation in PTNBs.

9. What effect does KMC have in reducing pain during painful procedures compared to other non-pharmacological measures in PTNBs?

Quality of evidence: HIGH

Summary: KMC, compared to incubator care or other non-pharmacological measures, reduces pain during invasive and/or painful procedures in PTNBs.

10. How does parental involvement affect pain control in PTNBs?

Quality of evidence: MODERATE

Summary: Parental involvement as active caregivers in painful procedures reduces the intensity of pain manifestations in PTNBs.

11. Is KMC alone or in combination with sucrose more effective in reducing procedural pain in PTNBs?

Quality of evidence: HIGH

Summary: KMC combined with sucrose administration does not provide greater pain reduction during heel prick in PTNBs than KMC alone.

12. Is KMC beneficial for the initiation and maintenance of breastfeeding in preterm infants?

Quality of evidence: HIGH

Summary: KMC benefits breastfeeding initiation and maintenance in PTNBs.

13. What is the impact of KMC on feeding methods and growth in PTNB or very low birth weight infants (VLBWI)?

Quality of evidence: HIGH

Summary: KMC performed at least six hours per day is associated with higher rates of exclusive breastfeeding (EBF) and greater weight gain, length, and head circumference. Early KMC (before the first week of life) is linked to reduced need for parenteral nutrition, shorter duration of nutritional support, and improved feeding tolerance.

14. Does KMC promote bonding and attachment between PTNBs and their families?

Quality of evidence: MODERATE

Summary: KMC promotes family bonding and attachment between PTNB and their families.

15. What effect does KMC have on maternal and paternal health?

Quality of evidence: HIGH

Summary: KMC reduces maternal anxiety, depression, and stress, and improves maternal attachment and sleep quality.

SECTION 2. CANDIDATES FOR KANGAROO MOTHER CARE

16. Can a preterm newborn with respiratory support undergo KMC?

Quality of evidence: MODERATE

Strength of recommendation: WEAK. The application of KMC is suggested for neonates with invasive or non-invasive respiratory support.

17. Is it safe to perform KMC on intubated preterm newborns?

Quality of evidence: MODERATE

Strength of recommendation: STRONG. Performing KMC on neonates with orotracheal or nasotracheal intubation does not increase rates of accidental extubation. However, recommendations regarding ventilation-associated pneumonia cannot be made due to lack of evidence.

18. Is it safe to perform KMC on a preterm newborn with a central venous catheter?

Quality of evidence: MODERATE

Strength of recommendation: STRONG. The application of KMC does not increase rates of accidental dislodgement of central or peripheral catheters, nor does it increase catheter-related bacteraemia.

SECTION 3. FAMILY TRAINING FOR KMC

19. Does prior family education increase their involvement in performing KMC?

Quality of evidence: LOW

Strength of recommendation: WEAK. Prenatal or prior information for families may increase their involvement in performing KMC.

20. Is parental training effective in increasing their autonomy in KMC?

Quality of evidence: MODERATE

Strength of recommendation: STRONG. It is recommended to provide standardised KMC information to parents and to conduct training sessions that enhance their skills and autonomy in performing KMC.

SECTION 4: PERFORMING KANGAROO CARE

21. When and for how long should KMC be performed on PTNBs?

Quality of evidence: MODERATE

Strength of recommendation 1: WEAK. Initiate KMC immediately (within the first hour of life) or as soon as possible.

Strength of recommendation 2: STRONG. Perform KMC for at least 6-8 hours per day.

22. Who should perform KMC? Mother, father, or others?

Quality of evidence: MODERATE

Strength of recommendation 1: STRONG. Whenever possible, the mother should be the primary provider of kangaroo care, but KMC with the father/partner should also be encouraged.

Strength of recommendation 2: WEAK. Another family member may perform KMC if the parents are unavailable or as a respite for the parents.

23. Is the use of supportive instruments, such as wraps or ergonomic carriers, recommended during KMC with PTNBs?

Quality of evidence: MODERATE and EXPERT CONSENSUS

Strength of recommendation 1: WEAK. Using ergonomic supports may increase the duration of KMC and improve both the parent and preterm newborn's comfort and satisfaction.

Strength of recommendation 2: STRONG. It is recommended to place the wrap low on the provider's abdomen, lifting it after a few minutes of holding the baby.

Strength of recommendation 3: STRONG. It is recommended to use cotton or synthetic Lycra wraps.

24. Does the use of a cap during KMC help maintain normal temperature in preterm newborns compared to not using one?

Quality of evidence: LOW and EXPERT CONSENSUS

Strength of recommendation: WEAK. The use of a cap for KMC is recommended, although it depends on the baby's gestational age and initial temperature. A blanket or covering over the head can be used as an alternative.

25. Is it necessary to protect the PTNB from light and sound during KMC?

Quality of evidence: MODERATE

Strength of recommendation: STRONG. It is recommended to create an optimal environment during KMC by reducing light (<600 lux) without covering the newborn's eyes, and by keeping noise levels suitable (<65 dB).

26. Does the posture and comfort of parents affect the duration of KMC?

Quality of evidence: LOW and EXPERT CONSENSUS

Strength of recommendation: STRONG. A comfortable armchair with a 15-30º recline is recommended to improve the kangaroo provider's posture, potentially increasing KMC duration.

27. How many people are recommended for the transfer from incubator to family for KMC?

Quality of evidence: LOW

Strength of recommendation: WEAK. A transfer involving two people (at least one health-care professional) is suggested, depending on the baby's overall condition, age, equipment, intubation status, and the parents' autonomy/skills in providing this care.

28. In preterm or low birth weight newborns, is a standing transfer safer than a seated transfer?

Quality of evidence: LOW

Strength of recommendation: WEAK. Consider parental autonomy, preterm newborn stability, and technique standardisation when choosing between standing or seated transfer.

29. How to perform a safe transfer for a preterm newborn with invasive or non invasive mechanical ventilation?

Quality of evidence: LOW and EXPERT CONSENSUS

Strength of recommendation 1: WEAK. For intubated patients, it is recommended NOT to disconnect the patient from the ventilator during transfer. At least two people should assist, with one managing the tubing and endotracheal tube (ETT).

Strength of recommendation 2: WEAK. It is suggested to place the tubing on the same side of the incubator to facilitate KMC without disconnecting any equipment.

Strength of recommendation 3: WEAK. Place the tubing over the shoulder of the KMC provider, securing it with tape/Velcro on the chair or on the provider, allowing slight slack for newborn movement.

Strength of recommendation 5: WEAK. Ensure the fixation is accessible and easily removable in case of an emergency.

30. Is using a containment nest the best way to transfer a PTNB?

Quality of evidence: LOW and EXPERT CONSENSUS

Strength of recommendation: WEAK. For a seated transfer from incubator to KMC provider, a containment nest is recommended as it may reduce stress, maintain temperature stability, provide containment, and optimise vestibular development.

31. Are there alternatives to the conventional prone position for KMC in hospitalised PTNBs?

Quality of evidence: MODERATE

Strength of recommendation: WEAK. Alternative KMC positions to prone, such as diagonal prone and vertical side-lying, are suggested. Diagonal prone KMC may foster mother-baby interaction, while vertical side-lying helps maintain normothermia, stable heart rate, and oxygen saturation in extremely PTNBs during the first five days of life.

Quality of evidence: EXPERT CONSENSUS

Strength of recommendation: WEAK. It is suggested to use a mirror or front camera on a mobile device to view the PTNB's face.

32. Does the prone KMC position increase the risk of developing IVH compared to the lateral KMC position or lateral position in an incubator for hospitalised PTNBs?

Quality of evidence: MODERATE

Strength of recommendation: WEAK. The vertical side-lying KMC position is suggested as an alternative to prone KMC in preterm newborns during the first 72 hours of life.

33. Does the position used in KMC influence motor neurodevelopment in PTNBs?

Quality of evidence: MODERATE

Strength of recommendation: STRONG. Conventional vertical KMC improves shortterm electromyographic activity.

34. Does feeding tolerance improve in PTNBs fed in the kangaroo position?

Quality of evidence: LOW

Strength of recommendation: WEAK. Feeding during KMC may improve feeding tolerance.

SECTION 5. FACILITATORS AND BARRIERS TO KANGAROO MOTHER CARE

35. Does an adjusted nurse-to-patient ratio in neonatal units, aligned with the European mean, improve the frequency and/or duration of KMC?

Quality of evidence: HIGH and EXPERT CONSENSUS

Strength of recommendation 1: STRONG. It is recommended to adjust the nurse-topatient ratio according to the case mix in the neonatal unit to facilitate the implementation and duration of KMC.

Strength of recommendation 2: WEAK. It is suggested that fostering parental training and their integration into the care teams may improve time optimisation and the continuity and quality of care.

36. Does the presence of an institutional guideline or protocol on KMC increase the percentage of newborns receiving KMC or its duration?

Quality of evidence: HIGH

Strength of recommendation: STRONG. The existence of an institutional guideline or protocol is recommended to improve the implementation and application of KMC.

37. In hospitalised neonates, does the structure of family support impact the frequency, duration, and continuity of KMC?

Quality of evidence: HIGH

Strength of recommendation: STRONG. It is recommended that neonatal units facilitate family, cultural, and/or religious support for the mother and family. The financial costs associated with NICU admission and inadequate parental leave policies may hinder KMC.

38. In newborns admitted to neonatal units, does a specific design and layout of space and furniture increase the frequency of KMC application?

Quality of evidence: HIGH

Strength of recommendation: STRONG. It is recommended to establish private rooms or designated areas where both parents can stay with their hospitalised preterm newborn (PTNB), as well as ensuring 24-hour unrestricted access to the unit. Lack of space, privacy, and appropriate resources interferes with the frequency of KMC.

39. Does the perceived professional competence of nurses by mothers and fathers of neonates eligible for KMC increase their willingness to perform KMC?

Quality of evidence: HIGH

Strength of recommendation: STRONG. It is recommended to acknowledge that a positive perception of professional competence may enhance parents' willingness to engage in KMC. Conversely, lack of information and support, combined with a negative perception of professional competence, may act as a barrier to KMC.

40. Does the level of specific competencies developed by neonatal unit nurses influence their perception of the need for/utilisation of and inclination to apply/recommend KMC?

Quality of evidence: MODERATE

Strength of recommendation: STRONG. It is recommended to promote KMC training among neonatal nurses and other healthcare professionals involved in PTNB care to facilitate its implementation.

41. Among neonatal unit nursing staff, does the perceived clinical severity of the patient influence the application of KMC?

Quality of evidence: HIGH

Strength of recommendation: STRONG. It is recommended to consider the importance of neonatal nurses' perceptions of the clinical severity of the newborn, particularly in situations where the nurse-to-patient ratio is low, as this may significantly impact KMC implementation.

42. Among parents of neonates eligible for KMC, does the perception of the patient's clinical severity improve their willingness to engage in KMC?

Quality of evidence: HIGH

Strength of recommendation: STRONG. Parents' perceptions of their newborn's clinical severity influence the frequency of KMC. Maternal health issues and caesarean delivery act as barriers to the implementation and duration of KMC.

43. Does the existence of an institutional support network facilitate the implementation of KMC?

Quality of evidence: HIGH

Strength of recommendation: STRONG. It is recommended to provide institutional support to healthcare professionals to enhance KMC implementation.

SECTION 6. EXTREME PREMATURITY AND KANGAROO MOTHER CARE

44. Is the application of KMC safe for Extremely Preterm?

Quality of evidence: LOW and EXPERT CONSENSUS

Strength of recommendation 1: STRONG. The application of KMC in Extremely Preterm is recommended as soon as possible.

Strength of recommendation 2: WEAK. It is suggested to perform KMC using a polyethylene bag to prevent hypothermia, at least during the first week of life in PTNBs. This should be tailored to each case while always maintaining skin-to-skin contact.

Introduction

3

3. INTRODUCTION

3.1. Definitions, background, and types

Kangaroo care is an evidence-based care strategy that involves placing a newborn (NB) or infant, wearing only a nappy and/or cap, in a vertical position and in direct skin-to-skin contact on the bare chest of the mother, father, or caregiver. The infant is positioned ventrally, with the head turned to one side and the arms and legs flexed.[1,2] Kangaroo positioning is part of kangaroo mother care (KMC), which is defined by the latest World Health Organisation (WHO) guidelines as early, continuous, and prolonged skin-to-skin contact between the mother (or another caregiver) and the baby; exclusive breastfeeding (EBF); and early discharge home.[3]

This Clinical Practice Guideline (CPG) focuses on the implementation of KMC.

KMC is recommended for newborns during their stay in neonatal units, with initiation as early as possible and for the longest duration and frequency feasible.[4] Most healthcare procedures and interventions can be performed while KMC is ongoing.[1]

The different modalities of KMC have been classed according to how it is applied—either continuous or intermittent—and based on the timing of its initiation, which can be immediate, early, or late.

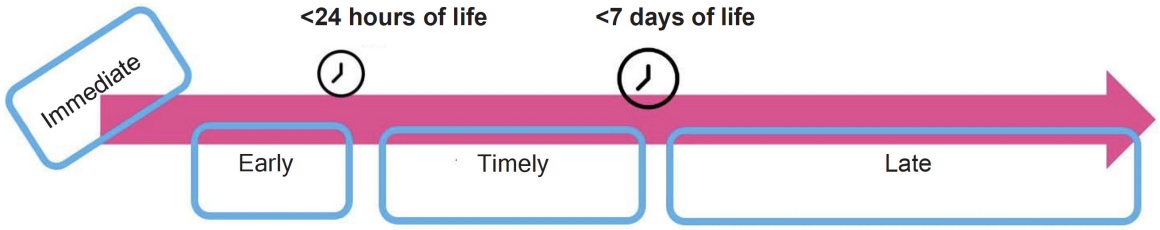
Based on its mode of application, KMC can be[4]:

- Continuous, when the infant remains hospitalised in KMC 24 hours a day, preferably with the mother, who provides nourishment.
- Intermittent, when the infant in the neonatal unit is placed in KMC with the mother, father, or caregiver for a variable duration over several days. Prolonged KMC is defined as lasting at least 8 hours per day.

According to the timing of initiation (Figure 1), KMC can be classed as[4,5]:

- Immediate: initiated within the first hour of life.
- Early: initiated within the first 24 hours of life.
- Timely: initiated within the first 7 days of life.
- Late: initiated after the first 7 days of life.

FIGURE 1. DEFINITIONS OF KMC BASED ON INITIATION TIMING.



Source: Prepared by the authors

3.2. Rationale

Despite its benefits and international recommendations, the implementation of KMC in neonatal services remains highly variable. Significant variations have been observed in the timing of initiation, eligibility criteria, duration, and frequency of KMC, as well as in the required equipment.[6] These inconsistencies may reduce the beneficial outcomes of KMC, significantly affecting the quality and safety of care provided to this population. Therefore, it is essential to have a Clinical Practice Guideline (CPG) that standardises KMC implementation practices based on scientific evidence, following a systematic development process.

3.3. Target population

This CPG is intended for the care of all preterm newborns (PTNBs) and/or low birth weight newborns (LBWNs) admitted to a neonatal unit, whether receiving basic, intermediate, or intensive care, and regardless of the architectural structure (open ward, family room, or couplet care room).

3.4. Care setting

These recommendations apply exclusively to the hospital setting.

3.5. Description of the care process

This CPG provides healthcare professionals and staff responsible for newborn care with a step-by-step guide for the correct clinical implementation of KMC. The clinical questions

addressed in this document were formulated using the PICO methodology (population, intervention, comparison, outcome).

3.6. Decision-making process

This CPG enables healthcare professionals to select an individualised care plan for each newborn receiving KMC, as well as to provide families with relevant and up-to-date information on its implementation. The recommendations are based on scientific and technical aspects of KMC application.

3.7. Clinical management development

The CPG includes a concise and user-friendly section summarising clinical recommendations based on a literature review. Additionally, for the most debated aspects of KMC, an expert panel was convened using the Delphi method to provide specific solutions and enhance decision-making in these areas.

Objectives

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4. OBJECTIVES

The objectives of this CPG are:

- To enhance healthcare professionals' knowledge of the impact of KMC, the criteria for eligible candidates, its implementation, and the training and education provided to families, by issuing recommendations and care standards.

- To equip healthcare professionals with the essential tools and care standards required for the implementation of KMC.

- To compile the most up-to-date information and recommendations based on the latest scientific evidence on KMC, with the aim of improving the quality of care provided to neonatal patients and their families.

Methods

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5. METHODS

5.1. Formation of the CPG Development Working Group

The Clinical Practice Guideline Development Working Group (CPG-DWG) was composed of the listed authors, who were selected based on their knowledge and clinical expertise in the subject matter. The methodological coordinators were Laura Collados Gómez and Isabel María Fernández Medina.

The CPG-DWG members have diverse professional backgrounds, including specialist paediatric nurses, clinical nurses with expertise in neonatology, academic nurses, and healthcare professionals involved in the care of hospitalised neonates. The review and validation process was carried out with the collaboration of healthcare professionals specialising in neonatal care, as well as members from academic and clinical institutions and associations of parents of premature infants.

5.2. Conflicts of interest

No member has declared any conflict of interest, whether financial or non-financial, professional, or related to direct family members or close associates.

5.3. Development Process Design

The methodology used to prepare this CPG followed the guidelines detailed in the Methodological Manual for the Development of Clinical Practice Guidelines of the Spanish National Health System, available at www.guiasalud.es/ (Instituto Aragonés de Ciencias de la Salud – I+CS; 2016).[6]

The main stages in the development process were:

1. Establishment of the CPG development group. The group was formed by a team of expert professionals with shared interests in the care of hospitalised neonates, particularly in KMC.

** Note: In accordance with the terminology used by the International Council of Nurses (ICN), throughout this CPG, the term 'nurse' refers to professionals of either sex.*

2. The clinical questions were formulated and prioritised following the PICO format: Population, Intervention, Comparison, and Outcome of interest.

3. A systematic literature search was conducted in the following databases: Database of Systematic Reviews (The Cochrane Library), Medline (via PubMed), CINAHL, and Scopus. The search prioritised the identification of randomised controlled trials (RCTs) and other documents synthesising scientific literature. Additionally, publications from scientific societies and organisations such as the WHO, UNICEF, and the Kangaroo Foundation were reviewed.

The search strategy employed Medical Subject Headings (MeSH) terms and natural language (Appendix 1. Documentary Language. Supplementary Material). These terms were combined using Boolean operators “AND,” “OR,” and “NOT”, applying a different search strategy for each section of this CPG.

A further targeted search for individual studies was performed to update relevant systematic reviews and address clinical questions for which no literature had been identified in the initial stage. The primary focus was on identifying RCTs and observational studies. These additional searches were conducted using specific queries in MEDLINE.

Articles were searched in both English and Spanish. The initial search began in September 2022 and was continuously updated until September 2023, ensuring the inclusion of the most impactful studies throughout the development of this CPG.

4. After identifying the relevant evidence from the literature search, working groups within the CPG-DWG were formed. Selected documents underwent peer review, and in cases of discrepancy, a third reviewer provided an additional assessment.

5. Each working group extracted information from the selected documents. Literature screening was performed independently by two researchers, following predefined inclusion and exclusion criteria. The CASPe (Critical Appraisal Skills Programme Español) tool was used for evaluating studies. For descriptive studies, the MINCIR group tool was applied. Each clinical question was addressed independently, prioritising high-quality evi-

dence and the most recent literature. A synthesis of the evidence was developed for each key question.

In cases where there was limited literature on a topic or controversy regarding a recommendation, these issues were resolved through a joint expert consultation, specifically within the CPG-DWG, using the Delphi Method in two rounds. The topics addressed using this methodology included:

- Safety of KMC in extremely preterm patients
- Exclusion criteria for performing KMC
- KMC in patients on NIMV: need for disconnection of tubing during transfer, fixation oftubing
- Transfer with a nest
- Use of a cap during KMC

The GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) system was used to assess the overall quality of the scientific evidence included in the CPG. The evidence was classed into four levels: high, moderate, low, and very low.

Additionally, the strength of recommendations was determined as either STRONG or WEAK. A strong recommendation (high confidence) indicates that most or all individuals would benefit from the recommended action. A weak recommendation (uncertainty remains) suggests that not all individuals would necessarily benefit from the recommended action.[7]

6. The CPG-DWG members participated in formulating and prioritising questions, as well as in the development and review of the first version of the CPG.

7. External reviewers contributed to the second version. Additionally, the Spanish Association of Parents of Prematurely Born Children (APREM) was consulted.

Results

6

6. CLINICAL SECTIONS

SECTION 1. IMPACT OF KANGAROO MOTHER CARE*

1. What is the impact of KMC on the morbidity and mortality of preterm newborns (PTNBs)?

A total of 32 articles identified in the literature search met the selection criteria. After removing duplicates and conducting a critical appraisal, five documents were included: one systematic review, one RCT, and three meta-analyses.

The systematic review by Conde-Agudelo et al. (21 studies, including 3,042 low birth weight newborns [LBWNs]) concluded that at six months of follow-up, KMC reduces mortality in LBWNs compared to conventional care (3.2% vs. 5.3%; RR: 0.67; 95% CI: 0.48 to 0.95; 12 trials, 2,293 infants). KMC was also associated with reductions in severe infection and nosocomial sepsis (6.6% vs. 13.1%; RR: 0.50; 95% CI: 0.36 to 0.69; 8 trials, 1,463 infants), hypothermia (RR: 0.28; 95% CI: 0.16 to 0.49; 9 trials, 989 infants), severe illness (5.3% vs. 17.8%; RR: 0.30; 95% CI: 0.14 to 0.67; one trial, 283 infants), and lower respiratory tract disease (4.6% vs. 12.5%; RR: 0.37; 95% CI: 0.15 to 0.89; one trial, 283 infants).[1]

Another clinical trial comparing early-initiated continuous KMC with late-initiated KMC in 73 relatively stable LBWNs at birth found no significant differences between the two study groups in terms of mortality, morbidity, severe infections, or hypothermia.[8]

Regarding mortality reduction, Boundy et al., in their meta-analysis including 124 studies with preterm and low birth weight newborns (LBWNs), found that KMC was associated with a 23% lower mortality rate. In LBWNs, a statistically significant reduction of up to 36% was observed. However, when neonates of all birth weights were considered, the

** Methodological note: This section evaluates the effect of KMC on two outcomes: mortality and morbidity. The strength of recommendation is marked as 'not applicable', as the response is not a recommendation but rather a statement confirming that the evidence demonstrates that KMC reduces morbidity and mortality. However, it is important to consider that the evidence is heterogeneous due to variations in socioeconomic contexts, baseline mortality rates, and differences in KMC intervention protocols across studies (timing of initiation, duration, continuous vs. intermittent kangaroo positioning, and setting of administration).*

reduction in mortality was not as significant.[2] Nevertheless, Guo, in a meta-analysis including 24 trials with 19,980 participants—10,354 who received KMC and 9,626 controls under conventional care—reported that KMC in PTNBs with low birth weight significantly reduces both shortterm mortality (OR: 0.72; 95% CI: 0.59 to 0.87) and long-term mortality (OR: -1.43; 95% CI: -2.88 to 0.02).[9] A meta-analysis by Sivanandan and Sankar, which included 31 RCTs and a total sample of 15,559 preterm and LBWNs, found that KMC not only reduces mortality compared to conventional incubator care (RR: 0.68; 95% CI: 0.53 to 0.86), but that its early initiation provides greater benefits than late initiation (RR: 0.85; 95% CI: 0.76 to 0.96).[5]

Quality of evidence: **HIGH**
Summary: not applicable.

2. Is KMC effective in reducing healthcare-associated infections in PTNBs?

The literature search identified a total of 12 articles that met the selection criteria. After removing duplicates and conducting a critical appraisal, three documents were included: one systematic review, one meta-analysis, and one systematic review with meta-analysis.

Nosocomial sepsis, particularly in PTNBs, remains a serious issue with high mortality rates. Conde-Agudelo and Díaz-Rossello reported that KMC is associated with a reduction in healthcare-associated infections and sepsis (4.0% vs. 11.4%; RR: 0.35; 95% CI: 0.22 to 0.54).[1] A study by Boundy et al. found that KMC is associated with a lower risk of sepsis (RR: 0.53; 95% CI: 0.34 to 0.83), but not with a reduction in methicillin-resistant Staphylococcus aureus (MRSA) infections or necrotising enterocolitis.[2]

KMC prevents nosocomial infections through various mechanisms. Skin-to-skin contact promotes colonisation of the neonate's skin with the mother's non-pathogenic flora, which may displace multidrug-resistant pathogenic flora in the newborn. It also reduces the duration of contact with neonatal unit healthcare personnel. Additionally, skin-to-skin contact enhances the skin's barrier function and helps maintain thermogenesis in PTNBs, which is another significant risk factor for infection. Moreover, when KMC is performed for more

than three hours, there is a significantly lower incidence of nosocomial sepsis (1/22 vs. 10/30; OR: 10.50; 95% CI: 1.23 to 89.67). The most critical factors identified for health-care-associated infections were the duration of parenteral nutrition—where a longer duration increases the likelihood of sepsis—and prolonged daily KMC as a protective factor ($p = 0.002$).[10]

Quality of evidence: **HIGH**
Summary: KMC is effective in reducing healthcare-associated infections and sepsis in PTNBs.

3. Does KMC reduce hospital stay and the likelihood of readmission in PTNBs?
The literature search identified 21 studies that met the inclusion criteria. After removing duplicates and conducting a critical appraisal, four documents were included: two metaanalyses, one RCT, and one systematic review with meta-analysis.

Previous studies have reported a lower risk of developing sepsis, which could be associated with a shorter hospital stay. Although a statistically significant reduction in hospital stay could not be demonstrated in all cases, there was a 58% reduction in the probability of hospital readmission (95% CI: 0.23 to 0.76). This may be because KMC could reduce comorbidities associated with prematurity itself, which would explain the decrease in readmission rates.[2] The meta-analysis conducted by Narciso, Beleza, and Imoto, which analysed 20 studies including 816 PTNBs, identified a statistically significant reduction in hospital stay in the KMC group compared to the conventional care group (MD: -1.75; 95% CI: -3.22 to -0.28). The duration of hospital stay varied from 3 days, 5 hours, and 16 minutes to 6 hours and 43 minutes, with a mean stay of 1 day and 18 hours less in the KMC group compared to conventional care.[11] The study by Boundy et al. showed that early KMC was associated with a statistically significant reduction in hospital stay duration (MD: 0.9 days; 95% CI: 0.6 to 1.2).[2]

Similar findings were reported in other studies, where early KMC was associated with a statistically significant reduction in hospital stay compared to late KMC (6.68 days vs. 7.58 days; 95% CI: 3.01 to 1.19). Additionally, in the early KMC group, 27% more cases were discharged within 7 days compared to the late KMC group.[8]

However, other studies have not found statistically significant differences in hospital stay duration or readmission rates in LBWN who received KMC compared to those who received only conventional care ($p < 0.05$).[12]

Quality of evidence: **MODERATE**
Summary: KMC appears to be effective in reducing hospital stay and readmission rates in PTNBs.

4. Does KMC improve apnoea, heart rate, temperature, respiratory rate, and oxygen saturation compared to incubator care?

The literature search identified 41 studies, which underwent a critical appraisal. Following this process, ten documents were included: three meta-analyses, six RCTs, and one retrospective study.

Several studies have examined the effects of KMC on physiological parameters, including apnoea, heart rate (HR), temperature, respiratory rate (RR), and oxygen saturation (SpO_2). The meta-analysis conducted by Cristóbal Cañadas et al. showed that the mean HR of PTNBs receiving KMC was higher than that of neonates receiving conventional care (372 neonates evaluated across eight independent studies). However, the difference between groups was not statistically significant (MD: 0.47 beats per minute; 95% CI: -1.94 to 2.88). Regarding RR, statistically significant differences were found in PTNBs undergoing KMC (419 infants evaluated in seven studies) (MD: -3.50; 95% CI: -5.17 to -1.83).[13]

Özdel and Sarı (2020) compared prone positioning and KMC positioning in PTNBs during enteral feeding via a feeding tube. Their findings indicated that PTNBs fed in the KMC position had a lower HR and a higher level of comfort after feeding. These positive effects help reduce energy expenditure, leading to a decrease in HR and an increase in sleep duration. Additionally, by reducing hypothermia, KMC contributes to haemodynamic stabilisation.[14]

KMC has been suggested as a protective mechanism against apnoea episodes. The meta-analysis by Montealegre-Pomar et al., which included 43 RCTs and one quasiex-

perimental study with a total sample of 416 neonates (including PTNBs, LBWNs, and full-term newborns), found that KMC was associated with a reduction in apnoea episodes (RR: 0.41; 95% CI: 0.22 to 0.78). This protective effect may be linked to the prone positioning of the newborn during KMC, which is associated with improved ventilatory mechanics and a potential reduction in the incidence of apnoea. Another possible advantage is that the newborn receives continuous multisensory stimulation (vestibular through the mother's chest movements, tactile through direct skin-to-skin contact, as well as olfactory, auditory, visual, and proprioceptive stimuli) throughout the technique.[15] The results of this study align with similar findings. The RCT conducted by Jayaraman et al. concluded that PTNBs undergoing KMC experienced fewer episodes of apnoea, with a stronger association observed when KMC was initiated early compared to late initiation (11.9% vs. 20%, p = 0.027).[16]

In the retrospective study by Xie et al., which included 145 PTNBs weighing less than 1000 grams and receiving invasive mechanical ventilation (IMV), apnoea frequency during hospital stay was lower in those who underwent KMC (23 vs. 20 episodes). In a multivariate analysis, KMC reduced apnoea duration (β: -5.88; 95% CI: -8.56 to -3.21).[17] Similarly, the meta-analysis by Boundy et al. indicated that KMC was associated with a non-statistically significant reduction in the risk of apnoea in six studies involving LBWN weighing less than 2000 grams (RR: 0.39; 95% CI: 0.13 to 1.14). Newborns receiving KMC had a slower RR by 3 breaths per minute (n = 12; 95% CI: -5.15 to -1.19) and a 0.9% higher SpO_2 than controls (n = 14; 95% CI: 0.35 to 1.45). However, KMC had no significant effect on mean HR (n = 15; MD: 0.41 beats per minute; 95% CI: -2.25 to 1.42).[2]

Regarding temperature, the same author demonstrated that KMC effectively maintained normothermia, reducing the incidence of both hyperthermia and hypothermia compared to conventional incubator care.[2] KMC was associated with a 78% lower risk of hypothermia (n = 9; 95% CI: 0.12 to 0.41) and a 23% lower risk of hyperthermia (n = 3; 95% CI: 0.59 to 1.01).[2]

Similarly, El-Farrash et al. reported that temperature was significantly higher in neonates who received KMC for 120 minutes compared to those in the 60-minute KMC group ($p < 0.05$) and that the incidence of hypothermia was lower during KMC.[18]

The mean body temperature of infants (523 PTNBs from 10 studies) was 0.05ºC higher in those receiving conventional care compared to those in KMC (95% CI: -0.07 to 0.16).[13] Linnér et al. studied 55 infants born at 32 weeks' gestational age (GA) with a birth weight of 1,760 grams, estimating that the mean body temperature in the KMC group was 0.3ºC lower one hour after birth (36.3ºC vs. 36.6ºC). However, these results should be interpreted with caution due to the small sample size of the included studies.[10] Findings from other studies, such as Sehgal et al., recorded a non-significant increase in axillary temperature during KMC, rising from 36.7ºC to 36.9ºC. This effect was attributed to improved neonatal cardiocirculatory function, without specifying whether there is a risk of hyperthermia during the process.[19]

Quality of evidence: **HIGH**
Summary: KMC stabilises HR, RR, SpO_2, and temperature, contributing to the stabilisation and improvement of cardiorespiratory function in PTNBs.

5. Is KMC beneficial for the neurodevelopment of PTNBs compared to incubator care?

The literature search identified 19 articles that met the selection criteria. After a critical appraisal and removal of duplicates, five articles were included: two RCTs, one systematic review with meta-analysis, and one cohort study.

The continued use of KMC provides medium- to long-term benefits that influence cognitive function, academic performance, and developmental outcomes ($p = 0.004$), improving the assessed parameters related to these aspects. KMC is considered a safe intervention with a positive impact on neurodevelopment, acting as a counterbalance to the negative stimuli experienced by PTNBs in NICUs. KMC may promote or protect brain structural development and synaptic efficiency by reducing maternal and infant stress, regulating physiological parameters, and stabilising the sleep-wake cycle.[20]

The total duration of KMC sessions also plays a role in neurodevelopmental improvement. In a study led by El-Farrash et al., an increase in neurobehavioural performance at 37 weeks of corrected age was observed in infants who received longer KMC sessions.

Newborns who underwent 60 or 120 minutes of KMC per day scored higher than the control group in attention, arousal, regulation, non-optimal reflexes, and movement quality and lower in handling, excitability, and lethargy on the Neonatal Intensive Care Unit Network Neurobehavioral Scale (NNNS) ($p < 0.05$). Salivary cortisol levels decreased in both KMC groups compared to the control group after seven days ($p < 0.05$). However, SpO_2 and temperature improvements were more pronounced in the 120-minute KMC group compared to the 60-minute group ($p < 0.05$), which explains the better neurobehavioural performance in the group with longer KMC sessions.[18]

Similarly, studies have shown that KMC induces structural changes in the brain, including variations in total grey matter volume, basal nuclei, cerebellum, and white matter organisation, which are linked to IQ, attention problems, memory, fine and gross motor skills, and coordination.[21]

A study by Charpak et al., which evaluated the academic performance and social adaptation of two groups of PTNBs 20 years later—one that had received KMC and another that had received conventional care—demonstrated that infants who underwent KMC scored higher in intellectual performance ($p = 0.009$), family adaptation ($p = 0.00014$), and social integration, exhibiting lower hyperactivity, aggression, and socially deviant behaviour.[22]

In a cohort study involving 144 infants weighing less than 2000 grams, a comparison was made between a group that received early (before 72 hours) and continuous (more than 8 hours per day) KMC and a control group that did not meet these KMC criteria. At 12 months of corrected gestational age, assessments were conducted using the Bayley Scales of Infant and Toddler Development, Third Edition (BSID-III). The results showed improvements in cognitive domain (110.38 ± 9.89 vs. 105.44 ± 8.77, $p = 0.023$), language domain (107.51 ± 10.72 vs. 101.05 ± 12.06, $p = 0.014$) and adaptive behaviour domain (87.97 ± 9.97 vs. 80 ± 9.1, $p < 0.001$).[23]

Quality of evidence: **HIGH**

Summary: KMC promotes neurocognitive development in preterm newborns compared to conventional incubator care.

6. Does KMC improve cerebral oxygenation in PTNBs compared to standard care?

Six documents identified in the literature search were included: two RCTs, one prospective observational study, one pilot study, and one systematic review.

Recent studies have focused on analysing the potential benefits of KMC on cerebral oxygenation. Lorenz et al. reported a significant increase in regional cerebral oxygen saturation ($rScO_2$) during KMC (74.8% ± 4.6%) compared to incubator care (73.6% ± 6.0%).[24] In a similar study, Meder et al. also found a significant increase in $rScO_2$ during KMC compared to baseline values in the incubator (77.72% ± 3.5% vs. 76.87% ± 2.97%; p = 0.01).[25]

However, other studies only showed non-significant increases in $rScO_2$, suggesting that the slight improvement observed during KMC might be associated with quiet sleep. Nevertheless, no concomitant amplitude-integrated electroencephalography (aEEG) recordings were performed, so further research is needed to confirm this hypothesis. Few studies have examined tissue oxygen extraction ratio (TOER), showing that TOER remained within the normal range and stable but without differences between KMC and incubator care, regardless of respiratory support.[26, 27]

In the study by Bembich et al., cortical activity was assessed using near-infrared spectroscopy (NIRS) in a sample of 15 PTNBs between 30 and 36 weeks of postmenstrual age (PMA), with 53 monitored KMC sessions. The findings showed that at 15 minutes of KMC, there was a bilateral increase in oxyhaemoglobin but also in deoxyhaemoglobin in the frontal, motor, and primary somatosensory areas; and at 30 minutes of KMC, increased cortical activity was identified in the right motor area and somatosensory cortex, with a rise in oxyhaemoglobin deoxyhaemoglobin returned to baseline levels.[28]

Given these findings, further research is needed to assess both cerebral electrical activity and oxygenation during KMC. Improved oxygenation in the prone position during KMC could be a contributing factor to KMC-related neurodevelopmental benefits.

Quality of evidence: **MODERATE**
Summary: Stable preterm newborns, regardless of respiratory support, maintain stable $rScO_2$ during KMC, with a slight upward trend.

7. What is the impact of KMC on preventing intraventricular haemorrhage in PTNBs?

The five studies identified in the literature review were included: two prospective observational studies and two RCTs.

In a prospective study by Sehgal et al., involving 40 ventilated PTNBs with a mean gestational age (GA) of 30.5 weeks and a mean birth weight of 1,378 grams, echocardiography and transfontanellar ultrasound were performed before KMC and again 30 minutes after. The findings showed: increased stroke volume in both ventricles, decreased pulmonary resistance, leading to improved cardiorespiratory function and increased inferior vena cava (IVC) flow (0.81 vs. 0.74; $p = 0.0001$), which is closelylinked to better cerebral blood flow. This finding is significant because low cerebral blood flow during the first 48 hours of life has been associated with the development of severe intracranial haemorrhages in PTNBs. Although cerebral oxygen supply was not directly measured, increased cerebral blood flow may enhance organ and tissue perfusion/oxygenation.[19]

Consistent with these findings, Chaudhari et al., in a study of 40 PTNBs born at 33 weeks' gestational age (GA), demonstrated that mean cerebral blood flow velocity increased after KMC (peak systolic velocity: $p = 0.03$; end-diastolic velocity: $p < 0.001$; mean velocity: $p < 0.001$), and these values remained elevated 60 minutes after KMC ended.[29] These results were corroborated by Nanavati and Prashanth, who studied 40 neonates born at 33 GA and concluded that KMC improves cerebral haemodynamics in clinically stable preterm neonates.[30]

In another observational analytical study, including 40 PTNBs with a mean GA of 31.91 weeks and a mean birth weight of 1,432.75 grams, cerebral blood flow was measured using Doppler ultrasound of the middle cerebral artery at 2 hours and 24 hours after the first KMC session. The study found a statistically significant decrease in pulsatility index and resistive index values, shifting from the 90th to the 50th percentile of normative values. The mean difference was 0.22 (95% CI: 0.02 to 0.43) for the pulsatility index and 0.05 (99% CI: 0.02 to 0.07) for the resistive index after the first KMC session. At 24 hours post-KMC initiation, there was a significant increase in peak systolic velocity, end-diastolic velocity, and mean velocity when comparing pre-KMC values with those on the second day before KMC. However, pulsatility and resistive index values were not significantly different. These findings suggest that cerebral blood flow in preterm infants tends to optimise after KMC initiation, a mechanism that could potentially prevent intraventricular haemorrhage and periventricular leukomalacia.[31]

Quality of evidence: **LOW**
Summary: KMC may be beneficial for cerebral oximetry and the prevention of intraventricular haemorrhage in PTNBs.

8. What is the impact of KMC on sleep in PTNBs?

The literature search identified seven studies. After a critical appraisal, five studies were included: two RCTs, one systematic review, one clinical guideline, and one prospective randomised trial.

The organisation of sleep and wake states is closely related to brain maturation. KMC has been shown to improve sleep organisation by increasing the amount of quiet sleep, improving sleep cycles, and reducing the number of awakenings. In PTNBs, sleep cycles generally require 60 minutes to complete, and the cycle begins within the first five minutes of KMC initiation, whereas this rarely occurs as quickly in an incubator. Therefore, each KMC session should last at least 65 minutes to allow the newborn to complete at least one full sleep cycle. All sleep behaviour changes observed during KMC are analogous to mature brain function, even after only two to three one-hour sessions, as two to three completed sleep cycles are needed within this period.[32] Well-defined sleep cycles improve PTNBs oxygenation, which is more stable during active and quiet sleep in ventilated

PTNBs. However, indeterminate sleep and awakenings are associated with hypoxaemia episodes and increased apnoea episodes in PTNBs with spontaneous breathing.[33]

Bastani et al. demonstrated that KMC increases the time PTNBs spend in deep sleep ($p < 0.001$) and quiet wakefulness ($p = 0.004$) while reducing light sleep or drowsiness ($p < 0.001$) and active wakefulness ($p = 0.02$) compared to simply being held in their mother's arms. However, no significant differences were found regarding crying.[34]

Another systematic review found that PTNBs who received KMC spent more time in quiet sleep. Additionally, they spent more time in an inactive wakeful state ($p = 0.0001$) and less time in a drowsy or crying state compared to controls ($p = 0.000$). Sleep-wake state organisation was also better in PTNBs receiving KMC.[35]

A single-blind prospective RCT conducted in PTNBs born at 31–33 weeks GA evaluated electroencephalographic activity and neurobehaviour during KMC. The study found that the percentage of mature sleep-wake cycles was significantly higher in the KMC group on day 7 ($p = 0.034$) and day 14 ($p = 0.039$). Additionally, neurobehavioural performance was also higher in the KMC group on day 7 and day 14 ($p < 0.001$ for both comparisons).[36]

Quality of evidence: **MODERATE**
Summary: The effectiveness of KMC is greater during sleep, as it improves sleep cycles and reduces the number of awakenings, thereby enhancing oxygenation in preterm newborns.

9. What effect does KMC have on pain reduction during a painful procedure compared to other non-pharmacological measures in PTNBs?

The literature search identified a total of 18 studies. After removing duplicates and conducting a critical appraisal, six studies were included: two systematic reviews, two meta-analyses, one clinical guideline, and one RCT.

PTNBs admitted to the Neonatal Intensive Care Unit (NICU) undergo multiple painful procedures, the most common being heel lance, venepuncture, intramuscular injection, endotracheal intubation, and lumbar puncture.[37] Untreated pain has adverse effects, leading to immediate haemodynamic instability and potentially affecting neurodevelopment, which may result in cognitive delays and behavioural problems.[38] KMC provides multisensory stimulation (tactile, auditory, and olfactory), which inhibits nociceptive signals in the spinothalamic pathways. Additionally, oxytocin release induced by KMC appears to play a role in pain modulation.[39]

A Cochrane systematic review, including 25 studies (n = 2,001) with term and preterm neonates, assessed the effect of KMC on pain from invasive procedures or compared it to no intervention, sucrose, or other interventions. The findings showed:Reduction in mean HR during the painful procedure in the KMC group (MD: -10.78; 95% CI: -13.63 to -7.93; 5 RCTs, 161 neonates); Reduction in crying duration during heel lance by 34.16 seconds in KMC (95% CI: -42.86 to -25.45; 2 RCTs; 33 neonates); Difference in SpO_2 30 seconds after the painful procedure in KMC by 1.73 (95% CI: -0.53 to 3.99; 2 RCTs; 101 neonates); Reduction in mean pain score measured using the Premature Infant Pain (PIPP) at 30 seconds post-procedure by 3.2 seconds in KMC (95% CI: -3.94 to -2.47; 5 RCTs, 268 neonates).[37]

Similarly, in the systematic review by Zhao et al., which included 12 studies with 1,172 neonates (585 [49.9%] in the KMC group and 587 [50.1%] in the control group), the meta-analysis found that HR during invasive procedures was significantly lower in KMC compared to other interventions (MD: -6.77; 95% CI: -13.03 to -0.50). However, when compared to other non-pharmacological interventions, there was no statistically significant difference in overall pain assessment (MD: -0.36; 95% CI: -0.80 to 0.08).[40]

The meta-analysis by Wang et al., which included 30 studies with 2,311 PTNBs (1,153 in the KMC group and 1,158 in the control group), compared KMC with standard care. The findings concluded that: 15 and 30 minutes of KMC had a moderate effect on pain relief in PTNBs (15 minutes: MD: -0.76; 95% CI: -1.02 to -0.50; 30 minutes: MD: -0.70; 95% CI: -0.93 to -0.48); KMC had no effect in very preterm infants (MD: -0.20; 95% CI: -0.47 to 0.07) but had a significant effect in PTNBs older than 32 weeks (MD: -0.74; 95%

CI: -0.90 to -0.58); KMC had a moderate effect on pain relief immediately after the procedure (MD: -0.66; 95% CI: -0.85 to -0.46) and at 30 and 60 seconds post-procedure (30 s: -0.66; 95% CI: -0.97 to -0.35; 60 s: MD: -0.70; 95% CI: -0.89 to -0.51); However, KMC had no effect on pain at 120 seconds post-procedure (MD: -0.18; 95% CI: -0.52 to 0.16).[41]

Finally, the meta-analysis by Sharma and Ruikar, which included six studies, assessed the effect of KMC on procedural pain in neonates receiving KMC compared to those receiving standard care. The analysis found a statistically significant reduction in pain in the KMC group post-procedure (MD: -2.04; 95% CI: -3.65 to -0.43).[42]

However, not only painful procedures should be considered. Even a procedure that is not inherently painful, such as a nappy change, can be stressful for PTNBs. Performing these procedures in skin-to-skin contact can significantly reduce stress levels.[43]

Quality of evidence: **HIGH**
Summary: KMC in PTNBs, compared to conventional incubator care or other nonpharmacological measures, reduces pain during invasive and/or painful procedures.

10. How does parental involvement influence pain management in PTNBs?
The literature search identified two articles: a randomised crossover study and a systematic review.

Evidence suggests that when parents are involved in pain management, PTNBs experience less pain. Additionally, many parents express a desire to participate in managing their child's pain. Kristoffersen et al. evaluated pain reduction during retinopathy of prematurity (ROP) screening in PTNBs under 32 weeks of gestation, comparing KMC versus standard care with parental involvement. Pain was assessed using the Premature Infant Pain Profile (PIPP). While no statistically significant differences were observed between the groups during screening, active parental participation had a pain-reducing effect compared to previous studies.[44]

Eissler et al. conducted a systematic review including 1,265 neonates born between 24 and 37 weeks of gestation, who underwent various painful procedures performed by different healthcare professionals. In these procedures, parents were present and actively involved in pain reduction. The study confirmed that KMC, parental-provided containment, and non-nutritive breast suckling were effective pain relief measures. Therefore, when parents are present, they should be encouraged to participate actively and voluntarily in their child's pain management.[45]

Quality of evidence: **MODERATE**
Summary: Parental involvement as active caregivers during painful procedures reduces the intensity of pain expression in PTNBs.

11. Is KMC alone or KMC combined with sucrose more effective in reducing procedural pain in PTNBs?

The literature search identified 12 studies. After a critical appraisal, five studies were included: two systematic reviews, two RCTs, and one clinical guideline.

Non-pharmacological interventions such as KMC, breastfeeding, containment, parental involvement, music therapy, and non-nutritive suckling are recognised as effective pain management strategies for painful procedures, with greater benefits observed when multiple interventions are combined.[36,38,44] Campbell-Yeo et al. conducted an RCT with 242 PTNBs born between 27+1 and 36+5 weeks of gestation, randomising them into three groups: KMC and water, KMC and 24% sucrose, or 24% sucrose alone before all routine painful procedures. Pain intensity was measured during three medically indicated heel pricks throughout hospitalisation using the Premature Infant Pain Profile (PIPP) scale. No additional benefit was observed when combining interventions, as shown by the mean PIPP scores at 30, 60, and 90 seconds after the first procedure: 5.76 (2.73) at 30 seconds; 5.93 (2.83) at 60 seconds; 5.89 (2.48) at 90 seconds. These differences were not statistically significant ($p = 0.234$).[39]

In another RCT, the effects of KMC and oral sucrose on pain relief during heel lance were compared in 64 infants born between 32 and 37 weeks. The PIPP scores were lower in the KMC group than in the sucrose group two minutes after the heel lance ($p < 0.001$). A

statistically significant difference was observed in PIPP score changes during and after the procedure (p = 0.002) between the oral sucrose and KMC groups, indicating the superiority of KMC.[46]

Quality of evidence: **HIGH**
Summary: KMC combined with sucrose did not provide greater pain reduction than KMC alone during heel lance in PTNBs.

12. Is KMC beneficial for the initiation and maintenance of breastfeeding in PTNBs?
The literature search identified 18 eligible studies. After removing duplicates and conducting a critical appraisal, seven studies were included: two systematic reviews, two meta-analyses, and three RCTs.

Breast milk is the most natural and optimal source of nutrition for newborns. However, for PTNBs, breastfeeding can be a challenge that requires active promotion. Boundy et al., in a meta-analysis, found that KMC increased the likelihood of exclusive EBF at hospital discharge by 50% (n = 13; 95% CI: 1.26 to 1.78) and that this increase persisted at follow-up between 1 and 4 months (n = 13; 95% CI: 1.26 to 1.78).[2]

In a review of 8 RCTs with PTNBs and LBWNs, Mekonnen et al. estimated that the mean time to initiate EBF was 2.6 days earlier in infants receiving KMC compared to those receiving conventional care (95% CI: 1.23 to 3.96).[47] Conde-Agudelo and Díaz-Rossello concluded that KMC increases EBF rates at discharge or at 40–41 weeks of corrected postmenstrual age (67.4% vs. 56.8%; RR: 1.21; 95% CI: 1.08 to 1.36; 4 studies, 1,197 mothers) and at follow-up between 1 and 3 months (86.9% vs. 76.5%; RR: 1.20; 95% CI: 1.01 to 1.43; 5 studies, 600 mothers).[1]

Regarding different KMC initiation times, Jayaraman et al. studied 60 neonates born after 28 weeks of gestation and found that early KMC (initiated within the first 4 days) significantly improved exclusive human milk feeding (86% vs. 45%; p < 0.001) and direct breastfeeding (49% vs. 30%; p = 0.021), with these benefits continuing after discharge (73% vs. 36%; p < 0.001).[16] These findings were supported by the 2023 meta-analysis by Sivanandan et al., which reported that early KMC (before 24 hours of life) increased the li-

kelihood of EBF by 1.12 times compared to KMC initiated after 24 hours.[5] Regarding KMC duration, a study by Pavlyshyn et al., involving 52 PTNBs, found that a longer duration of KMC (>3 hours per day) was associated with higher breastfeeding rates at discharge compared to shorter KMC sessions (OR = 3.70; 95% CI: 1.16 to 11.86).[48]

Another trial investigating the effect of KMC duration on breastfeeding rates in 120 PTNBs concluded that longer KMC sessions in stable PTNBs shorten the time to full enteral feeding and improve breastfeeding success ($p < 0.001$).[18]

Quality of evidence: **HIGH**
Summary: KMC is beneficial for the initiation and maintenance of breastfeeding in PTNBs.

13. What is the impact of KMC on feeding patterns and growth in PTNBs?
The literature search identified 17 studies. After a critical appraisal, five studies were included: one longitudinal study, one prospective cohort study, two meta-analyses, and one systematic review.

In a randomised controlled longitudinal study involving 79 mother-PTNB dyads, Wang et al. compared KMC and standard care. Several benefits were observed in the KMC group: Higher EBF rates at 6 months of corrected age (OR: 14.6; 95% CI: 3.5 to 60.9); Significant weight and length gains by hospital discharge; Greater increases in weight, length, and head circumference in follow-up assessments.[49]

Similar findings were reported in other studies: KMC promoted weight gain, length growth, and head circumference increase: Weight gain (MD: 4.1 g/day; 95% CI: 2.3 to 5.9; 11 trials, 1,198 infants); Length increase (MD: 0.21 cm/week; 95% CI: 0.03 to 0.38; 3 trials, 377 infants); Head circumference growth (MD: 0.14 cm/week; 95% CI: 0.06 to 0.22; 4 trials, 495 infants).[1]

A systematic review with meta-analysis, including 1,368 articles and 743 PTNBs receiving KMC, concluded that PTNBs who underwent KMC for at least 6 hours/day gained more weight than controls, with a mean difference of 8.99 grams/day (95% CI: 8.14 to 9.84).

However, in PTNBs receiving KMC for two hours or less per day, no statistically significant differences were observed (1.16 g/day; 95% CI: -0.19 to 2.51). No statistically significant differences were found in PTNBs weighing less than 1,500 grams. Regarding length growth, PTNBs who received KMC for at least 6 hours per day gained 0.29 cm more per week (95% CI: 0.15 to 0.43). They also showed greater head circumference growth, with a difference of 0.27 cm per week (95% CI: 0.23 to 0.31).[50]

In addition to improved weight gain, feeding during KMC was associated with a reduction in 2-hour postprandial gastric residual volume compared to the supine position in an incubator (0.9 ml ± 1.6 vs. 2.0 ml ± 2.3; $p < 0.001$) and greater feeding comfort, evidenced by a decrease in HR and reduced stress.[14,51] In a prospective cohort study, Pandya et al. compared 96 neonates ≤34 weeks' GA and ≤1,250 grams at birth who were exposed to KMC during the first week of life with 96 neonates from an earlier period when KMC was only introduced after achieving exclusive enteral nutrition (EEN), haemodynamic stability, and no oxygen requirement. The study found that in the group exposed to KMC within the first week of life: Time to achieve EEN was shorter (9 days vs. 12.5 days; $p < 0.001$); Total parenteral nutrition (TPN) duration was reduced (MD: 3.72 days; 95% CI: 2.03 to 5.41); Fewer neonates experienced feeding intolerance episodes (74% vs. 54%; OR: 0.42; 95% CI: 0.22 to 0.76); Higher weight at discharge.[52] These findings align with the review by Heller et al., which reported that early KMC was associated with higher EBF rates at discharge (OR: 1.69; 95% CI: 1.11 to 2.58).[53]

Quality of evidence: **HIGH**

Summary 1: KMC, when performed for at least 6 hours per day, is associated with higher exclusive breastfeeding rates and greater weight, length, and head circumference gains.

Summary 2: Early KMC (before the first week of life) is associated with a shorter time to achieve exclusive enteral nutrition (EEN), reduced duration of total parenteral nutrition (TPN), and improved feeding tolerance.

14. Does KMC promote family bonding and attachment between PTNBs and their family?

The literature review identified four articles, all of which were included: two RCTs and two systematic reviews.

The study by Cho et al. found that KMC improves attachment ($F = 25.881$; $p < 0.001$) and reduces maternal stress ($F = 47.320$; $p < 0.001$) compared to conventional incubator care.54 This suggests better family adaptation to the care of a PTNB. Other studies have confirmed improved maternal attachment in PTNBs undergoing KMC ($p < 0.05$).[55]

KMC contributes to the humanisation of neonatal care and strengthens emotional bonds between mother and child across low- and high-income countries, diverse contexts, and cultures.

Similar findings were reported in the systematic review by Gupta et al., which reviewed 30 studies assessing early KMC, including eight focusing on PTNBs or ill neonates of various gestational ages. The review concluded that early KMC (at least 60 minutes per day) has a positive influence on mother-infant interaction and, consequently, on attachment bonding.[56] A core principle of attachment theory is the relationship between parental responsiveness to a child's attachment behaviours and the quality of attachment. The review by Norholt concluded that KMC increases maternal responsiveness and places the mother-infant dyad on a more positive relational trajectory. Early maternal tactile contact is a fundamental component in the development of attachment and a healthy mother-child relationship.[57]

Quality of evidence: **MODERATE**

Summary: KMC promotes family bonding and attachment between PTNBs and their families.

15. What effect does KMC have on parental health?

The literature search identified 20 articles, and after a critical appraisal, five RCTs, one qualitative study, one systematic review, and one systematic review with meta-analysis were included.

Maternal anxiety, depression, and stress are common among mothers of PTNBs during the postnatal period. A systematic review by Gadapani Pathak et al., which included 30 studies (24 focusing solely on mothers and 6 on both mothers and fathers) with 7,719 PTNBs, found that KMC reduces the risk of postpartum depressive symptoms (RR: 0.76; 95% CI: 0.59 to 0.96), maternal stress scores (SMD: -0.82; 95% CI: -1.32 to -0.32), and maternal anxiety (SMD: -0.62; 95% CI: -1.01 to -0.23). It also increases attachment and bonding scores (SMD: 1.19; 95% CI: 0.27 to 2.10).[58]

The study by Rao et al. determined that early KMC can reduce maternal stress, anxiety, and depression levels.[59] Additionally, other studies have concluded that early PTNBparent interaction significantly reduces the risk of postpartum depression.[60] Skin-to-skin contact during KMC triggers oxytocin release, which acts both at the peripheral level in the CNS (promoting uterine contractions during labour and milk ejection during breastfeeding) and at the central level, where it is associated with sexual and reproductive responses. Oxytocin is an antagonist of adrenaline, which is responsible for initiating 'fight or flight' mechanisms linked to stress, anxiety, aggression, and cardiovascular activation, stimulating the sympathetic nervous system and the release of catecholamines, including epinephrine. As a result, oxytocin regulates processes related to calmness, socialisation, and connection, encouraging maternal behaviours that strengthen bonding with the newborn.[61]

KMC also helps parents feel more relaxed, comfortable, and content, reducing feelings of guilt and facilitating maternal emotional adjustment to premature birth.[54]

An RCT involving 126 mothers of PTNBs admitted to the NICU demonstrated that scores for coercion factors, interpersonal relationships, depression, anxiety, hostility, and additional stress-related factors were lower in the KMC group than in the control group ($p < 0.05$). Regarding sleep quality, factors such as night-time awakenings, total sleep

duration, overall sleep quality, daytime mood, and daytime physical functioning were also significantly lower in the KMC group compared to the control group ($p < 0.05$).[62]

There is limited evidence evaluating the impact of KMC on fathers. However, a qualitative exploratory study on fathers of PTNBs found that KMC enables a positive psychological connection with their baby ('Embracing father-infant Kangaroo Care') and helps them develop caregiving skills.[63]

Quality of evidence: **HIGH**
Summary: KMC reduces maternal anxiety, depression, and stress while improving attachment and sleep quality in mothers.

SECTION 2. CANDIDATES FOR KANGAROO MOTHER CARE

One of the areas with the greatest variability in KMC practice concerns which PTNBs are eligible for KMC, or more precisely, which PTNBs should not undergo KMC. A review of the available studies applied the following exclusion criteria for KMC in the study population:

1. Extremely Preterm
2. Presence of a central vascular catheter
3. Newborn receiving vasoactive drugs
4. Newborn on invasive mechanical ventilation

Additionally, a descriptive study conducted among neonatal nurses in Spain regarding KMC practice identified the most common exclusion criteria as: haemodynamic instability; High-Frequency Oscillatory Ventilation (HFOV); immediate postoperative period; umbilical catheter, and invasive mechanical ventilation (IMV).[64]

Given these discrepancies, a Delphi consensus was conducted among the GEDC authors, leading to the agreement that KMC is contraindicated in the following situations:

- Presence of an umbilical catheter placed within one hour before KMC initiation

- High-frequency mechanical ventilation
- Inability to tolerate handling, i.e., haemodynamic or respiratory instability during manipulations requiring recovery manoeuvres for more than 15 minutes

The following conditions are not considered contraindications for KMC, though each case should be individually assessed:

- Extremely Preterm (< 28 weeks)
- Presence of an umbilical venous catheter
- Presence of an umbilical arterial catheter
- Invasive mechanical ventilation
- Requirement for inhaled nitric oxide therapy
- Need for FiO_2 > 0.6 with invasive mechanical ventilation
- Need for FiO_2 > 0.6 with any type of ventilation (invasive or non-invasive)
- Requirement for vasoactive drugs > 5 mcg/kg/min
- Severe parental anxiety or depression
- Extremely immature and fragile skin
- High-activity macroenvironment (excessive noise, light, or unavoidable staff movement)

Due to the limited evidence on this topic, the following recommendations are made with caution. Each case should be evaluated individually, weighing the risk-benefit ratio. In cases where risks outweigh the potential benefits, it is recommended to postpone KMC initiation until the condition improves or the device is removed.

16. Can a preterm newborn with respiratory support undergo KMC?

The literature search identified four studies, all of which were included: one cohort study, one observational study, one quasi-experimental study, and one RCT.

In a cohort study, Lee et al. compared KMC versus conventional incubator/cradle care in neonates with bronchopulmonary dysplasia (BPD) (defined as oxygen dependence at 36 weeks postmenstrual age) receiving Neurally Adjusted Ventilatory Assistance (NAVA), both invasive (IMV) and non-invasive (NIMV). The study found that in 47% of cases, neo-

nates remained more respiratory-stable in NAVA mode (IMV or NIMV) during KMC. Specifically, they determined that: In neonates on invasive NAVA (IMV): Peak and minimum diaphragmatic electrical activity, respiratory rate (RR), neural RR, time on ventilatory support, peak inspiratory pressure, and mean airway pressure were significantly lower during KMC compared to incubator care; In neonates on non-invasive NAVA (NIMV): Peak and minimum diaphragmatic electrical activity, time on ventilatory support, and inspiratory pressure were lower during KMC than in the incubator; Subanalysis by gestational age: Neonates born before 28 weeks showed significantly lower peak and minimum diaphragmatic electrical activity during KMC; No differences were observed in the number of desaturations or bradycardic episodes between KMC and incubator care.[65]

Lorenz et al. conducted an observational study on preterm neonates born before 33 weeks with a mean birth weight of 969 grams, all receiving respiratory support (10 intubated, 15 on Continuous Positive Airway Pressure [CPAP], and 15 on high-flow nasal cannulas). The study assessed SpO_2 stability and regional cerebral oxygenation during KMC versus standard incubator care. Regional cerebral oxygenation was similar during KMC compared to incubator care; No clinically significant differences were observed in HR, SpO_2, FiO_2, or temperature; Neonates remained clinically stable during KMC.[66]

In neonates receiving invasive and non-invasive NAVA, with a median gestational age of 27+4 weeks and a mean birth weight of 1,000 grams, clinical stability was defined by: SpO_2 targets between 90–95%; HR > 80 bpm. Studies on neonates with both invasive and non-invasive respiratory support found no significant variations in clinical stability during KMC.[65]

Moreover, PTNBs on respiratory support remain haemodynamically stable during KMC. Some authors define this stability as the absence of bradycardic events (HR < 100 bpm for more than 5 seconds) or hypoxaemic events (SpO_2 < 80% for more than 5 seconds). However, episodes of instability in the first 30 minutes after transfer—whether to KMC or back to the incubator—appear to be common.[66] Other studies, including those by Bisanalli et al. and De Oliveira Azevedo et al., confirmed that KMC does not cause changes in ventilator settings in intubated PTNBs.[67,68]

Quality of evidence: **MODERATE**
Strength of recommendation: WEAK. The application of KMC is suggested for neonates on invasive or non-invasive respiratory support.

17. Is KMC safe for intubated PTNBs?

The literature search identified four studies, all of which were included: two RCTs, one quasi-experimental study, and one project.

Evidence suggests that there are no significant differences in accidental extubations when comparing KMC with standard incubator care. However, adequate staff training and standardised KMC protocols are essential to prevent accidental extubations.[67–69]

De Oliveira Azevedo et al., in a quasi-experimental study on PTNBs <1,500 grams and <29 weeks GA, reported that HR increased and FiO_2 requirements decreased after 30 minutes of KMC; In a sample of 43 neonates, no accidental extubations were observed.[68] Nation et al., in a study on intubated neonates (mean GA: 25.84 weeks; mean weight: 837.01 grams; n = 11), also reported: No cases of accidental extubation or cardiopulmonary events (e.g., bradycardia or desaturation).[70] Other studies have reported similar findings, with no increase in accidental extubation rates or ventilatory disconnection events during KMC.[65,67] Kelley-Quon et al., in a project promoting KMC in neonates who had undergone surgery, found no significant increase in accidental extubations compared to previous standard practices.[69] Regarding ventilator-associated pneumonia (VAP) rates, no evidence has been found suggesting an increased risk in patients undergoing KMC.

Quality of evidence: **MODERATE**
Strength of recommendation: **STRONG**. The application of KMC in neonates with orotracheal or nasotracheal intubation does not increase accidental extubation rates.
Additionally, no recommendations can be made regarding ventilator-associated pneumonia due to a lack of evidence.

18. Is KMC safe for PTNBs with a central venous catheter?

The literature search identified eight studies meeting the selection criteria. After a critical appraisal, five studies were included: two observational studies, one quasi-experimental study, one prospective evaluation, and one RCT.

Available evidence indicates that the rate of accidental catheter dislodgement during KMC is not significantly higher.[67,70,71] Specifically, in neonates with umbilical catheters, no increased risk of accidental displacement has been reported.[67,71] However, some studies suggest a potential risk of bacterial colonisation, though without statistical significance.[71]

Nation et al. found no accidental displacement of central venous catheters during KMC or transfer.[70] In a prospective observational study involving 333 patients (GA 28–37 weeks), Catherine et al. reported: 10 cases of central catheter-associated infections, including: 3 cases of methicillin-resistant Staphylococcus aureus, 5 cases of coagulase-negative Staphylococcus and 2 cases of Escherichia coli; These infections were not statistically significant; No umbilical catheter displacement occurred during KMC or transfer; The 5 reported catheter dislodgements in the study did not occur during KMC.[71] Another study on 20 PTNBs undergoing KMC for one hour found no catheter (central or peripheral) losses, with neonates remaining stable.[67]

In an observational study on 38 PTNBs (mean corrected GA: 31 weeks, range 25–34) undergoing 83 KMC sessions, 56.6% of sessions involved neonates with a central venous catheter, and no accidental dislodgements were reported.[72] Montaner et al., in a study on 178 patients with umbilical venous catheters (mean GA: 30+3 weeks), found no statistically significant differences in catheter complications (e.g., haemorrhage, displacement, or accidental removal) between those who underwent KMC and those who did not.[73]

Quality of evidence: **MODERATE**.
Strength of recommendation: **STRONG**. KMC does not increase the rates of accidental central or peripheral catheter dislodgement, nor does it increase catheter-associated bacteraemia rates.

SECTION 3. FAMILY TRAINING IN KANGAROO MOTHER CARE

The European Standards of Care for Newborn Health project, conducted by the European Foundation for the Care of Newborn Infants (EFCNI), identifies Infant- and Family-Centred Developmental Care (IFCDC) as one of its key standards. IFCDC is a neonatal care framework that integrates neurodevelopmental and neurobehavioural theories, parent-infant interaction, parental involvement, breastfeeding promotion, environmental adaptation, and hospital system changes.[74]

This care paradigm is based on: Als' Synactive Theory, applied through the Newborn Individualised Developmental Care and Assessment Program (NIDCAP)[75]; Brazelton's theory, applied through training in the Newborn Behavioral Assessment Scale (NBAS).[76,77]

19. Does prior education of families increase their involvement in KMC?

The literature search identified two studies, both of which were included: one descriptive study and one RCT.

Proper counselling and education play a crucial role in family acceptance of KMC, helping caregivers become more inclined to provide this care. Providing KMC education and information to parents can promote earlier and more frequent KMC use, particularly in PTNBs born before 28 weeks of gestation.[78]

Kenaley et al. conducted a study aimed at reducing the time taken for parents to initiate KMC with their newborns on respiratory support. During NICU consultations, parents were educated about KMC, with some receiving this information even before birth. A checklist was developed for nurses to use during the first KMC session. The mean time to the first KMC session was reduced from 6.4 to 1.2 days ($p < 0.01$). The proportion of parents initiating KMC within the first 24 hours increased from 6% to 35%.[33]

Quality of evidence: **LOW**
Strength of recommendation: **WEAK**. Providing pre-delivery and/or prenatal information to families may increase their involvement in KMC.

20. Is parental training effective in increasing autonomy in KMC?

The literature search identified 28 studies. After duplicate removal and critical appraisal, eight studies were selected: one multicentre study, one protocol, one descriptive study, one cross-sectional study, one quasi-experimental study, one observational study, one systematic review with meta-analysis, and one systematic review.

One of the core components of the Infant- and Family-Centred Developmental Care (IFCDC) standard from EFCNI is parental training and education in this care paradigm. This is achieved through models such as FICare, NIDCAP, FINE, and CLOSE, all of which include KMC as an integral part.[79-82]

Olawuyi et al., in a cross-sectional study in Nigeria, assessed knowledge, attitudes, and practice of KMC among mothers of PTNBs. 66.6% of participants demonstrated good knowledge of KMC. 80% knew about KMC, its benefits, and how to position the newborn. 71.7% expressed positive attitudes towards its practice (they believed KMC was safe and reported feeling happy to do it). The study concluded that when mothers understand their role in their PTNB's survival, they become more motivated and that maternal knowledge significantly influences KMC use ($p < 0.05$).[78]

Craig et al. developed recommendations and protocols for Development and Family Centred Care (DFCC) and found that parental training and education improved their involvement in neonatal care.[83] Toivonen et al. evaluated the impact of CLOSE collaboration, an educational intervention, on DFCC quality. The programme was effective in increasing parental collaboration with healthcare professionals, enhancing DFCC, and strengthening parent-infant bonding.[84]

Immediately after birth, the newborn's natural environment is close to their mother. In an observational study, Feeley, Gottlieb, and Zelkowitz found that nurses can facilitate attachment and physical closeness by initiating early KMC. This helps establish mutual re-

cognition between the newborn and parents, empowering parents to actively participate in their newborn's care.[85]

Admission to the NICU is a stressful event for families. Providing comprehensive information to parents about the importance of NICU care can reduce family anxiety, improve well-being, and enhance parental competence in neonatal care. This also supports informed decision-making throughout the newborn's critical care process.[86] Clear, complete, and simple information facilitates parental learning, encourages autonomy, and builds confidence in caring for their child, even after hospital discharge.[87]

Quality of evidence: **MODERATE**
Strength of recommendation: **STRONG**. It is recommended to provide parents with standardised information on KMC. Parental training should be conducted to enhance their skills and autonomy in performing KMC.

SECTION 4: PERFORMING KANGAROO MOTHER CARE

21. When and for how long should KMC be performed with PTNBs?

The literature search identified 39 studies that met the selection criteria. After duplicate removal and critical appraisal, three documents were included: a systematic review, a WHO report, and the European Standards of Care for Newborn Health portal by the European Foundation for the Care of Newborn Infants (EFCNI).

A recent systematic review, which included studies from low- and lower-middle-income countries, compared early KMC (before 24 hours of life) versus late KMC in PTNBs or LBWNs. The findings indicated: A reduced risk of mortality at 28 days (RR: 0.78; 95% CI: 0.66 to 0.92; 3 RCTs, 3,533 PTNBs); Higher rates of EBF at discharge (RR: 1.12; 95% CI: 1.07 to 1.16; 2 RCTs, 3,464 PTNBs); Mortality reduction was associated with KMC duration of at least >16 hours per day, though limited data were available for durations of <8 hours or 8–16 hours per day. Exclusion criteria in these studies included unstable PTNBs, neonates receiving intravenous perfusions, and ventilated patients.[5]

The latest WHO guidelines on PTNB care recommend immediate KMC after birth, even before the infant is clinically stable, unless the neonate cannot breathe spontaneously after resuscitation, is in shock, or requires invasive mechanical ventilation (IMV). During KMC, the PTNB should be continuously monitored, assessing HR, RR, colour, temperature, and SpO_2.[4,74]

However, there is limited evidence on immediate KMC in high-income countries, so this recommendation should be applied with caution.

Quality of evidence: **MODERATE**
Strength of recommendation 1: W**EAK**. Immediate KMC (within the first hour of life) is suggested, or as early as possible.
Strength of recommendation 2: **STRONG**. At least 6–8 hours of KMC per day is recommended.

22. Who should provide KMC? Mother vs. Father vs. Others

The literature search identified seven studies, all of which were included: one systematic review, four RCTs, one descriptive study, and one qualitative study.

It is recommended that immediate and early KMC be provided by the mother whenever possible, due to its benefits in breastfeeding. However, KMC should also be encouraged
with the father and other family members (e.g., siblings, grandparents, or volunteers) to maximise KMC duration and ensure the benefits outlined in Section 1 of this CPG.

However, few studies have examined differences based on the KMC provider (mother, father, other family members, or volunteers).

Vogl et al. (2021) conducted a prospective study on triads of PTNBs (GA 30–36+6), their mothers, and their fathers (only heterosexual couples). KMC was performed intermittently for 90 minutes per session, accumulating 3 hours per day. The variables assessed were heart rate variability (six components monitored), apnoea and periodic breathing, salivary cortisol levels (parents and newborns), psychosocial questionnaires

(Revised Dyadic Adjustment Scale, Postpartum Bonding Test, Perceived Parental Competence Scale), In a sample size of 20 triads, no differences were observed between mother- and father-provided KMC in any heart rate variability components, nor in the time spent in apnoea or periodic breathing episodes during KMC, nor in the scores of psychosocial questionnaire between mothers and fathers, with both showing non-stressful relationships and normal parent-child bonding. No salivary cortisol data were reported.[88]

In the 2021 crossover RCT involving 64 preterm infants, procedural pain was assessed during KMC provided by the mother (intervention group) versus the father (control group). No significant differences were found in PIPP scores at 0, 60 seconds, or 5 minutes between the mother and father KMC groups.[89]

A systematic review (14 studies, 511 PTNBs <28 weeks GA and 478 fathers) aimed to identify parental interventions in the NICU. Findings indicated: No significant differences in physiological, biochemical, or behavioural outcomes of PTNBs based on whether KMC was provided by the mother or the father; Mothers initiated KMC earlier (fathers typically started from the third day of life); Mother-provided KMC was more effective than father-provided KMC for procedural pain relief; Mother-father dyads showed synchronised levels of stress and anxiety.[90]

In a qualitative study by Dong et al., 10 fathers who had provided KMC to their PTNB were interviewed. Key themes included: KMC fostered a positive connection with their child, with reported feelings of nervousness, calmness, connection, and confidence; KMC as a learning experience, reshaping their perception of paternal caregiving; Conflicts in prioritisation between work, home responsibilities, and hospital time; Physical discomfort (e.g., sweating, reclining chair position).[63]

Regarding other family members, an RCT in Iran (80 PTNBs <32 weeks GA, 1500–2500 grams) compared KMC provided by the maternal grandmother (intervention group) versus the mother (control group). Both groups showed improvements in HR, SpO_2, RR, and temperature after 15 minutes of KMC, compared to incubator care. There were no

significant differences between the grandmother and mother KMC groups: HR: 137.63 vs 139.12; RR: 43.05 vs 44.25; SpO_2: 96.60 vs 96.47; Temperature: 37.05°C vs 37.04°C. However, results should be interpreted with caution, as KMC sessions lasted only 30 minutes once per day.[91]

Quality of evidence: **MODERATE**
Strength of recommendation 1: **STRONG**. Whenever possible, the mother should be the primary provider of KMC, while also encouraging KMC with the father/partner.
Strength of recommendation 2: **WEAK**. KMC by another family member is recommended if the parents are unavailable or as an alternative to provide them with rest.

Preparation of the Newborn and Environment

23. Is the use of supportive instruments, such as wraps or ergonomic carriers, recommended during KMC with PTNBs?
The literature search identified 13 articles, of which 9 were selected, including a systematic review, a narrative review, four RCTs (one of which was a pilot study), a research and development study, and two web-based sources.

The use of supportive instruments, such as wraps or ergonomic carriers, during KMC may enhance safety and comfort for both parents and newborns (Appendix 2). However, in neonatal units, it is common practice to use a blanket, sheet, muslin cloth, or the parent's clothing for PTNBs during KMC.

An RCT conducted by Chavula et al. in Malawi studied 241 mother-infant pairs, who were randomly assigned to either the intervention group, in which KMC was performed using the ergonomic CarePlus Wrap, or the control group, where KMC was carried out using the traditional Malawian chitenje. The study population included 90% PTNBs, with a mean KMC initiation of 1.5 days of life. The results showed that the use of the CarePlus Wrap improved KMC duration, with 90.4% of mothers in the intervention group performing KMC for more than 10 hours per day, compared to 77.45% in the control group ($p = 0.03$).[92]

Similarly, a pilot RCT conducted by Zengin et al. in Turkey evaluated the design of a specific KMC garment, named 'Sarbebe'. The study included 60 PTNBs, with a mean KMC initiation of 19 days of life. The results indicated that KMC duration was significantly longer in the Sarbebe group, with a mean of 65.8 (±16.4) minutes compared to 34.5 (±16.7) minutes in the control group ($p < 0.001$). The newborns in the intervention group also had a higher post-KMC temperature, measuring 37.0°C (±0.3) compared to 36.7°C (±0.3) in the control group, while no significant differences were observed in respiratory rate or oxygen saturation. Additionally, comfort and satisfaction scores were significantly higher in the Sarbebe group. The KC Comfort Scale scores were 84 (±1.5) in the intervention group versus 71.1 (±14.8) in the control group ($p < 0.001$). The Maternal Satisfaction Scale results were 4.9 (±0.3) in the intervention group compared to 4.1 (±1) in the control group ($p < 0.001$), and the Comfort-Neo Scale scores were 8.67 (±3.46) in the intervention group versus 12.47 (±6.9) in the control group ($p < 0.001$).[93]

No studies have been found that evaluate the use of an elastic tubular band or wrap for performing KMC in PTNBs.

Despite the limited evidence on this matter, and with the aim of ensuring a safe kangaroo position (maintaining airway patency) as well as enhancing the satisfaction and comfort of KMC providers, expert consensus and contributions from external reviewers recommend the use of a cotton lycra wrap and, if unavailable, synthetic lycra as an alternative.

Quality of evidence: **MODERATE and EXPERT CONSENSUS**
Strength of recommendation 1: **WEAK**. The use of ergonomic supports is suggested as a means to increase KMC duration, as well as to improve comfort and satisfaction for both the parent and the PTNB.
Strength of recommendation 2: **STRONG**. The wrap should initially be positioned low on the provider's abdomen, and after a few minutes of settling the baby, it should be gradually raised.
Strength of recommendation 3: **STRONG**. Cotton lycra wraps are recommended, with synthetic lycra as an alternative when necessary.

24. Does the use of a cap during KMC in PTNBs or LBWNs help maintain a normal thermal range compared to not using one?

A multicentre RCT conducted by Cavallin et al. across three centres in Africa studied newborns weighing less than 2500 grams who received KMC within the first seven days of life. The study compared KMC with a woollen cap versus KMC without a cap (control group). With a sample of 300 subjects, a mean gestational age of 34 weeks, and a median age of four days, the study found that the mean time spent in normothermia (36.5–37.5°C) was 55% (SD 24) in the cap group and 56% (SD 24) in the no-hat group (OR: 0.95; 95% CI: 0.86–1.04). No significant differences were observed between the groups in terms of hypothermia or hyperthermia episodes.

However, as this study only followed newborns during their first seven days of life, it remains unclear whether normothermia would be maintained beyond this period, particularly considering the potential impact of hypothermia on growth and development in preterm infants.[94]

Quality of evidence: **LOW and EXPERT CONSENSUS**
Strength of recommendation: **WEAK**. The use of a cap during KMC is recommended; however, this should be adjusted based on gestational age, days of life, and the newborn's temperature before and during KMC. Alternatively, a blanket or cover can be used to protect the baby's head.

25. Is it necessary to protect PTNBs from light and sound during KMC?

PTNBs admitted to a NICU are constantly exposed to various light and sound stimuli during medical procedures and routine care. Prolonged exposure to these stimuli can be harmful over time, potentially affecting neurodevelopment during hospitalisation. The intensity of visual stimuli plays a crucial role in the development of visual acuity, colour perception, eye growth, and retinal maturation.[95]

Noise exposure can have both short- and long-term effects. In the short term, it may lead to episodes of apnoea, bradycardia, and hypertension, while in the long term, it has been linked to disorganised, maladaptive behaviour, sleep disturbances, and emotional development disorders. Studies suggest that sound peaks have a greater impact on PTNB comfort than light peaks. Additionally, excessive noise is a source of stress not only for newborns and their families but also for healthcare professionals.[96]

Recent evidence highlights the benefits of light-dark cycles in the NICU, showing that exposure to natural circadian rhythms can lead to improved clinical outcomes, including weight gain and shorter hospital stays, compared to PTNBs exposed to either constant light or near-total darkness. Consequently, it is recommended that the eyes of PTNBs be covered when exposed to direct light stimuli.[97]

However, during KMC, it is advised to reduce noise levels by lowering monitor alarms, ventilator sounds, and telephone ringtones, as noise levels are typically regulated inside incubators. Instead, soft music can be introduced. Additionally, light exposure should be adjusted by keeping lights dim and lowering blinds, aiming to enhance parent-infant interactions.[74,98]

It is suggested that illumination levels be maintained between a minimum of 10 lux and a maximum of 600 lux. Regarding noise exposure, ambient sound levels should not exceed 45 dB for more than an hour, with sound peaks not exceeding 50 dB for more than 10% of the time and isolated noise events remaining below 65 dB.[74]

Quality of evidence: **MODERATE**
Strength of recommendation: **STRONG**. It is recommended to create an optimal environment during KMC by reducing light exposure (<600 lux) without covering the PTNB's eyes and maintaining appropriate noise levels (<65 dB).

26. Does parental posture and comfort influence KMC duration?

Available evidence suggests that a highly comfortable chair with a reclining angle of 15–30º may help increase KMC duration and reduce associated complications. An RCT conducted in Indonesia compared the use of an ergonomic sofa during KMC with a standard chair (control group), assessing maternal posture using the Rapid Upper Limb Assessment (RULA) scale. The results showed a mean RULA score of 2.17 (0.37) in the ergonomic sofa group compared to 3.42 (0.78) in the control group ($p < 0.001$). These findings suggest that improving parental comfort may extend total KMC duration and reduce musculoskeletal discomfort.[99]

Quality of evidence: **LOW and EXPERT CONSENSUS**
Strength of recommendation: **STRONG**. A comfortable chair with a 15–30º recline is recommended to improve the posture of the KMC provider, which may help increase KMC duration.

Transfer process

A literature review identified 12 eligible studies, of which 8 were selected after critical reading. These included one crossover RCT, two descriptive studies, three reviews, one consensus document, and one procedural review.

The transfer process refers to moving the newborn from the incubator or thermal cot to the bare chest of the mother, father, or caregiver, as well as the reverse transfer back to the incubator or cot. Within Kangaroo Care, the transfer is considered the most stressful and vulnerable moment, posing the greatest risks for PTNBs.

Two types of transfers are distinguished:[100]

1. Standing transfer: The mother, father, or caregiver stands beside the incubator and directly lifts the PTNB, supporting the head with one hand and the body

with the other. The baby is placed skin-to-skin on the chest at the edge of the incubator, minimising exposure to convective heat loss. Nursing staff manage IV lines, cables, and/or ventilator tubing and assist the parent in sitting down with the baby.

2. Seated transfer: Performed by nursing staff, who support the PTNB with one hand above and the other below, keeping them contained and gently placing them on the waiting parent's chest while they sit slightly reclined in a chair. It is also recommended to transfer the newborn in the prone position, using a sandwich hold—one hand on top and one underneath— before placing them on the parent's chest. Another healthcare professional handles the IV lines, cables, and ventilator or NIMV tubing.

27. How many people are recommended for transferring a PTNB from an incubator to a KMC provider?

In general, the recommended number of staff involved in the transfer of a newborn varies depending on the newborn's fragility, degree of prematurity, and the medical devices or access points in use. Other studies on PTNBs requiring invasive mechanical ventilation (IMV) have reported that two to three nurses are necessary,[101] or alternatively, one nurse plus the mother or father.[102] However, Bisanalli et al., in their observational study, indicated that for a seated transfer of low-birth-weight PTNBs on CPAP or synchronised intermittent mandatory ventilation (SIMV), one nurse and another healthcare professional are required.[67]

Quality of evidence: **LOW**.
Strength of recommendation: **WEAK**. It is suggested that the transfer be performed by two people, with at least one being a healthcare professional. However, this will depend on the newborn's overall condition and age, the medical devices in use, whether the baby is intubated, and the parents' autonomy and skill in providing this care.

28. Is the standing transfer safer than the seated transfer for PTNBs?

The available evidence does not provide a clear consensus on which type of transfer minimises stress more effectively or which is safer. Ludington-Hoe et al. measured the adaptation time of ventilated PTNBs under 29 weeks GA after both types of transfer. Their findings indicated an adaptation time of 3 minutes for the standing transfer and 11 minutes for the seated transfer, suggesting that the seated transfer induces more stress than the standing transfer.[103] A subsequent replication of the study reached the same conclusion, reaffirming that standing transfer is less detrimental to PTNBs' physiological organisation, thermal stress, and behavioural responses compared to the seated transfer.[104]

Neu et al. examined the effects of standing transfers performed by parents versus seated transfers performed by healthcare professionals in 15 ventilated PTNBs with a mean gestational age of 27.7 2 weeks and 18 days of life at the time of the study. They analysed minimum and maximum HR and SpO_2 values during the transfers using an autoregressive moving average model and assessed motor, physiological, and selfregulation organisation through the Assessment of Behavioral Systems Observation (ABSO) scale. Their findings showed that both minimum and maximum SpO_2 levels decreased during the transfer from the incubator, returned to baseline during KMC, and decreased again during the transfer back to the bed. During the transfer from the incubator, the minimum SpO_2 dropped by 2% from a baseline of 93.4% when performed by a nurse, and by 2.9% from a baseline of 93.1% when performed by the parents. When transferring back to the incubator, the minimum SpO_2 dropped by 2.8% in the nurse-led transfer and by 4.3% in the parent-led transfer. However, SpO_2 levels returned to normal (>92%) one minute after the nurse-led transfer and immediately after the parent-led transfer. Regarding HR changes, a 5% increase was observed from a baseline of 156.3 bpm in the nurse-led transfer, while a 2% increase was recorded from a baseline of 159.5 bpm in the parent-led transfer from the incubator. The study also found that both types of transfers led to physiological and motor disorganisation, reduced self-regulation, and greater need for caregiver facilitation.[102]

Hedberg et al. recommend the seated transfer as the preferred method, emphasising the importance of standardising the technique to reduce instability associated with the transfer.[105] Meanwhile, Schultz et al. report that, based on their experience, nurse-led transfers

are perceived as more effective and less stressful than parent-led ones, although they do not provide supporting data. They argue that the neonate's physiological stability and the standardisation of transfer techniques have a greater impact on outcomes than the transfer method itself.[104]

In conclusion, to ensure a safe transfer, it is essential to understand both transfer techniques and assess each individual situation, considering the neonate's prematurity and fragility, as well as the physical and emotional capacity of the parents. If the neonate is extremely preterm, has multiple medical devices, and the mother is anxious or has limited physical capacity, a seated transfer may be preferable. However, if the mother is physically well, a standing transfer can be agreed upon.

Quality of evidence: **LOW**
Strength of recommendation: **WEAK**. It is suggested to assess parental autonomy, the stability of the PTNB, and the standardisation of the technique to determine whether a standing or seated transfer is more appropriate.

29. How to perform a safe transfer in PTNBs with IMV or NIMV?

There are no clinical trials or high-quality evidence supporting a standardised safe procedure for transferring a PTNB during KMC. However, publications describe protocols and experiences related to transferring PTNBs with IMV or NIMV while performing KMC.[67,101,104] In the absence of RCTs validating this practice and considering the risk of hypoxic episodes and respiratory instability, the expert group recommends not disconnecting the tubing but rather designating one person to manage it.

Additionally, the expert group advises against securing the tubing to the caregiver due to the risk of extubation and instead suggests placing it over the caregiver's shoulder. For a safe transfer, it is recommended to suction secretions if necessary and drain condensation from the tubing. The PTNB should be kept in a slightly flexed position with an open airway.[67,101, 104]

Appendix 3 includes a checklist for performing a safe transfer, developed by the CPG working group. Appendix 4 provides a step-by-step visual guide for a standing transfer of an intubated PTNB during KMC.

Quality of evidence: **LOW and EXPERT CONSENSUS**
Strength of recommendation 1: **WEAK**. In intubated patients, it is recommended NOT TO DISCONNECT the patient from the ventilator during transfer. At least two people should participate in the transfer, with one person responsible for managing the tubing and the endotracheal tube (ETT).
Strength of recommendation 2: **WEAK**. It is suggested to position the tubing on the same side as the incubator to facilitate KMC without requiring disconnection.
Strength of recommendation 3: **WEAK**. It is recommended to place the tubing over the shoulder of the KMC provider, securing it with tape/Velcro to the chair or, alternatively, to the KMC provider.
Strength of recommendation 4: **WEAK**. A slight slack should be allowed in this fixation to permit the PTNB's movements.
Strength of recommendation 5: **WEAK**. The fixation should be easily accessible and simple to remove in case of an emergency.

30. Is the nest the best method for transferring PTNBs?

There is no evidence in the reviewed literature regarding the use of the nest for transfer. Ludington-Hoe et al., in reference to the standing transfer, recommend using a blanket folded into four parts placed under the neonate in the supine position so that the mother can hold the baby, providing containment along with her warm body to minimise the stress of being moved.[101] Instead of a blanket, the nest could serve as containment until the transfer is completed and may be replaced afterward if necessary.

Quality of evidence: **LOW and EXPERT CONSENSUS**
Strength of recommendation: **WEAK**. In the seated transfer from the incubator to the kangaroo care provider, it is recommended to use the containment nest, as it may minimise neonatal stress, prevent temperature fluctuations, ensure containment, and optimise vestibular development.

Kangaroo position/posture

A literature search identified 21 studies that met the selection criteria. After removing duplicates, 15 studies remained, and following a critical review, 13 were included. These studies comprised two systematic reviews, two quasi-experimental studies, two cohort studies, three studies with a quality improvement design following the implementation of enhancements, two descriptive studies (one of which included Bayesian analysis), one research protocol, and one presentation at an international congress.

31. Are there alternatives to the conventional prone position in kangaroo care for hospitalised PTNBs?

The various guidelines reviewed recommend the kangaroo position, in which the newborn is placed vertically between the mother's or father's breasts/chest, with the head turned to the side and upright (neither flexed nor extended), the hips flexed and extended in a "frog-like" position, and the arms also flexed (Figure 1). Some pilot experiences have explored performing KMC in a semi-reclined or diagonal position to allow visual contact between the mother and baby (Figure 2).[106,107]

Figure 1. Conventional kangaroo position: vertical prone. Illustration by authors (Lucía Jiménez)

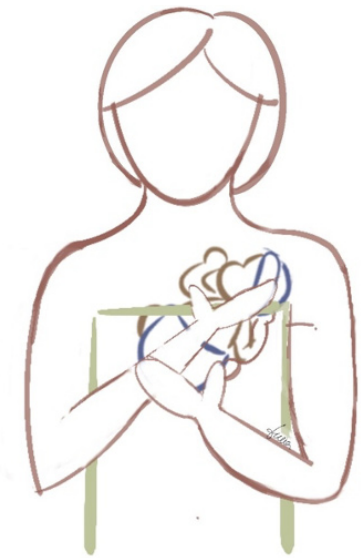

Figure 2. Diagonal kangaroo position. Illustration by authors (Lucía Jiménez)

In the non-randomised pilot experimental study on the diagonal prone position published by Buil et al., with a sample of 15 PTNBs and a mean gestational age of 29.3 (±2.5) weeks, eight PTNBs were placed in the diagonal position and seven in the vertical position. The study analysed the impact of positioning on physiological variables, sleep patterns, maternal behaviour, and maternal depression. Findings indicated that PTNBs spent more time in deep sleep in the diagonal position compared to the vertical position (22% vs. 6%; p: data not available). Both groups showed a decrease in heart rate (HR) and respiratory rate (RR) during KMC, but significant differences were found in oxygen saturation (SpO2), with a mean of 96% (±1.9) in the diagonal position versus 98.4% (±1.3) in the vertical position ($p = 0.018$). KMC sessions lasted longer in the diagonal group than in the vertical group (118 minutes vs. 96 minutes; $p = 0.039$). Regarding maternal behaviour, mothers in the diagonal position group tended to spend more time looking at their baby's face (51.4% of KMC time vs. 29.0%; $p = 0.089$) and significantly less time looking elsewhere (3.6% vs. 23.2%; $p = 0.002$).[106]

Subsequently, the previous study was replicated without randomisation, following up PTNBs between 27 and 31+6 weeks' GA during the first 15 days of life while undergoing KMC The study monitored dyadic communication (vocalisation, smiling, and eye contact) by recording the first five minutes of each KMC session and assessed the infant's behavioural state using the Neonatal Behavioural Assessment Scale (NBAS) or Brazelton Scale. With a sample of 34 dyads, 17 in each group, findings showed that PTNBs in the experimental diagonal position group spent less time in a drowsy state (58% vs. 70% in the vertical position; p = data not available) and more time in deep sleep (19% vs. 3%; $p < 0.0001$). Significant differences were found between groups in terms of dyadic communication, with more vocalisations, smiling, eye contact, and interaction in the diagonal position group.[107] At 15 days of life, scores on the Edinburgh Postnatal Depression Scale were lower in the diagonal position group compared to the vertical position group (7.0 ± 4.4 vs. 9.0 ± 2.7; $p = 0.115$).[106] However, both studies had limitations, including the lack of randomisation, absence of data on maternal depression history, and the short duration of KMC sessions, which may introduce bias in the interpretation of the results.

In a prospective observational study involving 20 infants with spontaneous breathing (n = 17) or NIMV (n = 3) and a mean gestational age of 33 weeks, researchers assessed regional ventilation indices and other cardiorespiratory parameters in three different conditions: supine positioning in a cot, prone positioning in a cot, and prone KMC. The findings indicated that KMC produced a distinct regional ventilation pattern independent of the prone position, leading to greater ventilation distribution towards the dorsal lung. No significant differences were observed in HR, RR, or SpO2 among the three positions.[108]

Furthermore, in the non-inferiority RCT by Collados-Gómez et al., which aimed to evaluate thermal stability in lateral KMC for PTNBs under 28 weeks' GA during the first five days of life, the intervention group was placed in a vertical lateral decubitus position (Figure 3). In this position, the infant was laid in lateral decubitus on the chest of the mother or father while maintaining vertical alignment. With a sample size of 70 EPTNBs at a mean gestational age of 26 weeks, infants in the lateral KMC intervention group had an axillary temperature of 36.79°C (SD: 0.43) at 60 minutes after the start of the first KMC session, compared to 36.78°C (SD: 0.38) in the prone KMC group (MD: 0.007; 95% CI: -0.2 to infinity; p = 0.022). No differences were found in clinical parameters between the groups at 60 minutes, such as SpO2, which was 94.5% (3.23) in the lateral KMC position and 95.39% (3.57) in the prone KMC position (MD: -0.89; 95% CI: -2.57 to 0.86), or HR, which was 152.77 bpm (11.32) in the lateral KMC position and 153.29 bpm (12.79) in the prone KMC position (MD: -0.53; 95% CI: - 6.50 to 5.45).[109]

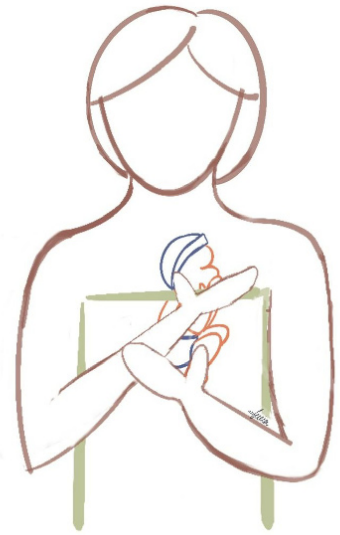

Figure 3. Vertical lateral kangaroo position. Illustration by authors (Lucía Jiménez)

Quality of evidence: **MODERATE**.
Strength of recommendation: **WEAK**. Alternative positions to the prone KMC position are suggested: diagonal prone position and vertical lateral position.
The diagonal prone KMC position may promote mother-infant communication and interaction.
The vertical lateral KMC position helps maintain normothermia and stable HR and SpO2 in extremely preterm newborns during the first five days of life.
Quality of evidence: **EXPERT CONSENSUS**
Strength of recommendation: **WEAK**. The use of a mirror or the front camera of a mobile device is suggested to allow visualisation of the preterm newborn's face.

32. Does the prone KMC position increase the risk of developing IVH compared to the lateral KMC position or lateral position in an incubator in hospitalised PTNBs?

During the first 72 hours of life, and particularly in infants born before 28 weeks of gestation, the risk of intraventricular haemorrhage (IVH) is higher. It is recommended to implement a bundle of measures to prevent IVH in PTNBs, including delayed cord clamping, avoiding hypercapnia and hypoxia, using NIMV, antenatal corticosteroids, positioning the

incubator at a 15–30° incline, keeping the newborn's head in a midline position, avoiding procedures that increase intracranial pressure (such as nappy changes), administering slow fluid boluses (over more than 60 seconds), and ensuring that handling is performed by experienced healthcare professionals, among other measures.[110–115]

However, in the systematic review by Romantsik et al., no strong, high-quality evidence was found to confirm that lateralising the head increases the risk of IVH. The review suggests that the risk of developing IVH of any grade in a supine position with the head in a neutral position is 1.1 times higher than in infants whose heads are lateralised whilein a supine position (95% CI: 0.78–1.56). However, the risk of developing grade III or IV IVH in a supine position with the head in a neutral position was lower (RR: 0.71, 95% CI: 0.37–1.33) compared to a lateralised head position. It should be noted that this systematic review compares a neutral supine position in an incubator versus a lateralised supine position in an incubator, rather than comparing different positions in kangaroo care.[116]

Additionally, a meta-analysis evaluating cerebral oxygenation in the prone versus supine position during the first two weeks of life in PTNBs found no differences in cerebral oxygenation during the first week (p = 0.98). In the second week, the study found that regional cerebral oxygen saturation (rScO2) was higher in infants positioned in prone compared to those in supine by 1.97% (95% CI: 0.87–3.07).[117]

Collados-Gómez et al., in their non-inferiority RCT, performed transfontanellar ultrasounds before the first KMC session and at 48 hours of life in extremely PTNBs. They found that IVH of any grade developed in 7.69% of infants in the intervention group (KMC), compared to 29.17% in the conventional prone position group (p = 0.08).[109]

Quality of evidence: **MODERATE**
Strength of recommendation: **WEAK**. It is suggested to consider the vertical lateral KMC position as an alternative to the prone position in Extremely Preterm during the first 72 hours of life.

33. Does the position adopted in KMC influence motor neurodevelopment in PTNBs?

The conventional prone position in KMC, compared to standard incubator care, increases short-term electromyographic activity of the biceps brachii and hamstrings ($p < 0.001$). Additionally, this position has been shown to enhance flexor muscle tone in these newborns. Since inadequate muscle tone hinders proper postural organisation in PTNBs, this could lead to delays in motor milestone acquisition and, consequently, in their overall motor development.[118,119.]

In a prospective study by Miranda et al., the aim was to compare electromyographic activity in three groups: PTNBs in KMC (n = 25; PMA 31.06 (2.2)), PTNBs in an incubator (n = 13; PMA 31.21 (1.68)), and PTNBs in KMC (n = 26; PMA 39.27 (0.92)). Electromyographic activity of the biceps brachii was higher at 48 hours in the PTNB in KMC group compared to those not positioned in KMC (49.30 (4.91) vs. 38.17 (3.10); $p = 0.004$).[120]

Another study, involving 80 PTNBs between 32 and 40 weeks, assessed the relationship between prone and lateral positions in KMC and early neuromotor development. It found that neonates placed in the lateral decubitus position during KMC exhibited greater flexion and increased trunk twisting ($p < 0.05$). The group assigned to the lateral position showed improvements in 13 out of 16 items evaluated using the Dubowitz examination, whereas the prone-position group improved in only five items. These findings suggest that the lateral position may have a positive impact on PTNB posture.[121]

Quality of evidence: **MODERATE**

Strength of recommendation: **STRONG**. The conventional vertical prone KMC position improves short-term electromyographic activity.

Feeding during KMC

34. Does feeding in the KMC position improve tolerance in PTNBs?

From the nine eligible studies identified in the literature search, two RCTs were selected.

The vertical prone position adopted by PTNBs during KMC may explain the reduction in feeding intolerance, leading to a shorter duration of parenteral nutrition and the establishment of EEN.

Valizadeh et al., in a single-blind RCT involving 100 PTNBs, assessed the impact of feeding during KMC on gastric residual volume two hours post-feeding. The study found that gastric residuals were lower in PTNBs fed in the KMC position compared to those fed in the supine position in an incubator (0.9 ml (1.6) vs. 2 ml (2.3); $p < 0.001$).[51]

Similarly, Özdel et al. conducted a crossover clinical trial with 30 PTNBs, in which infants were fed via a gastric tube while in the prone KMC position. Before 48 hours, their feeding tolerance was monitored in the prone position within the incubator. The PTNBs, with a postnatal gestational age of 33.1 weeks (1.53), exhibited lower heart rates, greater comfort, and reduced stress 30 minutes and three hours after feeding when in the KMC position. The study also found a lower residual gastric volume three hours post-feeding in the KMC group compared to the incubator group (0.04 ml (0.19) vs. 0.1 ml (0.25); $p = 0.29$).[14]

Quality of evidence: **LOW**

Strength of recommendation: **WEAK**. Feeding during KMC may improve feeding tolerance.

SECTION 5. FACILITATORS AND BARRIERS TO KANGAROO MOTHER CARE

35. Does adjusting the nurse-to-patient ratio in neonatal units to the European mean improve the frequency and/or duration of KMC?

Nine of the thirteen eligible documents were selected for this question, comprising five systematic reviews, two narrative reviews, one descriptive study, and one web-based resource.

A high nurse-to-patient ratio acts as a barrier to KMC implementation due to two main factors: the overall high workload and the specific perception of KMC as a factor that increases this workload.[122-124]

Regarding workload, hospital administrators also identify KMC as an additional burden, as it requires intensive staff support. Consequently, nursing staff policies and shift schedules should be reviewed before KMC implementation.[124,125] High staff turnover, resulting from structural shortages in healthcare personnel, has also been identified as a barrier to KMC.[126,127] Leadership instability (high level of evidence) and reluctance to allocate sufficient resources to neonatal units further hinder KMC implementation,[123-125] whereas facilitating decision-making and ensuring adequate resource allocation promote its practice.[128]

Concerning the time required for KMC, healthcare professionals perceive fewer barriers when parents are granted unrestricted access to the neonatal unit and when mothers are allowed to have a companion.[127,128] However, there is ongoing debate regarding the time investment needed for KMC, the training required for families, and its impact on healthcare professionals' workload.[129] When KMC is understood as an effective care practice that does not interfere with the management of other patients and does not increase workload, it becomes a strong enabler. Conversely, concerns over KMC arise when an inadequate nurse-to-patient ratio leads to a perceived inability to provide proper care.[123]

Expert consensus highlights that all training and education processes require empathy, dedication, and availability—particularly from nursing professionals, given their accessi-

bility and expertise in Health Education. While this process may initially be perceived as time- and resource-intensive, the extended hospital stay of preterm infants allows for medium-term benefits. Integrating families into the care teams can optimise time management, improve care quality, and enhance perceived satisfaction. This approach promotes continuity of care and aligns with one of the care standards established by the European Foundation for the Care of Newborn Infants (EFCNI).[74]

Quality of evidence: **HIGH and EXPERT CONSENSUS**
Strength of recommendation 1: **STRONG**. It is recommended that the nurse-to-patient ratio be adjusted according to the specific case mix of neonatal units to facilitate the implementation and duration of KMC.
Strength of recommendation 2: **WEAK**. It is suggested to promote parental training and their integration into care teams to optimise time management, ensure continuity of care, and enhance care quality.

36. Does an institutional guideline or protocol on KMC increase the percentage of newborns receiving KMC and/or its duration?

All the documents identified in the literature search were included in this question, comprising three systematic reviews, two narrative reviews, and one descriptive study.

The absence of guidelines or protocols on KMC represents a significant barrier to its implementation, whereas the presence of global policies such as DFCC and clear guidelines for promotion and implementation act as facilitators.[122,123,129]

The existence of a KMC protocol in the NICU can enhance its acceptance and help nurses feel more confident, thereby encouraging families to engage in this practice.[125,129] Conversely, limited knowledge about KMC is a barrier not only to its implementation but also to ensuring an adequate duration of practice.[123] However, this challenge can be addressed through institutional guidelines or protocols. Additionally, training healthcare professionals and managers in KMC—including undergraduate education and virtual training—can improve its acceptance.[129]

The absence of protocols leads to inconsistent implementation of KMC, which has been identified as a barrier.Additionally, it creates uncertainty among healthcare professionals when providing KMC, as they fear causing harm, particularly concerning the medical devices used by the newborn and the care of clinically unstable neonates, a term for which there is not always a clear consensus.[127,129,130]

In developing countries, KMC is sometimes perceived as the 'poor man's alternative' in contrast to the higher cost of incubator care. This perception can contribute to the belief that KMC is an inferior method, leading to mistrust and resistance to the adoption of new protocols.[129]

Quality of evidence: **HIGH**
Strength of recommendation: **STRONG**. The establishment of an institutional guideline or protocol is recommended to improve the implementation and application of KMC.

37. Does the structure of family support and assistance impact the frequency, duration, and continuity of KMC in hospitalised neonates?

From the 18 results identified in the literature search, nine were selected: two systematic reviews, four narrative reviews, two RCTs, and a web-based resource.

Support from the partner and other family members in alleviating additional responsibilities (such as meals, laundry, etc.) is a facilitating factor and improves the duration of KMC by allowing the mother to spend more time in the NICU.[123,127] In this regard, assistance from mothers and sisters during KMC and the presence of genderequal societal roles enhance maternal support.[118] Conversely, mothers are less likely to remain in hospital to practise KMC if their families are unable to visit them.[127]

During neonatal hospitalisation, a lack of available time for practising KMC is often related to the need to divide time between the NICU and home to care for other children, particularly when siblings are not allowed to stay overnight in the hospital due to the absence of family rooms. This lack of time is a significant barrier to KMC and becomes even more pronounced in the home setting after neonatal discharge, as parents must manage additional household responsibilities. Furthermore, at home, visitors may pose an added

obstacle to KMC, as can time constraints when parents are required to return to work early due to inadequate parental leave.[129]

Cultural traditions that do not align with early initiation of KMC (such as back-carrying practices or postnatal confinement) and gender roles that stigmatise paternal involvement may also act as major barriers.[130]

Other facilitators related to sociocultural support networks include mothers sharing their KMC experiences within the NICU,as well as the role of social workers in providing information and access to available financial resources and support groups.[124,129]

Quality of evidence: **HIGH**
Strength of recommendation: **STRONG**. It is recommended that neonatal units facilitate family support for the mother and family. The costs associated with NICU admission and insufficient parental leave may hinder the practice of KMC.

38. In hospitalised neonates, does a specific design and layout of space and furniture increase the frequency of KMC application?

The lack of adequate space and resources (such as chairs, beds, support wraps, screens, and curtains) constitutes a barrier, as it affects parental motivation and comfort while also limiting healthcare professionals' ability to offer KMC.Conversely, the provision of appropriate resources, dedicated spaces, and privacy acts as a facilitator.[127,131]

From a structural perspective, overcrowding and limited space in healthcare facilities pose additional challenges to KMC, as they may lead to earlier discharges or restrictive visiting policies due to space constraints. If parents are unable to visit their infants because of restrictive policies, KMC cannot take place.[123] Additionally, the NICU environment—particularly concerning noise levels—has also been identified as a potential barrier or limiting factor.[126] The lack of privacy due to limited space and the absence of screens or partitions is a significant barrier for mothers, reducing the duration of KMC.Conversely, the availability of private rooms or areas where both parents can stay may contribute to the successful implementation of KMC.[123,129]

It is recommended to create an optimal environment in terms of lighting, noise levels, and privacy to facilitate KMC. Additionally, parents of newborns should be able to relax in order to maximise the benefits of KMC. For healthcare professionals, working in low-light conditions may present a challenge, and in the absence of individual or family rooms that ensure privacy and a neutral environment, being in a shared space surrounded by other families and their newborns can lead to increased noise, heightened stress, and reduced privacy.[95] A pilot RCT evaluating an intervention to reduce light and noise levels during KMC surveyed 21 nurses from a level III NICU. The nurses completed questionnaires assessing the acceptability of lowering light and noise levels in the unit and whether these changes interfered with care provision. The majority of nurses found the reduced light and noise levels acceptable and reported that they did not interfere with their ability to provide care, instead offering benefits to the newborns.[96]

To ensure optimal KMC, families of hospitalised newborns should have 24-hour access to their infants. Ideally, parents should have access to a family room where they can remain close to their child at all times.[132] Family rooms appear to reduce maternal stress and reinforce the maternal role by allowing parents to spend more time with their newborn.[85] In their absence, open-plan units with shared spaces should provide comfortable reclining chairs for families, access to bathrooms, and measures to ensure privacy (such as screens or spacing between incubator stations). Additionally, creating a favourable environment for KMC may involve the use of soft lighting, pastel colours, child-friendly décor, and materials adapted to neonatal care settings.[74,133–135]

Quality of evidence: **HIGH**
Strength of recommendation: **STRONG**. It is recommended to establish private areas or rooms where both parents can stay with their hospitalised preterm newborn, as well as to ensure unrestricted 24-hour access to the unit. The lack of space, privacy, and adequate resources hinders the frequency of KMC implementation.

39. Does the professional competence of nurses, as perceived by parents of neonates eligible for KMC, increase their willingness or readiness to practise KMC?
The five studies identified in the literature search were included, comprising four systematic reviews and one narrative review.

The presence of well-trained nurses reduces maternal apprehension regarding KMC and the handling of their newborn, thereby facilitating its implementation.[129] A negative perception of the interaction between parents and healthcare professionals acts as a barrier to KMC, whereas supportive and empowering attitudes towards parents serve as facilitators.[123] Accessibility to healthcare staff and clear guidance on KMC are also key enablers, whereas a lack of practical assistance, failure to provide information, or merely instructing parents to perform KMC without guidance, hinder its acceptance.[122,129]

Some healthcare professionals are reluctant to involve parents in neonatal care. Additionally, certain behaviours, such as being perceived as noisy, inattentive, or lacking respect for privacy, negatively impact KMC implementation.[127] Certain culturally ingrained practices among professionals, such as immediate bathing of the newborn and the insistence on dressing them in clothes, socks, and a hat, may also interfere with caregivers' acceptance of KMC.[129]

A lack of belief in KMC's efficacy among professionals and inadequate training represent significant barriers to its proper implementation and duration. It is therefore essential for healthcare professionals to be well-versed in both the benefits and practice of KMC, enabling them to communicate this knowledge effectively to parents.[123]

Quality of evidence: **HIGH**
Strength of recommendation: **STRONG**. It is recommended to consider that a positive perception of professional competence may increase parents' willingness to practise KMC. Conversely, a lack of information and support, combined with a negative perception of professional competence, may hinder their readiness to engage in KMC.

40. Does the level of development of specific competencies among neonatal unit nurses influence their perception of the necessity/utility of KMC and their inclination to apply or recommend it?

Of the 13 identified documents, 12 were selected: three systematic reviews, two reviews, two cohort studies, three descriptive studies, one mixed-methods study, and a consensus document.

The lack of access to adequate and consistent training represents a barrier to the acceptance and implementation of KMC among healthcare professionals, also leading to contradictory knowledge regarding its appropriate timing and duration.[124,125] Conversely, centres that provide specific training on KMC achieve higher success rates in its implementation than those that do not train their staff, as proper education fosters confidence in carrying out KMC.[126,129]

In general, nurses with more experience in the profession or in KMC are more supportive of the method and more successful in its implementation. Due to the influence hierarchies among professional colleagues, less experienced nurses tend to be influenced by their more senior counterparts.[122,123] However, in some cases, limited experience poses a barrier for newly qualified nurses, who may be swayed by the opinions of senior nurses, leading them to seek help based on personal preference or other reasons rather than from professionals who can provide an evidence-based response. The prior experience of senior nurses with KMC determines both their own attitudes and those of younger nurses, potentially acting as either a barrier or a facilitator.[126]

The general lack of acceptance or belief in the effectiveness of KMC among other healthcare professionals, along with the guidelines derived from these perceptions, can also act as a barrier.[122,124] Another factor limiting the practice of KMC, linked to professional competence, is the division of labour responsibilities among healthcare professionals.[123]

According to the WHO clinical practice guidelines, all staff should receive appropriate training in all aspects of KMC. This training should cover when and how to initiate KMC, how to position the newborn, its impact on breastfeeding, how to involve parents, and how to address potential challenges that may arise during KMC.[4]

All institutions providing neonatal care should have a written policy on KMC, and all pregnant women and their families should be informed about its benefits and practical application when their child is born preterm, with low birth weight, or ill. Therefore, healthcare professionals should receive training in the skills required to implement the written policy within their area of care.[135] Additionally, promoting skin-to-skin contact between preterm infants and their mothers in the NICU is one of the ten research priorities identified to improve neonatal health globally by 2025.[136]

A descriptive study exploring nurses' knowledge and perceptions of KMC, using an adapted version of the Kangaroo Care Questionnaire, found that 82.5% (430 respondents) stated that KMC was practised in some form in their neonatal units, generally at the parents' request (87% of cases). Of the NICUs that responded, 62% were Level III units, 38% were Level II, and 1% were Level I. KMC was practised more frequently in Level III NICUs (90%) compared to Level II NICUs (69%; $p < 0.05$). Regarding nurses' knowledge of KMC, the overall average score across the sample was 75%. Interestingly, in NICUs where KMC was not practised, the average knowledge score was 79%, whereas in NICUs where KMC was implemented, the average score was 74% ($p < .02$). The majority of nurses demonstrated awareness of the effects of KMC across most topics. However, only 7% of the respondents were aware that the most physiologically stressful part of KMC for the baby is the transfer to the parent's chest. Regarding barriers, 64% of respondents reported having difficulties implementing KMC. The main barriers identified were concerns about infant safety and the reservations of medical staff. Overall, respondents demonstrated moderate knowledge about the types of infants for whom KMC has been established as safe, as well as its general effects on both infants and mothers. The reported safety concerns included difficulty in assessing infants' readiness for KMC (49%) and the risk of parents overstimulating the neonate during KMC (37%). When exploring the reasons for not practising KMC in NICUs where it was not implemented, the identified barriers included the lack of guidelines, experience, and information about KMC (20%), the perception that it required excessive time and effort (16%), lack of medical support (12%), staff discomfort (11%), and limited space in the units, making it difficult to accommodate a chair for the mother or ensure privacy (9%). Regarding nurses' perceptions of KMC, three subcategories emerged: appropriateness, advantages, and disadvantages. Respondents from NICUs that practised KMC had significantly more positive perceptions

($p < .0001$). Additionally, respondents from NICUs where KMC was implemented were more flexible in determining which infants could undergo KMC, particularly in terms of gestational age and weight criteria. They also recognised more benefits of KMC, especially regarding improved neonatal outcomes and quality of care, but were simultaneously more critical of potential disadvantages. In summary, this study highlights the need to enhance knowledge of the scientific evidence on KMC to improve its implementation.[137]

In another study examining current neonatal unit practices, respondents were asked about exclusion criteria for performing KMC. Three additional items yielded the following results: 55.3% (183) reported having placed limitations on KMC due to the SARS-CoV-2 pandemic, 96.7% (320) believed that it would be important to provide parents with written guidelines on the recommendations and implications of KMC, and 96.4% (319) stated that having a nationally standardised consensus guideline on KMC would be beneficial.[64]

Quality of evidence: **MODERATE**
Strength of recommendation: **STRONG**. It is recommended to promote training in KMC for neonatal nurses and healthcare professionals involved in the care of preterm newborns to facilitate the implementation of KMC.

41. Does the perception of the patient's clinical severity among neonatal unit nurses influence the implementation of KMC?

Two studies were selected, consisting of a systematic review and a narrative review.

Nurses express concern about the implementation of KMC in relation to the newborn's health conditions and required care. Factors such as prematurity, the presence of comorbidities, or clinical instability are perceived as barriers. This concern for the newborn's stability extends to their overall care needs, with fears that KMC might compromise the provision of appropriate medical care, particularly in settings where the nurse-to-patient ratio is low. In line with these barriers, high workloads and the absence of organisational support or clear guidelines are particularly limiting factors when dealing with clinically unstable newborns.[122,124]

Quality of evidence: **HIGH**
Strength of recommendation: **STRONG**. It is recommended to consider the importance of neonatal nurses' perceptions of the clinical severity of the newborn, especially in situations where the nurse-to-patient ratio is low, as this can significantly influence the implementation of neonatal-centred care (KMC).

42. Do parents of neonates eligible for KMC perceive the severity of their baby's clinical condition as a factor that improves their willingness to practise KMC?
The literature search identified ten eligible documents, of which eight were selected, including four systematic reviews, three narrative reviews, and one qualitative study.

Fear and anxiety about negatively impacting the newborn's health or unintentionally causing harm during KMC are common among parents. These concerns are particularly linked to the baby's medical condition, clinical instability, size, respiratory capacity, the risk of accidental removal of medical devices, or the inability to see their baby's face during KMC.[122–124,129,138] In some parents, this fear inhibits caregiving activities; however, in others, concern leads to more active monitoring of the baby's progress.[80] While these factors act as barriers, believing that the newborn enjoys KMC, observing reduced anxiety, increased happiness, longer sleep duration, and improved feeding tolerance are strong facilitators of its acceptance, alongside knowledge of its benefits.[122,123,129]

When doubts arise regarding KMC implementation, nurses tend to be overly cautious in their assessments. They commonly question the baby's stability and care requirements, particularly in neonates with intravenous catheters, those who are intubated, or those weighing less than 1000 grams.[122,123,129] These uncertainties are exacerbated by the lack of clear guidelines, leading to inconsistent application of KMC, miscommunication within the healthcare team, and inadequate patient handovers.[122-124]

The mother's health condition and concerns about her physical and mental well-being can also act as barriers to KMC. These concerns include fatigue, postpartum depression, and pain, particularly following caesarean sections.[86,126] Caesarean delivery negatively impacts the mother's experience of having a newborn admitted to the NICU, as post-surgical pain limits the energy required for KMC and is aggravated by the need to remain in

a seated position for prolonged periods while holding the newborn against the chest or abdomen.[127,138]

Quality of evidence: **HIGH**
Strength of recommendation: **STRONG**. The perceptions of mothers and fathers regarding the clinical severity of their newborn influence the frequency of KMC practice. Maternal health issues and caesarean delivery act as barriers to the implementation and duration of KMC.

43. Does the existence of an institutional support network facilitate the implementation of KMC?

Of the ten eligible studies, seven were selected to answer this question, including three systematic reviews, two narrative reviews, one RCT, and one qualitative study.

The lack of prioritisation of KMC by international leaders represents a limitation. However, KMC can be facilitated when institutions actively promote the method, empower decision-making, and allocate specific resources.[127] Addressing staff shortages and high turnover rates, as well as fostering effective communication and coordination within the healthcare team, act as facilitators of KMC.[138]

The lack of professional support perceived by primary caregivers constitutes a barrier, making it an institutional responsibility to empower both healthcare professionals and parents in decision-making regarding KMC.[41,44,47] In this regard, providing information and training for both professionals and parents on early KMC and its benefits, as well as developing and implementing clear institutional guidelines for its promotion, is essential.[123,124]

A care model focused on the needs of the newborn and the mother encourages the implementation of KMC. This is closely linked to the institutional framework established for neonatal care in each healthcare facility. Feelings of isolation and loneliness experienced by mothers during KMC are barriers. Institutions should respond to this issue by providing adequate resources and infrastructure to meet mothers' needs for support.[123,124]

Quality of evidence: **HIGH**

Strength of recommendation: **STRONG**. It is recommended to provide institutional support to healthcare professionals to facilitate the implementation of KMC.

SECTION 6. EXTREME PREMATURITY AND KANGAROO MOTHER CARE

44. Is KMC safe for extremely preterm newborns?

There is very limited scientific evidence evaluating the efficacy and safety of KMC in newborns with a postmenstrual age of less than 28 weeks' GA. The six studies identified in the literature search were included: two pre-post quasi-experimental studies, three descriptive studies, and a presentation at an international congress.

In an observational study, Kommers et al. compared heart rate (HR) variability during KMC versus incubator care in six PTNBs (191 observations) with a postmenstrual age of 28.6 weeks [27–29.6]. The study found a statistically significant improvement in six out of the eight HR variability components during KMC compared to incubator care, with these benefits persisting after KMC. Additionally, an improvement in HR was observed: 159 bpm (146–170) in the incubator versus 156 bpm (145–167) in KMC, as well as in respiratory rate (RR): 49 (42–62) in the incubator versus 47 (38–61) in KMC ($p < 0.01$).[139]

Regarding temperature, PTNBs maintained normothermia during KMC, as indicated in studies such as that by Lorenz et al., which reported normothermia in PTNBs of 29 weeks' postmenstrual age during KMC, with no significant differences compared to incubator care (36.8°C (0.6) in the incubator vs. 36.8°C (0.3) in KMC, $p = 0.58$).[66] In the RCT by Karlsson et al., which studied PTNBs at 25+3 weeks' GA, a 0.2°C increase was found in KMC compared to incubator care; however, in both groups, the axillary temperature of the newborns remained below 36.5°C.[140] Similarly, the study by Blomqvist et al. found that temperature increased by 0.3°C in KMC compared to incubator care.[141]

Maastrup et al., in their sample of 22 PTNBs with a mean GA of 26+5, found no statistically significant difference in mean temperature before, during, or after KMC.[142] In the RCT by Collados-Gómez et al., a total of 70 Extremely Preterm underwent a mean of four KMC sessions within the first five days of life. A total of 285 KMC sessions were recorded, with a mean gestational age at birth of 26+1 (1+1) in both groups. At 60 minutes after initiating KMC, the intervention group in lateral KMC maintained an axillary temperature of 36.83°C (0.40), while the control group in prone KMC maintained a temperature

of 36.83°C (0.36) (p = 0.75). In this study, KMC was performed by placing the PTNBs inside a polyethylene bag to maintain humidity while ensuring skin-to-skin contact. The bag covered only the body surface areas not in direct contact with the KMC provider's skin.[109]

Regarding the increased risk of developing IVH, it is recommended to review section 6.7 of this CPG.

Quality of evidence: **LOW and EXPERT CONSENSUS**
Strength of recommendation 1: **STRONG**. It is recommended to initiate KMC in extremely preterm newborns as soon as clinically feasible.
Strength of recommendation 2: **WEAK**. It is suggested to perform KMC using a polyethylene bag to prevent hypothermia, at least during the first week of life in preterm newborns, with individualised assessment in each case and always maintaining skin-toskin contact.

References

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7. References

1. Conde-Agudelo A, Díaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. Vol. 2016, Cochrane Database Syst Rev.2016; 2016 (8): CD002771.

2. Boundy EO, Dastjerdi R, Spiegelman D, Fawzi WW, Missmer SA, Lieberman E, et al. Kangaroo mother care and neonatal outcomes: A meta-analysis. Pediatrics. 2016;137(1) :e20152238.

3. World Health Organization. Kangaroo mother care: a practical guide. World Health Organization; 2003.

4. World Health Organization. WHO recommendations for care of the preterm or low birth weight infant. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO.

5. Sivanandan S, Sankar MJ. Kangaroo mother care for preterm or low birth weight infants: a systematic review and meta-analysis. BMJ Glob Health. 2023;8(6):e010728.

6. Instituto Aragonés de Ciencias de la Salud (IACS). Elaboración de Guías de Práctica Clínica en el Sistema Nacional de Salud. Actualización del Manual Metodológico. Ministerio de Sanidad SS e I, editor. Zaragoza; 2016.

7. Andrews JC, Schünemann HJ, Oxman AD, Pottie K, Meerpohl JJ, Coello PA. GRADE guidelines: 15. Going from evidence to recommendation—determinants of a recommendation's direction and strength. J Clin Epidemiol. 66(7):726-35.

8. Nagai S, Andrianarimanana D, Rabesandratana N, Yonemoto N, Nakayama T, Mori R. Earlier versus later continuous Kangaroo Mother Care (KMC) for stable low-birthweight infants: A randomized controlled trial. Acta Paediatr. 2010;99(6):826-35.

9. Guo W. Evaluation of the impact of kangaroo mother care on neonatal mortality and hospitalization: A meta-analysis. Adv Clin Exp Med. 2023;32(2):175-83.

10. Linnér A, Klemming S, Sundberg B, Lilliesköld S, Westrup B, Jonas W, et al. Immediate skin-to-skin contact is feasible for very preterm infants but thermal control remains a challenge. Acta Paediatr.2020;109(4):697-704.

11. Narciso LM, Beleza LO, Imoto AM. The effectiveness of Kangaroo Mother Care in hospitalization period of preterm and low birth weight infants: systematic review and meta-analysis. J Pediatr (Rio J). marzo de 2022;98(2):117-25.

12. Jafari M, Farajzadeh F, Asgharlu Z, Derakhshani N, Asl Y. Effect of Kangaroo Mother Care on hospital management indicators: A systematic review and meta-analysis of randomized controlled trials. J Educ Health Promot. 2019;8(1):96.

13. Cañadas DC, Perales AB, Martínez RG, Casado-Belmonte MDP, Carreño TP. Effects of Kangaroo Mother Care in the NICU on the Physiological Stress Parameters of Premature Infants: A Meta-Analysis of RCTs. Int J Environ Res Public Health. 2022;19(1):583.

14. Özdel D, Sarı HY. Effects of the prone position and kangaroo care on gastric residual volume, vital signs and comfort in preterm infants. Jpn J Nurs Sci. 2020;17(1): e12287.

15. Montealegre-Pomar A, Bohorquez A, Charpak N. Systematic review and meta-analysis suggest that Kangaroo position protects against apnoea of prematurity. Acta Paediatr. 2020. 109 (7):1310-1316.

16. Jayaraman D, Mukhopadhyay K, Bhalla AK, Dhaliwal LK. Randomized Controlled Trial on Effect of Intermittent Early Versus Late Kangaroo Mother Care on Human Milk Feeding in Low-Birth-Weight Neonates. J Hum Lact . 2017;33(3):533-9.

17. Xie X, Chen X, Sun P, Cao A, Zhuang Y, Xiong X, et al. Kangaroo Mother Care Reduces Noninvasive Ventilation and Total Oxygen Support Duration in Extremely Low Birth Weight Infants. Am J Perinatol. 2021;38(8):791-5.

18. El-Farrash RA, Shinkar DM, Ragab DA, Salem RM, Saad WE, Farag AS. Longer duration of kangaroo care improves neurobehavioral performance and feeding in preterm infants: a randomized controlled trial. Pediatr Res.2020; 87(4):683-8.

19. Sehgal A, Nitzan I, Jayawickreme N, Menahem S. Impact of Skin-to-Skin Parent-Infant Care on Preterm Circulatory Physiology. J Pediatr. 2020;222:91-97.e2.

20. Head LM. The effect of kangaroo care on neurodevelopmental outcomes in preterm infants. J Perinat Neonatal Nurs. 2014;28(4):290-9.

21. Charpak N, Tessier R, Ruiz JG, Uriza F, Hernandez JT, Cortes D, et al. Kangaroo mother care had a protective effect on the volume of brain structures in young adults born preterm. Acta Paediatr. 2022;111(5):1004.

22. Charpak N, Tessier R, Ruiz JG, Hernandez JT, Uriza F, Villegas J. Twenty-year Follow-up of Kangaroo Mother Care Versus Traditional Care. Pediatrics. 2017;139(1):e20162063.

23. Bisanalli S, Balachander B, Shashidhar A, Raman V, Josit P, Rao SP. The beneficial effect of early and prolonged kangaroo mother care on long-term neuro-developmental outcomes in low birth neonates – A cohort study. Acta Paediatr.2023; 112(11):2400-7.

24. Lorenz L, Marulli A, Dawson JA, Owen LS, Manley BJ, Donath SM. Cerebral oxygenation during skin-to-skin care in preterm infants not receiving respiratory support. Arch Child Fetal Neonatal Ed. 2018;103(2):F137–42.

25. Meder U, Tarjanyi E, Kovacs K, Szakmar E, Cseko AJ, Hazay T. Cerebral oxygenation in preterm infants during maternal singing combined with skin-to-skin care. Pediatr Res. 2021; 90(4):809-14.

26. Solaz-García Á, Sánchez-Illana Á, Lara-Cantón I, Montejano-Lozoya R, Gimeno-Navarro A, Pinilla-González A, et al. Analysis of Fractional Cerebral Oxygen Extraction in Preterm Infants during the Kangaroo Care. Neonatology. 2023;120(4):508-16.

27. Solaz-García Á, Lara-Cantón I, Pinilla-González A, Montejano-Lozoya R, Gimeno-Navarro A, Sánchez-Illana Á, et al. Impact of Kangaroo Care on Premature Infants' Oxygenation: Systematic Review. Neonatology. 2022;119(5):537-46.

28. Bembich S, Castelpietra E, Cont G, Travan L, Cavasin J, Dolliani M, et al. Cortical activation and oxygen perfusion in preterm newborns during kangaroo mother care: A pilot study. Acta Paediatr Oslo. 2023;112(5):942-50.

29. Chaudhari AJ, Nimbalkar SM, Patel DV, Phatak AG. Effect of Kangaroo Mother Care on Cerebral Hemodynamics in Preterm Neonates Assessed by Transcranial Doppler Sonography in Middle Cerebral Artery. Indian Pediatr. 2023;60(1):27-32.

30. Nanavati RN, Prashanth RR. Effect of Kangaroo Mother Care on Cerebral Hemodynamics in Preterm Infants. Indian Pediatr. 2023; 60(1):13-4.

31. Sahoo M, Dubey B, Vani K, Maria A. Changes in cerebral blood flow parameters among preterm 30–34 week neonates who are initiated on kangaroo mother care - A prospective analytical observational study. Early Hum Dev. 2023;180:105764.

32. Ludington-Hoe SM, Morgan K, Abouelfettoh A. A Clinical Guideline for Implementation of Kangaroo Care With Premature Infants of 30 or More Weeks. Postmenstrual Age. Adv Neonatal Care. 2008;8(3):S3–23.

33. Kenaley KM, Rickolt AL, Vandersteur DA, Ryan JD, Stefano JL. An intervention to decrease time to parents' first hold of infants in the Neonatal Intensive Care Unit requiring respiratory support. J Perinatol. 2020; 40(5):812-9.

34. Bastani F, Rajai N, Farsi Z, Als H. The Effects of Kangaroo Care on the Sleep and Wake States of Preterm Infants. J Nurs Res. 2017; 25(3):231-9.

35. van den Hoogen A, Teunis CJ, Shellhaas RA, Pillen S, Benders M, Dudink J. How to improve sleep in a neonatal intensive care unit: A systematic review. Early Hum Dev. 2017;113:78-86.

36. Wang Y, Dong W, Zhang L, Zhang R. The effect of kangaroo mother care on aEEG activity and neurobehavior in preterm infants: a randomized controlled trial. J Matern Fetal Neonatal Med. 2022; 35(25):6483-8.

37. Johnston C, Campbell-Yeo M, Disher T, Benoit B, Fernandes A, Streiner D. Skin-to-skin care for procedural pain in neonates. Cochrane Database Syst Rev. 2017; 2 (2): CD008435.

38. Campbell-Yeo M, Eriksson M, Benoit B. Assessment and Management of Pain in Preterm Infants: A Practice Update. Children. 2022; 9(2):244.

39. Campbell-Yeo M, Johnston CC, Benoit B, Disher T, Caddell K, Vincer M. Sustained efficacy of kangaroo care for repeated painful procedures over neonatal intensive care unit hospitalization: A single-blind randomized controlled trial. Pain. 2019; 160(11):2580-8.

40. Zhao Y, Dong Y, Cao J. Kangaroo Care for Relieving Neonatal Pain Caused by Invasive Procedures: A Systematic Review and Meta-Analysis. Comput Intell Neurosci. 2022:1-9.

41. Wang F, Zhang Q, Ni ZH, Lv HT. Effects of kangaroo care on pain relief in premature infants during painful procedures: A meta-analysis. J Spec Pediatr Nurs. 2022; 27(4):12390.

42. Sharma H, Ruikar M. Kangaroo mother care (KMC) for procedural pain in infants: A meta-analysis from the current evidence of randomized control trials and cross-over trials. J Fam Med Prim Care. 2022;11(4):1250.

43. Lyngstad LT, Tandberg BS, Storm H, Ekeberg BL, Moen A. Does skin-to-skin contact reduce stress during diaper change in preterm infants? Early Hum Dev. 2014; 90(4):169-72.

44. Kristoffersen L, Støen R, Bergseng H, Follestad T, Theodorsson E, Vederhus B. Skin-to-skin contact during eye examination did not reduce pain compared to standard care with parental support in preterm infants. Acta Paediatr. 2019;108(8):1434-40.

45. Eissler AB, Zwakhalen S, Stoffel L, Hahn S. Systematic Review of the Effectiveness of Involving Parents During Painful Interventions for Their Preterm Infants. J Obstet Gynecol Neonatal Nurs. 2022; 51(1):6-15.

46. Sen E, Manav G. Effect of Kangaroo Care and Oral Sucrose on Pain in Premature Infants: A Randomized Controlled Trial. Pain Manag Nurs. 2020; 21(6):556-64.

47. Mekonnen AG, Yehualashet SS, Bayleyegn AD. The effects of kangaroo mother care on the time to breastfeeding initiation among preterm and LBW infants: A meta-analysis of published studies. Int Breastfeed J. 2019; 14(12).

48. Pavlyshyn H, Sarapuk I, Casper C, Makieieva N. Kangaroo mother care can improve the short-term outcomes of very preterm infants. J Neonatal Perinat Med. 2021; 14(1):21-8.

49. Wang Y, Zhao T, Zhang Y, Li S, Cong X. Positive Effects of Kangaroo Mother Care on Long-Term Breastfeeding Rates, Growth, and Neurodevelopment in Preterm Infants. Breastfeed Med. 2021;16(4):282-91.

50. Charpak N, Montealegre-Pomar A, Bohorquez A. Systematic review and meta-analysis suggest that the duration of Kangaroo mother care has a direct impact on neonatal growth. Acta Paediatr. 2021; 110(1):45-59.

51. Valizadeh S, Hosseini MB, Jafarabadi MA, Mohebbi L. Comparison of the effect of nutrition in kangaroo mother care and supine positions on gavage residual volume in preterm infants. Evid Based Care J. 2015; 5:17-24.

52. Pandya D, Kartikeswar GAP, Patwardhan G, Kadam S, Pandit A, Patole S. Effect of early kangaroo mother care on time to full feeds in preterm infants - A prospective cohort study. Early Hum Dev. 2021; 154:105312.

53. Heller N, Rüdiger M, Hoffmeister V, Mense L. Mother's Own Milk Feeding in Preterm Newborns Admitted to the Neonatal Intensive Care Unit or Special-Care Nursery: Obstacles, Interventions, Risk Calculation. Int J Env Res Public Health. 2021;18(8):4140.

54. Cho ES, Kim SJ, Kwon MS, Cho H, Kim EH, Jun EM. The Effects of Kangaroo Care in the Neonatal Intensive Care Unit on the Physiological Functions of Preterm Infants, Maternal-Infant Attachment, and Maternal Stress. J Pediatr Nurs. 2016; 31(4):430-8.

55. Kurt F, Kucukoglu S, Ozdemir A, Ozcan Z. The effect of kangaroo care on maternal attachment in preterm infants. Niger J Clin Pract. 2020; 23(1):26-32.

56. Gupta N, Deierl A, Hills E, Banerjee J. Systematic review confirmed the benefits of early skin-to-skin contact but highlighted lack of studies on very and extremely preterm infants. Acta Paediatr. 2021; 110(8):2310-5.

57. Norholt H. Revisiting the roots of attachment: A review of the biological and psychological effects of maternal skin-to-skin contact and carrying of full-term infants. Infant Behav Dev. 2020; 60: 101441.

58. Pathak BG, Sinha B, Sharma N, Mazumder S, Bhandari N. Effects of kangaroo mother care on maternal and paternal health: systematic review and meta-analysis. Bull World Health Organ.2023; 101(06):391-402.

59. Rao P, R R, Bethou A, Bhat V, P C. Does Kangaroo Mother Care Reduce Anxiety in Postnatal Mothers of Preterm Babies? - A Descriptive Study from a Tertiary Care Centre in South India. J Nepal Health Res Counc. 2019; 17(1):42-5.

60. Xie J, Zhu L, Zhu T, Jian Y, Ding Y, Zhou M. Parental Engagement and Early Interactions With Preterm Infants Reduce Risk of Late Postpartum Depression. J Nerv Ment Dis. 2019; 207(5):360-4.

61. Badr HA, Zauszniewski JA. Kangaroo care and postpartum depression: The role of oxytocin. Int J Nurs Sci. 2017; 4(2):179-83.

62. Chen W yan, Wu Y ying, Xu M yan, Tung TH. Effect of Kangaroo Mother Care on the Psychological Stress Response and Sleep Quality of Mothers With Premature Infants in the Neonatal Intensive Care Unit. Front Pediatr. 2022;10:879956.

63. Dong Q, Steen M, Wepa D, Eden A. Exploratory study of fathers providing Kangaroo Care in a Neonatal Intensive Care Unit. J Clin Nurs. 2022. Epub ahead of print.

64. Solaz-García Á, Ros-Navarret R, Gimeno-Navarro A, Izquierdo-Macián I. Conocimientos y percepciones de los profesionales sanitarios de las unidades neonatales españolas sobre Método Canguro. Evidentia. 2022; v19:13891.

65. Lee J, Parikka V, Lehtonen L, Soukka H. Parent–infant skin-to-skin contact reduces the electrical activity of the diaphragm and stabilizes respiratory function in preterm infants. Pediatr Res. 2022; 91(5):1163-7.

66. Lorenz L, Dawson JA, Jones H, Jacobs SE, Cheong JL, Donath SM. Skin-to-skin care in preterm infants receiving respiratory support does not lead to physiological instability. Arch Child Fetal Neonatal Ed. 2017;102(4):F339–44

67. Bisanalli S, Nesargi S, Govindu RM, Rao SP. Kangaroo Mother Care in Hospitalized Low Birth-Weight Infants on Respiratory Support. Adv Neonatal Care.2019;19(6):E21–5

68. de Oliveira Azevedo VMG, Xavier CC, de Oliveira Gontijo F. Safety of Kangaroo Mother Care in Intubated Neonates Under 1500 g. J Trop Pediatr. 2012;58(1):38–42.

69. Kelley-Quon LI, Kenney BD, Bartman T, Thomas R, Robinson V, Nwomeh BC. Safety and feasibility of skin-to-skin care for surgical infants: A quality improvement project. J Pediatr Surg. 2019; 54(11):2428-34.

70. Nation H, Sanlorenzo L, Lebar K, Brandon D. A Quality Improvement Project to Increase Frequency of Skin-to-Skin Contact for Extreme Low-Birth-Weight Infants in the Neonatal Intensive Care Unit. J Perinat Neonatal Nurs. 2021; 35(3):247-57.

71. Catherine ZG, Béatrice P, Fabrice L, Claire H, Alain D. Skin-to-skin contact with an umbilical venous catheter: prospective evaluation in a level 3 unit. Eur J Pediatr. 2016; 175(4):551-5.

72. Bedetti L, Lugli L, Bertoncelli N, Spaggiari E, Garetti E, Lucaccioni L. Early Skin-to-Skin Contact in Preterm Infants: Is It Safe? An Italian Experience. Children. 2023;10(3):570.

73. Montaner A, Merayo L, Camba F, Cosmo I, Carrillo E, Ramos I. Skin to Skin contact in premature newborn with umbilical venous catheter, is it safe? En: XIII International Kangaroo Mother Care Congress and Workshop. 2022,

74. European Foundation for the Care of Newborn Infants. European Standards of Care for Newborn Health . Disponible en: https://newborn-health-standards.org/about/project-overview/

75. Als H. A Synactive Model of Neonatal Behavioral Organization: Phys Occup Ther Pediatr. 1986;6(3–4):3–53.

76. Brazelton TB, Nugent KJ. Clinics in Developmental Medicine. Neonatal Behavioral Assessment Scale LONDON: William Heinemann Medical Books Ltd., editor. Philadelphia: J.B. Lippincott Co. ; 1973.

77. NIDCAP. Disponible en: https://nidcap.org/

78. Olawuyi O, Ezenwa BN, Fajolu IB, Onwuama M, Ezeaka CV. Knowledge, attitude and practice of kangaroo mother care among mothers in the neonatal wards of a tertiary care center. Pan Afr Med J. 2021; 38(364).

79. O'Brien K, Robson K, Bracht M, Cruz M, Lui K, Alvaro R. Effectiveness of Family Integrated Care in neonatal intensive care units on infant and parent outcomes: a multicentre, multinational, cluster-randomised controlled trial. Lancet Child Adolesc Health. 2018; 2(4):245-54.

80. Warren I. Family and Infant Neurodevelopmental Education: an innovative, educational pathway for neonatal healthcare professionals. Infant.2017; 13(5):200-3.

81. FINE Training. Family and Infant Neurodevelopmental Education. Disponible en: https://www.finetraininguk.com/

82. Ahlqvist-Björkroth S, Boukydis Z, Axelin AM, Lehtonen L. Close Collaboration with ParentsTM intervention to improve parents' psychological well-being and child development: Description of the intervention and study protocol. Behav Brain Res. 2017; 325:303-10.

83. Craig JW, Glick C, Phillips R, Hall SL, Smith J, Browne J. Recommendations for involving the family in developmental care of the NICU baby. J Perinatol. 2015;35(S1):S5–8,

84. Toivonen M, Lehtonen L, Ahlqvist-Björkroth S, Axelin A. Effects of the Close Collaboration With Parents Intervention on the Quality of Family-Centered Care in NICUs. Adv Neonatal Care. 2023;23(3):281–9.

85. Feeley N, Gottlieb L, Zelkowitz P. Infant, mother, and contextual predictors of mother-very low birth weight infant interaction at 9 months of age. J Dev Behav Pediatr. 2005; 26(1):24-33.

86. Labrie NHM, Veenendaal NR, Ludolph RA, Ket JCF, van der Schoor SRD, van Kempen AAMW. Effects of parent-provider communication during infant hospitalization in the NICU on parents: A systematic review with meta-synthesis and narrative synthesis. Patient Educ Couns. 2021;104(7):1526-52.

87. Gómez-Cantarino S, García-Valdivieso I, Moncunill-Martínez E, Yáñez-Araque B, Gurrutxaga MIU. Developing a Family-Centered Care Model in the Neonatal Intensive Care Unit (NICU): A New Vision to Manage Healthcare. Int J Env Res Public Health. 2020; 17(19):7197.

88. Vogl JL, Dunne EC, Liu C, Bradley A, Rwei A, Lonergan EK. Kangaroo father care: A pilot feasibility study of physiologic, biologic, and psychosocial measures to capture the effects of father–infant and mother–infant skin-to-skin contact in the Neonatal Intensive Care Unit. Dev Psychobiol. 2021; 63(5):1521-33.

89. Shukla VV, Chaudhari AJ, Nimbalkar SM, Phatak AG, Patel DV, Nimbalkar AS. Skin-to-Skin Care by Mother vs. Father for Preterm Neonatal Pain: A Randomized Control Trial (ENVIRON Trial). Int J Pediatr. 2021;2021:8886887.

90. Filippa M, Saliba S, Esseily R, Gratier M, Grandjean D, Kuhn P. Systematic review shows the benefits of involving the fathers of preterm infants in early interventions in neonatal intensive care units. Acta Paediatr. 2021; 110(9):2509-20.

91. Dargahiyan Z, Ghasemi F, Karami K, Valizadeh F, Mohammadi R. A comparative study of the effects of Kangaroo care by mothers and maternal grandmothers on the vital signs of hospitalized preterm newborns: a randomized controlled clinical trial study. Trials. 2023;24(1):275.

92. Chavula K, Guenther T, Valsangkar B, Lwesha V, Banda G, Wensaas MB. Improving skin-to-skin practice for babies in kangaroo mother care in Malawi through the use of a customized baby wrap: A randomized control trial. PLoS One. 2020;15(3):e0229720.

93. Zengin H, Cinar N. Designing dress (Sarbebe) for kangaroo care, the effect of kangaroo care provided with this dress on mother and newborn's comfort †. Health Care Women Int. 2022; 43(6):642-62.

94. Cavallin F, Segafredo G, Pizzol D, Massavon W, Lusiani M, Wingi O. Thermal Effect of a Woolen Cap in Low Birth Weight Infants During Kangaroo Care. Pediatrics.2018; 141(6):20173073.

95. Enfermería NeNe. Fundación Nene/SIBEN. Estrategias para promover un ambiente que favorezca el óptimo neurodesarrollo: estímulos sonoros y lumínicos. 2019.

96. Aita M, Stremler R, Feeley N, Nuyt AM, Lavallée A. Acceptability to nurses of reducing NICU light and noise levels during skin-to-skin care: A pilot study. Appl Nurs Res. 2019; 47:29-31.

97. Hazelhoff EM, Dudink J, Meijer JH, Kervezee L. Beginning to See the Light: Lessons Learned From the Development of the Circadian System for Optimizing Light Conditions in the Neonatal Intensive Care Unit. Front Neurosci. 2021; 15: 634034.

98. Almadhoob A, Ohlsson A. Sound reduction management in the neonatal intensive care unit for preterm or very low birth weight infants. Cochrane Database Syst Rev. 2015; 1:CD010333.

99. Saptaputra SK, Kurniawidjaja LM, Susilowati IH, Pratomo H. Ergonomic sofa design to support kangaroo mother care in Indonesia. J Neonatal Nurs. 2021; 27(6):471-5.

100. Nyqvist KH, Anderson GC, Bergman N, Cattaneo A, Charpak N, Davanzo R, et al. State of the art and recommendationsKangaroo mother care: application in a high-tech environment. Acta Pædiatr. 2010;99(6): :820–6.

101. Ludington-Hoe SM, Ferreira C, Swinth J, Ceccardi JJ. Safe Criteria and Procedure for Kangaroo Care With Intubated Preterm Infants. J Obstet Gynecol Neonatal Nurs. 2003; 32(5):579-88.

102. Neu M, V BJ, Vojir C. The Impact of Two Transfer Techniques Used During Skin-to-Skin Care on The Physiologic and Behavioral Responses of Preterm Infants. Nurs Res. 2000; 49(4):215-23.

103. Ludington-Hoe SM, Ferreira CN, Goldstein MR. Kangaroo Care with a ventilated preterm infant. Acta Paediatr. 1998; 87(6):711-3.

104. Schultz D, Shindruk C, Gigolyk S, Ludington-Hoe SM, Kostandy RR. A standardized transfer procedure for fragile and intubated infants in the NICU. Birth Defects Res. 2019; 111(15):1073-80.

105. Hedberg Nyqvist K, Heinemann AB. Kangaroo Mother Care: Optimal Support of Preterm Infants' Transition to Extra-Uterine Life in the High Tech NICU Environment. Curr Womens Health Rev. 2011; 7(3):278-87.

106. Buil A, Caeymaex L, Mero S, Sankey C, Apter G, Devouche E. Kangaroo supported diagonal flexion positioning: Positive impact on maternal stress and postpartum depression risk and on skin-to-skin practice with very preterm infants. J Neonatal Nurs. 2019; 25(2):86-92.

107. Buil A, Sankey C, Caeymaex L, Apter G, Gratier M, Devouche E. Fostering mother-very preterm infant communication during skin-to-skin contact through a modified positioning. Early Hum Dev. 2020; 141:104939.

108. Schinckel NF, Hickey L, Perkins EJ, Pereira-Fantini PM, Koeppenkastrop S, Stafford I. Skin-to-skin care alters regional ventilation in stable neonates. Arch Child Fetal Neonatal Ed. 2021; 106(1):76-80.

109. Collados-Gómez L. Kangaroo Care in preterm infants under 28 weeks. Lateral position versus traditional position: CANGULAT study. En: XIII International Conference on Kangaroo Mother Care. 2022.

110. de Bijl-Marcus K, Brouwer AJ, De Vries LS, Groenendaal F, Wezel-Meijler G van. Neonatal care bundles are associated with a reduction in the incidence of intraventricular haemorrhage in preterm infants: a multicentre cohort study. Arch Child Fetal Neonatal Ed. 2020; 105(4):419-24.

111. Gross M, Engel C, Trotter A. Evaluating the Effect of a Neonatal Care Bundle for the Prevention of Intraventricular Hemorrhage in Preterm Infants. Child. 2021;8(4):257.

112. Kramer KP, Minot K, Butler C, Haynes K, Mason A, Nguyen L. Reduction of Severe Intraventricular Hemorrhage in Preterm Infants: A Quality Improvement Project. Pediatrics. 2022;149(3):e2021050652.

113. al-Haddad BJS, Bergam B, Johnson A, Kolnik S, Thompson T, Perez KM, et al. Effectiveness of a care bundle for primary prevention of intraventricular hemorrhage in high-risk neonates: a Bayesian analysis. J Perinatol. 2023; 43(6): 722-7.

114. Murthy P, Zein H, Thomas S, Scott JN, Mehrem AA, Esser MJ, et al. Neuroprotection Care Bundle Implementation to Decrease Acute Brain Injury in Preterm Infants. Pediatr Neurol. 2020;110:42-8.

115. Travers CP, Gentle S, Freeman AE, Nichols K, V SV, Purvis D. A Quality Improvement Bundle to Improve Outcomes in Extremely Preterm Infants in the First Week. Pediatrics. 2022; 149(2):e2020037341.

116. Romantsik O, Calevo MG, Bruschettini M. Head midline position for preventing the occurrence or extension of germinal matrix-intraventricular hemorrhage in preterm infants. Cochrane Database Syst Rev. 2017; 7(7):CD012362.

117. Maes E, Cools F, Dereymaeker A, Jansen K, Naulaers G, Thewissen L. Cerebral oxygenation and body position in the preterm infant: A systematic review and meta-analysis. Acta Paediatr. 2023; 112(1):42-52.

118. Diniz KT, Cabral-Filho JE, Miranda RM, Souza Lima GM, Vasconcelos D de A. Effect of the kangaroo position on the electromyographic activity of preterm children: A follow-up study. BMC Pediatr. 2013; 13:79.

119. Diniz KT, Cabral Filho JE, Miranda RM, Souza Lima GM, dos Santos Figueredo NP, de Araújo KFN. WITHDRAWN: Short-time effect of the kangaroo position on electromyographic activity of premature infants: a randomized clinical trial. J Pediatr Rio J. 2019; 18: S0021-7557(19)30322.

120. Miranda RM, Cabral Filho JE, Diniz KT, Souza Lima GM, Vasconcelos D de A. Electromyographic activity of preterm newborns in the kangaroo position: a cohort study. BMJ Open. 2014;4(10):e005560.

121. Barradas J, Fonseca A, Guimarães CLN, Souza Lima GM. Relationship between positioning of premature infants in Kangaroo Mother Care and early neuromotor development. J Pediatr (Rio J). 2006;82(6):475-80.

122. Seidman G, Unnikrishnan S, Kenny E, Myslinski S, Cairns-Smith S, Mulligan B. Barriers and enablers of Kangaroo mother care practice: A systematic review. PLoS One. 2015; 10(5):125643.

123. Gill VR, Liley HG, Erdei C, Sen S, Davidge R, Wright AL. Improving the uptake of Kangaroo Mother Care in neonatal units: A narrative review and conceptual framework. Acta Paediatr. 2021; 110(5):1407-16.

124. Maniago JD, Almazan JU, Albougami AS. Nurses' Kangaroo Mother Care practice implementation and future challenges: an integrative review. Scand J Caring Sci.2020; 34(2):293-304.

125. Blomqvist YT, Frölund L, Rubertsson C, Nyqvist KH. Provision of Kangaroo Mother Care: Supportive factors and barriers perceived by parents. Scand J Caring Sci. 2013; 27(2):345-53.

126. Chan GJ, Labar AS, Wall S, Atun R. Kangaroo mother care: A systematic review of barriers and enablers. Bull World Health Organ. 2016; 94(2):130-41.

127. Smith ER, Bergelson I, Constantian S, Valsangkar B, Chan GJ. Barriers and enablers of health system adoption of kangaroo mother care: a systematic review of caregiver perspectives. BMC Pediatr. 2017;17(1):35.

128. Chan GJ, Valsangkar B, Kajeepeta S, Boundy EO, Wall S. What is kangaroo mother care? Systematic review of the literature. J Glob Health. 2016;6(1):010701.

129. Chan G, Bergelson I, Smith ER, Skotnes T, Wall S. Barriers and enablers of kangaroo mother care implementation from a health systems perspective: A systematic review. Health Policy Plan. 2017;32(10):1466–75.

130. Kostandy RR, Ludington-Hoe SM. The evolution of the science of kangaroo (mother) care (skin-to-skin contact. Birth Defects Res. 2019; 111(15):1032-43.

131. Mohammadi M, Sattarzadeh N, Heidarzadeh M, Hosseini MB, Hakimi S. Implementation Barriers for Practicing Continuous Kangaroo Mother Care from the Perspective of Neonatologists and Nurses. J Caring Sci. 2021; 10(3):137-44.

132. Saptaputra SK, Kurniawidjaja M, Susilowati IH, Pratomo H. How to improve the effectiveness and efficiency of Kangaroo Mother Care: a literature review of equipment supporting continuous Kangaroo Mother Care. Gac Sanit. 2021; 35:S98–102.

133. Solís-García G, Cambra-Rufino L, Piris Borregas S, Carrasco Pérez A, López Maestro M, De la Cruz Bértolo J, et al. Architectural design, facilities and family participation in neonatal units in Spain: A multicentre study. Acta Paediatr. 2024;113(4):716-21.

134. Denham ME, Bushehri Y, Lim L. Through the Eyes of the User: Evaluating Neonatal Intensive Care Unit Design. HERD. 2018;11(3):49-65.

135. Trujillo JLH, Aviñó AM i, Millán CL. User Evaluation of Neonatology Ward Design. HERD. 2017;10(2):23-48.

136. Yoshida S, Martines J, Lawn JE, Wall S, Souza JP, Rudan I. Setting research priorities to improve global newborn health and prevent stillbirths by 2025. J Glob Health. 2016;6(1):010508.

137. Engler AJ, Ludington-Hoe SM, Cusson RM, Adams R, Bahnsen M, Brumbaugh E. Kangaroo care: national survey of practice, knowledge, barriers, and perceptions. MCN Am J Matern Child Nurs. 2002; 27(3):146-53.

138. Lewis TP, Andrews KG, Shenberger E, Betancourt TS, Fink G, Pereira S. Caregiving can be costly: A qualitative study of barriers and facilitators to conducting kangaroo mother care in a US tertiary hospital neonatal intensive care unit. BMC Pregnancy Childbirth. 2019;19(1):227.

139. Kommers DR, Joshi R, Pul C, Atallah L, Feijs L, Oei G. Features of Heart Rate Variability Capture Regulatory Changes During Kangaroo Care in Preterm Infants. J Pediatr. 2017;182:92-98.e1.

140. Karlsson V, Heinemann AB, Sjörs G, Nykvist KH, Ågren J. Early Skin-to-Skin Care in Extremely Preterm Infants. Therm Balance Care Environ J Pediatr. 2012;161(3):422-6.

141. Blomqvist YT, Karlsson V, Dawit F, Sindelar R, Ågren J. Physiological Stability in Very Preterm Infants During Skin-to-Skin Contact as Assessed by Near-Infrared Spectroscopy. Adv Neonatal Care. 2020; 20(6):495-8.

142. Maastrup R, Greisen G. Extremely preterm infants tolerate skin-to-skin contact during the first weeks of life. Acta Paediatr. 2010; 99(8):1145-9.

Appendices

8

8. APPENDICES

Appendix 1. Documentary language (descriptors and free text search)

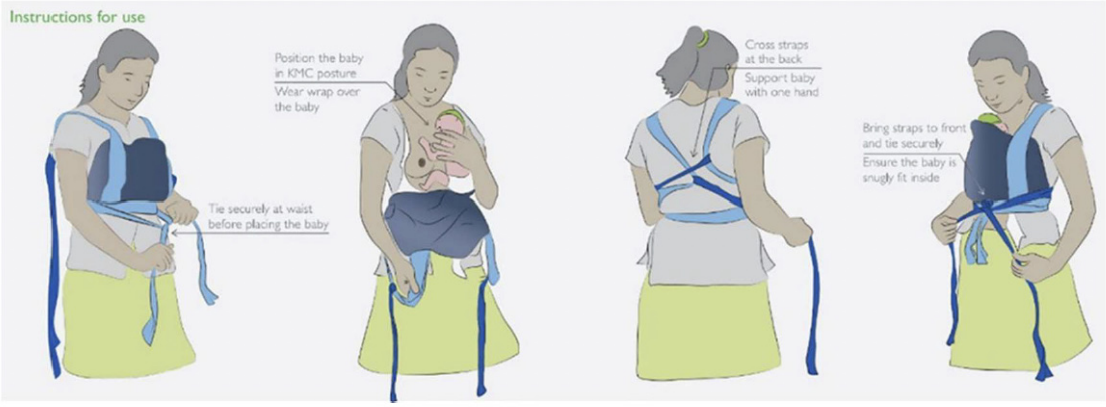
	DESCRIPTORES	LENGUAJE LIBRE
P	"Infant, Premature"[Mesh] "Infant, Newborn"[Mesh] "Infant, Low Birth Weight"[Mesh] "Intensive Care Units, Neonatal"[Mesh] “Intensive Care Units, Pediatric"[Mesh] "Nurseries, Hospital"[Mesh] “Health Services” [Mesh]	infant LBW low birth weight neonat* newborn prematureOR VLBW
I	"Kangaroo-Mother Care Method"[Mesh] "Patient Positioning"[Mesh] "Infant Care"[Mesh] “Nurses, Neonatal"[Mesh] "Prone Position"[Mesh]	Chest to chest Kangaroo care Kangaroo Mother Care Kangaroo position KMC Parent–infant Skin contact Skin to skin Skin two skin skin-to-skin contact skin-to-skin" SSC
C	"Incubators, Infant"[Mesh] "Supine Position"[Mesh] "Prone Position"[Mesh]	Cradle hold Diagonal flexion positioning Lateral positioning Midline head position Tradicional care
O	“Survival” [Mesh] “Sepsis” [Mesh] “ Necrotising enterocolitis“[Mesh] “Brain injury on imaging” [Mesh] “Retinopathy of prematurity (preterm only)”[Mesh] “General gross motor ability”[Mesh] “General cognitive ability”[Mesh] “Quality of life”[Mesh] “Visual impairment or blindness”[Mesh] “Hearing impairment or deafness”[Mesh] “Chronic lung disease/bronchopulmonary dysplasia”[Mesh] “Neurodevelopmental outcomes” [Mesh] “Premature mortality” [Mesh] “Morbidity” [Mesh] “Vital sign” [Mesh] “ Breast Feeding” [Mesh] “Pain” [Mesh]	Adverse events Adverse events Apnoea Axilar temperature Barriers Bradypnea Cardiorespiratory Physiology Cerebral oxygenation development Epigenetic Neurodevelopment Physiological Stability Safe

	“Pain management” [Mesh] "Apnea"[Mesh] "Bradycardia"[Mesh] "Skin Temperature"[Mesh] "Body Temperature"[Mesh] "Body Temperature Regulation"[Mesh] "Body Temperature Changes"[Mesh] "Hypothermia"[Mesh] "Epigenesis, Genetic"[Mesh] "Ventilator Weaning"[Mesh] "Intubation, Intratracheal"[Mesh] "Outcome Assessment, Health Care"[Mesh] “Patient Safety"[Mesh] "Contraindications"[Mesh] "Feasibility Studies"[Mesh] "Respiratory Physiological Phenomena"[Mesh] "Cardiovascular Physiological Phenomena"[Mesh] "Apnea"[Mesh] "Oxygen Consumption"[Mesh] "Cerebrovascular Circulation"[Mesh] “Brain injuries” [Mesh] "Infant, Extremely Premature/growth and development"[Mesh] "Language Development"[Mesh] "Developmental Disabilities"[Mesh] "Cognition Disorders"[Mesh]	
S	“Cross-Sectional Studies” [Mesh] “Feasibility studies” [Mesh] “Surveys and Questionnaires” [Mesh]	randomized controlled trial controlled clinical trial

Table by authors

Appendix 2. Supportive devices

Figure 1. Instructions for CarePlus Wrap use



Source: Chavula K, Guenther T, Valsangkar B, Lwesha V, Banda G, Wensaas MB, et al. (2020) Improving skin-to-skin practice for babies in kangaroo mother care in Malawi through the use of a customized baby wrap: A randomized control trial. PLoS One 15(3):e0229720.

Figure 2. 'Sarbebe' kangaroo care clothing

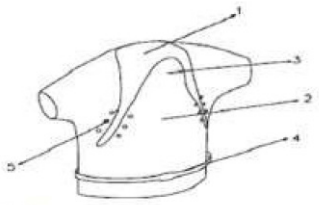


Figure 1. Front view of sarbebe.

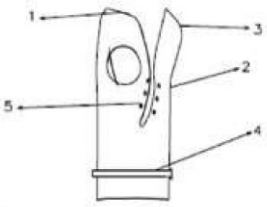


Figure 2. Side view of sarbebe.

Source: Zengin H, Cinar N. Designing dress (Sarbebe) for kangaroo care, the effect of kangaroo care provided with this dress on mother and newborn's comfort †. Health Care Women Int. 2022 Jun 3;43(6):642-62.

Figure 3. Wrap developed by Estrella Gargallo in collaboration with the company Buff.

Source: La Vanguardia. La exitosa idea de una enfermera que ha ayudado a miles de bebés [*The bright idea of a nurse that has helped thousands of babies*]; 2019 [updated on 23 Nov 2019]. Available at: https://www.lavanguardia.com/vida/20191122/471785113921/idea-enfermera-ayudado-miles-bebes.html

Appendix 3. Standing transfer checklist for KMC in patients with NIMV or IMV

CHECKLIST 1: FROM INCUBATOR TO KMC

Preliminary considerations:

- The neonate is stable (as agreed by healthcare professionals and parents)..... ☐
- Parents are willing, trained and prepared (they have the knowledge, time, clothing and have attended to their own needs: hygiene, meals, breast milk expression, etc.)..... ☐
- All necessary healthcare professionals are present (according to the complexity of the neonate's condition)..... ☐
- The environment is appropriate (light, noise)..... ☐
- All movements are gentle, slow, and well-coordinated..... ☐

IF ALL ITEMS ARE CHECKED, THE INFANT MAY BE TRANSFERRED TO KMC

BEFORE THE TRANSFER

- Hand hygiene by all participants..... ☐
- Intubation kit prepared and checked: appropriately sized orotracheal tube, laryngoscope with blade and functioning light, and ETT securement (for intubated neonates only)..... ☐
- Bag-valve mask ventilation-ready, checked, and accessible..... ☐
- Suction equipment operational and accessible..... ☐
- Suction secretions and/or drain condensation from the circuit, if necessary..... ☐
- Monitor vital signs, ensure normothermia, place cap on neonate, and temporarily silence alarms..... ☐
- ETT, CPAP, feeding tubes, catheters, and other devices secured and correctly positioned..... ☐
- Enteral feeding paused during transfer and feeding tube closed..... ☐
- Ventilator tubing and all cables positioned on the side where the transfer will take place. Ensure sufficient length and accessibility for ventilator, infusion pumps, monitor, etc., during KMC..... ☐
- Unnecessary cables or devices disconnected (blood pressure cuff, temperature probe)..... ☐
- Clean nappy..... ☐
- **Armchair placed at appropriate distance**..... ☐
- Infant in supine or lateral position, with appropriate containment (limbs flexed, hands near mouth, head aligned with torso, neck in neutral position; if intubated, head directed towards tubing)..... ☐
- Each participant is aware of their role:..... ☐
  - **Parent** stands beside the open incubator, placing one hand under the infant's head, neck, and back, and the other around the back, hips, and legs, bringing the baby close to their chest. The infant's head should face the ventilator.
  - **Nurse** ensures that the ETT or NIMV device moves in unison with the infant.
  - **Nursing assistant or nurse** manages the tubing, cables, and systems accompanying the infant.
  - **Nursing assistant** helps the parent to sit down and covers the infant.

AFTER THE TRANSFER

- Infant is stable. Vital signs and ventilator/CPAP parameters are within the target range..... ☐
- Ventilator tubing and other cables secured (**avoid excessive use of adhesive tape**)..... ☐
- ETT, orogastric tube, catheters, and other devices fixed and positioned correctly..... ☐
- Reconnect enteral nutrition..... ☐
- Infant in proper position (flexion, midline alignment, skin-to-skin, etc.). ☐
- Airway patency monitored..... ☐
- Armchair position locked with backrest and footrest appropriately adjusted..... ☐
- Infant and parent are comfortable..... ☐
- Adequate access to ventilator, infusion pumps, monitor, etc..... ☐

Appendix 3. Standing transfer checklist for KMC in patients with NIMV or IMV

CHECKLIST 2: FROM KMC TO INCUBATOR

Preliminary considerations:

- Shared and mutually agreed decision to end KMC.....☐
- All necessary healthcare professionals are present (according to the complexity of the neonate's condition).....☐
- The environment is appropriate (light, noise).....☐
- All movements are gentle, slow, and well-coordinated.....☐

BEFORE THE TRANSFER

- Hand hygiene by all participants.....☐
- Intubation kit prepared and checked: appropriately sized orotracheal tube, laryngoscope with blade and functioning light, and ETT securement (for intubated neonates only).....☐
- Bag-valve mask ventilation ready, checked, and accessible.....☐
- Suction equipment operational and accessible.....☐
- Monitor vital signs and temporarily silence alarms.....☐
- ETT, NIMV, feeding tubes, catheters, and other devices secured and correctly positioned.....☐
- Enteral feeding paused during transfer and feeding tube closed.....☐
- Ventilator tubing and all cables positioned on the side where the transfer will take place.....☐
- Unnecessary cables or devices disconnected (e.g., temperature probe, ECG).....☐
- Check that no tubing or devices are fixed or entangled in a way that may cause disconnection or tension.....☐
- Incubator prepared.....☐
- Each participant is aware of their role:.....☐
  - **Nursing assistant** helps the parent to stand up holding the infant.
  - **Parent** gently places the infant in the incubator with the assistance of the **nurse**.
  - **Nurse** ensures that the ETT or NIMV device moves in unison with the infant.
  - **Nurse or nursing assistant** manages the tubing, systems, and cables.

AFTER THE TRANSFER

- Infant is stable. Vital signs and ventilator/NIMV parameters are within the target range.....☐
- Ventilator tubing and other cables secured and anchored.....☐
- ETT, NIMV, feeding tubes, catheters, and other devices correctly positioned and secured.....☐
- Reconnect enteral nutrition.....☐
- Reconnect necessary devices (temperature probe, blood pressure cuff)☐
- Clean nappy.....☐
- Provide containment for a few minutes.....☐
- Infant in correct, comfortable position.....☐
- Environment is appropriate.....☐
- Duration and tolerance of KMC recorded.....☐

Checklists by authors.[63,92,93]

Bringas Fuente S, González Alcalde P, Pérez Santos AB, Hernández Fernández L, Valero Díaz F, Herranz Gómez C. *Protocolo del método madre canguro (MMC) o contacto piel con piel (CPP)*. Unidad de Neonatología. Servicio de Pediatría. Hospital Universitario Marqués de Valdecilla [*Kangaroo Mother Care (KMC) or Skin-to-Skin Contact (SSC) Protocol*. Neonatology Unit, Paediatrics Department. Marqués de Valdecilla University Hospital].

Appendix 4: Step-by-Step Guide for Standing Transfer of an Intubated Preterm Newborn

Source: Courtesy of 12 de Octubre University Hospital, Madrid